Four Essays on Firm Offshoring and Innovation Behavior

Dissertation
zur Erlangung des Grades
Doktor der Wirtschaftswissenschaften (Dr. rer. pol.)
am Fachbereich Wirtschaftswissenschaften
der Universität Konstanz

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Konstanz, den 24. Juni 2009

Tag der mündlichen Prüfung: 30. Juli 2009.

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For my parents
and my sister María
and all their babysitting
and housesitting hours
that made this possible

For Nacho, María Clara and Juan Lucas
for always being my
source of strength and motivation

Acknowledgements

When I arrived in Konstanz in August 2000 I had only planned to finish my Master in mathematical Finance and never really considered to pursue a doctoral degree at the University of Konstanz. Working at Prof. Winfried Pohlmeier's Chair for Econometrics from 2000 to 2004 though, gave me the opportunity to interact with his PhD assistants and I realized that pursuing a doctoral degree at the university was not only something I could do, it was something I wanted to do. Encouraged by Prof. Pohlmeier I enrolled in the PhD program in August 2004 and started as a PhD Assistant at Prof. Jan-Egbert Sturm's Chair for Monetary Economics. I am therefore truly indebted to both Prof. Pohlmeier and Prof. Sturm for giving me the opportunity of deepening in my research interests and always being there as a source of intellectual inspiration and confidence in the past 5 years. I am also truly thankful for the trust they deposited in me, for their understanding every time difficulties arose and for never allowing me to consider stepping back and not finishing my PhD degree.

When in December 2005 I decided to return to my home-country, Uruguay, due to private reasons, I had the opportunity to start working at Watson Wyatt Worldwide as a researcher in the Montevideo Global Research Services unit. Watson Wyatt provided the financial support to continue with my PhD studies in the last 3 years, financing my trips and courses in Europe and providing the necessary research resources. But furthermore, the firm gave me the opportunity to redefine my research interests and combining client support work, a management role in leading research in different areas and, of course, my role as a researcher I discovered my passion for the research in the area of Multinationals. Mike Orszag, Head of Research at Watson Wyatt, was undoubtedly a source of inspiration and strength. His innovative ideas, his support, his advice, his trust and his never-ending energy made and make my work at Watson Wyatt enjoyable and dynamic and were key to this dissertation. I am therefore particulary thankful for his professional and intellectual advice and for offering me the opportunity of developing the research area in multinationals, for trusting in my judgement around multinational consulting but also for his patience and for giving me liberty to think and research for myself, which is not standard when researching in a firm environment.

In the context of a joint project for the Inter-American Development Bank I learned to work with my co-author Adriana Cassoni who became not only an intellectual referent, but also a friend. I am therefore truly thankful to all her coaching, pushing, pressuring, commenting and criticizing my work.

I also owe this to my husband Juan Ignacio and to my children, María Clara and Juan Lucas, who were an immense source of strength and motivation, for their support, for their understanding and for keeping me focussed and determined in my endeavors. But I specially owe this achievement to my parents, my husband, my brother Juan Bautista and particularly to my sister María, who gave up a large part of their private life to help me, day after day, coping with my three jobs, our daughter, my recent pregnancy, our dog, our house and all those other responsibilities that are part of my life. I also thank my dear friend Ana Lariau for her unconditional help and support in the last three years, for all the GOF and for being an unconditional friend and colleague without which this dissertation would not have been possible. And of course to Julia Hisge and Juan Ignacio Scasso for their proofreading and always helping with my last minute requests.

Finally, I would also like to thank my colleagues Jonathan Gardner and Mirko Cardinale with whom it is and was a pleasure to work with. To Ivanna Echegoyen, Natalia Garabato, Irene Mussio, Micaela Kulesz, Christian Tondo for many inspirational conversations. To my colleagues Neha Sand, Awie Foong, Tao Hao, Juan Ignacio Scasso, Karla Estavillo, Federico Cabrera, Pamela Ibarguren for their comments and invaluable assistance. To Sofia Jaunsolo and Alejandra Maiztegui for their support on the practical and administrative side, always being there for me when I needed it. And to my friends, that through being there and receiving me in their homes when is was abroad provided the last but not least cornerstone upon which my life was based in the past five years: Raban und Annette Fuhrmann, Tobias Geisen, Boris und Sabine Gierszewski, Thomas Heise, Julia Hisge, Mari, Edwin, Daniel and Miriam Schulz, Sylvia Stumpf, Juliane Sturm and Christian Walter.

Table of Contents

List of Tables

List of Figures

Introduction and Summary

This dissertation consists of four stand-alone papers who were written in the context of my work as a researcher at Watson Wyatt Worldwide (Chapters 1 and 2) and as a consultant for the Inter-American Development Bank (IADB), (Chapters 3 and 4). These papers deal with two major topics. The first topic looks at the behavior of multinational companies (MNCs) in terms of their offshoring behavior. Chapters 1 and 2 are contributions to this area, focussing on the choice of entry-mode made by MNCs when going offshore. The second field of interest is devoted to firm's innovation behavior. Chapters 3 and 4 analyze those issues in the context of Uruguayan firms.

Chapter 1 reviews and criticizes in depth the literature on foreign establishment mode choices by MNCs providing a motivation to perform a robustness analysis, that is then performed in Chapter 2. Through a review of the theoretical approaches behind each study, as well as by comparing the way theoretical constructs are operationalized, Chapter 1 pools different studies that are part of empirical literature in the field of foreign entry-mode decisions into different classes, comparing their results. The literature's main results are then compared within those classes, finding inconsistencies in the significance and sign found for almost every explanatory variable studied in the context of entry-mode decisions. An explanation on the reasons behind those inconsistencies is also provided, yielding a strong motivation for pursuing model misspecification checks and robustness analysis for those variables.

Motivated by Chapter 1, in Chapter 2 a robustness analysis is performed on the variables usually found in literature to be determinants for entry-mode choices. I perform a so-called Extreme Bound Analysis (EBA) to determine which of almost 60 explanatory variables are robust to different model specifications. I do so by looking at the entire distribution of the estimator for each explanatory variable's coefficient, following the methodology introduced by Sala-i-Martin (1997a) in a multinomial logit framework. To perform this analysis I build a unique dataset, that accounts for more than 4000 offshoring events of the largest 50 Multinational Companies (MNCs) worldwide in the last 15 years. In Chapter 2 I use 640 of those events, them being entries into foreign countries done by the largest 22 financial MNCs in the last 15 years. Based on over eight million regressions, my results are able to isolate 15 variables that seem robustly related to an MNC's entry-mode decision. Multinational firms' size and its international experience increase the likelihood of Greenfield Investments (GI) over choosing Merger & Acquisitions (M&A) or any type of entry-mode involving a partner. Conversely, its host-country experience as well as the larger its experience differential in M&A over GI, make greenfields less probable. In terms of the host-country's characteristics, more cultural distance between home and host-country, a better developed financial sector (or local credit market) in the host-country, a more regulated environment for obtaining licenses and more macroeconomic sustainability increase the chances of GI, while a worse local infrastructure, higher ITC costs and more difficulties in registering property and employing workers decrease the odds of greenfields. Joint Ventures are more likely if the MNC is larger and if the host-country has more macroeconomic sustainability and/or if it has a worse investment environment. A small and expensive talent pool, make Joint Ventures (JV) less likely if compared to M&A. In addition, I find that the size, expensiveness and quality of the talent pool determine the likelihood of full GI due to the latter's character of being generated from scratch, rather than because it is done in a full ownership mode or without interacting with another company, be it a target or a partner. The same applies for a host-country's political stability.

Chapter 3 is the result of joint work with Adriana Cassoni and was developed under the sponsorship of the IADB, for the Innovation Network. We there analyze the innovation behavior of Uruguayan firms using a microeconomic dataset, stemming from Uruguayan Innovation Surveys (IS) which we matched to Uruguayan Economic Activity Surveys (EAS). We there review the theoretical and applied literature on the innovative behavior of firms and its impact on productivity, so as to depict the setting within which the models estimated for Uruguay are specified. We describe the main characteristics of Uruguayan data, thus setting a benchmark for a better understanding of the descriptive analysis afterwards summarized. Finally, we estimate a model using a panel approach and correcting for survey design and sample bias, following in general lines the specification of Crépon et al. (1998), although with several modifications and making use of new innovation and output indicators proposed by us. Our results depict an innovation behavior that heavily relies on innovation in processes and whose main impact on firm productivity occurs through the improvement of firm internal efficiency, as opposed to product innovation.

In the context of the paper prepared for the IADB we encountered that the empirical literature dealing with the innovation behavior has difficulties to empirically implement the theoretical model derived by Crépon et al. (1998). Most variables and proxies used to operationalize the mentioned model are mediocre in terms of replicating the underlying theoretical concepts and are not able to capture the complexity of innovation behavior when it comes to model innovation inputs and the value of the innovation output obtained. In Chapter 4 we therefore suggest and construct alternative measures for capturing those dimensions. Two of our indicators can be applied using standard IS data, while the remaining three indicators make use of EAS data. We analyze their comparative performance in a productivity equation and conclude that our specification based on value added per employee as a proxy of productivity and using our indicators for innovation output value significantly improves the measuring of the impact of innovation on productivity growth yielding more accurate and detailed results.

Einleitung und Zusammenfassung

Diese Doktorarbeit besteht aus vier eigenständigen Forschungsarbeiten, die ich während meiner Tätigkeit als Forscherin im Unternehmen Watson Wyatt Worldwide (Kapitel 1 und 2) sowie als Beraterin für die Inter-American Development Bank, IADB, (Kapitel 3 und 4) verfasst habe. Dabei galt mein Forschungsinteresse hauptsächlich zwei Themen. Erstes Themengebiet ist das Offshoring-Verhalten multinationaler Unternehmen (MNU). Kapitel 1 und 2 befassen sich mit diesem Gegenstand und richten ihr Hauptaugenmerk auf die Wahl des Eintrittsmodus beim Offshoring von MNU. Das zweite Kernthema ist das Innovationsverhalten von Unternehmen, das in Kapitel 3 und 4 für uruguayische Unternehmen analysiert wird.

Kapitel 1 prüft und kritisiert eingehend die Literatur über die Wahl der Eintrittsmodi ausländischer Niederlassungen von MNU. Dies motiviert die Durchführung einer Robustheitsanalyse, die in Kapitel 2 realisiert wird. Auf Grundlage eines Überblicks über die theoretischen Ansätze hinter jeder Studie sowie eines Vergleichs der angewandten theoretischen Konstrukte werden in Kapitel 1 verschiedene Studien, die Teil der empirischen Literatur über Eintrittsmodus-Entscheidungen sind, in unterschiedliche Klassen unterteilt, deren Ergebnisse verglichen werden. Es folgt ein Vergleich der Hauptergebnisse innerhalb dieser Klassifizierungen. Dabei werden Unstimmigkeiten hinsichtlich der Signifikanz und des Signums von fast jeder erklärende Variable gefunden, die im Zusammenhang mit der Eintrittsmodus-Entscheidung untersucht wird. Eine Erklärung für die Gründe dieser Unstimmigkeiten wird ebenfalls geliefert und motiviert eine Überprüfung der Modell-Falschauslegung und zur Durchführung einer Robustheitsanalyse.

Ausgehend von Kapitel 1 wird in Kapitel 2 eine Robustheitsanalyse durchgeführt, die die Variablen berücksichtigt, die in der Literatur üblicherweise als Determinanten für die Wahl von Eintrittsmodi gelten. Ferner führe ich eine Extreme Bounds Analysise (EBA) durch, um zu bestimmen, welche der fast sechzig erklärenden

Variablen robust/stabil gegenüber verschiedenen Modell-Spezifikationen sind. Dies geschieht, indem ich die gesamte Schätzerverteilung für den Koeffizienten jeder erklärenden Variable untersuche. Dabei schließ ich mich der Methodologie an, die Sala-i-Martin (1997a) eingeführt hat und wende sie in einem in einem Multinominalen Logit Ansatz an. Um die Analyse durchzuführen, habe ich einen einmaligen Datensatz erstellt, der mehr als 4.000 Offshoring-Ereignisse der größten fünfzig Multinationale Unternehmen (MNU) weltweit innerhalb der letzten fünfzehn Jahren berücksichtigt. In Kapitel 2 werden 640 dieser Events genutzt. Es handelt sich dabei um Eintritte in fremden Länder, welche die 22 größten Finanz-MNU in den letzten fünfzehn Jahre getätigt haben. Basierend auf über acht Millionen Regressionen isolieren meine Ergebnisse fünfzehn Variablen, die robust mit der Eintrittsmodus-Entscheidung der MNU zusammenzuhängen erscheinen. Die Größe der MNU sowie die internationale Erfahrung steigern die Wahrscheinlichkeit von Greenfield Investment (GI) gegenüber der Wahl von Merger & Acquisitions (M&A) oder einem anderen Eintrittsmodus, der einen Partner beinhaltet. Umgekehrt machen sowohl die Gastland-Erfahrung als auch eine umfassendere Erfahrungen im Bereich M&A im Gegensatz zu Greenfield Investment, machen Greenfields weniger wahrscheinlich. In Bezug auf die Eigenschaften des Gastlands fördern mehr kulturelle Distanz zwischen Heim- und Gastland, ein besser entwickelter finanzieller Sektor (oder lokaler Kreditmarkt) im Gastland, eine geregelteres Umfeld zur Erlangung von Lizenzen sowie mehr makroökonomische Stabilität die Chancen von Greenfield Investment, während eine schlechtere örtliche Infrastruktur, höhere ITC-Kosten und Schwierigkeiten beim Anmelden von Eigentum und beim Einstellen von Mitarbeitern mindern die Chancen auf Greenfield. Joint Ventures sind wahrscheinlicher, wenn das MNU größer ist und wenn das Gastland bessere makroökonomische Zukunftsaussichten hat und/oder, wenn es eine schlechtere Investmentumgebung hat. Ein kleines und teures Talent Pool macht Joint Ventures verglichen mit M&A nicht sonderlich wahrscheinlich. Zudem bedingen meiner Meinung nach Größe, Kostspieligkeit und Qualität des Talent Pools die Wahrscheinlichkeit von vollständiger Greenfield Investments. Dies gilt auch für die politische Stabilität des Gastlandes.

Kapitel 3 ist das Ergebnis einer gemeinsamen Arbeit mit Adriana Cassoni, die mit Unterstützung seitens der IADB für das Innovation Network entstand. Wir analysieren das Innovationsverhalten uruguayischer Unternehmen mithilfe eines mikroökonomischen Datensatzes, der aus den uruguayischen Innovation Surveys (IS) stammt, die wir den uruguayischen Economic Activity Surveys (EAS) angepasst haben. Wir untersuchen dabei die theoretische und angewandte Literatur über das Innovationsverhalten von Unternehmen und seine Auswirkung auf die Produktivität und veranschaulichen so den Hintergrund, in dem die für Uruguay berechnetet Modelle spezifiziert sind. Ferner werden die Hauptmerkmale der uruguayischen Daten beschrieben. Auf diese Weise wird die Grundlage für ein besseres Verständnis der deskriptiven Analyse geschaffen, die im Anschluss zusammengefasst wird. Schließlich berechnen wir ein Modell, indem wir ein Panel Ansatz anwenden und das Modell für Stichprobendesign und sample bias korrigieren. Dabei wird grundsätzlich der Ausführung von Crépon et al. (1998) gefolgt. Es werden jedoch einige Anpassungen vorgenommen und Gebrauch von neuen Innovations- und Output-Indikatoren gemacht, die von uns aufgestellt werden. Unsere Ergebnisse stellen ein Innovationsverhalten dar, das stark auf der Innovation von Prozessen beruht und dessen Haupteinfluss auf die Unternehmensproduktivität durch die Verbesserung der innerbetrieblichen Effizienz - im Gegensatz zur Produktinnovation - entsteht.

Im Zusammenhang mit der Arbeit, die für die IADB entstand, entdeckten wir, dass die empirische Literatur, die sich mit dem Innovationsverhalten beschäftigt, Schwierigkeiten hat, das von Crépon et al. (1998) abgeleitete theoretische Model empirisch anzuwenden. Die meisten Variablen und Proxy-Variablen die genutzt werden, um das genannte Modell anzuwenden sind in Bezug auf die zugrunde liegenden theoretischen Konzepte nur mittelmäßige Approximationen und sie können die Komplexität des Innovationsverhaltens nicht erfassen, und modellieren darum den Mix von Innovationsinputs und der Wert des Innovationoutputs nur unzureichend. In Kapitel 4 schlagen wir deshalb alternative Indikatoren vor, die diese Dimensionen erfassen. Zwei unserer Indikatoren können angewandt werden, wenn Standard IS-Daten genutzt werden, während die weiteren drei Indikatoren mit EAS-Daten genutzt werden können. Wir analysieren die Vergleichsmessung in einer Produktivitätsgleichung und folgern daraus, dass unsere Anpassung - basierend auf dem pro Angestellten hinzugefügten Wert als eine Proxy-Variable von Produktivität sowie unter Gebrauch unserer Indikatoren für den Wert des Innovation-Outputs - die Messung des Einflusses der Innovation auf das Produktivitätswachstum bedeutend verbessert.

Chapter 1

How to go in? – Reviewing the literature on foreign entry-mode choice

1.1 Introduction

For multinational companies (MNCs), going offshore has become standard operating practice. For the foreseeable future, MNCs are likely to continue establishing more outposts on foreign shores. This transfers the competition for talent and market share from home to offshoring locations, posing competitive challenges to multinational firms.

In this context MNCs will have to take their decision of going abroad taking various factors into account. Most of these factors, as are price differentials or talent provision are highly linked with the location decision. Other factors, like the type of entry, have been analyzed by literature from a theoretical point of view[1], as well as in several country case studies, mostly based on survey data or on aggregate foreign direct investment (FDI) data[2]. Nevertheless, both strands of literature – location choice and type of entry-mode – have found mixed results with respect to the determinants to both type of choices as well as with respect to the expected sign of their effect. A comparison of their results reminds us of Sala-i-Martin's (1997b) two

[1] Among the most recent studies are Mueller (2001), Goerg (2000), Ferrett (2003), Bertrand and Madariaga (2003), Nocke and Yeaple (2004) and Norbäck and Persson (2007).

[2] See e.g. Bertrand and Madariaga (2003) on the U.S., Hennart and Park (1993) on Japan and Wes and Lankes (2001) on CEE countries.

million regressions in empirical growth literature, since most variables change sign and significance depending on the model specification, and even among the different theoretical models, expected signs in several variables are not consistent.

This paper reviews and criticizes the above mentioned literature in depth providing a motivation to perform a robustness analysis. Through a review of the theoretical approaches behind each study, as well as by comparing the way theoretical constructs are operationalized, this paper is able to pool the different studies that are part of empirical literature in the field of foreign entry-mode decisions into different classes, allowing for a comparison of their results. The literature's main results are then compared within those groups finding inconsistencies in the significance and sign found by different studies for almost every explanatory variable studied in the context of entry-mode decisions. An explanation on the reasons behind those inconsistencies is also provided, yielding a strong motivation for pursuing model misspecification checks and robustness analysis in future research. The present paper extends the extensive review by Slangen and Hennart (2007) in that it also includes and compares studies focusing on multichotomous foreign entry-mode decisions, i.e. distinguishing among three or more entry modes, as well as studies looking at less researched establishment modes, e.g. Brownfields.

In section 2.2.1 the theoretical framework around MNC decision making in entry-mode decisions is introduced. In section 1.3 the review of the current empirical literature follows. The review is structured in two parts. The first part looks at the operationalization of theoretical constructs and the second part focusses on the divergence among the different studies' results. Section 1.4 aims at determining the main sources of the existence of diverging results, while 2.4 makes suggestions of improvements and for future research on the topic and concludes.

1.2 Theoretical motivation

1.2.1 The different modes of entry

Although MNCs generally take their business abroad to reduce costs and to access new markets, their approaches differ. One can distinguish among three main types of modes of entry when going offshore: Mergers and Acquisitions, Joint Ventures

and Greenfield Investments.
Foreign establishment or entry modes can be characterized through two dimensions. Firstly, an entry-mode is characterized by the fact of being something completely new or, conversely, by being based on something preexistent. On the other hand, the entry-mode can be partially owned or of shared ownership (SOS), or be fully or wholly owned (WOS). The interaction of these two dimensions should yield four well-defined categories, them being fully owned greenfield investments, partially owned greenfield investments, fully owned acquisitions and partially owned acquisitions. Sadly, when it comes to define partially owned ventures, the literature is not consistent in the terminology it uses. Certain studies will refer to joint ventures as partially owned greenfields and therefore characterized by the fact of being new entities, while other studies will also define certain partial acquisitions as joint ventures, relying on the legal form used to define the partnership among the two or more owners.

For the sake of clarity in this paper I will restrict the use of these terms based on the following definitions.

In mergers and acquisitions (M&A) a company acquires all or part of another company's tangible and intangible assets. Given that this paper focuses on foreign entry-mode decisions, I only refer to cross-border M&A, i.e. to M&A in which the acquired company does not reside in the same country where the ultimate MNC's parent company is headquartered. Among M&A I will distinguish between full acquisitions (FA) accounting for M&A with 100% ownership and control over the acquired enterprise and partial acquisitions (PA) where sought ownership is less than 100% although still seeking for control.

In a Joint Venture (JV) at least two different companies agree to jointly create and control a third independent legal entity. This means that I define JV as partially owned GI, since they need to refer to the joint ownership of a fully new entity[3]. To account for them being cross borders, I only refer to JV created outside the location of the studied MNC's headquarters.

In a greenfield investment (GI) the MNC creates a fully new enterprise – as a subsidiary – or expands its own firm in a new country – e.g. creating a new branch,

[3]Still, it has to be noted that in terms of the data on JV, the extent to which a new entity is indeed new in the case of a JV, may just stem from the fact that it is legally new.

while being the only owner to that new enterprise. In this case too, I only take cross border GI into account.

All three entry modes — M&A, JV and GI — may be undertaken for similar reasons, usually to reduce costs, gain access to new resources or to expand operations into new markets. Still, the specific motivation for setting up an offshore operation strongly affects the choice of entry-mode. For example, entering a new and unfamiliar market can be made easier by acquiring an established local brand. On the other hand, setting up a back office might be easier through a GI than through a merger or acquisition. In a GI, new recruits are steeped in the corporate culture and values from the beginning, while in a merger or acquisition, employees from acquired or merging enterprises must acclimate to a new environment that might have very different practices, values and goals.

1.2.2 Main differences among entry modes

The three entry modes differ in terms of several dimensions, as are the new venture's maturity, its shared or full ownership, the financial risks embedded in the decision, the negotiation time-frame needed to consolidate the deal, the velocity in which first results can be obtained and the extent to which trust between partners is needed or asymmetric information can affect the decision[4].

In mergers and acquisitions, two existing organizations must learn to work together as one (or one culture prevails over the other). Both greenfield investments and joint ventures create a new organization with its own corporate culture. The lack of a cultural legacy gives greenfield investments and joint ventures the advantage of flexibility, enabling them to more easily adapt to the parent firm's culture.

In full M&A and in greenfield investments, the parent company is fully in control, thereby minimizing potential dissention and conflicts. In partial M&A and in joint ventures, at least two existing organizations must reach consensus and deal with conflicts as part of the common governance. Nevertheless, the potential for conflict differs for full acquisitions and greenfield investments. In an acquisition, the

[4] See Newburry and Zeira (1997). The authors distinguish among 10 factors that differentiate these three entry modes: age, equity ownership, financial risk, goal conflict, negotiation time-frame, number of owners, ownership type, secrecy, speed of results and trust. For details on each difference see Newburry and Zeira (1997), p. 90ff.

acquiring company typically puts its own people in key leadership positions, and the acquired organization may resist the new management style, putting the merged venture at risk.

In joint ventures, all participants share the financial risks, while in mergers and acquisitions and greenfield investments, the parent company assumes the full risk.

Two additional factors play an important role in the venture's success: the negotiation time-frame and the speed of results. In mergers and acquisitions, the negotiation time-frame is tight and due diligence takes place under a great deal of pressure, which can adversely affect the quality of the information fed into the decision-making process. In fact, it may increase information costs (entry costs) and can lead to a bad investment decision, that otherwise could have been avoided in the presence of better information. Joint ventures and greenfield investments have no additional time constraints (besides the usual ones related to the MNC's normal business), leaving more room for careful consideration, which may minimize potential mistakes.

Mergers and acquisitions are often chosen to make a fast entry into a strongly consolidated market — such as by acquiring an existing local brand — or to access expertise or assets that are lacking or insufficient in the parent company. This speeds results because complementary assets and cultures are merged rather than generated. Conversely, in joint ventures and greenfield investments, the parent company must commit significant time and resources before seeing the first results.

1.2.3 Theoretical framework and Hypotheses

Certain advantage providing conditions with respect to ownership, location and internalization must be given in order to make offshoring interesting[5]. A firm entering an offshore venture – and hence facing disadvantages in terms of brand, cultural clash or local market knowledge when compared to its local competitors – will need to have some competitive advantages in order to offset the above gap. Some of these ownership advantages are e.g. to be in possession of superior technology or of a better product, or to have better access to international resources, e.g. capital, commercialization processes or management processes are part of the MNC's attributes. Other advantages are provided by the location itself, i.e. are those related to the

[5]See the OLI-theory by Dunning (1993).

host-county's resources and economic conditions, as low cost talent, an attractive local market and natural resources, providing there is an adequate business environment. Further factors that affect the decision are related to the parent industry or the penetrated industry, as well as to characteristics of the subsidiary or target in question.

Factors at five levels can be considered to affect foreign entry-mode decisions. At the firm level MNC characteristics will play an important role. At the industry level, attributes of the parent company's industry or of the penetrated industry – as well as how these two industries relate – have to be taken into account. At the host-country level features determining a location's suitability for offshoring and its availability of resources may affect the foreign establishment mode as well. Finally, characteristics of the subsidiary, target or new venture itself – e.g. its size or the motivation of the offshore event and the role the new unit will play in the overall organization of the MNC –, as well as deal-specific attributes – e.g. mode of payment – constitute the variables at the two remaining levels. The latter level is widely underresearched.

Different theoretical approaches have been developed and adapted to understand the determinants of foreign entry-mode choices, usually focusing on one specific level of the defined above. Among those approaches, the internalization and transaction cost theory[6] and the organizational learning approach[7] focus on determinants and processes that explain entry-mode decisions through characteristics at the firm level. Information economics is rather applied to deal-specific determinants, although the extent to which information asymmetries matter in the decision are also determined by firm level and host-country level characteristics. The main theoretical approach to assess the role of industry attributes in this type of decisions is industrial organization economics.

1.2.3.1 Determinants at the MNC level

As stated above, internalization theory and transaction costs theory provide the most used and traditional theoretical framework to explain the entry-mode choice by MNCs. According to those theories MNCs will decide if they trade inputs based

[6] See seminal work by Buckley and Casson (1976), Dunning (1981) and Rugman (1981). Also see Hennart (1982), as well as the more comprehensive study by Buckley and Casson (1998). The main adaptors of this theory to entry-mode decisions were Hennart and Park (1993).

[7] Padmanabhan and Cho (1999) and Barkema and Vermeulen (1998) are the main references applying organizational learning arguments to entry-mode choice.

on a market-like exchange arrangement – e.g. licenses – or if contrarily they internalize the market by entering through foreign direct investment (FDI). Hennart and Park (1993) apply this idea to the choice between M&A and GI by extending the above reasoning by analogy to the latter choice, in the sense that the decision will incorporate a comparison of both approaches in terms of their transaction-associated costs for accessing or exploiting intermediate inputs. The main idea behind this theoretical approach is that the markets for certain inputs are inefficient, especially if those inputs are of tacit nature and hence difficult to price and to buy disembodied from their owner[8]. Such assets are mainly knowledge driven and are usually related to an MNC's experience or technical expertise[9].

The best example to such an input and how it affects entry-mode decisions is the technological know-how an MNC may have or want to acquire. A firm with a high technological expertise will probably choose to expand into an offshore venture – to lower production or R&D costs, generate economies of scale or enter a new market – through a GI mode. In this way, they will be able to transfer their knowledge in a fully controlled environment with controlled initial conditions with respect to staffing, infrastructure, etc. and hence lower transaction costs. Contrarily, if a firm wants to acquire technological knowledge in a fast and efficient way, it may be less costly to do so by acquiring a firm which already developed the needed expertise, instead of generating it in-house. Given that generating technological expertise is costly and time consuming, while buying it in disembodied form – e.g. through outsourcers or consulting advice – is also costly due to its tacit nature, firms seeking to acquire such an expertise will attempt to do so by pursuing M&A[10]. Looking at the latest data trends, it seems that technology sourcing has indeed become a very important motivation behind M&A entries since the 1990s[11], with less technology intensive MNCs trying to catch-up in their technology gap through acquisitions[12]. This leads to the first theoretical hypothesis used in entry-mode literature:

[8]See Hennart (1982, 1988).

[9]See Hennart and Park (1993).

[10]See Hennart el al. (1996).

[11]See Bertrand, Hakkala, and Norbäck (2007). According to their results, R&D intensity in units acquired via M&A or via GI has different determinants at both firm and host-country level, pointing at the fact that the motivation behind those two types of entry modes is different.

[12]In fact, there is a recent trend among small ITC firms in emerging markets, which are conceived just to develop one potential innovative idea in the expectation of being acquired by leading IT MNCs. As a response, large MNCs may tend to decrease innovation risks by rather monitoring and being aware of these firms' activities, in order to acquire small, innovative and independent firms and its innovative products, instead of developing new products in-house.

Hypothesis 1: *Ceteris paribus*, the greater the levels of an MNC's technological expertise, the greater the likelihood of entering offshore ventures via Greenfield Investment.

Analogously, an MNC's international expertise can also be considered an asset of tacit nature. Firms possessing international expertise may also reduce the costs associated with a greenfield investment, since the firm may already operate in the target host-country or in a similar host-country. Firms with a lower degree of internationalization will on the contrary be more tempted to enter a new country through acquisition, since international experience cannot be acquired in loose form. Mainly the acquiring of other firms with the needed international exposure will allow these MNC to access this type of experience without incurring in the large costs associated with the consequences of starting an offshore venture from scratch although lacking the needed experience to do so in a cost-efficient way. The hypothesis therefore used in empirical studies around entry-mode choices is:

Hypothesis 2: *Ceteris paribus*, the greater the level of an MNC's international expertise, the greater the likelihood of entering offshore ventures via Greenfield Investment.

Furthermore, if an MNC has already operated in the specific host-country in which it is considering a new venture, this should alleviate transaction costs of a GI, since the MNC is supposed to already have acquired the expertise on how to lower entry-costs in that country. Nevertheless, if one considers information economics[13] as a further theoretical approach, one could sustain that in the specific case of M&A as a mode of entry, the asymmetry of information faced by an MNC with low host-country exposure, will lower the likelihood of entry through M&A since the MNC is not able to fully assess the potential acquisition targets. In the same way, a firm with host-country experience will be acquainted with the market and with potential M&A targets, leading to an increase in the likelihood of an entry through M&A[14]. The direction of the overall impact of the MNC's host-country experience on the choice of entry-mode is therefore not obvious *a priori*. From this, two alternative theoretical hypotheses are used in the literature:

[13] See Stigler (1961).

[14] See Hennart and Park (1993).

Hypothesis 3a: *Ceteris paribus*, the greater the host-country experience of an MNC, the greater the likelihood of entering offshore ventures via Greenfield Investment.

Hypothesis 3b: *Ceteris paribus*, the greater the host-country experience of an MNC, the greater the likelihood of entering offshore ventures via M&A.

Hypothesis 1 and hypothesis 2 can also be obtained through a organizational learning perspective[15], in which MNCs will acquire those assets of tacit nature – e.g. expertise in international ventures or technological know-how – through the sole fact of operating in those areas. This idea can be extended to product expertise and diversification. In fact, both transaction costs theory and organizational learning consider that the degree of diversification of an MNC generates organizational skills in balancing and controlling very different units and needs, and that this management expertise will decrease the adjustment and management costs associated with merging or acquiring a new firm. Less diversified firms will not have the management expertise to deal with M&A in a cost-efficient way and this will hence lower the likelihood of this type of entry[16].

Contrarily, from the perspective of information economics, Cho and Padmanabhan (1995) state that a high level of diversification should increase the technological expertise of an MNC across various fields, leading to an increased likelihood in GI. Finally, Barkema and Vermeulen (1998) consider the relationship to be inverse-U-shaped, given that highly diversified firms reach a scale and complexity level that limits their ability of intra-firm information sharing.

Here too the theoretical overall effect of diversification on entry-mode decisions is divergent for different theoretical approaches and leads to the following alternative hypotheses:

Hypothesis 4a: *Ceteris paribus*, the greater an MNC's product diversification, the greater the likelihood of entering offshore ventures via Greenfield Investment.

[15]See Padmanabhan and Cho (1999) and Barkema and Vermeulen (1998).
[16]See Caves and Mehra (1986) and Hennart and Park (1993).

Hypothesis 4b: *Ceteris paribus*, the greater an MNC's product diversification, the greater the likelihood of entering offshore ventures via M&A.

Hypothesis 4c: *Ceteris paribus*, the relationship of an MNC's product diversification and the likelihood of entering offshore ventures via M&A is curvilinear, displaying an inverse U-shape.

A further important asset in terms of a firm's knowledge is the one related to previous experience in a specific entry-mode. The first to include this type of expertise in their study are Padmanabhan and Cho (1999). Both from the transaction costs and the organizational learning perspective, a large experience in one mode of entry compared to the other mode of entry, will make the latter less probable:

Hypothesis 5: *Ceteris paribus*, the greater the level of an MNC's expertise in one mode vs. the alternative entry modes, the greater the likelihood of entering offshore ventures via the mode in which it has accumulated previous expertise.

Finally and although not used as a typical hypothesis in most reviewed studies, according to the theoretical model derived by Nocke and Yeaple (2004) firm efficiency should also affect the choice of the mode of entry for an MNC's investment abroad. For more efficient firms the superior gain of expanding through GI may serve as a driver to engage in GI. Contrarily, MNCs with low degree of efficiency may still want to expand to access other markets, inputs or expertise, but will only be able to do it through M&A since otherwise the costs of doing so will probably offset the expansion opportunity gains due to the firm's low efficiency. Their findings sustain that MNCs choosing GI as a mode of entry are systematically more efficient than firms engaging in M&A[17]. This can be summarized in the following hypothesis:

Hypothesis 6: *Ceteris paribus*, the greater the MNC's degree of efficiency, the greater the likelihood of entering offshore ventures via Greenfield Investment.

[17] Nocke and Yeaple (2004), p. 2 and p. 21ff.

1.2.3.2 Determinants at the industry level

The type of industry entered in terms of its degree of concentration, its size and its growth rate also have important consequences on the mode of entry, since they determine the market-entry barrier costs[18].

When analyzing the effects of an entry in terms of industrial organization economics a major difference between a GI and an M&A entry arises. In fact, only a GI entry can have effects on local supply, since it will substantially increase the amount of goods offered in the market, having an impact on the assets' prices and on the profit margins of already installed firms[19]. Furthermore, despite not having been noted in the current literature, a GI will also have an effect on labor demand, increasing competition in the local labor market and hence affecting industry specific wages and increasing the risk of employee turnover for incumbent firms.

Based on the above, the concentration of an industry , as well as its growth rate, will play a substantial role in determining whether such an impact on local labor supply and on local labor demand will generate a reaction of installed firms and therefore affect market-entry barrier costs.

In a highly concentrated industry a GI will need to substantially increase local supply to be able to gain some market share when entering. Prices and profit margins of established firms will thus be severely affected. In other words, concentrated industries will be more prone to offer more entry resistance and strike-back strategies of local firms. An M&A entry will avoid the retaliation from incumbents, given that, in principle, there will not be any local supply or local labor demand effects stemming from this type of entry. This yields the following hypothesis:

Hypothesis 7: *Ceteris paribus*, the larger the industry's concentration, the greater the likelihood of entering offshore ventures via M&A.

The industry's size will also play a major role. A highly developed industry will provide the necessary targets for M&A, while a small industry will imply less availability of take-over targets[20]. Literature therefore hypothesizes:

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[18]See Caves and Mehra (1986) and Hennart and Park (1993).
[19]See Caves and Mehra (1986) and Hennart and Park (1993).
[20]See Caves and Mehra (1986), Zejan (1990), O hUallacháin and Reid (1997) and Barkema and

Hypothesis 8: *Ceteris paribus*, the larger the industry's size (and hence availability of targets), the greater the likelihood of entering offshore ventures via M&A.

In quickly growing industries, two elements have to be taken into account. Firstly, given that the industry is growing at a high speed, the local supply increase of a GI will not be of major interest for current players and the risk of suffering retaliation from established firms is lower. Conversely, a quickly growing industry will make a quick entry necessary to avoid the loss of profits associated to a slow entry-mode as is GI[21]. Nevertheless, given that growing industries can be attractive for foreign MNC's the competition for targets in those industries is also likely to be high. Norbäck and Persson (2003, 2007) show, that if the competition among MNCs to enter into a foreign industry is high, then the bidding process aiming at acquiring any local strategically valuable firms will end up making M&A more expensive than GI. A developed and growing market will thus provide for the availability of potential M&A targets, but not necessarily make M&A the best option. This explains the existence of GI in industries displaying a recent growth pattern. For very slowly growing industries the same arguments apply as for concentrated industries and M&A entries will therefore be preferred. The hypothesis that can be found in literature is hence:

Hypothesis 9: *Ceteris paribus*, the effect of industry's growth rate on the likelihood of entering offshore ventures via M&A is curvilinear, displaying a U-shape.

Finally, it has to be noted that according to the industrial organization perspective, there will be a natural bias of entering foreign markets through M&A. Norbäck and Persson (2003) model the risk of entering into a new market as composed by two risks, the individual risk of a misinvestment and the market risk if the firm fails to enter the market in a profitable way as expected. If firms are symmetric enough to allow the assumption that market risk is similar to all firms willing to entry, then choosing M&A as the entry-mode may appear attractive since the individual uncertainty associated with a misinvestment would be reduced.

1.2.3.3 Determinants at the host-country level

Several host-country characteristics can be seen as affecting the mode of entry. According to a survey performed on 134 Western European firms in the manufacturing

Vermeulen (1998).

[21] See Caves and Mehra (1986) and Zejan (1990).

sector investing in CEE or CIS countries, market access and lower production costs (relative to other offshoring locations) are the main drivers of their offshoring decisions[22]. In Wes and Lankes' (2001) study, the only determinants that significantly differ between GI and M&A as entry-modes in their importance as decision drivers are the importance of lower costs (more important for GI than for M&A) and the motive of responding to a one-off opportunity due to a country's development transition[23]. Moreover, according to respondents, skilled labor productivity is higher for GI and in GI labor costs are a higher proportion of total production costs, suggesting that GI seem to have higher capital and labor costs (mainly because they are more skilled labor intensive). All three motives suggested by the aforementioned survey are intimately related with host-country characteristics: the host-country's cost structure, its offering of one-off opportunities (e.g. in transition countries) and the availability of skilled labor.

On the other hand, theoretical models like the ones presented in Nocke and Yeaple (2004), Goerg (2000), and Norbäck and Persson (2003, 2007) also introduce variables related to host-country conditions as key decision drivers for the mode of entry.

According to the theoretical model by Nocke and Yeaple (2004), in the limit, as factor price differentials between home and host-country disappear, all transactions are M&A. This is so as in their model the only reason for the existence of GI are factor price differentials[24]. The idea behind this assumption is that only large price differentials will be able to offset the extra costs associated with starting a venture from scratch and hence increase the odds of GI as opposed to M&A[25]. These cost differentials can be either referring to labor, to infrastructure and capital goods, to intermediate inputs or to a combination of the former. The hypothesis associated with this idea is thus:

Hypothesis 10: *Ceteris paribus*, the larger the cost differential between home and host-country, the greater the likelihood of entering offshore ventures via Greenfield Investment.

[22] See Wes and Lankes (2001).

[23] These one-off opportunities can go either way. Either as an opportunity due to cheap or interesting targets, or as investment opportunities encouraged by host-country policies.

[24] See Nocke and Yeaple (2004), Proposition 3, p.20.

[25] Behind this assumption are the original international trade models, that explain FDI as stemming from factor price differentials. See e.g. Bergstrand and Egger (2007).

Cultural distance is also believed to play a substantial role in the choice of the mode of entry. MNCs entering through M&A into a cultural distant country will face more difficulties to transfer organizational practices, corporate values and soft skills in an environment (the acquired firm) where already other practices have been internalized by employees[26]. Contrarily, through GI the MNC can choose the employees, recruit according to its necessities and introduce its organizational culture from the beginning, reducing adaptation costs[27]. The supposition hence goes:

Hypothesis 11: *Ceteris paribus*, the larger the cultural distance between home and host-country, the greater the likelihood of entering offshore ventures via Greenfield Investment.

A country which has acquired a certain degree of specialization as an attractor for certain type of FDI, should work as an attractor – following agglomeration theory – for further FDI. But agglomeration generates two opposite effects, it leads to more competition both at the local industry level as well as in terms of MNCs competing for take-over targets[28] hence increasing market entry costs and on the other hand they produce positive externalities as the markets for intermediate inputs and labor develop to match the growing industry's needs[29]. These positive externalities will make an entry through GI easier. Given the effect on competition for local firms, as well as among local firms and the considerations already discussed in the context of industry level hypotheses, the overall impact of the host-country's specialization on entry-mode decisions is not obvious *a priori* and yields the alternative hypotheses:

Hypothesis 12a: *Ceteris paribus*, the greater a host-country's specialization, the greater the likelihood of entering offshore ventures via Greenfield Investment.

Hypothesis 12b: *Ceteris paribus*, the greater a host-country's specialization, the greater the likelihood of entering offshore ventures via M&A.

[26] See Hofstede (1980), Kogut and Singh (1988), Hennart and Park (1993), Cho and Padmanabhan (1995) and Barkema and Vermeulen (1998).
[27] See Hennart et al. (1996).
[28] See Bertrand and Madariaga (2003).
[29] See Venables (1996) and Fujita et al. (1999).

Macroeconomic and political stability are rather related to the actual decision of entering a host-country at all and can therefore be found in literature dealing with location choices[30], but have not been explicitly included in the literature of entry-mode choice. Still, it can be argued that they may affect the likelihood of GI vs. M&A as well. For example, because greenfield investments require more time to achieve results, mergers and acquisitions seem more attractive in the face of macroeconomic instability which could cut the venture short. In a premature exit, greenfield investments are less likely to have borne fruit than mergers and acquisitions. In fact, Buiter, Lago, and Rey (1998) argue that early transition countries – since they are more volatile as advanced transition ones – will have a riskier macroeconomic environment and the country will hence pay higher discounts on the prices of existing assets. As a consequence, the larger the macroeconomic risk (or the earlier the transition stage of the economy), the more likely becomes M&A as the mode of entry. Although not explicitly exploring the impact of macroeconomic and political stability in their studies, Wilson (1980) includes a variable accounting for the development of a country so as to capture "economic and market conditions of the location of the subsidiaries"[31], while Barkema and Vermeulen (1998) try to control for an overall country risk but do not provide an explanation on why it should affect entry-mode decisions. Overinterpreting the intention in their studies one could state that they depart from the hypothesis that the greater a host-country's macroeconomic and political stability the greater the likelihood of GI as a mode of entry:

Hypothesis 13: *Ceteris paribus*, the greater a host-country's macroeconomic and political stability (i.e. the less a country's risk), the greater the likelihood of entering offshore ventures via GI.

Table 1.1 summarizes the hypotheses above.

[30]See e.g. Veugelers (1991).
[31]See Wilson (1980), p.60.

Table 1.1: Summary of theoretical hypotheses: Predicted signs

Variable	M&A	GI	Hypothesis
MNC characteristics			
Technological expertise	−	+	1
International experience	−	+	2
Host-country experience	−	+	3a
Host-country experience	+	−	3b
Product diversification	−	+	4a
Product diversification	+	−	4b
Product diversification	∩	∪	4c
Previous expertise differential in M&A over GI	+	−	5
Efficiency	−	+	6
Industry characteristics			
Concentration	+	−	7
Size	+	−	8
Growth rate	∪	∩	9
Host-country characteristics			
Cost differential	−	+	10
Cultural distance	−	+	11
Specialization	−	+	12a
Specialization	+	−	12b
Macroeconomic/Political stability	−	+	13

Notes: − means "decreases the likelihood of that entry-mode"; + means "increases the likelihood of that entry-mode"; ∩ and ∪ mean "relationship between the variable in question and the likelihood of the entry-mode is curvilinear".

1.2.3.4 What about Joint Ventures?

To which extent determinants for Joint Ventures will differ from those of full ownership modes, either M&A or GI, is not easy to theorize *a priori*. Main differences will arise from the fact that JV imply a shared ownership, but also will depend on who the partner is: is it a foreign partner? is it from a different industry? is it a host-country local firm? Given the general data scarcity in terms of JV and the lack of detail missing for hypotheses referring to those events in the reviewed literature, I will review certain intuitions with respect to how JV may differ from other entry modes instead of formally stating hypotheses that differentiate them from other entry modes.

According to Chen and Hennart (2002) the difficulty of market entry, e.g. through the existence of market barriers in the host-market, increase the likelihood of an entry via JV. In the same line of reasoning, MNCs with less competitive strengths will probably also favor JV over a fully owned GI, but not necessarily over M&A. This means that variables at all three levels might affect the odds of entering via JV: at the MNC level, the firm's competitiveness should determine if a full or shared ownership is preferred; at the host-country level the existence of market entry restrictions – be it of legal or economic nature – will also favor a JV entry-mode; finally, highly concentrated industries also increase the likelihood of shared ownership entry modes[32].

Other advantages of having a local partner arise in very business unfriendly or culturally different environments, in which local partners will offer the competitive advantage of knowing better the "rules" to circumvent potential problems. Indeed, cultural distance not only affects the interaction with the new unit itself and thus its employees, but it will also have an effect on the management of local vendors, customers, outsourcers and regulatory bodies[33]. In that context having a local partner might be the intermediate point between an M&A and its cultural clash costs within the firm, and a GI and its costs associated with an outward cultural clash. From that point of view one could state that the more cultural distance and the more unfriendly the local business environment, the more likely a JV becomes as the chosen entry-mode.

1.2.3.5 Further hypotheses

Besides the 13 hypotheses presented in this paper, several others are investigated in the literature. These hypotheses mainly refer to subsidiary level determinants and can be found in studies either using microeconomic datasets or survey data for firms in single home-countries[34] or exceptional papers based on survey data for firms in multiple home-countries as Harzing (2002) and Dikova and van Witteloostuijn (2007).

Harzing's (2002) main contribution to the literature on entry-modes was to incorporate the MNC's international corporate strategy as a further explanatory variable. She distinguishes between a multidomestic and a global strategy. The global strategy

[32]See Hennart and Larimo (1998).
[33]See Hennart and Larimo (1998).
[34]See Hennart and Park (1993), Meyer and Estrin (1997), Hennart and Larimo (1998), Padmanabhan and Cho (1999), Brouthers and Brouthers (2000), Chen and Hennart (2002), Cheng (2006) and Slangen and Hennart (2008a).

competes at the global level and is rather focused on generating economies of scale, with subsidiaries responding to the parent and not to local market demand. The multidomestic strategy competes at the domestic level and thus allows for much more independence and horizontality, displaying a decentralized structure where subsidiaries are able to define their strategy, responding to their respective local market's demands. According to these definitions it is expected that global strategies will prefer full ownership modes, in particular GI entries, while multidomestic strategies will increase the odds of M&A entries.

A further relevant variable in the literature is the relative size of the investment or resource commitment. The larger the size the more likely M&A becomes, since management costs and cultural clash can be assumed to be proportional to the size of the new venture[35]. Empirical results confirm this in most studies where this variable is included[36].

The motivation and future role of the new unit are also important. A unit devoted to R&D will need a different talent pool than a manufacturing unit and will also integrate into the MNC's structure differently. The existence of M&A targets for both types of units will probably also differ. R&D units will make full ownership and GI entries more preferable, while market-oriented units are more likely to be acquired[37].

The advertising intensity (of the parent or of the penetrated industry) and the difficulty of building a brand is a further relevant factor and is implemented by several studies[38]. In advertising intensive industries brand recognition can be assumed to be important, and hence such penetrated industries are more likely to be entered by acquisitions or joint ventures as a way to overcome the costs of building a brand.

[35] See Caves and Mehra (1986), Kogut and Singh (1988), Hennart and Park (1993) and Padmanabhan and Cho (1999).

[36] See Hennart and Park (1993), Brouthers and Brouthers (2000), Harzing (2002), Cheng (2006), Dikova and van Witteloostuijn (2007) and Slangen and Hennart (2008b).

[37] See Griffith, Redding, and Simpson (2004) for a study based on UK micro-data, looking at mode of entry for R&D units and its effects on productivity.

[38] See Kogut and Singh (1988), Hennart and Park (1993), Louri (2001), Chen and Hennart (2002), Lopez-Duarte and Garcia-Canal (2002), Chen and Zeng (2004), Cheng (2006) and Dikova and van Witteloostuijn (2007).

1.3 Review of the empirical literature

The first empirical (rather exploratory) work on entry-mode choice can be found in Wilson (1980), who performed an ordinary least squares (OLS) regression on the entries via M&A to total entries ratio of almost 400 multinationals during a period of 70 years. Given the nature of his study and data availability all explanatory variables used where restricted to MNC characteristics. Most studies after Wilson's (1980) paper analyze the mode of entry by means of a binary or categorical dependent variable – e.g. entry via M&A vs. entry via Greenfield Investment – and therefore perform a probit or logistic analysis. A comprehensive review of most important studies in the field can be found in Tables 1.3 to 1.20 in the Appendix. A further strand of the literature not analyzed here looks at the *ex-post* effects of entry distinguishing among different entry modes and their consequences in terms of firm's and the new unit's performance[39], as well as in terms of knowledge spillovers and technology transfer into the host-country[40] and its impact on R&D activity[41].

While the hypotheses highlighted in the previous section review most theoretical arguments that are currently used in the entry-mode literature, empirical studies have found different ways of implementing and analyzing those arguments. Given the inconsistency of their results it is important to understand how these studies operationalize the before- mentioned hypotheses, since different proxies for analogous theoretical constructs may be one of the underlying causes for inconsistencies among the various studies' results. The first part of this section will thus summarize the way empirical studies operationalize the named hypotheses, while the second part of this section will compare their empirical results.

1.3.1 Operationalization of theoretical constructs

The 13 hypotheses stated in the previous section can be tested using different variables to proxy the theoretical constructs behind them. For example, to proxy an MNC's international experience one could use the ratio of foreign sales over total sales[42], or instead use the MNC's export ratio[43]. Nevertheless, one could imagine a fully local firm, that can still be exporting most of its production, without having

[39] See Bertrand, Hakkala, and Norbäck (2007) and Slangen and Hennart (2008a).
[40] See Griffith, Redding, and Simpson (2004).
[41] See Bertrand, Hakkala, and Norbäck (2007).
[42] See Forsgren (1989).
[43] See Brouthers and Brouthers (2000).

any subsidiaries abroad, e.g. commodity producers in developing countries. The above measures would therefore be a mediocre proxy for international experience. Even in the case of MNCs these measures could be mediocre proxies, since due to optimal international taxation strategies, foreign sales or the value of exports are not necessarily reflecting the physical allocation of production processes or the complexity of a firm's multinational structure. The number of subsidiaries abroad or the number of countries the firm operates in can hence be seen as a better measure of international experience. Furthermore, Slangen and Hennart (2007) suggest the number of years the firm has been operating internationally. In other words, a single theoretical construct will develop into multiple empirical proxies and this can be partly generating the differences among results. Please note that while the comparison of proxies that follows is only a summary, in the Appendix, Tables 1.4 to 1.11 display the operationalization of theoretical variables for the reviewed literature in more detail.

1.3.1.1 MNC Technological expertise

According to the first proposed hypothesis, technological expertise should matter since an MNC with higher technological know-how will be less prone to transfer its knowledge into a pre-existing enterprise, and an MNC with less technological expertise is more likely to access certain know-how by acquisition mode, than by GI. Caves and Mehra (1986) proxied the above construct using the R&D intensity of the industry entered, while Larimo (2003) used the R&D intensity of the parent's industry. Both studies used industry proxies, instead of looking at the individual firm's R&D intensity. Although this may account to some extent for the technological expertise of a firm if working with firms from various sectors, it cannot be used if all firms belong to the same industry. To assess an individual MNC's R&D intensity, the most frequent measure are R&D expenditures relative to the number of employees[44], or relative to domestic sales[45], to total sales or turnover[46] or just as an average annual expenditure in the previous 5 years[47]. The latter measures often stem from survey or microeconomic data and are hence difficult to implement in multiple countries studies.

[44]See Hennart (1991), Agarwal (1994), Cho and Padmanabhan (1995).
[45]See Hennart and Park (1993).
[46]See Andersson and Svensson (1994), Padmanabhan and Cho (1999), Brouthers and Brouthers (2000) and Harzing (2002).
[47]See Chen and Zeng (2004).

1.3.1.2 MNC International Experience

In addition to the measures already discussed at the introductory paragraph of this section, several other proxys for an MNC's international experience are suggested by literature. Based on survey data, Meyer and Estrin (1997) consider that the influence of international experience in entry-mode decisions can be understood as a threshold between having or not having experience of this kind, and they thus include a dummy based on the answer of the question whether the event was the first major offshoring event or not. Other studies accounting for an MNC's previous international experience either use the number of years since the firm opened its first unit or subsidiary abroad[48], or the number of countries the firm operates in previous to the offshoring event[49]. On the other hand, Andersson and Svensson (1994) use the age of the firm and the number of manufacturing units it has as a general measure of its experience, without distinguishing whether it is international or not. Zejan (1990) suggests to use the log number of years, given that it can be expected that additional years will have decreasing experience returns and hence affect the mode of entry non-linearly. Padmanabhan and Cho (1999) suggest an improved proxy combining these two types of measures, by multiplying the number of subsidiaries abroad times the years of operating internationally, using a count-years measure for international experience.

1.3.1.3 MNC Host-country experience

Studies accounting for international experience construct analogous proxies for host-country experience using either the time elapsed since the opening of the first unit in the host-country[50], the number of years the firm has had any type of contacts in the region[51], a dummy on the existence of previous offshoring events into the host-country[52], as well as count-years measured in the way explained above, but for subsidiaries in the host-country[53]. Barkema and Vermeulen (1998) use a count-variable that tracks the number of a firm's previous entries into the host economy.

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[48] See Wilson (1980) and Harzing (2002).
[49] See Barkema and Vermeulen (1998).
[50] See Hennart and Park (1993).
[51] See Meyer and Estrin (1997).
[52] See Andersson and Svensson (1994).
[53] See Padmanabhan and Cho (1999).

1.3.1.4 MNC Product Diversification

According to the hypotheses presented earlier, product diversification could affect an MNC's entry-mode decision in different ways, mainly depending on how the diversification relates to technological expertise and management expertise. The relationship is believed to be non-linear and this is the reason why both a proxy for product diversification and its squared value are included as regressors. Most authors working with microeconomic data and accounting for product diversification in their analysis use measures based on the Standard Industrial Classification (SIC) codes[54]. Padmanabhan and Cho (1999) apply an entropy measure for diversification and Hennart and Park (1993) propose a Herfindahl-Hirschman Index (HHI) using the breakdown of the firm's sales and its number of products[55]. The two latter measures account for more complexity in terms of a firms' diversification, than just using the number of different SIC codes or product codes a firm operates in, as it accounts for the relative importance of each industry segment in the total operations of the firm, instead of just including the fact that it operates in a certain industry sub-group. They are therefore more accurate measures of a firm's diversification and should yield differing results, given that counting measures overestimate a firm's diversification by not adjusting the relative weight of each activity in the overall activity.

1.3.1.5 MNC Expertise differential among the different entry-modes

Padmanabhan and Cho (1999) include a count-years variable for a MNC's specific experience in one mode of entry (M&A in their case). This measure has a major drawback given that it does not account for cumulated experience in the other modes, while firms can increase their experience in different modes simultaneously. As it does not measure expertise differentials among the various entry modes it is likely to capture a size effect, as larger firms will have more experience in each specific entry-mode.

[54] Wilson (1980) uses the number of different SIC codes in which the firm's subsidiaries are classified. Meyer and Estrin (1997) use the number of activity codes adjusted by turnover, Barkema and Vermeulen (1998) use the number of SBI codes (analogous to SIC codes for Belgium) in which the firm operates. Finally, both Brouthers and Brouthers (2000) and Harzing (2002) use the number of different product codes.

[55] The authors use the Wernerfelt and Montgomery (1986) modification of the HHI.

1.3.1.6 MNC Efficiency

None of the previous mentioned studies include any variables exploring the impact of firm efficiency on entry-mode decisions. As explained in the theoretical section, the model by Nocke and Yeaple (2004) would imply that less efficient firms are more inclined to enter via M&A, and more efficient firms could capitalize their efficiency differential by affording entries through GI. In a first exploratory analysis, the authors proxy efficiency through firm sales over average industry sales, and through value added per employee relative to the industry's value added per employee mean. No other studies account for firm efficiency.

1.3.1.7 Market entry barrier costs and industry level determinants

As a proxy for the difficulty of entry into the new unit's market, Caves and Mehra (1986) use the number of firms in the size class of the new unit and within the entered industry. Hennart and Park (1993), Hennart and Reddy (1997), Hennart and Larimo (1998) and Chen and Zeng (2004) use a concentration index for the largest 50 companies in each four digit SIC U.S. Industry, to account for the entered industry's concentration. All five studies count with the blessing of only studying the U.S. as a host-market, which provides the needed data availability to account for market concentration. Louri (2001) uses concentration ratios in terms of employment for the 4, 8 and 20 largest firms in the Greek penetrated markets. The fact that most other studies are not accounting for industry level determinants – among them concentration – highlights the difficulty of including these type of measures in the context of multiple country analysis or when entering industries in developing countries, where this type of data is scarce or difficult to retrieve.

Other empirical studies proxy the difficulty of entry through greenfield investment, or equivalently the benefit to quick entry due to the existence of market barriers, through variables looking at the growth of the industry entered relative to the country's growth[56], or at the differential between a sector's growth (using four digits SIC to define sectors) and the mean of all sectors' growth rate, using average annual growth rates over the previous five years[57]. When industry data are scarce, studies use real GNP or GDP growth to account for industry growth[58].

[56] See Meyer and Estrin (1997).
[57] See Chen and Zeng (2004).
[58] See Barkema and Vermeulen (1998) and Larimo (2003), which use the host economy's GDP growth rate and Andersson and Svensson (1994) that use host-country's GDP growth rate.

1.3.1.8 Cost differential between home and host-country

As explained before in hypothesis 10 a large price differential between home and host economies should increase the likelihood of greenfields. Bertrand and Madariaga (2003) use average wages to assess the impact of cost differentials between countries. Other studies as Zejan (1990), Andersson and Svensson (1994), Barkema and Vermeulen (1998) and Padmanabhan and Cho (1999) include host-country development as a way to capture cost differentials. This hypothesis is widely under-researched as none of the reviewed studies – besides Bertrand and Madariaga (2003) – accounts for the cost differential in specific production factors, nor mentions its relevance when making such decisions.

1.3.1.9 Cultural Distance between home and host-country

The measure used by all studies[59] incorporating cultural distance as a variable is based on Kogut and Singh's (1988) methodology, which averages Hofstede's (1980) four cultural dimensions, (i) tolerance of power distance, (ii) uncertainty avoidance, (iii) masculinity-femininity and (iv) individuality[60]. This measure is attractive since it looks at employee's work-related values, being closer to the cultural distance concept that matters to entry-mode decisions than other measures. Nevertheless, this has also been a widely discussed and criticized index, since it is based on survey data that was initially collated by surveying IBM employees in the firm's subsidiaries across the world between 1967 and 1973. It has been extended since, and a re-edition of the dimensions was released in 2001, with its sample having been extended to include pilots from commercial airlines, students, up-market consumers, local elites and others[61]. It can still be argued, that the sampling method used to derive Hofstede's cultural distance indices is far from being random, not even general. In the context of a multinational going abroad, what matters is the cultural differences it will face within the workforce, as well as its reactiveness to changes and direction coming from abroad. Clearly, students, elites and the workforce in one of the most brand-strong multinationals of our time are not a representative sample for a country's workforce. In addition, it can be claimed that the aggregation of all four (or five) dimensions by simple averaging using Kogut and Singh's procedure cannot

[59] See e.g. Barkema and Vermeulen (1998), Padmanabhan and Cho (1999), Brouthers and Brouthers (2000) and Harzing (2002).

[60] Actually, Hofstede (1980) added a further measure accounting for long-term vs. short-term orientation.

[61] See "About..." in http://www.geert-hofstede.com/geert_hofstede_resources.shtml, accessed 26th January 2009.

yield a measure that truly ranks the differences among countries in terms of their work related values in a reliable way.

Using the latest values of Hofstede's five dimensions[62] and applying Kogut and Singh's (1988) methodology, (extended to account for the fifth dimension in those country pairs having a figure for long-term orientation) one can find results that call for caution when using this index to compare distances among different country *pairs*. Although it might be an excellent measure for measuring the cultural distance from different host-countries to an anchor country, when comparing distances between different origin-destination pairs weird results arise. For instance, when comparing different score differentials one can obtain that Belgium and The Netherlands are more distant of each other than Germany and South Korea. Given the subjective nature of the data in this index and the fact that it appears to have rather ordinal than cardinal properties, the ranking of a home-country's distance to several host-countries using this measure might be reliable, but it seems that comparing distance measures across different country pairs might be too adventurous.

1.3.1.10 Host-country specialization as a generator of agglomeration

Industrial hubs and clusters in India and China seem to act as magnets for further investments in that area. In fact, according to agglomeration and the latest economic geography theories a country's reputation as a specialized offshoring spot having attracted a few investments, will attract further investments of a similar type[63]. On the one hand specialization might be seen as a positive externality of agglomeration, while on the other hand it can be seen in the opposite way[64]. It is in fact difficult to determine which of both came first. A good proxy to capture this phenomenon will thus need to capture both dimensions. The only study including a proxy for this theoretical construct is Bertrand and Madariaga (2003) and it uses past FDI to account for agglomeration.

[62] Source: http://www.geert-hofstede.com/hofstede_dimensions.php.

[63] See e.g. Fujita, Krugman, and Venables (1999) and Fujita and Thisse (2002). In fact Le Gall (2007) even argues that firms trying to locate abroad will not consider countries as their location choice, but instead they will directly decide among different clusters.

[64] See Fujita et al (1999), who argue that specialization will lead to agglomeration.

1.3.1.11 Host-country Macroeconomic and Political Stability

As already mentioned, although Wilson (1980) attempted to account for country risk with a developed vs. developing host-country dummy, one could state that only one study of those reviewed in this article include country-risk indicators as control variables for the choice of entry-mode. Barkema and Vermeulen (1998) use a general country-risk measure based on Goodnow and Hansz (1972) complemented with Euromoney ratings.

1.3.2 Comparison of empirical results

The differences in the results obtained in different empirical studies already led to enriching discussions, as the one between Hennart and Reddy (1997) and Reuer and Koza (2000)[65]. As Hennart and Reddy note at the end of their paper, some inconsistencies in results may be generated because of the use of different dependent variables. Accounting for this comment I compare the results of empirical studies by pooling them into sub-groups dealing with the same (or almost identical) dependent variables. Note that the large amount of hypotheses and the relatively small number of empirical studies – under 40 – makes the various subsets of studies accounting for the same hypothesis and/or including comparable variables small, not allowing for a regression-based meta-analysis.

Most studies analyze the mode of entry or establishment mode, comparing only M&A and GI entries. A second strand of the literature compares the entry-mode in terms of its ownership character, distinguishing between full ownership and shared or partial ownership. As already mentioned, by combining these two concepts, one can generate several "new" conceptual (and practical) entry modes as are fully owned acquisitions and greenfields vs. partial acquisition or joint ventures (either acquired or greenfield joint ventures). A few studies use these distinctions to perform multinomial logistic regressions[66], most other studies focus on comparing two entry modes pooling them either by entry-mode or by ownership mode, what makes a comparison among results difficult[67]. As an example, joint ventures are not always classified in the same way, some studies analyze JV as a separate category standing for shared

[65] See Hennart and Reddy (2000).
[66] See e.g., Kogut and Singh (1988), Barkema and Vermeulen (1998), Lopez-Duarte and Garcia-Canal (2002) and Wei, Liu, and Liu (2005).
[67] See Slangen and Hennart (2007).

ownership (vs. fully owned M&A and GI)[68], others include JV within GI since the entity created is a new entity[69] and only a few studies distinguish between different types of JV according to either contractual attributes[70] or to its establishment mode. Among the latter are Barkema and Vermeulen (1998) and Lopez-Duarte and Garcia-Canal (2002), who differentiate among 4 modes of entry, full ownership GI and M&A, as well as greenfield JV and partial acquisitions or JV through M&A[71].

The review of the empirical literature's results will hence be made by comparing studies with similar dependent variables (at least conceptually comparing the same type of entries) and within each strand I will summarize results referring to the hypotheses analyzed in this paper, as well as to other hypotheses not included here. Please refer to Tables 1.12 to 1.20, for a detailed break-down of the summary below in terms of individual papers and their empirical results.

1.3.2.1 M&A vs. GI

Slangen and Hennart (2007) do an extensive survey of the literature focusing exclusively on the choice between M&A vs. GI entry. In addition to the 14 papers there reviewed[72], I review further eight studies assessing the determinants of the choice between M&A and GI as the preferred foreign-entry-mode[73].

As per hypothesis 1, one could expect that MNC with high levels of technological

[68] See Chen and Hennart (2002).
[69] See Hennart and Reddy (1997).
[70] See Wei, Liu, and Liu (2005).
[71] Certain studies compare mixed type of choices, e.g. Hennart and Reddy (1997) who look at the choice between full acquisition – including the dimensions of being a M&A and of WOS – and greenfield joint ventures – including the GI and SOS dimension–, hence capturing some determinants between M&A and GI in general. These type of results are not clear-cut and difficult to interpret, if the motivation behind the analysis is to understand at which dimension – new vs. old, shared vs. full ownership – determinants play a predominant role. The authors suggest to overcome this difficulty by comparing full and partial acquisitions instead, but this would not capture any differences stemming from the choice between a joint venture as an intermediate solution between M&A and GI, and would be biased towards the determinants of acquisitions only, probably only capturing the shared vs. full ownership dimension.
[72] See Wilson (1980), Caves and Mehra (1986), Zejan (1990), Hennart and Park (1993), Andersson and Svensson (1994), Cho and Padmanabhan (1995), Hennart, Larimo, and Chen (1996), Meyer and Estrin (1997), Barkema and Vermeulen (1998), Padmanabhan and Cho (1999), Brouthers and Brouthers (2000), Harzing (2002), Larimo (2003) and Chen and Zeng (2004). I excluded Forsgren (1989).
[73] See O hUallacháin and Reid (1997), Hennart and Reddy (1997), Lopez-Duarte and Garcia-Canal (2002), Bertrand and Madariaga (2003), Nocke and Yeaple (2004), Cheng (2006), Dikova and van Witteloostuijn (2007) and Slangen and Hennart (2008b).

expertise will be more inclined to enter via GI, since a new and controlled environment will be safer in terms of protecting their above-average technical know-how. The reviewed empirical literature is not fully conclusive on the matter, since R&D intensity and the technological expertise of the MNC has been found to be positively related to entry via GI in ten of the summarized studies[74], conversely other studies yield a negative relationship[75] or find no significant relationship between technological expertise and the mode of entry[76]. (See Table 1.12.)

Similarly, international experience, that is hypothesized to be increasing the likelihood of greenfield entry (hypothesis 2), is found to be positively related to GI in Barkema and Vermeulen (1998), Wilson (1980) and Brouthers and Brouthers (2000); conversely Caves and Mehra (1986), Harzing (2002) and Slangen and Hennart (2008b) find it to be negatively related. The remaining seven reviewed studies including this variable obtain non-significant results[77]. Host-country experience is predominantly found to be negatively affecting the odds of a GI entry[78], although five reviewed studies have non-significant results[79] and Hennart, Larimo, and Chen (1996) find a U-shaped relationship, with higher likelihood of GI if host-country experience is rather very low or very high.

The MNC's product diversification is not significant in six studies[80], negatively related to GI likelihood in other six studies[81] and inversely U-shaped in Barkema and Vermeulen (1998), rather supporting hypotheses 4b and 4c. Thus, according to previous studies greenfields are more likely in less diversified MNCs, or according to a non-linear relationship in very little or highly diversified firms.

[74] See Hennart and Park (1993), Andersson and Svensson (1994), Cho and Padmanabhan (1995), Hennart, Larimo, and Chen (1996), Meyer and Estrin (1997), Brouthers and Brouthers (2000), Harzing (2002), Chen and Zeng (2004), Cheng (2006) and Slangen and Hennart (2008b).
[75] See Lopez-Duarte and Garcia-Canal (2002).
[76] See Padmanabhan and Cho (1999), Chen and Zeng (2004), Nocke and Yeaple (2004) and Dikova and van Witteloostuijn (2007).
[77] See Zejan (1990), Cho and Padmanabhan (1995), Meyer and Estrin (1997), Padmanabhan and Cho (1999), Lopez-Duarte and Garcia-Canal (2002), Larimo (2003) and Dikova and van Witteloostuijn (2007).
[78] See Andersson and Svensson (1994), Hennart and Reddy (1997), Barkema and Vermeulen (1998), Nocke and Yeaple (2004) and Slangen and Hennart (2008b).
[79] See Hennart and Park (1993), Cho and Padmanabhan (1995), Meyer and Estrin (1997), Padmanabhan and Cho (1999) and Larimo (2003).
[80] See Hennart and Park (1993), Cho and Padmanabhan (1995), Padmanabhan and Cho (1999), Brouthers and Brouthers (2000), Harzing (2002) and Nocke and Yeaple (2004).
[81] See Wilson (1980), Caves and Mehra (1986), Zejan (1990), Meyer and Estrin (1997), Larimo (2003) and Slangen and Hennart (2008a).

Previous experience in a specific mode or the experience differential between one mode and the other is significant in all studies including this type of variable, irrespective of the experience being in M&A or in GI, and the likelihood of an entry-mode is always positively related with previous experience in that mode or with a positive experience differential in that specific mode over the other ones. Although only a few studies include this variable, the results seem to be robust to different specifications.

As already stated Nocke and Yeaple (2004) find a positive result between firm efficiency and entry through GI, but no further studies include efficiency proxies, so as to be able to say something about this variable's robustness to model specification changes. Barkema and Vermeulen (1998) include free cash availability – which could be seen as proxying the efficiency of a firm – but obtain a negative relationship with GI entry, which is consistent with the fact that free cash flows are a good indicator of a firm's possibilities to acquire other firms.

At the industry level, among the reviewed studies Barkema and Vermeulen (1998) and Caves and Mehra (1986) include the industry's size as a variable to proxy market-entry barriers and their results are non-significant with respect to that variable. Conversely, a larger market is found to be positively linked to GI entry by Bertrand and Madariaga (2003) – using the lagged host-country's GDP – and Nocke and Yeaple (2004) – using log population –, while Zejan (1990) finds non-significant results for market size when proxying it through GDP per capita.

Industry growth or growth deviation are more popular measures for market-entry barriers or the need for a quick entry, but results are not robust across studies here either; in fact, Zejan (1990), Meyer and Estrin (1997) and Brouthers and Brouthers (2000) find a positive relationship, while Hennart and Reddy (1997), Chen and Zeng (2004) and Slangen and Hennart (2008b) find a negative one and the studies by Andersson and Svensson (1994), Barkema and Vermeulen (1998) and Dikova and van Witteloostuijn (2007) yield a non-significant relationship between GI entry and the industry's growth rate. Finally, Hennart and Park (1993), Caves and Mehra (1986) and Hennart, Larimo, and Chen (1996) find an inversely U-shaped relationship which could explain the mixed results above, since the odds of GI would be lower for very slow and very fast growing industries, as expected by hypothesis 9.

At the host-country level results are equally mixed as the above, although in most cases very few studies implement variables that account for hypotheses 10 to 13, exception made for hypothesis 11 (cultural distance).
As already noted, only Bertrand and Madariaga (2003) include a cost variable – in their case labor costs – to expressly account for the cost differential hypothesis. The variable is not significant in their regressions.

To account for cultural distance – and to some extent a cost differential – certain studies include home-country, or host-country dummies. Their results suggest that if the MNC's home-country is the UK, Japan or non-European countries this will increase the likelihood of GI entry, while it being the US increases the likelihood of M&A. Results for Germany are not significant for both studies including a dummy for that country. On the other hand, all dummies for regions included in Lopez-Duarte and Garcia-Canal (2002) are not significant in their regressions. O hUallacháin and Reid (1997) use an indicator for distance that equals one if the US (host) state is at the Pacific coast, and 0 if it is not[82]. For the specific sample of Japanese firms entering the US they find that there is higher likelihood of a GI for those states that are nearer to Japan, than for the others. This would not be the expected relationship departing from hypothesis 11.

With respect to Kogut and Singh's (1988) index, implemented in other eight studies[83] – all of them being based on the same data[84] and constructed in the same way – five studies obtain results that support hypothesis 11, finding a positive relationship between cultural distance and greenfields[85] while the other three display non-significant results[86].

Only Bertrand and Madariaga (2003) account for the specialization/agglomeration

[82]In other words, US states with this distance variable equalling one are less distant.
[83]See Cho and Padmanabhan (1995), Barkema and Vermeulen (1998), Padmanabhan and Cho (1999), Brouthers and Brouthers (2000), Harzing (2002), Larimo (2003), Cheng (2006) and Slangen and Hennart (2008b).
[84]See Hofstede (1980).
[85]See Barkema and Vermeulen (1998), Harzing (2002), Larimo (2003), Cheng (2006) and Slangen and Hennart (2008b).
[86]See Cho and Padmanabhan (1995), Padmanabhan and Cho (1999) and Brouthers and Brouthers (2000).

argument and they find non-significant results. With respect to country risk – as being the best implemented approximation to macroeconomic and political stability – both Wilson (1980) and Barkema and Vermeulen (1998) find that the higher the country risk, the more likely GI becomes. Still, both general country risk and host-country development measures in these studies can be considered to be capturing the cost differential effect and are hence to be interpreted carefully.

As already explained in the previous section, several other hypotheses, besides those presented here, are investigated in the literature. At the MNC level, studies find that followers tend to choose GI over M&A[87], and that this is also the case in advertising intense firms[88]. An MNC with better organizational skills or more experienced in a broad sense, is more likely to choose M&A[89], as well as human resources endowed MNCs[90] and firms with a multidomestic international strategy[91]. At the Industry level most studies looking at the degree of relatedness between the new subsidiary and the parent MNC find non-significant results, although three studies find a positive relationship (more related increases the odds of GI) as expected by transaction cost and internalization theories[92]. Reputation barriers and restructuring costs have an equal number of model specifications finding a positive and a negative link to the entry-mode[93]. As to industry concentration, three studies report insignificant results, one finds a positive and another finds a negative link to GI[94].

Research with data available at the subsidiary or transaction level, also include attributes of the subsidiary. Among them the relative size of the subsidiary with respect to the parent, i.e. the degree of resources commitment needed for the transaction, is present in seven studies[95] and all but Padmanabhan and Cho (1999) find that the larger the size, the less probable are GI entries. The planned subsidiary autonomy increases the likelihood of M&A according to Slangen and Hennart (2008b).

[87] See Hennart and Park (1993) and O hUallacháin and Reid (1997).

[88] Chen and Zeng (2004) and Cheng (2006) find positive results, while Hennart and Park (1993) and Lopez-Duarte and Garcia-Canal (2002) find non-significant results.

[89] See Andersson and Svensson (1994).

[90] See Hennart and Park (1993).

[91] See Harzing (2002) and Dikova and van Witteloostuijn (2007).

[92] See Hennart and Park (1993), Hennart and Reddy (1997) and Chen and Zeng (2004).

[93] See Chen and Zeng (2004) and Meyer and Estrin (1997).

[94] See Hennart and Park (1993), Hennart and Reddy (1997) and Dikova and van Witteloostuijn (2007); Chen and Zeng (2004); and Cheng (2006), respectively.

[95] See Hennart and Park (1993), Padmanabhan and Cho (1999), Brouthers and Brouthers (2000), Harzing (2002), Cheng (2006), Dikova and van Witteloostuijn (2007) and Slangen and Hennart (2008b).

Other results referring to the subsidiary's indigestibility, or its development or motivation are summarized in the tables in the Appendix. Control variables accounting for MNC size and time trends are mostly non-significant.

1.3.2.2 Brownfield Investment vs. M&A or vs. GI

Among the reviewed research only Cheng (2006) deals with brownfield investments (BI). While technically being acquisitions, Brownfield Investments are defined as those transactions in which the target company is acquired to be fully or significantly restructured, i.e. they are acquired to be recycled. Even though Cheng's (2006) results are not comparable to those of other studies they are still relevant (and therefore included here) to understand how certain variables determining the choice between GI and M&A are relevant at pre- or post-acquisition stages.

The extent to which BI differs in its determinants from GI, can reveal part of the determinants between acquiring or starting something fully new, *irrespective* of the costs of building something from scratch, since these type of costs (in form of restructuring costs) will affect both greenfields and brownfields.

In addition, comparing BI to M&A, also sheds light on how important (re)structuring costs are to dissuade M&A, since the main difference between BI and M&A are the post-acquisition costs associated with the recycling of the BI unit.

Cheng (2006) results suggest that the main differences in entering via M&A or via BI are the MNC's technological intensity, as well as its advertising intensity, both reducing the odds of M&A. One could argue, that the intuition behind these results is that high R&D intensity, as well as to be strong in its marketing abilities, are entry-mode determinants at the level of set-up costs and post-acquisition unit management, since this is where BI and M&A will differ, and not in pre-acquisition stages. In addition, the more training and remuneration intensity the MNC has for its expatriates, the more likely M&A becomes, since these costs will be higher in brownfields than in M&A.

Conversely, if the choice is between BI and GI, advertising intensity will favor GI, as well as a larger cultural distance. Previous M&A experience, a concentrated target industry and a large resource commitment make GI less likely against BI, where market-entry will be faster. Here too, the MNC's training and remuneration intensity is significantly related to entry-mode choice, but making GI less likely than BI, since a new enterprise will probably require more expatriates than brownfields.

1.3.2.3 M&A vs. GI vs. JV

What distinguishes a joint venture from full or controlling M&A and GI is the fact that in a JV two or more firms pool their assets to form a new entity, of which they will share ownership and control[96]. This can happen through an acquisition of a previous existing enterprise, or conversely the agreement can be planned to create a new venture from scratch. Kogut and Singh (1988) pioneered in the field by distinguishing among the three entry modes and performing a multinomial logistic regression with firm data of the early 1980s. Their findings supported the hypothesis of cultural distance increasing the odds of greenfields, both using an averaged indicator as well as in each of Hofstede's uncertainty avoidance components. Furthermore they find that for non-US firms, size is positively linked to GI likelihood. For US firms on the other hand size decreases the odds of greenfields. Also, manufacturing firms are more likely to build units from scratch, as opposed to M&A as mode of entry, highlighting the importance of subsidiary level determinants, as in this case the sector they belong to. Joint ventures in turn are more likely for technically expert MNCs, the larger a US firm, and also for larger cultural distance. These results support the hypothesis that new entities (GI and JV) are preferred if cultural distance – in organizational terms, since the index is based on Hofstede's (1980) indicators – is large.

1.3.2.4 Full Ownership vs. Shared Ownership

Besides the literature around entry-mode, there are also studies dealing with the ownership structure decision in cross-border ventures, distinguishing between JV and fully owned ventures[97]. Only a few combine the distinction between ownership and entry-mode, looking at a multinomial decision framework[98] or doing different sets of regressions that look at the determinants of entry-mode or of ownership-mode

[96] See Kogut and Singh (1988).

[97] See e.g. Erramili and Rao (1993), Gatignon and Anderson (1988), Hennart (1991), Hennart and Larimo (1998) and Chen and Hennart (2002).

[98] See Barkema and Vermeulen (1998), Kogut and Singh (1988) and Lopez-Duarte and Garcia-Canal (2002).

and comparing their results[99].

Here too, results seem not to be robust to different model specifications. The MNC's technological intensity is positively related to shared ownership in Hennart and Larimo (1998), negatively related in Padmanabhan and Cho (1999) and Dikova and van Witteloostuijn (2007), and is not significant in Chen and Hennart (2002), in none of the proxies used: neither R&D expenditures at the firm level nor at the industry level are significant. Furthermore, distinguishing between low and high technology industries in Dikova and van Witteloostuijn (2007) does not yield significant results either.

With respect to international experience, Dikova and van Witteloostuijn (2007) obtain a negative link between shared ownership and international experience, while Padmanabhan and Cho (1999) obtain non-significant coefficients for that variable, as well as for host-country experience. Hennart and Larimo (1998) obtain similar results. Contrarily, Dikova and van Witteloostuijn (2007) find a significant positive relationship between the MNC's regional experience and the likelihood of shared ownership.

Another variable that is found to be significantly increasing the odds of shared ownership is the existence of restrictions to foreign ownership[100], which seems to be straightforward since in those cases having a local partner is the best way to overcome those restrictions. Access to natural resources also appears to be significantly increasing the likelihood of shared ownership[101] and this could be related to the fact that the access to natural resources is usually more regulated than the entry into other sectors. Institutional advancement is also found to be positively linked to the odds of shared ownership as opposed to full ownership[102], as well as industry concentration[103], and the MNC's and subsidiary's size[104].

[99] See Hennart and Reddy (1997), Padmanabhan and Cho (1999) and Dikova and van Witteloostuijn (2007).
[100] See Padmanabhan and Cho (1999).
[101] See Hennart and Larimo (1998) and Chen and Hennart (2002).
[102] See Dikova and van Witteloostuijn (2007).
[103] See Hennart and Larimo (1998).
[104] See Hennart and Larimo (1998), Padmanabhan and Cho (1999) and Dikova and van Witteloostuijn (2007).

1.3.2.5 Full M&A vs. Partial M&A vs. GI vs. JV(GI)

Barkema and Vermeulen (1998) compare full M&A against partial M&A, GI and JV – being JV defined as greenfield JV –, with full M&A as the base outcome. Most regressors are found to be not significant for the odds of partial acquisitions as opposed to full acquisitions, exception made for free cash availability which decreases the likelihood of partial acquisitions according to their results. This result is in line with the expected since cash availability is believed by practitioners to be a main driver of M&A activity and the higher the availability the more likely full acquisitions become. In fact, free cash availability is decreasing the odds of all three alternative entry modes if compared to full acquisitions. MNC size is found to increase partial acquisitions' odds, as well as the interaction term accounting for MNC international experience and product diversification.

Furthermore, according to Barkema and Vermeulen (1998), all explanatory variables that are significantly affecting the likelihood of JV and of GI (as preferred entry-mode over full acquisitions) affect both modes of entry in the same way. (See Table 1.20 for details.) In other words, it seems that the determinants inclining a firm to choose GI and JV over full acquisitions are similar.

Lopez-Duarte and Garcia-Canal (2002) look at full M&A, partial M&A and greenfield JV, as opposed to GI entry, obtaining few significant results. The effects of regressors on the likelihood of choosing a full or a partial acquisition over a GI behave similarly. Technological intensity seems to increase likelihood of both full and partial M&A when compared to GI entry, which contradicts hypothesis 1. Cultural distance decreases their odds, being in line with hypothesis 11. Furthermore, internationally experienced MNCs are less prone to choose JV over GI according to their results. This can be seen as contradicting hypothesis 2 – which technically compares GI to M&A and not to JV – since GI can be considered the most complex entry-mode of the three in terms of the initial effort required and its long term associated risks. Still, given JV require negotiation skills that can also be associated to international experience, the results are not surprising. MNCs' size and entering culturally distant countries also increase the odds of JV over GI. The latter result is interesting, since it suggests that between GI and JV, as well as between M&A and JV, JV are preferred in culturally distant host-countries. This supports the intuition that having a local partner is an efficient way of sorting out difficulties in an unknown environment and a intermediate solution to deal with cultural clashes within the firm and with respect to the local external environment.

1.4 Why are results across studies so different? An explanation

Summarizing the findings of the previous section it can be stated that results are not consistent across studies, even when controlling for the fact that only studies looking at the same dependent variable are compared. In addition, for those studies looking at more than one model specification results are not robust to model specification either. Sadly, most of the reviewed papers do not present any model specification tests, nor robustness checks for their significant variables. Several reasons can be argued to be generating the inconsistency of results: (a) different operationalization of variables, (b) different type of data leading to mediocre proxies at the firm or industry level, (c) omitted variable biases, stemming from (c.1) ad-hoc modeling and lack of model misspecification testing and (c.2) explanatory variables not included at all relevant levels due to data availability, (d) the lack of interaction effects among different hypotheses and (e) insufficient modeling of host-country determinants.

1.4.1 Different operationalization of variables

Differing operationalization of theoretical constructs, in addition to sample specificities seems to be the most straightforward cause of differences among results. Clearly, an international experience measure accounting for the number of countries in which a MNC is present, will not capture the temporal dimension needed to truly assess whether the MNC has only recently become international or whether its international experience is already mature. Likewise, proxies only looking at the number of years an MNC has been internationally active, will not reflect how broad the firm's international network is. In this sense, both measures will be capturing different dimensions of a firm's international experience and hence account for different effects.

In terms of a firm's technological expertise, half of the studies including that variable use R&D over sales as a proxy, three studies construct their variable with Likert-type (and hence subjective) survey responses, and the rest of the studies approximates the

R&D intensity of a firm through the technological intensity of the industry it belongs to. While the first measures are stemming from hard data and capture a firm's effort in pursuing innovation and developing in-house technological expertise, the second type of measures stem from subjective data, while the third type of measures neglect firm-specificities at all. Here too, although used for the same theoretical construct, variables will shed light on different attributes of a firm's technological intensity.

At the industry level, similar concerns can be raised. For example when it comes to operationalize industry growth, certain studies look at sector growth in employment, while others do it with respect to production. For countries in which employment rigidities are higher, or capital-labor intensity differ, these two growth measures will reflect different growth patterns, that do not necessarily reflect the extent to which an industry is growing. Production growth will probably better capture the fact that an increase in local supply will matter less – as needed to operationalize hypothesis 9 – while growth in employment rates will be influenced by labor supply availability and employment rigidities. In addition, given data unavailability, some studies proxy industry growth through the host-country's GDP or GNP growth, not being able to distinguish between quickly and slowly growing industries within the host-country. Finally, also here, studies with survey data account for industry growth based on respondents subjective perceptions.

Even if one compares the results among these sub-classes of proxies, these are still inconsistent among studies. As an example, 7 of 10 studies accounting for cultural distance use exactly the same index stemming from the same data, namely Kogut and Singh's (1988) index based on Hofstede data. Kogut and Singh (1988), Barkema and Vermeulen (1998), Harzing (2002) and Cheng (2006) obtain a significant positive relationship between cultural distance and the likelihood of GI, while Slangen and Hennart (2008b) sometimes obtain a negative relationship and other times a positive one depending on the model they use, and neither Brouthers and Brouthers (2000), nor Padmanabhan and Cho (1999) obtain significant results. The differences in the operationalization of variables can hence not be the only source of inconsistencies.

1.4.2 Mediocre proxies at the firm or industry level

As was highlighted above, the lack of industry and firm data leads to very different strategies of approximating theoretical constructs. Of all 27 studies reviewed, 4 are multiple home-country and host-country studies (MuMu), 4 look at multiple home-countries entering a single host-country (MuSi), 12 look at firm's from a single country or from two countries entering multiple host-countries (SiMu) and the remaining seven look at one or two home-countries entering a single host-country (SiSi). Furthermore, all studies but O hUallacháin and Reid (1997)[105] look at firms from multiple industries, although seven studies restrict their analysis to manufacturing industries.

As already mentioned in previous sections, studies dealing with multiple host-countries and multiple industries find it difficult to operationalize the theoretical constructs for host-country level variables, as well as for variables at the industry level for penetrated industries. Data on very differing host-countries is difficult to obtain at the industrial level and even when being available they might not be comparable across countries. Analogously, studies with multiple home-countries rarely have microeconomic data or survey data that allows to fully assess the characteristics of parent companies, while accounting differences among home-countries makes it difficult to compare such data even in those cases in which it is available. Both of these difficulties are present in multiple – home and host – country studies. So, while MuMu studies might have more generalizable findings giventhat they are not restricted to single home and host-country pairs, they usually lack the necessary detail or accuracy in the variables used to approximate theoretical constructs. Conversely, SiSi studies usually have better operationalization possibilities for theoretical constructs, but are not generalizable to other country pairs. In fact, all seven SiSi studies included here[106] focus on Japanese investments entering the U.S.[107]

So, although industry level determinants are hypothesized to be of relevance in most studies, certain authors are only able to account for them using country level data: Andersson and Svensson (1994) and Larimo (2003) use host-country GDP growth and Barkema and Vermeulen (1998) use host-country GNP growth for proxying industry growth; Barkema and Vermeulen (1998) proxy industry size by real host-country GNP; Zejan (1990) and Betrand and Madariaga (2003) use host-country GDP to proxy industry or market size, while Nocke and Yeaple (2004) look at host-

[105] O hUallacháin and Reid (1997) focus on the automobile sector only.

[106] Hennart and Park (1993), Hennart et al. (1996), O hUallacháin and Reid (1997), Hennart and Reddy (1997), Hennart and Larimo (1998), Chen and Hennart (2002) and Chen and Zeng (2004).

[107] Two of these studies – Hennart et al. (1996) and Hennart and Larimo (1998) – also look at Finnish investments into the U.S.

country population data. All these are mediocre proxies for industry size and industry growth as even in quickly growing countries, industries will differ in their growth pattern. In fact, for emerging countries, overall GDP growth may be stemming from a change in the country's industrial mix, with certain industries being substituted by others. For example, in certain technological hubs in India, low technology industries are shrinking or being relocated. This could be the precise reason why e.g. a vertically organized MNC could be looking to enter that industry, since targets or labor in that area have become cheaper. An overall country level growth indicator, will not be able to capture these nuances introducing noise in the estimates.

Similarly, at the firm level, variables as R&D intensity, advertising intensity or product diversification are sometimes operationalized through the analogous variable at the industry level given that no microeconomic data are available. In this way, differences between firms within the same industry cannot be assessed and even worse, firms with an above average R&D or advertising intensity, are pooled together with their peers that have below average intensities in those categories. Given that e.g. the motivation to protect an R&D investment can be seen as being almost the opposite for above sector average technological intensive firms, than for those below, this type of approximation will bias estimates towards non-significance.

1.4.3 Omitted variable biases

It can therefore be said, that most studies reviewed in this paper encounter operationalization difficulties at different levels, depending on the type of data they manage. These difficulties are either addressed by using mediocre proxies, not necessarily capturing the underlying theoretical concept, or by not accounting for theoretical constructs at the level in question at all. Not accounting for certain hypotheses at all will lead to omitted variable biases. That will also be the case if the analysis concentrates on only one or two of the four relevant levels, whitout controlling for the not analyzed ones.

Indeed, while all studies include variables at the firm level, only 60% of studies (16) try to account for industry level variables, 74% (20) include at least one host-country level variable and less than 50% include subsidiary level determinants. Finally, only five studies include determinants at all four levels[108].

[108] Hennart and Park (1993), Meyer and Estrin (1997), Dikova and van Witteloostuijn (2007), Barkema

1.4.3.1 Missing relevant levels

Studies neglecting the existence of variables within a certain level will not only miss the information with respect to those determinants, but also will not be able to disentangle the effect of variables at that level, in their included proxies at other levels. Say, by not accounting for the penetrated industry's determinants, host-country variables will be capturing the individual effects of their embedded industries. Similarly, if neglecting the parent industry's determinants, then firm-level variables will account for those effects. Studies missing a whole relevant level should therefore at least include dummies to control for intra-level differences, i.e. firm-dummies, sector-dummies, home-country dummies, or host-country dummies.

Although this seems straightforward, only 5 of 27 studies explicitly try to account for all four relevant information levels.

1.4.3.2 Lack of model misspecification testing

Independently of whether certain levels have been neglected or not, it is surprising that most available papers on entry-mode choice do not perform, or at least do not report, model misspecification testing. Certain studies, as Slangen and Hennart (2008b), look at different model specifications, but no robustness check is performed on the results. Given the contradictory perspectives in terms of the impact of certain variables on entry-mode decisions provided by different theories, as well as the lack of a comprehensive and widely accepted theoretical model in this area, most econometric models are adjusted ad-hoc, either integrating insights from various – sometimes contradicting – theories or just including the perspective of one single theoretical approach. In both cases the econometric model may suffer from misspecification, in the first case because of lack of internal-consistency and in the second because of the omission of variables. It is therefore highly recommendable that studies in the area perform model misspecification tests and robustness checks to determine if their results are the fortuitous outcome of the implemented ad-hoc model or if they are indeed robust to changes in model specification.

and Vermeulen (1998) and Slangen and Hennart (2008b).

1.4.4 Interaction effects among hypotheses

As already suggested by Slangen and Hennart (2007) certain variables might be moderating the effects of other variables. As an example the authors suggest that the extent to which the new unit will be integrated into the overall structure of the MNC, i.e. whether a vertical or horizontal motivation is behind the acquisition or greenfield investment, will affect the relevance of the MNC's host-country experience or the cultural distance between home and host-country as determinants for the entry-mode decision. These interactions work across levels, since the MNCs characteristics – experience, diversification, organization – will affect the way host-country or industry level determinants come into play. If all relevant hypotheses are implemented and the effects would only be additive, this should not play a significant role, since the regression results for one variable are conditional on the effects of the accompanying variables and both effects would be captured. In the above example, if the main driver of the decision is the vertical integration of a new unit, this may incline the odds of the decision towards GI so that being culturally near to the host-country will not have any impact on the decision. If the main concern of the firm is the cultural distance – say conditioned due to previous bad experiences – then cultural distance will prevail as a determinant. But if the effect of those variables is not believed to be additive, i.e. if cultural distance's relevance as a decision driver depends on the planned level of integration of the new unit, then only an interaction term will be able to capture the moderating effect of one variable over the other.

As an example, Slangen and Hennart (2008b) find a positive relationship for cultural distance and GI in most of their specified models, but when letting cultural distance interact with the MNC's international experience or with its experience in a specific entry-mode, the interaction term turns out positive and the remaining effect of cultural distance becomes significantly negative. This suggests that the effect of cultural distance on the mode of entry is attenuated by the MNC's experience, so that for culturally distant countries the preferableness of GI as an entry-mode increases if the MNC has vast international experience or if the MNC has much experience in either types of entry-mode, but once accounted for the level of experience of the MNC in those areas, distance seems to reduce the preference for GI.

These interaction effects might be found between several variables and theoretical constructs: MNC experience might mitigate the effects of cultural distance; horizontal vs. vertical integration will affect the importance of market-entry barrier costs; M&A experience could lessen the importance of asymmetric information; MNC technological intensity could interact with the impact of the host-country's specialization; etc.

A main source of finding inconsistent results across studies and – to a large extent – the majority of non-significant results in the studies reviewed, could therefore be due to the absence of interaction terms that account for the above described mechanisms.

1.4.5 Insufficient modeling of host-country determinants

Finally, it has to be noted that although there is an overwhelming amount of theoretical approaches dealing with firm and industry level determinants, little has been said about host-country level determinants. Although location choice decisions have been modeled upon host-country attributes, in the context of foreign establishment decisions little has been researched besides cultural distance between home and host-country. It is evident that production factor cost differentials, as well as country risk and country development are major drivers when deciding between two foreign locations. But once that decision has been made, it should be interesting to assess if those same variables have a direct effect on the mode of entry. Just capturing an overall country risk or the cultural distance between home and host-country, will not be able to disentangle the effects of country employment rigidities, the extent to which a country is business friendly, the availability and quality of labor or the development of its infrastructure. Given that GI will have to build a unit from scratch, these factors can be understood to be of upmost importance in the entry-mode decision since they will affect GI entry modes, while not necessarily M&A entries. Surprisingly these variables have not been explored yet which might have led yo severe biases in multi-host-country studies.

1.5 Conclusions and suggestions for future research

The core decision of defining the type of entry in an offshore venture is central to determining the access to talent, knowledge and production factors and has been analyzed by the literature from several theoretical standpoints – including transaction costs and internalization theory, organizational learning and industrial organization strains, among others. In addition, several empirical studies have analyzed to which extent these theories are recognizable in empirical data using different sub-sets of home and host-countries along different time periods.

In this paper I show that previous empirical studies analyzing the entry-mode decision of firms into foreign countries display a high variability in terms of the variables they use, how these variables are operationalized and the results they obtain. By analyzing those differences in depth this paper is able to identify five potential sources for the inconsistencies found.

Firstly, most studies are found to apply different operationalization of identical theoretical constructs, mainly due to data availability issues. Although this is the most straightforward source for differences, it is shown that even among studies using an identical operationalization and the same data, inconsistencies persist.

As a second source of inconsistencies, besides the differences in operationalized variables, the operationalization itself comes under scrutiny. Here, mediocre proxies for certain firm level attributes, sometimes approximated at the industry level, or industry level characteristics approximated by host-country level data are understood to be introducing noise in the regressions biasing results towards non-significance. Also due to the lack of data, some studies neglect the existence of relevant variables at certain levels – being the subsidiary and industry levels the most affected – generating omitted variable biases. Since most analyzed studies use either binomial or multinomial logit specifications, the omitted variable bias becomes even more relevant. In fact, even in those cases in which omitted variables are orthogonal to regressors, estimated *ceteris paribus* coefficients will be downward biased, with a variance of coefficients that is directly related to the unobserved heterogeneity. According to Lee (1982) only if the omitted variable is independent of the regressors conditional on the response variable there would be no bias, which is a highly restrictive assumption that cannot be assumed to hold in the context of the models on entry-mode decisions. Other simulation studies looking into misspecification of discrete response models, as Ruud (1983), demonstrate that coefficients can be estimated consistently up to a certain – unknown – scaling factor. Although these findings would allow at least for a relative interpretation of the effects in empirical studies suffering from omitted variable biases, they only hold under restrictive assumptions as well. In any case, the reviewed studies not only do not discuss the effects on their results and how these should be interpreted in case there would be omitted variables, but they also fail to report any model misspecification tests. This makes it difficult to assess whether the obtained results are robust to model specification, the latter usually stemming from ad-hoc modeling and not being based on a comprehensive theoretical model.

A further source of inconsistencies is that only one out of 27 studies accounts for interaction effects among the various theoretical constructs, although there seems to be plenty of room to believe that these effects are truly important[109]. Finally, the modeling of determinants for entry-mode decisions at the host-country level is widely under-researched and host-country determinants are controlled for rather generally, instead of distinguishing among different host-country attributes that may affect entry-mode decisions in opposite directions.

The previous analysis suggests that future research should try to (1) include variables at all four levels or at least caveat for the absence of some of those levels, trying to account for their impact on decisions through level-individual effects implemented at least through dummies; (2) perform robustness analysis and model misspecification tests to make sure that given the sample and period analyzed, the results found are robust to model specification and potential non-randomness of the used data; (3) account for the interaction effects between the theoretical constructs and (4) model the host-country determinants in more detail to distinguish between host-country factors that affect entry-mode decisions directly, by having differentiated impacts on the life cycle of the new unit.

[109] See e.g. Slangen and Hennart (2008b).

Bibliography

Agarwal, S. (1994). Socio-cultural distance and the choice of joint ventures: A contingency perspective. *Journal of International Marketing 2*(2), 63–80.

Andersson, T. and R. Svensson (1994). Entry Modes for Direct Investment Determined by the Composition of Firm-Specific Skills. *Scandinavian Journal of Economics 96*(4), 551–560.

Barkema, H. and F. Vermeulen (1998). International Expansion through start-up or acquisition: a learning perspective. *Academy of Management Journal 41*(7), 7–26.

Bergstrand, J. and P. Egger (2007). A knowledge-and-physical-capital model of international trade flows, foreign direct investment, and multinational enterprises. *Journal of International Economics 73*(2), 278–308.

Bertrand, O., K. Hakkala, and P. Norbäck (2007). Cross-Border Acquisition or Greenfield Entry: Does it Matter for Affiliate R&D. IFN Working Paper No. 693, Research Institute of Industrial Economics.

Bertrand, O. and N. Madariaga (2003). U.S. Greenfield Investments and M&A location: impact of American continental integration and Insider vs. Outsider position. In *Royal Economic Society Annual Conference 2003*. Royal Economic Society. http://repec.org/res2003/Bertrand.pdf (accessed June 9, 2008).

Brouthers, K. and L. Brouthers (2000). Acquisition or greenfield start-up? Institutional, cultural and transaction cost influences. *Strategic Management Journal 21*(1), 89–97.

Buckley, P. and M. Casson (1976). *The Future of the Multinational Enterprise*. New York: Holmes & Meier.

Buckley, P. and M. Casson (1998). Analyzing Foreign Market Entry Strategies: Extending the Internalization Approach. *Journal of International Business Studies 29*(3), 539–562.

Buiter, W., R. Lago, and H. Rey (1998). Financing in transition: investing in enterprises during macroeconomic transition. EBRD Working Paper 35, (London: European Bank for Reconstruction and Development), mimeo.

Caves, R. and S. Mehra (1986). Entry of foreign multinationals into US manufacturing industries. In *Competition in Global Industries*, Ed. M. Porter, 449-481. Boston, MA: Harvard Business School Press.

Chen, S.-F. and J. Hennart (2002). Japanese Investors' Choice of Joint Ventures Versus Wholly-owned Subsidiaries in the US: The Role of Market Barriers and

Firm Capabilities. *Journal of International Business Studies 33*(1), 1–18.

Chen, S.-F. and M. Zeng (2004). Japanese investors' choice of acquisitions vs. startups in the US: the role of reputation barriers and advertising outlays. *International Journal of Research in Marketing 21*(2), 123–136.

Cheng, Y.-M. (2006). Determinants of FDI mode Choice: Acquisition, Brownfield, and Greenfield Entry in Foreign Markets. *Canadian Journal of Administrative Sciences 23*(3), 202–220.

Cho, K. and P. Padmanabhan (1995). Acquisition versus new venture: The choice of foreign establishment mode by Japanese firms. *Journal of International Management 1*(3), 255–285.

Davies, S. and B. Lyons (1996). *Industrial Organization in the European Union*. Oxford: Clarendon Press.

Dikova, D. and A. van Witteloostuijn (2007). Foreign direct investment mode choice: entry and establishment modes in transition economies. *Journal of International Business Studies 38*(6), 1013–1033.

Dunning, J. (1981). Explaining the International Direct Investment Position of Countries: Towards a dynamic and development approach. *Weltwirtschaftliches Archiv 117*(1), 30–64.

Dunning, J. (1993). *Multinational Enterprises and the Global Economy*. Reading, MA and Wokingham, UK: Addison Wesley.

Erramili, M. and C. Rao (1993). Service firms' international entry-mode choice: a modified transaction-cost analysis approach. *Journal of Marketing 57*(3), 19–38.

Ferrett, B. (2003). Greenfield Investment versus Acquisition: Positive Analysis. GEP Research Paper 2003/02, http://search.ssrn.com/sol3/papers.cfm?abstract_id=408922 (accessed June 9, 2008).

Forsgren, M. (1989). Foreign acquisitions: Internalization or network interdependency? *Advances in International Marketing 3*(1), 141–159.

Fujita, M., P. Krugman, and A. Venables (1999). *The Spatial Economy: Cities, Regions and International Trade*. Cambridge, Mass.: MIT Press.

Fujita, M. and J. Thisse (2002). *Economics of Agglomeration: Cities, Industrial Location, and Regional Growth*. Cambridge, UK ; New York : Cambridge University Press.

Gatignon, H. and E. Anderson (1988). The Multinational Corporation's Degree of Control over Subsidiaries: An Empirical Test of a Transaction Cost Explanation. *Journal of Law, Economics and Organization 4*(2), 305–336.

Goerg, H. (2000). Analysing foreign market entry: The choice between greenfield investment and acquisition. *Journal of Economic Studies 27*(3), 165–181.

Goodnow, J. and J. Hansz (1972). Environmental determinants of overseas market entry strategies. *Journal of International Business Studies 3*, 33–50.

Griffith, R., S. Redding, and H. Simpson (2004). Foreign Ownership and Productivity: New Evidence from the Service Sector and the R&D Lab. *Oxford Review of Economic Policy 20*(3), 440–456.

Harzing, A.-W. (2002). Acquisitions versus greenfield investments: international strategy and management of entry modes. *Strategic Management Journal 23*(3), 211–227.

Hennart, J. (1982). *A Theory of the Multinational Enterprise*. Ann Arbor: University of Michigan Press.

Hennart, J. (1988). A transaction cost theory of equity joint ventures. *Strategic Management Journal 9*(4), 316–374.

Hennart, J. (1991). The Transaction Costs Theory of Joint Ventures: An Empirical Study of Japanese Subsidiaries in the United States. *Management Science 37*(4), 483–497.

Hennart, J. and J. Larimo (1998). The Impact of Culture on the Strategy of Multinational Enterprises: Does National Origin Affect Ownership Decisions? *Journal of International Business Studies 29*(3), 515–538.

Hennart, J., J. Larimo, and S.-F. Chen (1996). Does National Origin Affect the Propensity of Foreign Investors to Enter the United States through Acquisitions? Discussion Paper no. 189, University of Vaasa, Finland.

Hennart, J. and Y. Park (1993). Greenfield vs Acquisition: The Strategy of Japanese Investors in the United States. *Management Science 39*(9), 1054–1070.

Hennart, J. and S. Reddy (1997). The Choice between Mergers/Acquisitions and Joint Ventures: the Case of Japanese Investors in the United States. *Strategic Management Journal 18*(1), 1–12.

Hennart, J. and S. Reddy (2000). Digestibility and Asymetric Information in the Choice between Acquisitions and Joint Ventures: Where's the Beef? *Strategic Management Journal 21*(2), 191–193.

Hofstede, G. (1980). *Culture's Consequences: International Differences in Work Related Values*. Beverly Hills, CA: SAGE.

Kogut, B. and H. Singh (1988). The Effect of National Culture on the Choice of Entry Mode. *Journal of International Business Studies 19*(3), 411–432.

Larimo, J. (2003). Form of investment by Nordic firms in world markets. *Journal of Business Research 56*(10), 791–803.

Le Gall, S. (2007). La localisation de I'investissement internationalement mobile: le choix du cluster. *Économies et Sociétés 17*(4), 803–832.

Lee, L. (1982). Specification error in multinomial logit models. *Journal of Econometrics 20*, 197–209.

Lopez-Duarte, C. and E. Garcia-Canal (2002). The Effect of Firm and Host Country Characteristics on the Choice of Entry Mode: Empirical Evidence from Spanish Firms. *Journal of Management and Governance 6*(2), 153–168.

Louri, H. (2001). Entry through Acquisition: Determinants of Multinational Firm Choices. *Review of Industrial Organization 19*(2), 199–209.

Meyer, K. and S. Estrin (1997). Privatisation acquisition and direct foreign investment: who buys state-owned enterprises? *MOCT-MOST: Economic Policy in Transnational Economies 7*(1), 159–172.

Mueller, T. (2001). Analyzing Modes of Foreign Entry: Greenfield Investment versus Acquisition. *University of Munich* Discussion Papers in Economics 2001-1, http://epub.ub.uni-muenchen.de/13/1/0101_mueller.pdf (accessed June 9, 2008).

Newburry, W. and Y. Zeira (1997). Generic Differences Between Equity International Joint Ventures (EIJVs), International Acquisitions (IAs) and International Greenfield Investments (IGIs): Implication for Parent Companies. *Journal of World Business 32*(2), 87–102.

Nocke, V. and S. Yeaple (2004). An Assignment Theory of Foreign Direct Investment. *NBER Working Paper* 11003, National Bureau of Economic Research. http://www.nber.org/papers/w11003.pdf (accessed December 20, 2007).

Norbäck, P. and L. Persson (2003). Cross-Border Acquisitions and Greenfield Entry: Profitability and Stock Market Value. *Centre of Economic Policy Research*, Discussion Paper No. 3998: 1-31.

Norbäck, P. and L. Persson (2007). Globalization and Profitability of Cross-Border Mergers & Acquisitions. *Centre of Economic Policy Research*, Discussion Paper No. 6102: 1-42.

O hUallacháin, B. and N. Reid (1997). Acquisition versus Greefield Investment: The location and growth of Japanese manufacturers in the United States. *Regional Studies 31*(4), 403–416.

Padmanabhan, P. and K. Cho (1999). Decision-specific experience in foreign ownership and establishment strategies: Evidence from Japanese firms. *Journal of International Business Studies 30*(1), 25–44.

Reuer, J. and M. Koza (2000). On Lemons and Indigestibility: Resource Assembly through Joint Ventures. *Strategic Management Journal 21*(2), 195–197.

Rugman, A. (1981). *Inside the Multinationals: The Economics of Internal Markets*. London: Croom Helm.

Ruud, P. (1983). Sufficient conditions for the consistency of maximum likelihood estimation despite misspecification of distribution in multinomial discrete models. *Econometrica 51*, 225–228.

Sala-i-Martin, X. (1997a). I Just Ran Four Million Regressions. NBER Working Paper 6252, National Bureau of Economic Research. http://www.nber.org/papers/w6252.pdf (accessed December 20, 2007).

Sala-i-Martin, X. (1997b). I Just Ran Two Million Regressions. *The American Economic Review 87*(2), 178–183.

Slangen, A. and J. Hennart (2007). Greenfield or Acquisition Entry: A Review of the Empirical Foreign Establishment Mode Literature. ERIM Report Series Reference ERS-2007-059-ORG. http://ssrn.com/abstract=1021882 (accessed May 28, 2008).

Slangen, A. and J. Hennart (2008a). Do Foreign Greenfields Outperform Foreign Acquisitions or Vice Versa? An Institutional Perspective. SSRN eLibrary, http://ssrn.com/paper=1117786, accessed November 30, 2008.

Slangen, A. and J. Hennart (2008b). Do Multinationals Really Prefer to Enter Culturally-Distant Countries Through Greenfields Rather than Through Acquisitions? The Role of Parent Experience and Subsidiary Autonomy. SSRN eLibrary, http://ssrn.com/paper=1021883, accessed November 30, 2008.

Stigler, G. (1961). The economics of information. *Journal of Political Economy 69*(3), 213–225.

Venables, A. (1996). Equilibrium Locations of Vertically Linked Industries. *International Economic Review 32*(2), 341–359.

Veugelers, R. (1991). Locational Determinants and Ranking of Host Countries: an Empirical Assessment. *Kyklos 44*(3), 363–382.

Wei, Y., B. Liu, and X. Liu (2005). Entry modes of foreign direct investment in China: a multinomial logit approach. *Journal of Business Research 58*(11), 1495–1505.

Wernerfelt, B. and C. Montgomery (1986). What is an Attractive Industry? *Management Science 32*(10), 1223–1230.

Wes, M. and H. Lankes (2001). FDI in Economies in Transition: M&As versus Greenfield Investment. *UNCTAD Trasnational Corporations 10*(3), 113–129.

Wilson, B. (1980). The Propensity of Multinational Companies to Expand through Acquisitions. *Journal of International Business Studies 11*(1), 59–65.

Zejan, M. (1990). New Ventures or Acquisitions: The Choice of Swedish Multinational Enterprises. *Journal of Industrial Economics 38*(3), 349–355.

Appendix: Literature Review - Detailed Tables

Table 1.2: List of reviewed studies

Wilson (1980)
Caves and Mehra (1986)
Kogut and Singh (1988)
Zejan (1990)
Hennart and Park (1993)
Andersson and Svensson (1994)
Cho and Padmanabhan (1995)
Hennart, Larimo, and Chen (1996)
O hUallacháin and Reid (1997)
Hennart and Reddy (1997)
Meyer and Estrin (1997)
Barkema and Vermeulen (1998)
Hennart and Larimo (1998)
Padmanabhan and Cho (1999)
Brouthers and Brouthers (2000)
Louri (2001)
Harzing (2002)
Chen and Hennart (2002)
Lopez-Duarte and Garcia-Canal (2002)
Bertrand and Madariaga (2003)
Larimo (2003)
Chen and Zeng (2004)
Nocke and Yeaple (2004)
Wei, Liu, and Liu (2005)
Cheng (2006)
Dikova and van Witteloostuijn (2007)
Slangen and Hennart (2008b)

Notes: See Table 1.3 for a description of each study's approach.

Table 1.3: Literature Review - Comparability of previous studies

Author(s)	Year	Home Countries	Host Countries	Total Countries	Industries	Sample Size	Time Horizon	Methodology	Dependent Variable
Wilson (1980)	1980	UK, US, Japan, Germany (West)	Multiple	4+	Multiple	389	1900-1969/1971	OLS	Percentage of acquired over total subsidiaries
Caves and Mehra (1986)	1986	Multiple	U.S.	1+	Multiple	138	1974-1980	Binomial Probit	M&A vs. GI
Kogut and Singh (1988)	1988	Multiple	U.S.	14+1	Multiple (20)	506	1981-1985	Multinomial Logit	M&A vs. GI vs. JV
Zejan (1990)	1990	Sweden	Multiple	1+35	Manufacturing	250	1969-1978	Binomial Probit	M&A vs. GI
Hennart and Park (1993)	1993	Japan	U.S.	1+1	Multiple (18 2D SIC Industries, only manufacturing)	270	1978-1980; 1984-1987	Binomial Logit	M&A vs. GI
Andersson and Svensson (1994)	1994	Sweden	Multiple	1+	Manufacturing	925	1965 - 1990	Binomial Logit	M&A vs. GI
Cho and Padmanabhan (1995)	1995	Japan	Multiple	1+	Multiple	756	1969-1991	Binomial Logit	M&A vs. GI
Hennart, Larimo, and Chen (1996)	1996	Japan, Finland	U.S.	2+1	Multiple	401	1978-1993	Binomial Logit	M&A vs. GI
O hUallacháin and Reid (1997)	1996	Japan	U.S.	1+1	Automobile	NA	1979/1989/1992	OLS	M&A (count) and GI (count), compares one regression per year and mode
Hennart and Reddy (1997)	1997	Japan	U.S.	1+1	Multiple (16 2D SIC Industries)	175	1978 - 1989	Binomial Logit	M&A vs. Greenfield JV
Meyer and Estrin (1997)	1997	Germany, UK	Multiple (CEE)	2+8	Multiple (3)	212	1994-1995	Binomial Logit	M&A vs. GI
Barkema and Vermeulen (1998)	1998	Netherlands	Multiple (50% EU)	1+	Multiple	829	1966 - 1994	Binomial Logit / Multinomial Logit	1) M&A vs. GI; 2) FA vs. FGI vs. JVGI vs. PA
Hennart and Larimo (1998)	1998	Japan, Finland	U.S.	2+1	Multiple (50% are SIC 35, 36 and 28)	1) 401; 2) 266; 3) 135;	1977 -1993	Binomial Logit	Shared vs. Full ownership - Run three regressions: 1) full sample; 2) only Japanese; 3) only Finnish
Padmanabhan and Cho (1999)	1999	Japan	Multiple (45)	1+45	Multiple (only Manufacturing)	605	1969 - 1991	Binomial Logit	1) Full vs. Shared ownership; 2) M&A vs. GI
Brouthers and Brouthers (2000)	2000	Japan	UK, France, Netherlands, Germany, Belgium, Luxembourg	1+6	Multiple	103	1980 - 1994	Binomial Logit	M&A vs. GI
Louri (2001)	2001	Multiple	Greece	1+	20 manufacturing industries (2D)	65	1987 - 1996	OLS	Relative size of entry (Total assets of target/Total assets Industry)
Harzing (2002)	2002	Multiple	Multiple	9+22	Multiple (9)	277	1995-1996	Binomial Logit	M&A vs. GI
Chen and Hennart (2002)	2002	Japan	U.S.	1+1	Multiple (N.A.)	269	1981 - 1989	Binomial Logit	JV vs. Full Ownership(M&A or GI)
Lopez-Duarte and Garcia-Canal (2002)	2002	Spain	Multiple	1+	Multiple	315	1988 - 1996	Binomial and multinomial logit	1) GIWO vs. (FA+PA+JV); 2) GIWO vs. JV vs. FA vs . PA
Bertrand and Madariaga (2003)	2003	U.S.	Canada, Mexico, Argentina, Brazil	1+4	Multiple	40	1989-1998	Panel Estimation under FE	Number of new subsidiaries in each country (separated by M&A and GI)
Larimo (2003)	2003	Denmark, Finland, Norway, Sweden	Multiple	4+	Multiple	3524	1960-1999	Binomial Logit	M&A vs. GI
Chen and Zeng (2004)	2004	Japan	U.S.	1+1	Manufacturing	269	1981 - 1989	Binomial Logit	M&A vs. GI
Nocke and Yeaple (2004)	2004	U.S.	Multiple	1+	Multiple	642	1994-1998	Binomial Logit	M&A vs. GI
Wei, Liu, and Liu (2005)	2005	Multiple	China	1+	Multiple (7 2D SSB Industries)	10607	1999	Multinominal Logit	Wholly Owned Enterprises vs. Equity Joint Ventures vs. Joint Stock Company vs. Contractual Joint Venture
Cheng (2006)	2006	Taiwan	Multiple	1+	Manufacture (SIC codes 20-39)	466	2005	Binomial Logit	Brownfield I. vs. GI vs. M&A. Three binomial models: 1) GI vs. M&A; 2) BI vs. M&A; 3) GI vs. BI
Dikova and van Witteloostuijn (2007)	2007	Multiple (EU)	Multiple (CEE)	11+	Multiple	160	1992-2002	Binomial Logit	1) M&A vs. GI; 2) Full vs. Shared ownership
Slangen and Hennart (2008b)	2007	Denmark	Multiple	1+35	Multiple (13)	171	1995-2003	Binomial Logit	M&A vs. GI

Notes: Total Countries is empty in those cases where the exact number of either home- or host-countries included is not reported.

Table 1.4: Operationalization of variables in previous studies - MNC level determinants

Author(s)	Year	Theoretical variables	Operationalization	Hypoth.
		MNC Level		
Kogut and Singh (1988)	1988	MNC Technological intensity	R&D expenditure/sales (tot.industry)	1
Hennart and Park (1993)	1993	MNC Technological intensity	R&D expenditure over sales (t-1)	1
Andersson and Svensson (1994)	1994	MNC Technological intensity	R&D expenditure over total turnover	1
Meyer and Estrin (1997)	1997	MNC Technological intensity	R&D expenditures	1
Hennart and Larimo (1998)	1998	MNC Technological intensity	Categorical variable=1 if total R&D expenditures as percentage of its worldwide sales is less than 1, =2 if more than 1 but less than 3, =3 otherwise	1
Padmanabhan and Cho (1999)	1999	MNC Technological intensity	R&D expenditure over sales	1
Brouthers and Brouthers (2000)	2000	MNC Technological intensity	R&D expenditure over sales	1
Louri (2001)	2001	MNC Technological intensity	Dummy=1 if industry is research intensive, 0 otherwise (Classification by Davies and Lyons (1996))	1
Harzing (2002)	2002	MNC Technological intensity	R&D expenditure over sales (t-1)	1
Chen and Hennart (2002)	2002	MNC Technological intensity[1]	R&D expenditures of industry	1
Chen and Hennart (2002)	2002	MNC Technological intensity[2]	R&D expenditures (t-1)	1
Lopez-Duarte and Garcia-Canal (2002)	2002	MNC Technological intensity	Dummy=1 if foreign investor ranks among the top Spanish firms investing in R&D	1
Chen and Zeng (2004)	2004	MNC Technological intensity[1]	Total shipment x R&D expenditures-to-sales ratio	1
Chen and Zeng (2004)	2004	MNC Technological intensity[2]	Average R&D expenditure by MNC in previous 5Y	1
Nocke and Yeaple (2004)	2004	MNC Technological intensity	Log R&D expenditures / Total sales of parent	1
Cheng (2006)	2006	MNC Technological intensity	R&D expenditures / total sales - average previous 3Y	1
Dikova and van Witteloostuijn (2007)	2007	MNC Technological intensity	Likert-type index survey question, 1 to 5, from "little amounts" to "great amounts" of money spent on R&D activities as percentage of annual sales	1
Slangen and Hennart (2008b)	2007	MNC Technological intensity	Likert-type index survey question, 1 to 7, from "none" to "very much"	1
Barkema and Vermeulen (1998)	1998	MNC International Experience	Number of countries with foreign subsidiaries	2
Wilson (1980)	1980	MNC International Experience[1]	Number of years since first subsidiary abroad	2
Wilson (1980)	1980	MNC International Experience[2]	Number of implantations before 1960 / total number of implantations	2
Kogut and Singh (1988)	1988	MNC International Experience	Number of countries with foreign subsidiaries	2
Zejan (1990)	1990	MNC International Experience	Log number of years since first subsidiary abroad	2
Meyer and Estrin (1997)	1997	MNC International Experience	Dummy=1 if event is first major international business of the firm	2
Padmanabhan and Cho (1999)	1999	MNC International Experience	Count-years of general international business experience at time of foreign entry	2
Brouthers and Brouthers (2000)	2000	MNC International Experience	Export ratio of parent	2
Harzing (2002)	2002	MNC International Experience	Number of years since first subsidiary abroad	2
Lopez-Duarte and Garcia-Canal (2002)	2002	MNC International Experience	Number of previous foreign investments	2
Dikova and van Witteloostuijn (2007)	2007	MNC International Experience	Number of years and countries in which the parent has done previous investments	2
Slangen and Hennart (2008b)	2007	MNC International Experience	Log number of countries with foreign subsidiaries	2
Kogut and Singh (1988)	1988	MNC Host-country experience	Dummy=1 if there exists a previous entry into host-country, 0 otherwise	3
Hennart and Park (1993)	1993	MNC Host-country experience	Number of years since first subsidiary in host-country	3
Andersson and Svensson (1994)	1994	MNC Host-country experience	Dummy=1 if there exists a previous entry into host-country, 0 otherwise	3
Hennart and Reddy (1997)	1997	MNC Host-country experience	Number of years since first subsidiary in host-country	3
Meyer and Estrin (1997)	1997	MNC Host-country experience[1]	Dummy =1 if only 1 project in CEE, 0 otherwise	3
Meyer and Estrin (1997)	1997	MNC Host-country experience[2]	Number of years MNC has contacts in host-country	3
Barkema and Vermeulen (1998)	1998	MNC Host-country experience	Number of previous entries into the host-country	3
Hennart and Larimo (1998)	1998	MNC Host-country experience	Number of years since first subsidiary in host-country	3
Padmanabhan and Cho (1999)	1999	MNC Host-country experience	Count-years of host-country experience at time of foreign entry	3
Nocke and Yeaple (2004)	2004	MNC Host-country experience	Dummy=1 if there exists a previous entry into host-country, 0 otherwise	3
Wei, Liu, and Liu (2005)	2005	MNC Host-country experience	Number of years since 1978 (China's opening) to the date of the event	3
Slangen and Hennart (2008b)	2007	MNC Host-country experience	Weighted average of previous existing units in host-country, with weights given by the relevance of the unit's role (1=License agreement; 2=Sales agreement; 3=Sales subsidiary; 4=Manufacturing or services subsidiary; 2=Other)	3
Dikova and van Witteloostuijn (2007)	2007	MNC Regional experience	Number of countries and years the firm has done business in the CEE region (not limited to FDI)	3

Notes: In case a theoretical variable is operationalized in more than one way in a same study, this is noted by consecutive supraindices. The description of the operationalization of each variable stems from the corresponding paper, although the wording was changed in most cases for simplification or consolidation with analogous measures in other papers.

Table 1.5: Operationalization of variables in previous studies - MNC level determinants (continued)

Author(s)	Year	Theoretical variables	Operationalization	Hypoth.
		MNC Level		
Wilson (1980)	1980	MNC Diversification	Number of different 4D SIC codes in which MNC operates	4
Kogut and Singh (1988)	1988	MNC Diversification	N.A.;	4
Zejan (1990)	1990	MNC Diversification	HHI for share of sales in 6D industries in 1978	4
Hennart and Park (1993)	1993	MNC Diversification	HHI for share of sales per product	4
Meyer and Estrin (1997)	1997	MNC Diversification	Number of activity codes in which MNC operates, adjusted for turnover	4
Barkema and Vermeulen (1998)	1998	MNC Diversification	Number of different 3D SIC codes in which MNC operates	4
Padmanabhan and Cho (1999)	1999	MNC Diversification	Entropy measure at the time of foreign entry	4
Brouthers and Brouthers (2000)	2000	MNC Diversification	Number of Kompass UCD codes in which MNC operates	4
Harzing (2002)	2002	MNC Diversification	Number of different 4D SIC codes in which MNC operates	4
Nocke and Yeaple (2004)	2004	MNC Diversification	$\log\left(\sum_j s_{pj}^2\right)^{-1}$, where s_{pj} is share of parent's sales in industry j	4
Slangen and Hennart (2008b)	2007	MNC Diversification	Log-number of different 4D SIC codes in which MNC operates	4
Barkema and Vermeulen (1998)	1998	MNC Diversification squared	MNC Diversification squared	4
Padmanabhan and Cho (1999)	1999	MNC Experience in FO vs. PO	Number of prior count-years of full or shared ownership experience (expressed as positive number if full ownership, negative for shared)	5
Padmanabhan and Cho (1999)	1999	MNC Experience in MA vs. GI	Count-years for decision specific experience at the time of foreign entry	5
Dikova and van Witteloostuijn (2007)	2007	MNC previous GI experience	Number of countries in which the firm has entered via GI and number of deals	5
Slangen and Hennart (2008b)	2007	MNC previous GI experience	Likert-type index survey question, 1 to 7, ranging from 'none' to 'very much'	5
Cheng (2006)	2006	MNC previous M&A experience	Number of previous foreign M&A deals	5
Dikova and van Witteloostuijn (2007)	2007	MNC previous M&A experience	Number of countries in which the firm has entered via M&A and number of deals	5
Slangen and Hennart (2008b)	2007	MNC previous M&A experience	Likert-type index survey question, 1 to 7, ranging from 'none' to 'very much'	5
Nocke and Yeaple (2004)	2004	MNC Efficiency[1]	Log sales of parent in the U.S.	6
Nocke and Yeaple (2004)	2004	MNC Efficiency[2]	Log value added per employee of parent	6
Barkema and Vermeulen (1998)	1998	MNC Free Cash Availability	Return On Equity	6
Louri (2001)	2001	MNC Profitability	Net profits / equity capital	6
Wilson (1980)	1980	MNC home-country (UK)	Dummy indicating the nationality of the parent (UK)	11
Wilson (1980)	1980	MNC home-country (Germany)	Dummy indicating the nationality of the parent (Germany)	11
Wilson (1980)	1980	MNC home-country (Japan)	Dummy indicating the nationality of the parent (Japan)	11
Wilson (1980)	1980	MNC home-country (US)	Dummy indicating the nationality of the parent (US)	11
Meyer and Estrin (1997)	1997	MNC home-country[1]	Dummy=1 if MNC is German, 0 otherwise	11
Meyer and Estrin (1997)	1997	MNC home-country[2]	Dummy=1 if MNC is not European, 0 otherwise	11
Hennart and Larimo (1998)	1998	MNC home-country	Dummy=1 if MNC is Japanese, 0 if Finnish	11
Louri (2001)	2001	MNC home-country	Dummy=1 if MNC is European, 0 otherwise	11

Notes: In case a theoretical variable is operationalized in more than one way in a same study, this is noted by consecutive supraindices. The description of the operationalization of each variable stems from the corresponding paper, although the wording was changed in most cases for simplification or consolidation with analogous measures in other papers.

Table 1.6: Operationalization of variables in previous studies - MNC level determinants (continued)

Author(s)	Year	Theoretical variables	Operationalization	Hypoth.
		MNC Level		
Barkema and Vermeulen (1998)	1998	MNC Size	Log total assets	Control
Hennart and Larimo (1998)	1998	MNC Size	Parent's global sales	Control
Padmanabhan and Cho (1999)	1999	MNC Size	Logarithm of parent's total assets	Control
Lopez-Duarte and Garcia-Canal (2002)	2002	MNC Size	Foreign investor turnover (inflation adjusted, t-1)	Control
Nocke and Yeaple (2004)	2004	MNC Size	Total number of employees	Control
Kogut and Singh (1988)	1988	MNC Size (non-US)	Total assets	Control
Kogut and Singh (1988)	1988	MNC Size (US)	Total assets	Control
Brouthers and Brouthers (2000)	2000	Interaction: Diversification and Experience	MNC Diversification x International experience	Interaction
Barkema and Vermeulen (1998)	1998	Interaction: International Experience and Product Diversification	International Experience x Product Diversification	Interaction
Barkema and Vermeulen (1998)	1998	Interaction: International Experience and Product Diversification squared	International Experience x Product Diversification squared	Interaction
Brouthers and Brouthers (2000)	2000	Interaction: Technology and Experience	Technological Intensity x International experience	Interaction
Hennart and Park (1993)	1993	Leader-Follower	Dummy=1 if follower; 0 otherwise	Other
O hUallacháin and Reid (1997)	1996	Leader-Follower	Dummy for the presence of a Japanese assembly plant in a state (1 = California, Illinois, Indiana, Kentuky, Michigan, Ohio, Tennessee; 0 = all other states)	Other
Hennart and Park (1993)	1993	MNC Advertising intensity	Media+Advertising Expend/Sales	Other
Cheng (2006)	2006	MNC Advertising intensity	Advertising expenditures to total sales ratio (average previous 3Y)	Other
Chen and Hennart (2002)	2002	MNC Advertising intensity in home-country	Advertising expenditures of Japanese investors in Japan (t-1)	Other
Chen and Zeng (2004)	2004	MNC Advertising intensity in home-country	Average advertising expenditures at home-country (5 previous years)	Other
Chen and Hennart (2002)	2002	MNC Advertising intensity in host-country	Advertising expenditures of Japanese investors in U.S. (previous 5Y)	Other
Lopez-Duarte and Garcia-Canal (2002)	2002	MNC Advertising intensity in host-country	Dummy=1 if foreign investor ranks among the top Spanish firms investing in advertising	Other
Chen and Zeng (2004)	2004	MNC Advertising intensity in host-country	Total advertising expenditures in host market (previous 5Y)	Other
Andersson and Svensson (1994)	1994	MNC Experience in general[1]	Previous number of manufacturing affliliates	Other
Andersson and Svensson (1994)	1994	MNC Experience in general[2]	Total turnover	Other
Hennart and Park (1993)	1993	MNC Financial leverage	Long term debt / market value	Other
Louri (2001)	2001	MNC Financial leverage	Short and long term debt / Net assets worth	Other
Hennart and Park (1993)	1993	MNC HHRR endowment	Domestic employment growth / domestic sales growth	Other
Padmanabhan and Cho (1999)	1999	MNC Home-market share	Ratio of the parent's sales to total industry sales at home in its core product market	Other
Slangen and Hennart (2008b)	2007	MNC Industry	Dummy=1 for non-manufacturing, =0 for manufacturing	Other
Harzing (2002)	2002	MNC International Strategy	Index based on survey questions describing multidomestic and global strategies; Composite score for level of control	Other
Nocke and Yeaple (2004)	2004	MNC International Strategy	MNC International Vertical Integration=Intra-firm imports/ Total imports	Other
Dikova and van Witteloostuijn (2007)	2007	MNC International Strategy	Index based on survey questions describing multidomestic and global strategies	Other
Louri (2001)	2001	MNC Inventory ratio	Inventory / Total assets	Other
Louri (2001)	2001	MNC labor intensity	Fixed capital / Employment	Other
Louri (2001)	2001	MNC Liquidity ratio	Working capital / Total assets	Other
Meyer and Estrin (1997)	1997	MNC Organizational skills[1]	Employees	Other
Meyer and Estrin (1997)	1997	MNC Organizational skills[2]	Employees squared	Other
Cheng (2006)	2006	Training & Remuneration Intensity for expatriates	Expenditures for T&R expatriates over total sales	Other

Notes: In case a theoretical variable is operationalized in more than one way in a same study, this is noted by consecutive supraindices. The description of the operationalization of each variable stems from the corresponding paper, although the wording was changed in most cases for simplification or consolidation with analogous measures in other papers.

Table 1.7: Operationalization of variables in previous studies - Industry level determinants

Author(s)	Year	Theoretical variables	Operationalization	Hypoth.
		Industry Level		
Dikova and van Witteloostuijn (2007)	2007	High-technology industry	Ranking of industry level expenditures (OECD Manufacturing Industry Classification)	1
Dikova and van Witteloostuijn (2007)	2007	Low-technology industry	Ranking of industry level expenditures (OECD Manufacturing Industry Classification)	1
Barkema and Vermeulen (1998)	1998	Industry size	Real GNP of host-country	8
Zejan (1990)	1990	Host-country market size	Host-country GDP	8
Bertrand and Madariaga (2003)	2003	Host-country market size	Host-country GDP (t-1)	8
Nocke and Yeaple (2004)	2004	Host-country market size	Log population	8
Zejan (1990)	1990	Industry growth	Growth of industrial production in 3D industries (previous 2Y)	9
Hennart and Park (1993)	1993	Industry growth	Absolute value of the difference between the growth rate of each 4D SIC industry and the sample mean / Std. Dev. (Caves and Mehra, 1986)	9
Andersson and Svensson (1994)	1994	Industry growth	Average annual growth rate of GDP for the whole period of study	9
Hennart and Reddy (1997)	1997	Industry growth	Absolute value of the difference between the growth rate of each 4D SIC industry and the sample mean / Std. Dev. (Caves and Mehra, 1986)	9
Meyer and Estrin (1997)	1997	Industry growth	Absolute value of the difference between the growth rate of each 4D SIC industry and the sample mean / Std. Dev. (Caves and Mehra, 1986)	9
Hennart and Larimo (1998)	1998	Industry growth	Average annual growth rate of shipments of the target U.S. 4D SIC industry (previous 5Y)	9
Brouthers and Brouthers (2000)	2000	Industry growth	Average annual growth rate of employment (by industry, previous 2Y)	9
Louri (2001)	2001	Industry growth	Average annual growth rate of employment (by industry, previous 5Y)	9
Chen and Zeng (2004)	2004	Industry growth	Absolute value of the difference between the growth rate of each 4D SIC industry and the sample mean / Std. Dev. (Caves and Mehra, 1986)	9
Dikova and van Witteloostuijn (2007)	2007	Industry growth	Likert-type index survey question, 1 to 5, ranking the expected host market's growth	9
Slangen and Hennart (2008b)	2007	Industry growth	Likert-type index survey question, 1 to 7, ranking the expected industry growth from "strongly negative" to "strongly positive"	9
Barkema and Vermeulen (1998)	1998	Industry growth	Host-country GNP growth	9
Kogut and Singh (1988)	1988	Type of industry (Manufacturing)	Dummy=1 for manufacturing industry, 0 otherwise	Control
Kogut and Singh (1988)	1988	Type of industry (Services)	Dummy=1 for services industry, 0 otherwise	Control
Hennart and Larimo (1998)	1998	Type of industry	Dummy=1 for electrical machinery industry, 0 otherwise	Control
Lopez-Duarte and Garcia-Canal (2002)	2002	Type of industry (Services)	Dummy=1 for services industry, 0 otherwise	Control
Lopez-Duarte and Garcia-Canal (2002)	2002	Type of industry (Financial)	Dummy=1 for financial industry, 0 otherwise	Control
Lopez-Duarte and Garcia-Canal (2002)	2002	Type of industry (Construction)	Dummy=1 for construction industry, 0 otherwise	Control
Lopez-Duarte and Garcia-Canal (2002)	2002	Type of industry (Manufacturing)	Dummy=1 for manufacturing industry, 0 otherwise	Control
Lopez-Duarte and Garcia-Canal (2002)	2002	Regulated Sector	Dummy=1 if regulated sector, 0 otherwise	Other
Meyer and Estrin (1997)	1997	First mover advantages[1]	Dummy=1 if non-food consumer goods, 0 otherwise	Other
Meyer and Estrin (1997)	1997	First mover advantages[2]	Dummy=1 if food & beverage industry, 0 otherwise	Other
Kogut and Singh (1988)	1988	Industry Advertising intensity	Advertising expenses as a share of sales in penetrated industry	Other
Louri (2001)	2001	Industry Advertising intensity	Advertising expenses as a share of sales in penetrated industry	Other
Chen and Hennart (2002)	2002	Industry Advertising intensity	Total media expenditures incurred to advertise a product in penetrated industry	Other
Chen and Zeng (2004)	2004	Industry Advertising intensity	Total media expenditures incurred to advertise a product in penetrated industry	Other
Dikova and van Witteloostuijn (2007)	2007	Industry Advertising intensity	Likert-type index survey question, 1 to 5, ranking the expenditure on marketing activities as a percentage of total sales	Other
Hennart and Park (1993)	1993	Industry concentration	HHI for 50 largest firms at 4D SIC industry	Other
Hennart and Reddy (1997)	1997	Industry concentration	HHI for each 4D SIC U.S. industry	Other
Hennart and Larimo (1998)	1998	Industry concentration	HHI for 50 largest firms at 4D SIC U.S. industry entered	Other
Louri (2001)	2001	Industry concentration	Concentration ratio of 4, 8 or 20 largest firms in terms of employment (by industry)	Other

Notes: In case a theoretical variable is operationalized in more than one way in a same study, this is noted by consecutive supraindices. The description of the operationalization of each variable stems from the corresponding paper, although the wording was changed in most cases for simplification or consolidation with analogous measures in other papers.

Table 1.8: Operationalization of variables in previous studies - Industry level determinants (continued)

Author(s)	Year	Theoretical variables	Operationalization	Hypoth.
		Industry Level		
Chen and Zeng (2004)	2004	Industry concentration	HHI for 50 largest firms at 4D SIC level	Other
Dikova and van Witteloostuijn (2007)	2007	Industry concentration	Likert-type index survey question, 1 to 5, ranking the intensity of local competition	Other
Hennart and Larimo (1998)	1998	Industry concentration squared	HHI for 50 largest firms at 4D SIC U.S. industry penetrated, squared	Other
Chen and Hennart (2002)	2002	Industry distribution barriers	Percentage of output shipped through distributors to business buyers	Other
Louri (2001)	2001	Industry profitability	Value added - Total wages / Gross value of production	Other
Chen and Hennart (2002)	2002	Industry reputation barriers/premium	Industry brand equity (value of brand reputation - premium paid over same product unbranded - as % of replacement investment)	Other
Chen and Zeng (2004)	2004	Industry reputation barriers/premium[1]	Percentage of brand equity in the replacement value of all firms at the 2D SIC level (Simon and Sullivan (1993) calculations)	Other
Chen and Zeng (2004)	2004	Industry reputation barriers/premium[2]	Industry brand equity squared	Other
Chen and Zeng (2004)	2004	Industry reputation barriers/premium[3]	Percentage of output that a 4D SIC industry ships to end-users with respect to total output (Consumers vs. Intermediate inputs)	Other
Meyer and Estrin (1997)	1997	Industry restructuring costs[1]	Employees over turnover ratio	Other
Meyer and Estrin (1997)	1997	Industry restructuring costs[2]	Dummy=1 if chemical industry, 0 otherwise	Other
Louri (2001)	2001	Industry sunk investment cost	1 - (Second hand bought machinery and equipment / total investment in machinery and equipment) in industry	Other
Zejan (1990)	1990	Relatedness of penetrated Industry	Dummy=1 if industry penetrated at 2D is NOT equal to parent industry, 0 otherwise	Other
Hennart and Park (1993)	1993	Relatedness of penetrated Industry	Dummy=1 if entry was made in a related industry (same products/product lines/SIC code), 0 otherwise	Other
Hennart and Reddy (1997)	1997	Relatedness of penetrated Industry[1]	Dummy=1 if at least one of the products produced by the American partner was also produced by the Japanese parent	Other
Hennart and Reddy (1997)	1997	Relatedness of penetrated Industry[2]	Dummy=1 if Japanese investor and affiliate manufacture one common product, 0 otherwise	Other
Barkema and Vermeulen (1998)	1998	Relatedness of penetrated Industry (H)	Horizontal expansion - Within the same 3D SBI category as the core activities of the firm	Other
Barkema and Vermeulen (1998)	1998	Relatedness of penetrated Industry (R)	Related expansion - Within the same 2D SBI category but not in the same 3D category	Other
Barkema and Vermeulen (1998)	1998	Relatedness of penetrated Industry (V)	Vertical expansion - Within the firms' value added chain	Other
Hennart and Larimo (1998)	1998	Relatedness of penetrated Industry	Dummy=1 if entry was made in a related industry (same products/product lines/SIC code), 0 otherwise	Other
Padmanabhan and Cho (1999)	1999	Relatedness of penetrated Industry	Dummy=1 if entry was made in a related industry (same products/product lines/SIC code), 0 otherwise	Other
Brouthers and Brouthers (2000)	2000	Relatedness of penetrated Industry	Dummy=1 if entry was made in a related industry (same products/product lines/SIC code), 0 otherwise	Other
Chen and Hennart (2002)	2002	Relatedness of penetrated Industry	Dummy=1 if any products made by the affiliate matched a product made by the parent, 0 otherwise	Other
Chen and Zeng (2004)	2004	Relatedness of penetrated Industry	Dummy=1 if entry was made in a related industry (same products/product lines/SIC code), 0 otherwise	Other
Dikova and van Witteloostuijn (2007)	2007	Relatedness of penetrated Industry	Likert-type index survey question, 1 to 5, ranking the relatedness of parent and subsidiary in terms of product line and line of business	Other
Slangen and Hennart (2008b)	2007	Relatedness of penetrated Industry	Categorical variables, 0=same industry, 1=same secondary industry, 2=different industry	Other
Wei, Liu, and Liu (2005)	2005	Industry asset intensity	Average level of fixed assets in the industry	Other
Cheng (2006)	2006	Industry concentration	Concentration ratio of the 4 largest firms in the host market (by 4D SIC industries)	Other

Notes: In case a theoretical variable is operationalized in more than one way in a same study, this is noted by consecutive supraindices. The description of the operationalization of each variable stems from the corresponding paper, although the wording was changed in most cases for simplification or consolidation with analogous measures in other papers.

Table 1.9: Operationalization of variables in previous studies - Host-country level determinants

Author(s)	**Year**	**Theoretical variables**	**Operationalization**	**Hypoth.**
		Host-country Level		
Louri (2001)	2001	Host-country labor costs	Average monthly salary in industry j / average monthly salary in manufacturing	10
Bertrand and Madariaga (2003)	2003	Host-country labor costs	Nominal wages	10
Kogut and Singh (1988)	1988	Cultural distance	Index following Kogut and Singh (1988) with Hofstede (1980) data	11
O hUallacháin and Reid (1997)	1996	Cultural distance	Dummy for States with a Pacific coastline (1 = Alaska, California, Hawaii, Oregon, Washington; 0 = all other states)	11
Barkema and Vermeulen (1998)	1998	Cultural distance	Index following Kogut and Singh (1988) with Hofstede (1980) data	11
Padmanabhan and Cho (1999)	1999	Cultural distance	Index following Kogut and Singh (1988) with Hofstede (1980) data	11
Brouthers and Brouthers (2000)	2000	Cultural distance	Index following Kogut and Singh (1988) with Hofstede (1980) data	11
Harzing (2002)	2002	Cultural distance	Index following Kogut and Singh (1988) with Hofstede (1980) data	11
Lopez-Duarte and Garcia-Canal (2002)	2002	Cultural distance (EU)	Dummy=1 if in EU, 0 otherwise	11
Lopez-Duarte and Garcia-Canal (2002)	2002	Cultural distance (OECD, non EU)	Dummy=1 if in OECD, and non-EU, 0 otherwise	11
Lopez-Duarte and Garcia-Canal (2002)	2002	Cultural distance (LatAm)	Dummy=1 if in LatAm, 0 otherwise	11
Lopez-Duarte and Garcia-Canal (2002)	2002	Cultural distance (non-OECD, non-LatAm)	Dummy=1 if non-OECD, non-LatAm, 0 otherwise	11
Wei, Liu, and Liu (2005)	2005	Cultural distance	Dummy=0 if Hong Kong, Macao and Taiwan, 1 otherwise	11
Cheng (2006)	2006	Cultural distance	Index following Kogut and Singh (1988) with Hofstede (1980) data	11
Slangen and Hennart (2008b)	2007	Cultural distance	Index following Kogut and Singh (1988) with Hofstede (1980) data	11
Kogut and Singh (1988)	1988	Uncertainty avoidance	Measure for willingness to accept managerial or organizational uncertainty (Hofstede, 1980)	11
Brouthers and Brouthers (2000)	2000	Uncertainty avoidance	Measure for willingness to accept managerial or organizational uncertainty (Hofstede, 1980)	11
Bertrand and Madariaga (2003)	2003	Specialization / Agglomeration	Past FDI (number of U.S. affiliates in host economy)	12
Wilson (1980)	1980	Country risk	Subsidiaries located in less developed countries (LDCs) / total number of subsidiaries	13
Barkema and Vermeulen (1998)	1998	Country risk (medium)	Goodnow and Hansz's clasification and Euromoney, dummy for medium country risk	13
Barkema and Vermeulen (1998)	1998	Country risk (high)	Goodnow and Hansz's clasification and Euromoney, dummy for high country risk	13
Zejan (1990)	1990	Host-country development	GDP per capita	10/13
Andersson and Svensson (1994)	1994	Host-country development	GDP per capita	10/13
Barkema and Vermeulen (1998)	1998	Host-country development	GNP per capita	10/13
Padmanabhan and Cho (1999)	1999	Host-country development	Dummy=1 if developed countries (industrial market economies), 0=developing countries according to WB clasification	10/13
Nocke and Yeaple (2004)	2004	Host-country development	Log real GDP per capita	10/13

Notes: In case a theoretical variable is operationalized in more than one way in a same study, this is noted by consecutive supraindices. The description of the operationalization of each variable stems from the corresponding paper, although the wording was changed in most cases for simplification or consolidation with analogous measures in other papers.

Table 1.10: Operationalization of variables in previous studies - Host-country level determinants (continued)

Author(s)	Year	Theoretical variables	Operationalization	Hypoth.
Host-country Level				
Nocke and Yeaple (2004)	2004	Host-country openness	(Exports plus Imports)/GDP	Other
Louri (2001)	2001	Location development	Dummy=1 if subsidiary in Athens area, 0 otherwise	Other
Wei, Liu, and Liu (2005)	2005	Location development	Dummy=1 if subsidiary in coastal areas, 0 if in inner areas	Other
Barkema and Vermeulen (1998)	1998	Foreign ownership restrictions	Dummy=1 if there are legal restriccions to foreign ownership, 0 if not	Other
Padmanabhan and Cho (1999)	1999	Foreign ownership restrictions	Dummy=1 if there are legal restriccions to foreign ownership, 0 if not	Other
Slangen and Hennart (2008b)	2007	Foreign ownership restrictions	Managers perception according to IMD's World Competitiveness Yearbook	Other
Louri (2001)	2001	Host-country Taxes	Taxation as a share of sales (by industry)	Other
Bertrand and Madariaga (2003)	2003	Host-country transaction costs	Bilateral Tariff Barrier	Other
Dikova and van Witteloostuijn (2007)	2007	Institutional advancement	Composite measure from WB Governance Indicators (Including: voice and accountability, political stability, government effectiveness, regulatory quality, rule of law and corruption control). Kaufmann et al. (2005)	Other
Dikova and van Witteloostuijn (2007)	2007	Investment incentives	Dummy=1 if any host-country government incentives influenced the decision, 0 otherwise	Other
O hUallacháin and Reid (1997)	1996	Organized labor	Percentage of non-agricultural employees belonging to trade unions (1970 / 1980) and percentage of manufacturing workers in trade unions (1989)	Other
Cheng (2006)	2006	Restrictions in equity markets	Index of Economic Freedom (Heritage Foundation)	Other
Hennart and Park (1993)	1993	Availability of bargains	Relative Value Index=$\frac{\$/¥}{Stock\,Indx._{US}/Stock\,Indx._{JP}}$	Other
O hUallacháin and Reid (1997)	1996	Availability of targets	Natural logarithm of the number of manufacturing establishments in a certain state, in a given year	Other
Slangen and Hennart (2008b)	2007	Availability of targets	Likert-type index survey question, 1 to 7, ranking the lack of acquisition targets from "not at all" to "to a very large extent"	Other
Meyer and Estrin (1997)	1997	Host-countries fixed effects	Dummies for each country	Other
Bertrand and Madariaga (2003)	2003	Multilateral treaties effect (NAFTA)	Dummy=1 for years of implementation of NAFTA	Other
Bertrand and Madariaga (2003)	2003	Multilateral treaties effect (MERCOSUR)	Dummy=1 for years of implementation of MERCOSUR	Other

Notes: In case a theoretical variable is operationalized in more than one way in a same study, this is noted by consecutive supraindices. The description of the operationalization of each variable stems from the corresponding paper, although the wording was changed in most cases for simplification or consolidation with analogous measures in other papers.

Table 1.11: Operationalization of variables in previous studies - Subsidiary level determinants and control variables

Author(s)	Year	Theoretical variables	Operationalization	Hypoth.
Subsidiary Level				
Hennart and Park (1993)	1993	Establishment mode	Dummy=1 if JV, 0 otherwise	Control
Hennart and Larimo (1998)	1998	Establishment mode	Dummy=1 if M&A, 0 otherwise	Control
Padmanabhan and Cho (1999)	1999	Establishment mode	Dummy=1 if M&A, 0 otherwise	Control
Chen and Hennart (2002)	2002	Establishment mode	Dummy=1 if M&A, 0 if GI	Control
Hennart and Reddy (1997)	1997	Indigestibility of target firm	Dummy=1 if (USSTRUC=0 & Size=1), 0 otherwise. Size=1 if U.S. partner is large > 5000 employees. USSTRUC=1 if U.S. partner is divisionalized.	Other
Meyer and Estrin (1997)	1997	Motivation	Dummy=1 if motivation is factor costs; 0 if market oriented	Other
Hennart and Larimo (1998)	1998	Motivation	Access to Natural Resources - Dummy=1 if subsidiary was in natural resource industry, 0 otherwise	Other
Chen and Hennart (2002)	2002	Motivation	Access to Natural Resources - Industry Energy Intensity (average energy cost per dollar of value added)	Other
Dikova and van Witteloostuijn (2007)	2007	Motivation	Dummy=1 if production subsidiary, 0 otherwise	Other
Barkema and Vermeulen (1998)	1998	Ownership	Dummy=1 if the expansion was wholly owned, 0 otherwise	Other
Hennart and Park (1993)	1993	Resource commitment	Employees in subsidiary / total employees parent	Other
Padmanabhan and Cho (1999)	1999	Resource commitment	Amount of investment in subsidiary / Parent's total assets	Other
Brouthers and Brouthers (2000)	2000	Resource commitment	Employees in subsidiary / total employees parent	Other
Harzing (2002)	2002	Resource commitment	Employees in subsidiary / total employees parent	Other
Dikova and van Witteloostuijn (2007)	2007	Resource commitment	Employees in subsidiary / total employees parent	Other
Slangen and Hennart (2008b)	2007	Resource commitment	Likert-type index survey question, 1 to 7, ranking the subsidiary size respective to parent, from "very small" to "very large"	Other
Slangen and Hennart (2008b)	2007	Subsidiary autonomy	Likert-type index survey question, 1 to 5, from "very little autonomy intended" to "very much autonomy intended"	Other
Harzing (2002)	2002	Subsidiary development	Year since opening or acquisition by previous owner	Other
Cheng (2006)	2006	Ownership (majority)	Dummy=1 if majority ownership, 0 otherwise	Other
Cheng (2006)	2006	Ownership (half)	Dummy=1 if half ownership, 0 otherwise	Other
Cheng (2006)	2006	Ownership (minority)	Dummy=1 if minority ownership, 0 otherwise	Other
Wei, Liu, and Liu (2005)	2005	Resource commitment	Amount of investment in subsidiary	Other
Cheng (2006)	2006	Resource commitment	Employees in subsidiary / total employees parent	Other
Control				
Zejan (1990)	1990	Time trend	Categorical variable going from 1969=1 to 1978=10	Control
Andersson and Svensson (1994)	1994	Time trend	Additive time dummies	Control
Barkema and Vermeulen (1998)	1998	Time trend	Dummies for each year	Control
Padmanabhan and Cho (1999)	1999	Time trend	Dummy=0 if pre 1986, 1 if post 1986	Control
Lopez-Duarte and Garcia-Canal (2002)	2002	Time trend	Year in which the FDI was made	Control
Slangen and Hennart (2008b)	2007	Time trend	Year dummies from 1995 to 2003	Control

Notes: Only time trend dummies and dummies controlling for the mode of entry were classified as control variables. Variables that might have been included by authors as control variables in their model specification but that correspond to a certain theoretical hypothesis, were included within the categories of explanatory variables at different levels.

Table 1.12: Results obtained in previous studies for MNC level determinants

Author(s)	Year	Theoretical variables	Result	Hypoth.
M&A vs. GI (base outcome is M&A)				
			GI	
Hennart and Park (1993)	1993	MNC Technological intensity	+	1
Andersson and Svensson (1994)	1994	MNC Technological intensity	+	1
Cho and Padmanabhan (1995)	1995	MNC Technological intensity	+	1
Hennart, Larimo, and Chen (1996)	1996	MNC Technological intensity	+	1
Meyer and Estrin (1997)	1997	MNC Technological intensity	+	1
Padmanabhan and Cho (1999)	1999	MNC Technological intensity	NS	1
Brouthers and Brouthers (2000)	2000	MNC Technological intensity	+	1
Harzing (2002)	2002	MNC Technological intensity	+	1
Lopez-Duarte and Garcia-Canal (2002)	2002	MNC Technological intensity	-	1
Chen and Hennart (2002)[b]	2002	MNC Technological intensity[1]	NS	1
Chen and Hennart (2002)[b]	2002	MNC Technological intensity[2]	NS	1
Larimo (2003)	2003	MNC Technological intensity	+	1
Chen and Zeng (2004)	2004	MNC Technological intensity[1]	NS	1
Chen and Zeng (2004)	2004	MNC Technological intensity[2]	+	1
Nocke and Yeaple (2004)	2004	MNC Technological intensity	NS	1
Cheng (2006)	2006	MNC Technological intensity	+	1
Dikova and van Witteloostuijn (2007)	2007	MNC Technological intensity	NS	1
Slangen and Hennart (2008b)	2007	MNC Technological intensity	+	1
Caves and Mehra (1986)	1986	MNC International Experience	-	2
Barkema and Vermeulen (1998)	1998	MNC International Experience	+	2
Wilson (1980)	1980	MNC International Experience[1]	+	2
Wilson (1980)	1980	MNC International Experience[2]	+	2
Zejan (1990)	1990	MNC International Experience	NS	2
Cho and Padmanabhan (1995)	1995	MNC International Experience	NS	2
Meyer and Estrin (1997)	1997	MNC International Experience	NS	2
Padmanabhan and Cho (1999)	1999	MNC International Experience	NS	2
Brouthers and Brouthers (2000)	2000	MNC International Experience	+	2
Harzing (2002)	2002	MNC International Experience	-	2
Lopez-Duarte and Garcia-Canal (2002)	2002	MNC International Experience	NS	2
Larimo (2003)	2003	MNC International Experience	NS	2
Dikova and van Witteloostuijn (2007)	2007	MNC International Experience	NS	2
Slangen and Hennart (2008b)	2007	MNC International Experience	-	2
Hennart and Park (1993)	1993	MNC Host-country experience	NS	3
Andersson and Svensson (1994)	1994	MNC Host-country experience	-	3
Cho and Padmanabhan (1995)	1995	MNC Host-country experience	NS	3
Hennart, Larimo, and Chen (1996)	1996	MNC Host-country experience	∪	3
Meyer and Estrin (1997)	1997	MNC Host-country experience[1]	NS	3
Meyer and Estrin (1997)	1997	MNC Host-country experience[2]	NS	3
Hennart and Reddy (1997)[a]	1997	MNC Host-country experience	-	3
Barkema and Vermeulen (1998)	1998	MNC Host-country experience	-	3
Padmanabhan and Cho (1999)	1999	MNC Host-country experience	NS	3
Larimo (2003)	2003	MNC Host-country experience	NS	3
Nocke and Yeaple (2004)	2004	MNC Host-country experience	-	3
Slangen and Hennart (2008b)	2007	MNC Host-country experience	-	3
Wilson (1980)	1980	MNC Diversification	-	4
Caves and Mehra (1986)	1986	MNC Diversification	-	4
Zejan (1990)	1990	MNC Diversification	-	4
Hennart and Park (1993)	1993	MNC Diversification	NS	4
Cho and Padmanabhan (1995)	1995	MNC Diversification	NS	4
Meyer and Estrin (1997)	1997	MNC Diversification	-	4
Barkema and Vermeulen (1998)	1998	MNC Diversification	∩	4
Padmanabhan and Cho (1999)	1999	MNC Diversification	NS	4
Brouthers and Brouthers (2000)	2000	MNC Diversification	NS	4
Harzing (2002)	2002	MNC Diversification	NS	4
Larimo (2003)	2003	MNC Diversification	-	4
Nocke and Yeaple (2004)	2004	MNC Diversification	NS	4
Slangen and Hennart (2008b)	2007	MNC Diversification	-	4
Barkema and Vermeulen (1998)	1998	MNC Diversification squared	∩	4

Notes: ∩ (∪) means a curvilinear relationship was found between the explanatory variable under study and the firm's propensity to expand through a specific entry-mode. See [1], [2] and [3] in Tables 1.4 to 1.11 for the operationalization of repeated theoretical constructs within the same paper. [a]Only Greenfield Joint Ventures are considered; [b]M&A includes JV.

Table 1.13: Results obtained in previous studies for MNC level determinants (continued)

Authors	Year	Theoretical variables	Result	Hypoth.
M&A vs. GI (base outcome is M&A)				
Padmanabhan and Cho (1999)	1999	MNC Experience in MA vs. GI	-	5
Dikova and van Witteloostuijn (2007)	2007	MNC previous GI experience	+	5
Slangen and Hennart (2008b)	2007	MNC previous GI experience	+	5
Cheng (2006)	2006	MNC previous M&A experience	-	5
Dikova and van Witteloostuijn (2007)	2007	MNC previous M&A experience	-	5
Slangen and Hennart (2008b)	2007	MNC previous M&A experience	-	5
Nocke and Yeaple (2004)	2004	MNC Efficiency[1]	+	6
Nocke and Yeaple (2004)	2004	MNC Efficiency[2]	+	6
Barkema and Vermeulen (1998)	1998	MNC Free Cash Availability	-	6
Wilson (1980)	1980	MNC home-country (UK)	+	11
Wilson (1980)	1980	MNC home-country (Germany)	NS	11
Wilson (1980)	1980	MNC home-country (Japan)	+	11
Wilson (1980)	1980	MNC home-country (US)	-	11
Hennart, Larimo, and Chen (1996)	1996	MNC home-country (Japan)	+	11
Meyer and Estrin (1997)	1997	MNC home-country[1]	NS	11
Meyer and Estrin (1997)	1997	MNC home-country[2]	+	11
Brouthers and Brouthers (2000)	2000	Interaction: Diversification and Experience	+	Interaction
Barkema and Vermeulen (1998)	1998	Interaction: Internat.Exp. and Prod.Div.	∪	Interaction
Barkema and Vermeulen (1998)	1998	Interaction: Internat.Exp. and Prod.Div. squared	∪	Interaction
Brouthers and Brouthers (2000)	2000	Interaction: Technology and Experience	+	Interaction
Caves and Mehra (1986)	1986	Leader-Follower	NS	Other
Hennart and Park (1993)	1993	Leader-Follower	+	Other
O hUallacháin and Reid (1997)	1996	Leader-Follower	+	Other
Hennart and Park (1993)	1993	MNC Advertising intensity	NS	Other
Cheng (2006)	2006	MNC Advertising intensity	+	Other
Chen and Hennart (2002)[b]	2002	MNC Advertising intensity in home-country	+	Other
Chen and Zeng (2004)	2004	MNC Advertising intensity in home-country	NS	Other
Lopez-Duarte and Garcia-Canal (2002)	2002	MNC Advertising intensity in host-country	NS	Other
Chen and Hennart (2002)[b]	2002	MNC Advertising intensity in host-country	+	Other
Chen and Zeng (2004)	2004	MNC Advertising intensity in host-country	+	Other
Andersson and Svensson (1994)	1994	MNC Experience in general[1]	-	Other
Andersson and Svensson (1994)	1994	MNC Experience in general[2]	-	Other
Hennart and Park (1993)	1993	MNC Financial leverage	NS	Other
Hennart and Park (1993)	1993	MNC HHRR endowment	-	Other
Cho and Padmanabhan (1995)	1995	MNC Home-market share	NS	Other
Padmanabhan and Cho (1999)	1999	MNC Home-market share	NS	Other
Slangen and Hennart (2008b)	2007	MNC Industry	NS	Other
Harzing (2002)	2002	MNC International Strategy (multidomestic)	-	Other
Nocke and Yeaple (2004)	2004	MNC International Strategy	NS	Other
Dikova and van Witteloostuijn (2007)	2007	MNC International Strategy	-	Other
Meyer and Estrin (1997)	1997	MNC Organizational skills[1]	-	Other
Meyer and Estrin (1997)	1997	MNC Organizational skills[2]	+	Other
Cheng (2006)	2006	Training & Remuneration Intensity for expatriates	-	Other
Cho and Padmanabhan (1995)	1995	MNC Size	NS	Control
Hennart, Larimo, and Chen (1996)	1996	MNC Size	NS	Control
Barkema and Vermeulen (1998)	1998	MNC Size	NS	Control
Padmanabhan and Cho (1999)	1999	MNC Size	NS	Control
Lopez-Duarte and Garcia-Canal (2002)	2002	MNC Size	-	Control
Larimo (2003)	2003	MNC Size	-	Control
Nocke and Yeaple (2004)	2004	MNC Size	NS	Control

Notes: ∩ (∪) means a curvilinear relationship was found between the explanatory variable under study and the firm's propensity to expand through a specific entry-mode. See [1], [2] and [3] in Tables 1.4 to 1.11 for the operationalization of repeated theoretical constructs within the same paper.

Table 1.14: Results obtained in previous studies for MNC level determinants (continued)

Authors	Year	Theoretical variables	Result			Hypoth.
Brownfield Investment vs. M&A; Brownfield Investment vs. GI (base outcome is BI)						
			M&A			
Cheng (2006)	2006	MNC Technological intensity	-			1
Cheng (2006)	2006	MNC previous M&A experience	NS			5
Cheng (2006)	2006	MNC Advertising intensity	-			Other
Cheng (2006)	2006	Training & Remuneration Intensity for expatriates	+			Other
			GI			
Cheng (2006)	2006	MNC Technological intensity	NS			1
Cheng (2006)	2006	MNC previous M&A experience	-			5
Cheng (2006)	2006	MNC Advertising intensity	+			Other
Cheng (2006)	2006	Training & Remuneration Intensity for expatriates	-			Other
M&A vs. GI vs. JV (base outcome is M&A)						
			GI	**JV**		
Kogut and Singh (1988)	1988	MNC Technological intensity	NS	+		1
Kogut and Singh (1988)	1988	MNC International Experience	NS	NS		2
Kogut and Singh (1988)	1988	MNC Host-country experience	NS	NS		3
Kogut and Singh (1988)	1988	MNC Diversification	NS	NS		4
Kogut and Singh (1988)	1988	MNC Size (non-US)	+	NS		Control
Kogut and Singh (1988)	1988	MNC Size (US)	-	+		Control
Full Ownership vs. Shared Ownership (base outcome is FO)						
			Shared Ownership			
Hennart and Larimo (1998)	1998	MNC Technological intensity	+			1
Padmanabhan and Cho (1999)	1999	MNC Technological intensity	-			1
Dikova and van Witteloostuijn (2007)	2007	MNC Technological intensity	-			1
Padmanabhan and Cho (1999)	1999	MNC International Experience	NS			2
Dikova and van Witteloostuijn (2007)	2007	MNC International Experience	-			2
Hennart and Larimo (1998)	1998	MNC Host-country experience	NS			3
Padmanabhan and Cho (1999)	1999	MNC Host-country experience	NS			3
Dikova and van Witteloostuijn (2007)	2007	MNC Regional experience	+			3
Padmanabhan and Cho (1999)	1999	MNC Experience in FO vs. PO	-			5
Hennart and Larimo (1998)	1998	MNC Home-country	+			11
Dikova and van Witteloostuijn (2007)	2007	MNC International Strategy	NS			Other
Hennart and Larimo (1998)	1998	MNC Size	+			Control
Padmanabhan and Cho (1999)	1999	MNC Size	NS			Control
Full M&A vs. Partial M&A vs. GI vs. JV (base outcome is GI)						
			FA	**PA**	**JV**	
Lopez-Duarte and Garcia-Canal (2002)	2002	MNC Technological intensity	+	+	NS	1
Lopez-Duarte and Garcia-Canal (2002)	2002	MNC International Experience	ND	ND	-	2
Lopez-Duarte and Garcia-Canal (2002)	2002	MNC Advertising intensity in host-country	NS	NS	NS	Other
Lopez-Duarte and Garcia-Canal (2002)	2002	MNC Size	ND	ND	+	Control
Full M&A vs. Partial M&A vs. GI vs. JV (base outcome is FA)						
			GI	**PA**	**JV**	
Barkema and Vermeulen (1998)	1998	MNC International Experience	+	NS	+	2
Barkema and Vermeulen (1998)	1998	MNC Host-country experience	-	NS	-	3
Barkema and Vermeulen (1998)	1998	MNC Diversification	+	NS	+	4
Barkema and Vermeulen (1998)	1998	MNC Diversification squared	-	NS	-	4
Barkema and Vermeulen (1998)	1998	MNC Free Cash Availability	-	-	-	6
Barkema and Vermeulen (1998)	1998	Interaction: International Experience and Product Diversification	-	NS	-	Interaction
Barkema and Vermeulen (1998)	1998	Interaction: International Experience and Product Diversification squared	+	+	+	Interaction
Barkema and Vermeulen (1998)	1998	MNC Size	NS	+	+	Control
Size of M&A investment						
Louri (2001)	2001	MNC Technological intensity	NS			1
Louri (2001)	2001	MNC Profitability	+			6
Louri (2001)	2001	MNC Home-country	NS			11
Louri (2001)	2001	MNC Financial leverage	+			Other
Louri (2001)	2001	MNC Inventory ratio	-			Other
Louri (2001)	2001	MNC labor intensity	+			Other
Louri (2001)	2001	MNC Liquidity ratio	-			Other
Fully Ownership vs. Equity JV vs. Joint Stock Company vs. Contractual JV (base outcome is FO)						
			EJV	**JSC**	**CJV**	
Wei, Liu, and Liu (2005)	2005	MNC Host-country experience	-	-	NS	3

Notes: ∩ (∪) means a curvilinear relationship was found between the explanatory variable under study and the firm's propensity to expand through a specific entry-mode. See [1], [2] and [3] in Tables 1.4 to 1.11 for the operationalization of repeated theoretical constructs within the same paper.

Table 1.15: Results obtained in previous studies for Industry level determinants

Authors	Year	Theoretical variables	Result	Hypoth.
M&A vs. GI (base outcome is M&A)				
			GI	
Caves and Mehra (1986)	1986	High-technology industry	NS	1
Dikova and van Witteloostuijn (2007)	2007	High-technology industry	-	1
Dikova and van Witteloostuijn (2007)	2007	Low-technology industry	NS	1
Barkema and Vermeulen (1998)	1998	Industry size	NS	8
Zejan (1990)	1990	Host-country market size	NS	8
Bertrand and Madariaga (2003)	2003	Host-country market size	+	8
Nocke and Yeaple (2004)	2004	Host-country market size	NS	8
Caves and Mehra (1986)	1986	Industry growth	∪	9
Zejan (1990)	1990	Industry growth	+	9
Hennart and Park (1993)	1993	Industry growth	∩	9
Andersson and Svensson (1994)	1994	Industry growth	NS	9
Hennart, Larimo, and Chen (1996)	1996	Industry growth	∪	9
Meyer and Estrin (1997)	1997	Industry growth	+	9
Hennart and Reddy (1997)[a]	1997	Industry growth	-	9
Brouthers and Brouthers (2000)	2000	Industry growth	+	9
Larimo (2003)	2003	Industry growth	+	9
Chen and Zeng (2004)	2004	Industry growth	-	9
Dikova and van Witteloostuijn (2007)	2007	Industry growth	NS	9
Slangen and Hennart (2008b)	2007	Industry growth	-	9
Barkema and Vermeulen (1998)	1998	Industry growth	NS	9
Caves and Mehra (1986)	1986	Type of industry (Durable goods)	+	Control
Hennart, Larimo, and Chen (1996)	1996	Type of industry (Resource-intensive)	-	Control
Lopez-Duarte and Garcia-Canal (2002)	2002	Type of industry (Construction)	NS	Control
Lopez-Duarte and Garcia-Canal (2002)	2002	Type of industry (Financial)	NS	Control
Lopez-Duarte and Garcia-Canal (2002)	2002	Type of industry (Manufacturing)	NA	Control
Lopez-Duarte and Garcia-Canal (2002)	2002	Type of industry (Services)	NS	Control
Lopez-Duarte and Garcia-Canal (2002)	2002	Regulated Sector	NS	Other
Meyer and Estrin (1997)	1997	First mover advantages[1]	+	Other
Meyer and Estrin (1997)	1997	First mover advantages[2]	-	Other
Caves and Mehra (1986)	1986	Industry Advertising intensity	NS	Other
Chen and Hennart (2002)[b]	2002	Industry Advertising intensity	NS	Other
Chen and Zeng (2004)	2004	Industry Advertising intensity	-	Other
Dikova and van Witteloostuijn (2007)	2007	Industry Advertising intensity	NS	Other
Caves and Mehra (1986)	1986	Industry concentration[1]	-	Other
Caves and Mehra (1986)	1986	Industry concentration[2]	NS	Other
Hennart and Park (1993)	1993	Industry concentration	NS	Other
Hennart, Larimo, and Chen (1996)	1996	Industry concentration	+	Other
Hennart and Reddy (1997)[a]	1997	Industry concentration	NS	Other
Chen and Zeng (2004)	2004	Industry concentration	+	Other
Cheng (2006)	2006	Industry concentration	-	Other
Dikova and van Witteloostuijn (2007)	2007	Industry concentration	NS	Other
Chen and Hennart (2002)[b]	2002	Industry distribution barriers	NS	Other
Chen and Hennart (2002)[b]	2002	Industry reputation barriers/premium	-	Other
Chen and Zeng (2004)	2004	Industry reputation barriers/premium[1]	+	Other
Chen and Zeng (2004)	2004	Industry reputation barriers/premium[2]	-	Other
Chen and Zeng (2004)	2004	Industry reputation barriers/premium[3]	-	Other
Meyer and Estrin (1997)	1997	Industry restructuring costs[1]	+	Other
Meyer and Estrin (1997)	1997	Industry restructuring costs[2]	-	Other
Caves and Mehra (1986)	1986	Relatedness of penetrated industry	NS	Other
Zejan (1990)	1990	Relatedness of penetrated Industry	NS	Other
Hennart and Park (1993)	1993	Relatedness of penetrated Industry	+	Other
Cho and Padmanabhan (1995)	1995	Relatedness of penetrated industry	NS	Other
Hennart, Larimo, and Chen (1996)	1996	Relatedness of penetrated industry	+	Other
Padmanabhan and Cho (1999)	1999	Relatedness of penetrated Industry	NS	Other
Brouthers and Brouthers (2000)	2000	Relatedness of penetrated Industry	NS	Other
Chen and Hennart (2002)[b]	2002	Relatedness of penetrated Industry	+	Other
Larimo (2003)	2003	Relatedness of penetrated industry	+	Other
Chen and Zeng (2004)	2004	Relatedness of penetrated Industry	+	Other
Dikova and van Witteloostuijn (2007)	2007	Relatedness of penetrated Industry	NS	Other
Slangen and Hennart (2008b)	2007	Relatedness of penetrated Industry	NS	Other
Barkema and Vermeulen (1998)	1998	Relatedness of penetrated Industry (H)	NS	Other
Barkema and Vermeulen (1998)	1998	Relatedness of penetrated Industry (R)	NS	Other
Barkema and Vermeulen (1998)	1998	Relatedness of penetrated Industry (V)	NS	Other
Hennart and Reddy (1997)[a]	1997	Relatedness of penetrated Industry[1]	+	Other
Hennart and Reddy (1997)[a]	1997	Relatedness of penetrated Industry[2]	NS	Other

Notes: ∩ (∪) means a curvilinear relationship was found between the explanatory variable under study and the firm's propensity to expand through a specific entry-mode. See [1], [2] and [3] in Tables 1.4 to 1.11 for the operationalization of repeated theoretical constructs within the same paper. [a]Only Greenfield Joint Ventures are considered; [b]M&A includes JV.

Table 1.16: Results obtained in previous studies for Industry level determinants (continued)

Authors	Year	Theoretical variables	Result			Hypoth.
Brownfield Investment vs. M&A; Brownfield Investment vs. GI (base outcome is BI)						
			M&A			
Cheng (2006)	2006	Industry concentration	NS			Other
			GI			
Cheng (2006)	2006	Industry concentration	+BI			Other
M&A vs. GI vs. JV (base outcome is M&A)						
			GI	**JV**		
Kogut and Singh (1988)	1988	Industry Advertising intensity	NS	NS		Other
Kogut and Singh (1988)	1988	Type of industry (Manufacturing)	+	NS		Control
Kogut and Singh (1988)	1988	Type of industry (Services)	NS	NS		Control
Full Ownership vs. Shared Ownership (base outcome is FO)						
			Shared Ownership			
Dikova and van Witteloostuijn (2007)	2007	High-technology industry	NS			1
Dikova and van Witteloostuijn (2007)	2007	Low-technology industry	NS			1
Hennart and Larimo (1998)	1998	Industry growth	NS			9
Dikova and van Witteloostuijn (2007)	2007	Industry growth	NS			9
Dikova and van Witteloostuijn (2007)	2007	Industry Advertising intensity	+			Other
Hennart and Larimo (1998)	1998	Industry concentration	∪			Other
Dikova and van Witteloostuijn (2007)	2007	Industry concentration	NS			Other
Hennart and Larimo (1998)	1998	Industry concentration squared	+			Other
Hennart and Larimo (1998)	1998	Relatedness of penetrated Industry	NS			Other
Padmanabhan and Cho (1999)	1999	Relatedness of penetrated Industry	NS			Other
Dikova and van Witteloostuijn (2007)	2007	Relatedness of penetrated Industry	NS			Other
Hennart and Larimo (1998)	1998	Type of industry	-			Control
Full M&A vs. Partial M&A vs. GI vs. JV (base outcome is GI)						
			FA	**PA**	**JV**	
Lopez-Duarte and Garcia-Canal (2002)	2002	Regulated Sector	NS	NS	NS	Other
Lopez-Duarte and Garcia-Canal (2002)	2002	Type of industry (Construction)	ND	ND	+	Control
Lopez-Duarte and Garcia-Canal (2002)	2002	Type of industry (Financial)	NS	NS	NS	Control
Lopez-Duarte and Garcia-Canal (2002)	2002	Type of industry (Manufacturing)	ND	ND	ND	Control
Lopez-Duarte and Garcia-Canal (2002)	2002	Type of industry (Services)	-	ND	ND	Control
Full M&A vs. Partial M&A vs. GI vs. JV (base outcome is FA)						
			GI	**PA**	**JV**	
Barkema and Vermeulen (1998)	1998	Industry size	NS	NS	NS	8
Barkema and Vermeulen (1998)	1998	Industry growth	NS	NS	+	9
Barkema and Vermeulen (1998)	1998	Relatedness of penetrated Industry (H)	+	NS	NS	Other
Barkema and Vermeulen (1998)	1998	Relatedness of penetrated Industry (R)	+	NS	+	Other
Barkema and Vermeulen (1998)	1998	Relatedness of penetrated Industry (V)	NS	NS	NS	Other
Size of M&A investment						
Louri (2001)	2001	Industry growth	NS			9
Louri (2001)	2001	Industry Advertising intensity	-			Other
Louri (2001)	2001	Industry concentration	NS			Other
Louri (2001)	2001	Industry profitability	NS			Other
Louri (2001)	2001	Industry sunk investment cost	+			Other
Fully Ownership vs. Equity JV vs. Joint Stock Company vs. Contractual JV (base outcome is FO)						
			EJV	**JSC**	**CJV**	
Wei, Liu, and Liu (2005)	2005	Industry asset intensity	+	NS	-	Other

Notes: ∩ (∪) means a curvilinear relationship was found between the explanatory variable under study and the firm's propensity to expand through a specific entry-mode. See [1], [2] and [3] in Tables 1.4 to 1.11 for the operationalization of repeated theoretical constructs within the same paper.

Table 1.17: Results obtained in previous studies for Host-country level determinants

Authors	Year	Theoretical variables	Result		Hypoth.
M&A vs. GI (base outcome is M&A)					
			GI		
Bertrand and Madariaga (2003)	2003	Host-country labor costs	NS		10
Cho and Padmanabhan (1995)	1995	Cultural distance	NS		10
O hUallacháin and Reid (1997)	1996	Cultural distance	+		11
Barkema and Vermeulen (1998)	1998	Cultural distance	+		11
Padmanabhan and Cho (1999)	1999	Cultural distance	NS		11
Brouthers and Brouthers (2000)	2000	Cultural distance	NS		11
Harzing (2002)	2002	Cultural distance	+		11
Larimo (2003)	2003	Cultural distance	+		10
Cheng (2006)	2006	Cultural distance	+		11
Slangen and Hennart (2008b)	2007	Cultural distance	+		11
Lopez-Duarte and Garcia-Canal (2002)	2002	Cultural distance (EU)	NA		11
Lopez-Duarte and Garcia-Canal (2002)	2002	Cultural distance (LatAm)	NS		11
Lopez-Duarte and Garcia-Canal (2002)	2002	Cultural distance (non-OECD, non-LatAm)	NS		11
Lopez-Duarte and Garcia-Canal (2002)	2002	Cultural distance (OECD, non EU)	NS		11
Brouthers and Brouthers (2000)	2000	Uncertainty avoidance	+		11
Bertrand and Madariaga (2003)	2003	Specialization / Agglomeration	NS		12
Wilson (1980)	1980	Country risk	+		13
Barkema and Vermeulen (1998)	1998	Country risk (high)	NS		13
Barkema and Vermeulen (1998)	1998	Country risk (medium)	+		13
Zejan (1990)	1990	Host-country development	-		10/13
Andersson and Svensson (1994)	1994	Host-country development	-		10/13
Cho and Padmanabhan (1995)	1995	Host-country development	-		10/13
Barkema and Vermeulen (1998)	1998	Host-country development	NS		10/13
Padmanabhan and Cho (1999)	1999	Host-country development	-		10/13
Larimo (2003)	2003	Host-country development	-		10/13
Nocke and Yeaple (2004)	2004	Host-country development	-		10/13
Slangen and Hennart (2008b)	2007	Foreign acquisition restrictions	+		Other
Cho and Padmanabhan (1995)	1995	Foreign ownership restrictions	-		Other
Barkema and Vermeulen (1998)	1998	Foreign ownership restrictions	+		Other
Padmanabhan and Cho (1999)	1999	Foreign ownership restrictions	NS		Other
Bertrand and Madariaga (2003)	2003	Host-country transaction costs	+		Other
Dikova and van Witteloostuijn (2007)	2007	Institutional advancement	-		Other
Dikova and van Witteloostuijn (2007)	2007	Investment incentives	NS		Other
O hUallacháin and Reid (1997)	1996	Organized labor	NS		Other
Nocke and Yeaple (2004)	2004	Host-country openness	+		Other
Cheng (2006)	2006	Restrictions in equity markets	-		Other
Hennart and Park (1993)	1993	Availability of bargains	NS		Other
O hUallacháin and Reid (1997)	1996	Availability of targets	+		Other
Slangen and Hennart (2008b)	2007	Availability of targets	+		Other
Meyer and Estrin (1997)	1997	Host-countries fixed effects	NS		Other
Bertrand and Madariaga (2003)	2003	Multilateral treaties effect (MERCOSUR)	+		Other
Bertrand and Madariaga (2003)	2003	Multilateral treaties effect (NAFTA)	NS		Other
Brownfield Investment vs. M&A; Brownfield Investment vs. GI (base outcome is BI)					
			M&A		
Cheng (2006)	2006	Cultural distance	NS		11
Cheng (2006)	2006	Restrictions in equity markets	NS		Other
			GI		
Cheng (2006)	2006	Cultural distance	-BI		11
Cheng (2006)	2006	Restrictions in equity markets	NS		Other
M&A vs. GI vs. JV (base outcome is M&A)					
			GI	**JV**	
Kogut and Singh (1988)	1988	Cultural distance	+	+	11
Kogut and Singh (1988)	1988	Uncertainty avoidance	+	+	11
Full Ownership vs. Shared Ownership (base outcome is FO)					
			Shared Ownership		
Padmanabhan and Cho (1999)	1999	Cultural distance	NS		11
Padmanabhan and Cho (1999)	1999	Host-country development	ND		10/13
Padmanabhan and Cho (1999)	1999	Foreign ownership restrictions	+		Other
Dikova and van Witteloostuijn (2007)	2007	Institutional advancement	+		Other
Dikova and van Witteloostuijn (2007)	2007	Investment incentives	NS		Other

Notes: ∩ (∪) **means a curvilinear relationship was found between the explanatory variable under study and the firm's propensity to expand through a specific entry-mode. See** [1], [2] **and** [3] **in Tables 1.4 to 1.11 for the operationalization of repeated theoretical constructs within the same paper.**

Table 1.18: Results obtained in previous studies for Host-country level determinants (continued)

Authors	Year	Theoretical variables	Result			Hypoth.
Full M&A vs. Partial M&A vs. GI vs. JV (base outcome is GI)						
			FA	**PA**	**JV**	
Lopez-Duarte and Garcia-Canal (2002)	2002	Cultural distance (EU)	ND	ND	ND	11
Lopez-Duarte and Garcia-Canal (2002)	2002	Cultural distance (LatAm)	-	ND	ND	11
Lopez-Duarte and Garcia-Canal (2002)	2002	Cultural distance (non-OECD, non-LatAm)	-	-	+	11
Lopez-Duarte and Garcia-Canal (2002)	2002	Cultural distance (OECD, non EU)	NS	NS	NS	11
Full M&A vs. Partial M&A vs. GI vs. JV (base outcome is FA)						
			GI	**PA**	**JV**	
Barkema and Vermeulen (1998)	1998	Cultural distance	+	+	+	11
Barkema and Vermeulen (1998)	1998	Country risk (high)	NS	+	+	13
Barkema and Vermeulen (1998)	1998	Country risk (medium)	+	NS	+	13
Barkema and Vermeulen (1998)	1998	Host-country development	NS	NS	NS	10/13
Barkema and Vermeulen (1998)	1998	Foreign ownership restrictions	NS	+	+	Other
Size of M&A investment						
Louri (2001)	2001	Host-country labor costs	-			10
Louri (2001)	2001	Location development	NS			13
Louri (2001)	2001	Host-country Taxes	NS			Other
Fully Ownership vs. Equity JV vs. Joint Stock Company vs. Contractual JV (base outcome is FO)						
			EJV	**JSC**	**CJV**	
Wei, Liu, and Liu (2005)	2005	Cultural distance	+	NS	-	11
Wei, Liu, and Liu (2005)	2005	Location development	-	-	+	13

Notes: $\cap$ ($\cup$) means a curvilinear relationship was found between the explanatory variable under study and the firm's propensity to expand through a specific entry-mode. See [1], [2] and [3] in Tables 1.4 to 1.11 for the operationalization of repeated theoretical constructs within the same paper.

Table 1.19: Results obtained in previous studies for Subsidiary level determinants

Authors	Year	Theoretical variables	Result			Hypoth.
M&A vs. GI (base outcome is M&A)						
			GI			
Caves and Mehra (1986)	1986	Establishment mode	+			Control
Hennart and Park (1993)	1993	Establishment mode	NS			Control
Hennart, Larimo, and Chen (1996)	1996	Establishment mode	NS			Control
Padmanabhan and Cho (1999)	1999	Establishment mode	ND			Control
Chen and Hennart (2002)[b]	2002	Establishment mode	NS			Control
Larimo (2003)	2003	Establishment mode	+			Control
Hennart and Reddy (1997)[a]	1997	Indigestibility of target firm	+			Other
Meyer and Estrin (1997)	1997	Motivation	-			Other
Chen and Hennart (2002)[b]	2002	Motivation	-			Other
Dikova and van Witteloostuijn (2007)	2007	Motivation	+			Other
Barkema and Vermeulen (1998)	1998	Ownership	NS			Other
Cheng (2006)	2006	Ownership (half)	NS			Other
Cheng (2006)	2006	Ownership (majority)	NS			Other
Cheng (2006)	2006	Ownership (minority)	NS			Other
Caves and Mehra (1986)	1986	Resource commitment	-			Other
Hennart and Park (1993)	1993	Resource commitment	-			Other
Cho and Padmanabhan (1995)	1995	Resource commitment	NS			Other
Padmanabhan and Cho (1999)	1999	Resource commitment	NS			Other
Brouthers and Brouthers (2000)	2000	Resource commitment	-			Other
Harzing (2002)	2002	Resource commitment	-			Other
Cheng (2006)	2006	Resource commitment	-			Other
Dikova and van Witteloostuijn (2007)	2007	Resource commitment	-			Other
Slangen and Hennart (2008b)	2007	Resource commitment	-			Other
Slangen and Hennart (2008b)	2007	Subsidiary autonomy	-			Other
Harzing (2002)	2002	Subsidiary development	-			Other
Brownfield Investment vs. M&A; Brownfield Investment vs. GI (base outcome is BI)						
			M&A			
Cheng (2006)	2006	Ownership (majority)	NS			Other
Cheng (2006)	2006	Ownership (half)	NS			Other
Cheng (2006)	2006	Ownership (minority)	NS			Other
Cheng (2006)	2006	Resource commitment	NS			Other
			GI			
Cheng (2006)	2006	Ownership (majority)	NS			Other
Cheng (2006)	2006	Ownership (half)	NS			Other
Cheng (2006)	2006	Ownership (minority)	NS			Other
Cheng (2006)	2006	Resource commitment	+BI			Other
Full Ownership vs. Shared Ownership (base outcome is FO)						
			Shared Ownership			
Hennart and Larimo (1998)	1998	Motivation	+			Other
Dikova and van Witteloostuijn (2007)	2007	Motivation	+			Other
Padmanabhan and Cho (1999)	1999	Resource commitment	NS			Other
Dikova and van Witteloostuijn (2007)	2007	Resource commitment	+			Other
Hennart and Larimo (1998)	1998	Establishment mode	NS			Control
Padmanabhan and Cho (1999)	1999	Establishment mode	NS			Control
Full M&A vs. Partial M&A vs. GI vs. JV (base outcome is FA)						
			GI	**PA**	**JV**	
Barkema and Vermeulen (1998)	1998	Ownership	ND	ND	ND	Other
Fully Ownership vs. Equity JV vs. Joint Stock Company vs. Contractual JV (base outcome is FO)						
			EJV	**JSC**	**CJV**	
Wei, Liu, and Liu (2005)	2005	Resource commitment	NS	NS	-	Other

Notes: ∩ (∪) means a curvilinear relationship was found between the explanatory variable under study and the firm's propensity to expand through a specific entry-mode. See [1], [2] and [3] in Tables 1.4 to 1.11 for the operationalization of repeated theoretical constructs within the same paper. [a]Only Greenfield Joint Ventures are considered; [b]M&A includes JV.

Table 1.20: Results obtained in previous studies for control variables

Authors	Year	Theoretical variables	Result			Hypoth.
M&A vs. GI (base outcome is M&A)						
			GI			
Zejan (1990)	1990	Time trend	-			Control
Andersson and Svensson (1994)	1994	Time trend	-			Control
Cho and Padmanabhan (1995)	1995	Time trend	NS			Control
Barkema and Vermeulen (1998)	1998	Time trend	NS			Control
Padmanabhan and Cho (1999)	1999	Time trend	NS			Control
Lopez-Duarte and Garcia-Canal (2002)	2002	Time trend	NS			Control
Larimo (2003)	2003	Time trend	-			Control
Slangen and Hennart (2008b)	2007	Time trend	ND			Control
Full Ownership vs. Shared Ownership (base outcome is FO)						
			Shared Ownership			
Padmanabhan and Cho (1999)	1999	Time trend	NS			Control
Full M&A vs. Partial M&A vs. GI vs. JV (base outcome is GI)						
			FA	**PA**	**JV**	
Lopez-Duarte and Garcia-Canal (2002)	2002	Time trend	+	+	ND	Control
Full M&A vs. Partial M&A vs. GI vs. JV (base outcome is FA)						
			GI	**PA**	**JV**	
Barkema and Vermeulen (1998)	1998	Time trend	ND	ND	ND	Control

Notes: ∩ (∪) means a curvilinear relationship was found between the explanatory variable under study and the firm's propensity to expand through a specific entry-mode. See [1], [2] and [3] in Tables 1.4 to 1.11 for the operationalization of repeated theoretical constructs within the same paper.

Chapter 2

Determining the Choice of Entry-mode of Multinationals - My 6 million regressions

2.1 Introduction

Motivated by the findings of Chapter 1 and the lack of robustness of the previous literature's results to model specification, in this paper I perform an Extreme Bounds Analysis (EBA) to determine which of almost 60 explanatory variables used by the literature are robust to different model specifications when modeling a Multinational Company's (MNC) entry-mode into a foreign market. I do so by following the methodology introduced by Sala-i-Martin (1997b) in a multinomial logit framework, based on 640 entries into foreign countries performed by the largest 22 financial MNCs in the last 15 years. I hence look at the entire distribution of the estimator for each explanatory variable's coefficient, and essentially apply Sala-i-Martin's (1997b) methodology in the context of foreign establishment mode decisions.

In this Chapter I firstly try to tackle some of the shortcomings of the previous literature as described in Chapter 1 and suggest additional hypotheses to capture host-country level determinants. I also improve the operationalization of industry level variables in a multi-home-country and -host-country setting, by restricting the analysis to financial MNCs. I then run the EBA on 60 variables capturing the literature's traditionally analyzed hypotheses, as well as own hypotheses introduced here. Based on over six million regressions, I find that an MNC's size and its international experience increase the likelihood of greenfield investments (GI) as opposed to Mergers & Acquisitions (M&A) or any type of entry-mode involving a partner, as can be Joint Ventures (JV). Conversely, findings imply that the larger its host-country experience, as well as its experience differential in M&A over GI, the less likely greenfields become. Although the first results may look surprising, these findings support the intuition that the more host-country experience, the more understanding of the local target market for mergers or acquisitions[1]. With respect to the host-country's characteristics, more cultural distance between home and host-country, a better developed local financial sector (or local credit market), a more regulated environment for obtaining licenses and more macroeconomic sustainability increase the chances of GI, while a worse local infrastructure, higher Information and Communications Technology (ICT) costs and more difficulties in registering property and employing workers decrease the odds of greenfields. Joint Ventures are more likely if the MNC is larger and if the host-country has more macroeconomic sustainability and/or if it has a worse investment environment. A small and expensive talent pool, make JV less likely when compared to M&A. China is a preferred location for GI and JV, while Brazil, Eastern Europe and MENA countries seem to favor M&A entries.

In addition, I find that the size, expensiveness and quality of the talent pool significantly increase the likelihood of full GI due to its character of being generated from scratch, rather than because it is done in a full ownership mode or without the interaction with a second enterprize. The same applies for a host-country's political stability.

The next section proposes alternative hypotheses to better capture host-country level determinants, while in section 2.3 the theoretical framework and methodology applied in this paper are described. Section 2.4 summarizes the results stemming from the EBA and finally, section 2.5 suggests topics for further research and concludes.

2.2 The Host-Country Level Determinants

2.2.1 New Hypotheses at the Host-Country Level

MNC location choice decisions are mainly driven by host-country characteristics, either in absolute terms or in terms of their differential to the same characteristics in the MNC's home-country. To which extent those differentials will play a larger role or not in the final location decision obviously also depends on firm and industry level attributes. Given the simultaneity through which location and entry-mode decisions are usually – although not always – carried out, if one would like to separate the effects of regressors on the location decision from the effect on the

[1] See Hypothesis 3b in Chapter 1.

entry-mode choice a two-step approach could be implemented. Modeling these decisions through a step-wise approach would introduce an artificial way of disentangling the effect of the same factors on the two dimensions of a cross-border entry-mode decision. None of the reviewed papers makes the different nature of those two dimensions explicit. Indeed, until date literature has failed to use a methodological framework that allows for a differentiated assessment of host-country characteristics' impact on location and on entry-mode. All 15 papers reviewed in the previous chapter that analyze MNC entries into multiple host-countries in a discrete dependent variable framework[2] include some sort of host-country determinants, but mostly as control variables and capturing various aspects on a broader basis, e.g. using the host-country's development[3], or country risk[4]. Even in those studies in which concrete hypotheses are looked at through host-country determinants, e.g. the impact of cultural distance on entry-mode decisions, there is no mention to the fact that in a multiple host-country context, those host-country-level determinants are also accounting for location decisions. In a two-step approach[5], when trying to isolate the differentiated impact of host-country attributes on entry-mode decisions only, the use of additional host-country variables becomes more relevant.

For instance, certain host-country level characteristics while being considered of utmost importance for offshoring location decisions in the literature around site-selection are neglected in entry-mode decisions literature, although they may be of relevance for the latter type of decision too. For example, if one approaches cross-country entry-mode decisions within such a two-step framework, the infrastructure development or talent availability of a country may bias an MNC's foreign-country location decision towards those countries with better infrastructure or talent pool. Once an MNC has decided to enter a certain host-country – conditional on the country choice and independently on how those host-country attributes determined the location choice – those same characteristics may be key to decide the establishment mode. Indeed, one may think of a worse infrastructure as a feature increasing the odds of M&A as opposed to GI, given that building something from scratch is more difficult in countries with bad infrastructure.

As was reviewed in Chapter 1, certain characteristics like the host-country's cost differential with respect to home-country costs, the cultural distance between home-

[2]See Section 1.4.2 and Table 1.3.

[3]See Zejan (1990), Andersson and Svensson (1994), Barkema and Vermeulen (1998), Padmanabhan and Cho (1999) and Nocke and Yeaple (2004).

[4]See Barkema and Vermeulen (1998).

[5]Please note that a detailed discussion on whether a two-step approach is adequate follows in the methodological section of this chapter.

and host-country, the degree of the host-country's specialization, as well as its political and macroeconomic stability have been considered in the literature of entry-mode decisions. In this section I propose to account for additional host-country characteristics that may not be captured by the more general variables that are usually used in the literature[6], e.g. dummies for country development or simply GDP per capita. Please note that the numbering of hypothesis will follow up on the 13 hypotheses already described in Chapter 1.

The infrastructure of a country can be understood as determining entry-mode decisions as it affects the ability or difficulty an MNC will encounter when starting a new venture from scratch. In an M&A, the target is already operating in the environment, which guarantees that it has an adequate infrastructure and that the acquiring MNC will not have to invest too much effort in adapting, changing or generating new infrastructure. Therefore, if a country counts with a poorly developed infrastructure, this characteristic may lower the odds of greenfield investments as opposed to M&A. In other words, a country with a low degree of infrastructure development will increase costs in a GI set-up, making a M&A entry more likely. This yields the following hypothesis:

Hypothesis 14: *Ceteris paribus*, the worse the host-country's infrastructure, the greater the likelihood of entering offshore ventures via M&A.

With respect to the business environment, a more friendly environment in terms of starting, registering, recruiting and hiring, as well as firing and closing a business will increase the likelihood of GI, as institutional variables determine how rigid the host-country is towards the starting of a venture from scratch. Since more rigidity implies more associated costs, it can be stated that:

Hypothesis 15: *Ceteris paribus*, the more friendly the host-country's business environment, the greater the likelihood of entering offshore ventures via GI.

Finally, a highly qualified and abundant talent pool of workers is a necessary condition for every offshore venture, but it increases the chances of a GI, since greenfield investments will have to recruit their staff from the available talent pool, as opposed to M&A ventures, which will start with an existing human resources endowment. The smaller the talent pool the higher the costs of finding employees and therefore the more attractive it is to enter via M&A since those costs have already been born:

[6]See Chapter 1.

Hypothesis 16: *Ceteris paribus*, the larger and better qualified the host-country's talent pool, the greater the likelihood of entering offshore ventures via GI.

2.2.2 Results from previous studies

Although none of the additional hypotheses above has been included or discussed explicitly in previous studies, one could try to align the variables used by certain studies to hypotheses 14 to 16, interpreting them in the context of the arguments presented in the previous section and so look at potentially interesting "previous" results.

None of the studies reviewed in Chapter 1 explicitly test for host-country infrastructure as a determinant of the choice of entry-mode. Zejan (1990), Andersson and Svensson (1994), Barkema and Vermeulen (1998), Padmanabhan and Cho (1999) and Nocke and Yeaple (2004) include host-country development as a general variable aiming at capturing cost-differentials, infrastructure and macroeconomic conditions and stability. Developed countries are supposed to have less of a cost differential, better infrastructure and macroeconomic conditions. The latter two would suggest that GI are preferred, while a low cost differential speaks rather for the contrary, according to hypotheses 14, 15 and 13 respectively. Four of the aforementioned studies[7] find a negative relationship between host-country development and greenfield entry, which points at the fact that the cost-differential argument seems to be predominant.

Hypothesis 15 makes reference to a host-country's business-friendly environment. Trying to account for the same spirit one can say that including the extent of the host-country's unionization[8], the existence of investment incentives and institutional advancement[9] or the existence of restrictions to foreign acquisitions, ownership or investments[10], can be understood as assessing the degree of friendliness of the business environment in the host-country. Here again there is no consistency among results: more institutional advancement yields lowers the likelihood for GI according to Dikova and van Witteloostuijn (2007), pointing in a different direction as the one suggested by hypothesis 15. Government incentives and organized labor yield non-significant results[11], as well as foreign ownership restrictions in Padmanabhan

[7] See Zejan (1990), Andersson and Svensson (1994), Padmanabhan and Cho (1999) and Nocke and Yeaple (2004).
[8] See O hUallacháin and Reid (1997).
[9] See Dikova and van Witteloostuijn (2007).
[10] See Barkema and Vermeulen (1998), Padmanabhan and Cho (1999), Cheng (2006) and Slangen and Hennart (2008b).
[11] See Dikova and van Witteloostuijn (2007) and O hUallacháin and Reid (1997), respectively.

and Cho (1999). Lopez-Duarte and Garcia-Canal (2002) find no significant results for the extent of sector regulation. Finally, legal or government restrictions are twice found to be positively related to GI likelihood[12], and twice negatively associated with the odds of greenfields[13].

Bertrand and Madariaga (2003) include host-country transaction costs – which can be understood as modeling either the cost differential or the friendliness of business environment – and obtain a positive relationship between the odds of GI and high host-country transaction costs, supporting both hypothesis 10 and hypothesis 15. Hypothesis 16 is neither operationalized, nor discussed in the reviewed literature.

2.3 Methodology and data used

2.3.1 Methodology

Let the sample have M multinationals, indexed by $m = 1, \ldots, M$. Let g_m^* be the latent propensity to offshore of multinational m.

$$g_m^* = \beta_0 X_{0m} + \varepsilon_{0m} \tag{2.1}$$

where X_{0m} are explanatory variables – characterizing the MNC – for the firm's offshore propensity.

If $g_m^* \geq c$ then one observes $g_m = 1$, i.e. an offshoring event takes place. If $g_m^* < c$, then $g_m = 0$, no offshoring event occurs. c can be defined as a threshold depending on which the offshoring decision is taken, e.g. a level of costs; a profit differential achievable through expansion into foreign markets; etc.

Observable is only $g_m = 1$, where at least one offshoring event takes place. Let O_{mt} be a variable denoting the existence and the extent of offshoring in MNC m at a moment in time t. O_{mt} can be characterized by three dimensions: size, place, and mode of entry

$$O_{mt} := (s_{mt}, l_{mt}, y_{mt}) \tag{2.2}$$

where l_{mt}, y_{mt} and s_{mt} are vectors containing all chosen locations abroad, its mode of entry and the extent of the investment done in that offshore venture, respectively.

[12]See Barkema and Vermeulen (1998) and Slangen and Hennart (2008b).
[13]See Cho and Padmanabhan (1995) and Cheng (2006).

The most complex – and probably comprehensive – way of estimating the determinants of an MNC's offshoring portfolio O_{mt} would be to jointly estimate a system of equations through a simultaneous equations model of the type:

$$\begin{cases} s_{mt} & = \beta_{sl} l_{mt} + \beta_{sy} y_{mt} + \beta_1 X_{1mt} + \varepsilon_{1mt} \\ l_{mt} & = \beta_{ly} y_{mt} + \beta_{ls} s_{mt} + \beta_2 X_{2mt} + \varepsilon_{2mt} \\ y_{mt} & = \beta_{yl} l_{mt} + \beta_{ys} s_{mt} + \beta_3 X_{3mt} + \varepsilon_{3mt} \end{cases}$$

Given that each multinational m will have several offshoring events, each one with its specific characteristics, I decided to treat each event as an individual cross-section unit. Every event will be indexed by e, $e = 1, \ldots, E$, being E the actual sample size or total number of events. This will obviously imply that there will be no independence among cross-section units since it is very unlikely that the decision making process of each event was made independently of previous or current offshoring ventures of the same MNC. Even more, given agglomeration theory arguments it would also be restrictive to believe that they happen independently of events from other MNCs.

The above can be true for events characterized by the three dimensions l_m, y_m and s_m – e.g. it is hard to believe that a MNC with a previous bad experience in, say, Thailand will take its next (integral) offshoring decision, in which the location choice is embedded, without taking that into account. Still, it could be argued that once an MNC has decided how much it wants to invest in a certain host-country – i.e. s_m and l_m have been decided – the decision of an entry-mode conditional on the above two dimensions will be so specific that one could treat every event as being independent from other events.

For the purpose of this study and based on the reasoning exposed above I decided to treat the decision process as a sequential process where, given that $g^*_m \geq c$, the first step determines the size of the offshoring venture, in a second stage the location is defined and the third stage chooses the mode of entry.

The first stage can thus be modeled through[14]:

$$s_e = \begin{cases} s^*_e = \beta_1 X_{1e} + \varepsilon_{1e}, & \text{if} \quad g_m = 1 \\ 0, & \text{if} \quad g_m = 0 \end{cases} \tag{2.3}$$

[14]For simplicity the time sub-index t will be dropped from notation.

being X_{1e} the explanatory variables for the size of the offshore investment and

$$\begin{pmatrix} \varepsilon_{0m} \\ \varepsilon_{1e} \end{pmatrix} \overset{i.i.d.}{\sim} \mathrm{N}\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_0^2 & \rho_{\sigma_0,\sigma_1} \\ \rho_{\sigma_0,\sigma_1} & \sigma_1^2 \end{pmatrix} \right)$$

where X_{1m} includes characteristics of the firm and of the industry/market it operates in.

In the second stage and conditional on the decided size for the offshore investment, the location is defined,

$$l_e = \beta_2 X_{2e} + \beta_{ls} s_e + \varepsilon_{2e} \tag{2.4}$$

where X_{2e} may include characteristics of the MNC – e.g. an internationally experienced MNC may be less reluctant to go to a non-traditional offshoring spot – and will also include characteristics of home and host-country (or its differentials), including those referring to the industry to which parent and target/new venture belong to[15].

In a final step, and given the size of the investment and the location has been chosen, the entry-mode is decided:

$$y_e = \beta_3 X_{3e} + \beta_{yl} l_e + \varepsilon_{3e} \tag{2.5}$$

In this way, the entry-mode decision is assumed to be taken conditional on a previous decision that determined the size of the offshoring effort as well as its location. In other words, even though X_{3e} may include the same explanatory variables used to determine location and/or size, these variables should now only be relevant if they play a role in the entry-mode decision itself, isolated from the previous location decision given that it is assumed that the entry-mode is taken conditional on the location choice and size.

Since the location decision is given, each event will be characterized by the MNC taking the decision, the industry in which the event falls and the host-country in which it will take place. This is important because it allows to treat all explanatory variables characterizing the MNC, the industry and the host-country as individual-specific variables and thus not varying across modes of entry. For example, the international experience of the MNC or the local infrastructure of the host-country of event e will be the same, irrespective of the entry being M&A or GI. Variables at

[15]See Veugelers (1991) and Gupta (2007) on offshoring location determinants, and Cheng (2007) for location decisions within China.

the three specified levels – MNC, industry, host-country – can hence be treated as independent of choice attributes and this allows for a multinomial logit approach.

Accordingly, results must be interpreted as relating only to the decision of entry-mode and not related to location choice decisions. If, e.g. the properties of the host-country's talent pool – a main driver in location decisions – are significantly related to the likelihood of a GI, then this relationship must be understood independently of the fact that firms may enter a host-country given the size or quality of its labor supply. Analogously, although cheap labor might be decisive for choosing an offshoring spot, it might be irrelevant for determining entry-mode.

Note that one could have cluster effects at the MNC level, i.e. one MNC might be affected less or more in its entry-mode decision by certain determinants given individual unobservable characteristics[16]. The most intuitive example for this are organizational values – e.g. prioritize the generation of in-house expertise as a way of fostering its employees' professional growth. Because I have several investment-events for each MNC, I control for MNC specific individual effects in all regressions by using clustered estimation procedures[17].

The multinomial logistic regression estimated is:

$$\log\left(\frac{\Pr(Y_e = j)}{\Pr(Y_e = 1)}\right) = \alpha_j + X_{3e}\beta_3' + \beta_{yl} l_e \tag{2.6}$$

Note that the advantage of estimating a multinomial logit instead of a conditional logit (where, besides individual attributes, choice attributes could have been included in the explanatory variables) is twofold:

1. avoid having independence from irrelevant alternatives

2. data availability and computational burden would make it necessary to pool locations – as to have a maximum of 10 to 12 choices – and this would make the characterization of host-country attributes very difficult.

This paper applies the above sketched multinomial logit approach in three different decision settings, see section 2.4 for a description.

[16] Pitts (1977) and Pitts (1980) argue that expansion through internal development and expansion through acquisitions are two pure strategies: firms either choose one strategy or the other (cf. Amburgey and Miner (1992)). Lamont and Anderson (1985) could not confirm this prediction for highly diversified U.S. firms.

[17] See Xu, Pan, and Beamish (2004).

2.3.2 Data

The analysis is based on a database that was designed and built to perform this analysis and was sponsored in terms of resources and time spent in building it by Watson Wyatt Worldwide. The so-called Watson Wyatt Offshoring Event Study 2008 database includes over 3400 offshoring-related events for the 40 largest MNCs worldwide[18]. It was built based on the MNCs' official press clippings of the last 15 years, as well as on Bloomberg data for M&A deals. Information stemming from both sources was then matched and checked for consistency to avoid repeating events. The database was constructed including all events related to a firm's decision to go abroad, as well as to exit of an offshore venture (e.g. divestiture), registering the exact date of the event. Every event was catalogued in terms of the chosen mode of entry – M&A (FA vs. PA), JV, GI –, the type of news – pre-announcement, actual deal, termination, license, post-announcement –, the payment mode chosen for the transaction, the sector and country of both parent and offshore enterprises, as well as several other deal specific or MNC specific characteristics. All data was deflated and all variables expressed in monetary terms are in terms of 2000 USD.

For the present analysis I only took financial MNCs into account[19] and only considered those deals that were neither pending nor terminated, i.e. those which actually took place. In total I used 640 events for this study, all of them being events of MNCs entering a foreign country, i.e. I did not consider divestitures or any other events of foreign country exit. This allowed me to have proxies at the industry level that were consistent across countries. Most studies with more than five host-countries have weak proxies to account for industry specific size and growth variables. By restricting my analysis to the financial sector only I am able to include sector specific attributes, that although less sophisticated than those used in other studies still allow me to perform an analysis including over 50 host-countries.

[18] The universe of MNCs initially considered was based on the top 100 non-financial transnational corporations (TNC) list and the top 50 financial TNC list for 2004 of the United Nations Conference on Trade and Development (UNCTAD), combined with the top 50 in the 2007 *Forbes* 500 list (ranked by assets) and the top 50 American companies according to the 2007 *FORTUNE* 500 ranking. Further criteria in terms of the internationalization degree of those MNCs were used to determine the final sample of MNCs.
See http://www.unctad.org/ for the UNCTAD rankings, for the *Fortune* ranking see http://money.cnn.com/magazines/fortune/fortune500/2007/full_list/ (accessed May 9, 2007) and for the *Forbes* 500 see http://www.forbes.com/2003/03/26/500sland.html (accessed May 24, 2007).

[19] The study included major financial MNCs, selected according to the criteria explained in the previous footnote. In total, 640 deals of 22 financial MNCs were considered. Six of them from the United States, three from the United Kingdom, three from the Benelux (Belgium, the Netherlands and Luxembourg), three from France and the remaining seven are from Germany, Italy, Japan, Spain and Switzerland. The names of the firms are not disclosed due to account management and confidentiality policies of Watson Wyatt Worldwide.

Tables 2.1 to 2.9 in the Appendix B describe all variables used in the analysis, with their respective sources. All variables included at the host-country level are annual. Most variables at the MNC level are annual, please see the note in Table 2.2 for details. All variables at the target and deal level are target and deal specific and are specified for the actual date of the event. Every deal is treated as an individual cross-section unit. Annual variables characterizing the host or home-country, the MNC involved or the industry associated to that individual deal, are matched by year (or date if the variable's frequency allows it) and by country for each deal.

In order to reduce the number of variables to be tested and the amount of potentially multicollinear variables in the EBA, as well as to pool those variables in a way to capture the hypotheses through single aggregated indicators for all host-country indicators – except for those related to distance – I constructed aggregated indices within the categories macroeconomic environment, infrastructure, country specialization (as an offshoring location for services and high end work), talent pool, labor costs, business environment and other costs. All indicators were derived through the same methodology, by calculating the simple average of a group of sub-indicators that were standardized to be a z-score. Aggregated indices are defined to be more risky or worse for higher values, and less risky or better for lower values. Accordingly, z-scores based on sub-indicators displaying the opposite behavior were reversed to make the aggregation possible. The generated z-scores for all sub-indicators range between 0 and 1, where 0 is taken by the country-year combination with the most favorable value and 1 is taken by the country-year combination with the worst value. The average of a given number of z-scores is thus also between 0 and 1 and therefore each final index will rank countries from 0 to 1, but both ordinal and cardinal characteristics of the data are preserved.

2.3.3 Operationalization of the Hypotheses

In this section I will describe the variables used to operationalize each hypothesis, with a brief discussion of its strengths and weaknesses as a proxy, as well as of the operationalization used in previous studies. The details concerning the construction of each variable, as well as the sources of information used can be found in the Appendix B.

2.3.3.1 MNC Technological expertise

Since this study is not based on survey data, but on publicly available data, and because the MNCs included in this study are from different home-countries and their reporting standards differ, it was almost impossible to retrieve the information on R&D expenditures in a consistent way for all MNCs. In fact, although Bloomberg includes a category for this type of information, the field was almost always empty and no information was available for most cases. In addition, it is difficult to assess to which extent a financial MNC is investing in R&D or innovation, since as the financial industry is providing services, almost every improvement in terms of processes – organizational or commercialization processes – could be understood as an innovation output. Given that all financial MNCs included in this study are active in the U.S. – irrespective of being American MNCs or not – I decided to proxy the R&D intensity through the number of worldwide patent applications of these MNCs.

2.3.3.2 MNC International Experience

For the purpose of this study I decided to use the number of subsidiaries abroad. This proxy allows for a ranking of the MNCs in terms of their international exposure, rather than for a dynamic measure of cumulated experience at the moment of deciding the entry-mode and can hence only account for differences among MNCs and not within one MNC[20].

2.3.3.3 MNC Host-country experience

Following the spirit of the latter measure, I use the number of subsidiaries of the MNC in the host economy, previous to the event.

2.3.3.4 MNC Product Diversification

I decided to apply a Herfindahl–Hirschman Index (HHI) measure, but instead of using the Wernerfelt and Montgomery (1986) approach suggested by Hennart and Park (1993), I apply a normalized HHI over the market share of different products offered by each MNC, controlling for the number of products offered, since some financial multinationals tend to differentiate more across similar type of products than others, not necessarily meaning they are more diversified.

[20] Originally I had constructed a variable accounting not only for the number of subsidiaries abroad, but also for their size (in terms of employees and sales) but the lack of availability of data for most MNCs in the sample made it impossible to use this variable.

2.3.3.5 MNC Expertise differential among the different entry-modes

To account for the expertise differential of one entry-mode over the other one, I decided to take the proportion of M&A experience in total offshoring experience as a measure for the expertise differential. The measure is thus constructed as the number of previous entries through M&A over the number of previous entries in all three modes considered – M&A, JV and GI.

2.3.3.6 MNC Efficiency

Since this paper is focusing on one industry only and the MNCs included operate worldwide I decided not to relativize my efficiency measures with respect to an industry average, since all MNCs included can be compared in absolute terms with each other as they operate in the same industry and in the same global market. Pinning their efficiency down to their home-country's industry average would have introduced more noise than information.

I introduce three efficiency measures allowing for three different efficiency dimensions. Firstly, I use a labor efficiency measure, proxied by the MNC's total turnover over the total number of employees. Secondly, I use an efficiency ratio that measures how much net revenue the MNC is able to generate for each dollar of its non-interest expenses. Finally, I use the price-to-earnings (P/E) ratio of the firm as a way to introduce the market's view of the firms past efficiency. Since the P/E ratio is the shareholders assessment of the future performance potential of the firm, it can act as a proxy for the market's reward for past efficiency (or for expected future efficiency).

2.3.3.7 Market entry barrier costs

The main reason I decided to restrict the present study to the financial industry, was the difficulty of constructing a homogeneous measure for industry size and industry growth – not mentioning of industry concentration – for various industries and the 52 host-countries included in this study, most of which are developing countries with scarce data. To allow for comparability among the different countries and the size of their financial industry I proxied the host-countries' financial industry size by liquid liabilities as a percentage of GDP, and its growth rate by the average annual growth of the proxied industry size in the five years previous to the offshoring event[21]. This measure accounts for Slangen and Hennart's (2007) comment, that using the real

[21] Similar to Brouthers and Brouthers (2000) proxy for market growth.

size of GNP or GDP[22] or its growth rate[23] to model the extent of market barrier costs was too vague since different industries within the same host-country could have differing behavior.

2.3.3.8 Cost differential between home and host-country

Since labor costs are not the only costs an MNC faces when engaging in an enterprise offshore, I include four types of variables to test the cost differential hypothesis.

Firstly, I use three measures for labor costs, that distinguish among three different levels of employment. Based on the Watson Wyatt Global Grades[24] I include labor cost measures at junior management and professional advisors positions (GGS 9), at middle management positions (GGS 14), and at senior management or heads of functions positions (GGS18). The Global 50 Remuneration Planning Reports present inter-quartile market ranges for the annual base salary[25] at the different GGS levels, and I use the median annual base salary (in USD) as the labor cost measure.

Furthermore, I include other costs' indicators for infrastructure and taxes. The ICT costs indicator includes internet access costs, and the occupancy costs indicator captures occupation costs per squared meter on an annual basis, as well as occupancy cost inflation. Finally, I also include an index integrating tax burden on profits. For details please refer to Appendix B.

2.3.3.9 Cultural Distance between home and host-country

As was already explained in Chapter 1, cultural distance is usually operationalized through Kogut and Singh's (1988) index based on Hofstede (1980) data. Although widely accepted as a measure of cultural distance, this proxy suffers from two caveats: firstly it is useful when comparing distances to an anchor country, but not necessarily reliable when comparing different country pairs. Secondly it is based on subjective

[22] As done by Barkema and Vermeulen (1998) and Zejan (1990) respectively.

[23] Barkema and Vermeulen (1998) and Larimo (2003) use the host economy's GDP growth rate and Andersson and Svensson (1994) use host-country's GDP growth rate.

[24] Watson Wyatt has developed a global framework in which a hierarchy of 25 job categories has been designed to match job positions and its remuneration characteristics for 58 different countries across the globe. This Global Grading System (GGS) ensures that survey collection of global remuneration data is consistent and comparable across countries and time. The data included considers full time employees on local employment terms, i.e. it does not consider expatriates or part-timers. See Watson Wyatt Worldwide (2008) for details on the methodology.

[25] The annual basic guaranteed salary includes the annual salary (12 months), plus any guaranteed additional months and/or bonuses due to legal vacation pay, extra contractual months and fixed cash allowances (e.g. food, housing, transportation), amongst others. See Watson Wyatt Worldwide (2008).

data, stemming from a survey performed on a non-representative sample. I therefore decided to use alternative and more conservative measures of cultural distance, that although not perfectly adapted to fit with the idea of organizational culture, seem to introduce less noise into the regressions than the original index, since they are stemming from hard data. To proxy cultural distance and hence the difficulty of managing a unit due to cultural clash or low responsiveness to directions from abroad I use (1) an indicator on physical distance, (2) a dummy variable accounting for the existence of a previous colonial relationship between the home and host-country, (3) a categorical variable taking the value 1 if both countries have the first language in common, 0.5 if the host-country speaks the home-country's language at least as a second language and 0 otherwise, and (4) a dummy variable accounting for the two countries to be neighbors or not. Measure (2) is an indirect indicator for organizational culture and work values, since countries having had a past colonial relationship have similarly rooted institutions – including educational institutions – which can shape the workforce in similar ways. Furthermore, language is known to be one of the most important variables determining the way people structure their thoughts and shaping people's analytical skills. This is this the reason why a common language indicator can also be used as a cultural distance indicator.

2.3.3.10 Host-country infrastructure

The poor development of a country's infrastructure can be a main obstacle when it comes to start a business from scratch and seems therefore to be a sure candidate among the determinants of an MNCs entry-mode into a foreign country. As already mentioned, Wilson (1980), Zejan (1990) and Barkema and Vermeulen (1998) all include GNP per capita as a control variable. Andersson and Svensson (1994) control for GDP per capita, as a proxy for the "*sophistication level in the host economy*"[26]. Dikova and van Witteloostuijn (2007) are the first introducing host-country governance variables and make use of the World Bank's governance indicators. They argue that the impact of firm level attributes in the entry-mode decision can be moderated by the host-country characteristics. Padmanabhan and Cho (1999) include a development dummy separating countries in industrial market industries and developing countries after the World Bank's classification. All of these measures although capturing partly the level of a country's infrastructure, are not specifically looking at how a country's infrastructure's development-needs may avoid greenfields or its excellent infrastructure conditions may attract them. In fact they may be capturing other attributes of a large and developed country, like the availability of more takeover targets or better-working markets making acquisitions easier, as Andersson

[26]See Andersson and Svensson (1994), p.555.

and Svensson (1994) try to capture with this variable. I try to account for infrastructure specific development and since the study focuses on MNCs providing services, I included an infrastructure indicator that proxies the development of Information and communications technology (ICT) infrastructure. The index's construction is based on z-scored sub-indicators as explained in section 2.3.2 and it is described in detail in Table 2.4.

2.3.3.11 Host-country Business Friendly Environment

Surprisingly this is a construct that is underresearched in the literature of entry-mode choice. But clearly, the extent to which a country has a business friendly environment will make it more or less difficult to enter the country via GI. I therefore included several indicators from the World Bank's Doing Business database[27], that incorporate the costs associated with starting business, with dealing with licenses, as well as with registering property, thus factoring in to which extent the host-country's institutional context affects the initial stages of setting up a whole new unit. Following a start-up's life-cycle, the next business environment indicators reveal the difficulties of employing workers, of employing associated costs (taxes and firing costs) and of enforcing contracts. A further indicator deals with the country's regulations around closing a business.

Irrespective of the easiness or costs associated with starting a business and running a business considered above, other factors like corruption and institutional strength can be supposed to affect the decision of entering a country via M&A or via GI. I therefore include two further indicators accounting for the institutional environment and the investment environment in the host-country. For methodological details on the indicators please see Appendix B.

2.3.3.12 Host-country Specialization

In terms of location analysis specialization is hence a clear candidate as explanatory variable. But should it also play a role in determining entry-mode choice? On the one hand, a specialized country will offer more takeover targets in its industries of specialization, as well as more Joint Venture partners. In terms of its impact on GI, one can argue that specialization often translates into human resources programs and educational programs improving the local talent pool. Conversely, the competition for talent may be higher and high turnover rates can be expected at the beginning of a new venture until a certain awareness of the MNC's brand is achieved at the

[27] See World Bank (2008).

host-country and/or employee loyalty and commitment. In any case, the fact that a country has specialized or gained a reputation of being a proper offshoring spot could affect the mode of entry. Since the paper deals with the financial industry, I focus on indicators of specialization that relate to service and skill intensive industries. The aggregate index I constructed for specialization includes the value added in services (as a percentage of GDP); the number of patents applications in that country, both by residents and by non-residents – to explore the impact of the level and amount of research done in the host-country, as well as the value of intellectual property –; the amount of high-technology exports and of services' exports; and finally it also includes net inflows of foreign direct investments (as a percentage of GDP). Agglomeration is usually present in location choice literature, rather than in foreign entry-mode studies. Among the latter, a study including an agglomeration proxy is Bertrand and Madariaga (2003) that use past FDI to account for agglomeration.

2.3.3.13 Host-country Talent Pool

The attributes of a country's talent pool can be separated into three dimensions: its size, its quality in terms of skills and its suitability for foreign enterprises. Further studies have not considered the size of the host-country's workforce directly, but as already mentioned some studies account for the size of the host economy, as a proxy for this and other constructs. I make use of a talent pool size indicator that accounts for the local workforce's size as well as its forecasted growth depending on several factors, as are population growth or migration. Secondly, I construct a quality indicator for the country's talent pool by considering the number of researchers per million, the amount of expenditure in R&D activities, tertiary enrolment rates and basic e-literacy. Finally, I have a indicator only regarding the English skills of the population, as a proxy for the workforce's suitability for foreign enterprises.

2.3.3.14 Host-country Macroeconomic and Political Stability

In this paper I use five combined indicators for macroeconomic and political stability.

The Macroeconomic Indicator (MEI) incorporating political stability aggregates the political stability indicator by Kaufmann, Kraay, and Mastruzzi (2006), together with several indicators from the ICRG (2003), including government stability, socioeconomic conditions, variables for internal conflict and for external conflicts, a democratic accountability proxy, as well as an index of the country's ethnic tensions.

The MEI addressing economic stability issues looks at the host economy's vulnerability in terms of its currency, of inflation and its purchasing power volatility. The third MEI takes the host-country's dependence into consideration, by pooling its dependence from international trade and its energy dependence. A further MEI looks at the country's development degree and by using GDP, as done by previous studies and explained before. Finally, the fifth MEI consists of the economy's Gross Domestic Savings as a percentage of GDP, as a way to proxy the economy's welfare sustainability.

2.4 EBA and Results

In the same way empirical growth economics is challenged by the fact that growth theory is not explicit enough about which variables should be part of the "true" regression[28], the literature review of the previous section has highlighted that in the context of entry-mode decisions theoretical models also lack being explicit enough about the variables that determine the choice of mode of entry. Furthermore, models stemming from different theoretical approaches to firm behavior are even contradictive in terms of how some of these variables affect the decision. Since almost every variable describing the firm itself, as well as the spatial context in which the decision is taken, can be theoretically founded as determining a firm's entry-mode decision, I decided to apply an extreme bounds analysis, following both Leamer's (1983, 1985) and Sala-i-Martin's (1997a, 1997b) approach, to determine which variables are indeed correlated with the choice of entry-mode.

In total, I have 59 variables describing firm, industry and host-country characteristics. Testing every variable against all possible combinations in groups of 6 of the remaining 58 variables would lead to 40.5 million regressions per tested variable, i.e. a total of 2.4 billion regressions. I therefore followed the approach suggested by Sala-i-Martin (1997a, 1997b) of having three fixed variables, the so-called baseline model, and testing each one of the other variables against the combinations in groups of three of the other 55 variables. This totals 1.6 million regressions of 7 variables (plus a constant) each, where 3 (and the constant) are fixed and the other four vary over all possible combinations of the 56 variables not included in the baseline model. In addition, dummies control for industry and time effects. As a further step, the fixed variables within the baseline model are also tested, allowing each one of the three fixed variables to be treated as a tested variable in the procedure explained above, regressed together with the baseline model of the other two fixed variables and all possible combinations of three of the regular 56 variables under scrutiny.

[28]See Sala-i-Martin (1997a, 1997b).

I ran these 1.6 million regressions for three different models, that regressed three different dependent variables on the above 56 candidates as choice determinants. One of those models was regressed for the whole sample and a separate sub-sample, so that in total 6 million regressions were estimated to generate the results summarized below.

The first model is a binomial logit with the Greenfield Investment Indicator as the dependent variable[29]. This indicator distinguishes between pure full ownership GI and any other entry-mode that involves a target or partner enterprise, i.e. M&A (full or partial) and JV. The base outcome of the regressions is the existence of a target or partner firm, so that displayed results are the coefficients for the odds of a GI entry. Results are reported for regressions on the full sample (Table 2.12) and for the sub-sample containing the events that have emerging markets as host-countries (Table 2.13).

The second model is a multinomial logit with the Entry-mode Indicator as the dependent variable[30]. This indicator distinguishes between pure full ownership GI, JV and M&A (full or partial). The base outcome of the regressions is M&A, so that displayed results are the coefficients for the odds of a GI entry (Table 2.14) and of a JV entry (Table 2.15).

The third model is a multinomial logit with the Entry-mode Control Indicator as the dependent variable[31]. This indicator distinguishes between pure full ownership GI, shared ownership modes (JV and partial M&A) and full ownership M&A. The base outcome of the regressions is partial ownership, so that displayed results are the coefficients for the odds of a full GI entry (Table 2.16) and of a full M&A entry (Table 2.17).

Tables 2.12 to 2.17 summarize the results of the aforementioned 8 million regressions in 13 columns. The name of the tested variables is listed in the first column and the second and third columns display the lower and upper extreme bounds, B^L and B^U respectively, as defined in Leamer (1983). If Leamer's strict criterion had been used, only the neighborhood dummy would have survived the analysis and all other variables would have been considered as non-robust. Applying Sala-i-Martin's (1997a,1997b) less extreme version of EBA as a sensitivity analysis, between 7 and 18 variables survive in the 5 different models tested. Columns 4 and 6 report the

[29]See Appendix B, Table 2.1 for a detailed description of the indicator.
[30]See Appendix B, Table 2.1 for a detailed description of the indicator.
[31]See Appendix B, Table 2.1 for a detailed description of the indicator.

estimated beta coefficients. Column 4 reports the average $\hat{\beta}_z^{NW}$ over all tested regressions for variable z, and column 6 reports the likelihood weighted coefficient, $\hat{\beta}_z^{W}$, as derived by equation (2.8). The eighth column shows the percentage of regressions (in total regressions) for each tested variables in which the latter turned out to be significant at a 5 percent significance level. Columns 9 to 12 display the CDF(0) under the following assumptions respectively: (a) the distribution of the estimators of β_z is normal, and β_z is $\hat{\beta}_j^{W}$, the likelihood-weighted average of all betas; (b) the distribution of the estimators of β_z is normal, and β_z is $\hat{\beta}_j^{NW}$, the non-weighted average of all betas; (c) the distribution of the estimators of β_z is not normal, and the CDF(0) is computed as a likelihood weighted average of all individual CDF(0); (d) the distribution of the estimators of β_z is not normal, and the CDF(0) is computed as the non-weighted average of all individual CDF(0). Please see the Appendix A for details on the methodology applied for the sensitivity analysis.

2.4.1 The baseline model

A baseline model should be the most resembling to the true data generating process and allow to be considered to be the "right model". In the context of entry-mode choice this is a difficult enterprize since most models stem from ad-hoc modeling and no unifying theory provides a theoretical model that can be looked at as providing the baseline variables. Therefore, the three fixed variables constituting the baseline model should be at least variables that have been used in most studies on the topic and its results should be to some extent consistent and robust across different studies and model specifications. As can be derived from section 1.3 this is a difficult enterprise in the context of entry-mode determinants. In principle two candidates appear to be adequate: previous experience in a specific entry-mode and host-country development. Although not implemented by all studies, they yield similar and significant results in most studies using them[32] and Table 1.17.

The experience in one specific entry-mode, say M&A, is a candidate for the baseline model, since all six reviewed studies including this variable obtain consistent and significant results of the existence of increased likelihood of using the entry-mode in which the MNC has more previous experience for future ventures.

Host-country development also yields consistent results across studies, at least in those cases where it turns out significant. It is mostly measured as GDP or GNP per capita and captures two effects: a macroeconomic stability effect and a cost differential effect. Given that in my set-up of multiple host-countries this variable

[32]See section 1.3.2.1.

would mainly capture the effect of the cost differential – it would act pretty much as a dummy for expensive vs. cheap countries, since developed countries are more expensive – I decided to split the effects into two variables. On the one hand I include the variable MEI-Welfare Sustainability[33] which follows the spirit of looking at a country's development, but rather captures the long-term stability of a country's development. On the other hand I include a variable to capture the cost differential, namely the OCI-ICT[34]. This variable captures the price differences in IT services as a way to account for both the development degree of the host-country's infrastructure and its cost structure. Given that I cannot control for the type of purpose intended with the new unit, ICT costs will better capture general cost-differentials affecting all new ventures in the context of financial MNCs, than other cost indicators like real-estate or labor costs, whose relevance will be conditioned by the type of unit sought.

Note that time, industry and regional dummies are not rotated among regressors but constitute part of the fixed variables.

2.4.2 Likelihood-weighted vs. non-weighted average approach

Since the likelihood-weighted measure is only valid if the models included are good specifications for the (true) data generating process, and given the way the combinations of variables are generated, it is highly likely, that this measure has to be looked at with caution, since several of the tested models are probably misspecified and suffering from omitted variables biases. If most or some of those models are not only misspecified due to omitted variables, but in addition have a spurious fit, then the non-weighted average of all models would be a superior measure, since it cannot be biased towards regressions with spurious goodness of fit produced e.g. by the endogeneity of one of the explanatory variables[35]. In addition, for varying sample sizes, weights are non-assertive and they may also be affected by the scaling of variables.

Weighted and non-weighted β_z averages do not differ in terms of signs and when looking at the coefficients they are almost always identical up to the first place after the comma. Nevertheless, when performing a t-test only 20 to 29 percent of the coefficients (depending on the regression) are not significantly different from each other[36]. Since only the sign of the effect will be interpreted in the results depicted

[33]See Table 2.4 for a description on the variable.
[34]See Table 2.5 for a description on the variable.
[35]See Sala-i-Martin (1997a, 1997b).
[36]See Table 2.10 in the Appendix.

below, this does not pose a supplementary difficulty when describing the results.

As to the comparison between models under the normality and under the non-normality assumption the correlation coefficients between the columns $\Phi_z^{W,N}(0)$ and $\Phi_z^{W,NN}(0)$, as well as between $\Phi_z^{NW,N}(0)$ and $\Phi_z^{NW,NN}(0)$ are all above 92%, making it plausible to assume that β_z is distributed normally[37].

2.4.3 Significance of the fixed variables in the baseline model

As explained in the methodological Appendix A the fixed variables are also tested, by keeping only the other two fixed variables fixed and letting the non-baseline-model variables combine in the same fashion as done before.

Previous experience in M&A deals: More experience in M&A increases the odds of GI in model 1 and model 2, probably capturing either MNC size or international experience, given that the result is the opposite for the M&A over GI experience differential. In model 2 the choice of JV vs. M&A seems not to suffer from cumulated M&A experience. For obvious reasons this variable does also not play a role when looking at partial vs. full acquisitions in model 3.

Macroeconomic sustainability: This variable is highly significant in all three models for the likelihood of GI, indicating that less sustainable countries decrease the likelihood of greenfields. It only falls below the 95% threshold in the regression looking at full vs. partial acquisition, i.e. it seem irrelevant in the context of deciding if an acquisition should be done under a full or a shared ownership mode.

ICT costs: The cost differential hypothesis is confirmed by the results yielding significantly negative coefficients for this variable with respect to the likelihood of GI, meaning that more expensive countries discourage greenfields. The variable is not significant in the context of deciding between a shared or a full acquisition, nor in the context of deciding between a JV and M&A.

2.4.4 Greenfield Investment vs. entry-mode involving a target

The correlation coefficients between the columns $\Phi_z^{W,N}(0)$ and $\Phi_z^{W,NN}(0)$, as well as between $\Phi_z^{NW,N}(0)$ and $\Phi_z^{NW,NN}(0)$ are around 94% for both the full sample regressions and the regressions performed on the developing countries sample, which

[37] See Table2.11 in the Appendix.

allows us to assume that the density function of the β_z coefficients is close to a normal distribution[38] in those two cases.

A total of 17 variables survive under the non-normality assumption and further ten can be considered under the normality assumption.

2.4.4.1 Compared results across the two samples

The careful reader is hereby reminded that all z-score based indicators (see Appendix B for details) get worse for higher values, so that the signs of coefficients in those cases have to be interpreted inversely.

1. **Surviving variables related to firm characteristics**

   MNC size: According to obtained results MNC with higher sales or a larger number of employees are more likely to enter via GI than through an entry-mode involving another enterprise as target. When using market cap as an indicator of MNC size I obtain a positive curvilinear relationship, implying that for small and large MNC entries through GI are more likely, but in the medium-sized spectrum M&A is more probable. This is in line with Meyer and Estrin (1997) findings. These results also hold in the sub-sample of developing countries.

   Host-country experience: The results suggest that previous experience in the host-country makes future GI entries into that country less likely. This is in line with the results of Andersson and Svensson (1994), Hennart and Reddy (1997), Barkema and Vermeulen (1998), Nocke and Yeaple (2004), Slangen and Hennart (2008b) and Wei, Liu, and Liu (2005), supporting hypothesis 3b. In the sub-sample of developing economies this result does no longer hold.

   M&A over GI previous expertise differential: As expected (see hypothesis 5) this variable is significantly decreasing the likelihood of GI. This result also holds in the regressions for developing countries as host-economies.

   International experience: Supporting the idea behind hypothesis 2, my findings for both the full and the emerging markets sub-sample imply that the

[38]Sala-i-Martin (1997b).

more internationally experienced, the more likely are GI entries. This is in line with the results found by Wilson (1980), Barkema and Vermeulen (1998) and Brouthers and Brouthers (2000).

2. **Variables related to industry characteristics**

   Sector size: The size of the industry appears to be positively linked to the probability of a GI entry in the regressions for both samples – full, emerging markets – contradicting the intuition behind hypothesis 8. On the other hand, this variable only is significant under the non-weighted approach, suggesting that in terms of the likelihood of the model in which it was included, regressions where sector size was non-significant outweight regressions in which it was significant[39]. Still, it is more likely that the puzzling result of a positive sign stems from the proxy used to measure the size of the financial market. In fact, the extent of liquid liabilities in a country also accounts for the availability of (local) credit in the host-country, which is in turn a proxy for the easiness of accessing to financing resources to fund new enterprises from scratch. It can therefore be argued that this is the effect being captured here.

3. **Variables related to host-country characteristics**

   Cultural distance: Four variables were included to account for cultural distance: a neighborhood dummy, physical distance between home and host-country, the existence of a past colonial relationship and sharing a common language. In all regressions for model 1, only the neighborhood dummy is significant. Even more, the neighborhood dummy is the only variable that in all models and regressions would survive the EBA applied following Leamer (1983). As expected being neighbors – almost a synonymous in terms of sharing cultural bonds – makes GI less probable, supporting hypothesis 11.

   Business environment: A more friendlier business environment should favor GI according to hypothesis 15. My results suggest that more difficulties registering property and a difficult environment with respect to employing workers are significantly discouraging GI[40]. In addition as per the positive coefficient

[39] Considering this a non-significant variable would be consistent with Barkema and Vermeulen's (1998) results.

[40] This result holds for the full sample and the emerging markets sub-sample.

found for BEI - Dealing with Licenses, the more difficult it is to obtain licenses, the more likely becomes a entry through GI. This result seems puzzling at first sight, but it is consistent across all models and specifications tested and may be explained through an alternative interpretation of the indicator. In fact a country with more burdensome procedures to obtain licenses, may also be a country guaranteeing property rights better, specially for intellectual property protection. The more burdensome procedures in this case might thus be capturing a better investment environment in terms of its legal framework. For the full sample, higher labor-associated costs, a worse institutional and investment environment and more difficulties to close a business seem to increase the odds of GI. Clearly all four variables are capturing the developed vs. developing countries effect, since all four turn out to be non-significant in the results for the emerging markets' sub-sample and within this study's sample of total events GI is more probable in developing countries[41].

Labor costs: All three indicators for labor costs indicate that higher labor costs discourage GI in accordance with the price-differential hypothesis. Still, since this result does not hold within the emerging markets sub-sample, it might just be capturing the fact that less GI take place in developed – and thus expensive – countries.

Talent pool: It appears that worse English skills, a worse talent pool quality and a large labor supply make GI more likely. Here again results do not hold for the developing countries sub-sample and are hence capturing the fact that GI is more probable in developing countries.

Infrastructure: The infrastructure indicator is significant both in the context of the full and of the emerging market sample, yielding a significant fall in GI likelihood in case of a worse infrastructure. This supports hypothesis 14.

Market: The results for both openness and market potential are rather surprising. They hold in both samples (full and developing economies) and suggest that less market potential and openness favors GI. This result may be caused by reverse causality, meaning that since market access rarely is a driver for most types of units that tend to be GIs – e.g. R&D units, design units, back

[41] In the sample less than 5% of events into developed economies are GI entries, while 31% of entries into emerging markets are GI.

offices –, greenfields tend to occur in countries where markets are not necessarily attractive. Controlling for the motivation of the offshore venture should eliminate this results.

4. **Regional Dummies**

   Events in North America, the European Union and Latin America decrease the odds of GI, as well as investing in Brazil, while investing in China is more likely to occur through GI. The dummies for North America and the EU are capturing the developed countries effect and the fact that MNCs prefer to enter Brazil via M&A or JV is explained by Brazil's tough business environment, because Brazil ranks high in most indicators related to the costs and difficulties of launching a new business. The positive coefficient in the dummy for China probably reflects the restrictions against M&A in the financial sector, which were softened in recent years, but prevailed in most years of the period of study.

2.4.4.2 Sub-sample specific results for emerging markets

In the emerging markets sub-sample two further variables – to those analyzed above – appear to be significant. A less specialized country in terms of exporting services and high-end or skill-intensive output is less attractive for GI, confirming the intuition that motivation behind GI seems to be rather for R&D units and skill intensive units, and providing direct support for the agglomeration hypothesis (12a) and indirect support for hypothesis 1. In addition, the macroeconomic environment indicator for host-country development is also significant, pointing at the fact that among emerging economies a more developed country is a better candidate to start a business from scratch (see hypothesis 13).

2.4.5 M&A vs. Greenfield Investment and JV

The correlation between the vectors of average coefficients under the normal and non-normal assumptions are above 96%, allowing here too the assumption of the β_z to be close to normal.

2.4.5.1 Determinants of choosing Greenfield Investment over M&A

The results for all variables significantly affecting the probability of choosing GI as a mode of entry instead of choosing an M&A entry are practically identical (in terms of sign and significance of variables) to those obtained for the choice between GI and a mode of entry involving a target or second enterprise, analyzed above. See Table 2.14 for the exact results.

2.4.5.2 Determinants of choosing JV over M&A

Eleven variables turn out to be significantly affecting the likelihood of choosing a JV as mode of entry instead of M&A. The only MNC attribute that survives the EBA analysis is the firm's size, yielding that larger MNCs are more likely to choose JV than M&A. This result is analogous to the one in Lopez-Duarte and Garcia-Canal (2002) and can be understood in the same way of why size is inclining the odds towards GI, namely because large MNCs are used to manage several units, providing the firm with the necessary expertise to deal with the supplementary difficulties that come with starting a new unit partnering with another enterprise.

Joint Ventures are an entry-mode that is commonly used in case of firms needing to access another firm's expertise in a non-core area of their business, as well as to acquire the local knowledge through an indigenous partner in a foreign country. In both cases the motivation is not necessarily market driven, which seems to be confirmed by the results on the openness and market potential indicators, which favor JVs when becoming worse. The explanation for this effect provided for GI is also applicable here.

With respect to other significant host-country attributes, my results imply that a smaller and more expensive talent pool discourage JV entries as opposed to M&A entries, while a worse investment environment makes JV more likely. Clearly, M&A reduce the need of looking for new recruits, which could explain that less and more expensive labor supply favors this type of entry. The fact that a worse investment environment discourages M&A vs. a partnered venture probably reveals the reluctance of MNCs to perform M&A deals in countries where the risk of asymmetric information is higher, since the investment environment is not transparent or efficient enough.

China as a host-country increases the odds of JVs, mirroring the fact that given the investment restrictions in the financial sector and the strong government regulation of the sector during most part of the nineties, JVs were the only feasible way for financial MNCs to offshore into China. This is in line with the intuition that the existence of market entry restrictions – be it of legal or economic nature – favors a JV entry-mode. North America again yields a negative coefficient for the likelihood of a non-M&A mode, this is no surprise since of 15 events entering the U.S. and Canada, only one is a GI and no JVs are registered. Brazil, Eastern European countries and Middle East and North African (MENA) countries also display low levels of JV activity, as is confirmed by the results of their respective dummy variables.

Interestingly, none of the cultural distance variables is significant for the JV vs. M&A decision.

2.4.6 Shared ownership vs. Full Greenfield Investment and Full M&A

The correlation between the vectors of average coefficients under the normal and non-normal assumptions are 97% and 94% for the results of full acquisitions against shared ownership and of full GI against shared ownership, respectively, allowing here too the assumption of the β_z to be close to normal.

2.4.6.1 Determinants of full GI over shared ownership modes

The results for all variables significantly affecting the probability of choosing full GI as a mode of entry instead of choosing a shared entry-mode are the same as those found for GI vs. entries involving a target or partner, in terms of sign and significance of variables. Exact results can be found in Table 2.16.

Still, it is interesting to note that five variables cease to be significant in the context of GI vs. shared ownership as opposed to GI vs. M&A: the size, costliness and quality of the talent pool play a role in GI vs. M&A but not here, indicating that labor supply side determinants are rather determining the odds of GI due to the latter's novel nature and not due to the lack of interaction with a target or partner. This implies that finding the adequate talent in a venture started from scratch poses more difficulties than dealing with recruitment issues in a merger or partnered enterprise. Analogously, political stability plays more a role in the aspect of starting something new – and hence extending the time-horizon in which the new venture will not yet yield results – than in the aspect of partnering or interacting with another firm. This is consistent with the argument of hypothesis 13.

The fact that the difficulties of closing a firm do not play a role here is rather surprising as one would expect the closing of a business to be more relevant in the context of deciding whether to start something alone or with a partner.

2.4.6.2 Determinants of full M&A over shared ownership modes

To which extent M&A is preferred as a full acquisition mode over shared ownership modes seems to depend only on 10 variables.

More international experience leads an MNC to prefer full acquisition over a partnered mode, while a high price-to-earnings ratio works the opposite way. The latter would imply that firms whose shareholders' assessment of future performance potential is positive, i.e. firms being rewarded by the market for past efficiency, are more inclined to enter shared ownership modes than firms that – in the eyes of the market – are less efficient. Since shared ownership implies higher ongoing management and organizational costs, this would confirm the idea that efficient firms are better prepared and therefore more likely to enter partnered ventures.

Host-country characteristics as higher wages and the existence of a small talent pool also increase the likelihood of an MNC deciding to go for a full acquisition, and on the other hand tax-burdened and less open countries speak for a shared ownership mode. Finally, shared ventures are preferred in India, while full acquisitions are more likely in Brazil.

2.5 Conclusion

Motivated by the large extent of empirical research studies on entry-mode decisions and the lack of consistency among their results in this Chapter I perform an EBA to determine which of almost 60 explanatory variables are robust to different model specifications. I do so by looking at the entire distribution of the estimator for each explanatory variable's coefficient, following the methodology introduced by Sala-i-Martin (1997a) in a multinomial logit framework, based on 640 entries into foreign countries done by the largest 22 financial MNCs in the last 15 years.

According to the findings of the above exercise based on over eight million regressions, an MNC's size and its international experience increase the likelihood of GI over choosing M&A or any type of entry-mode involving a partner. Conversely, its host-country experience as well as the larger its experience differential in M&A over GI, make greenfields less probable. In terms of the host-country's characteristics, more cultural distance between home and host-country, a better developed financial sector (or local credit market) in the host-country, a more regulated environment for obtaining licenses and more macroeconomic sustainability increases the chances of GI, while a worse local infrastructure, higher ICT costs and more difficulties in registering property and employing workers decrease the odds of greenfields. Joint Ventures are more likely if the MNC is larger and if the host-country has more macroeconomic sustainability. Host-countries with a worse investment environment also increase the odds of JV as opposed to full ownership modes. A small and expensive talent pool, make JV less likely if compared to M&A. China is a preferred location for GI and JV, while Brazil, Eastern Europe and MENA countries seem to favor M&A entries. In addition, I find that the size, expensiveness and quality of the talent pool determine the likelihood of full GI due to the latter's character of being generated from scratch, rather than because it is done in a full ownership mode or without interacting with another enterprise, be it a target or a partner. The same applies for a host-country's political stability.

When it comes to choose a full ownership M&A over a partial acquisition or shared ownership entry-mode, more international experience, high labor costs and a small talent pool favor full M&A, while more efficient MNCs and/or a host-country with less openness, a less developed market and higher tax burden discourage full acquisitions, inclining the decision to a shared ownership mode of entry.

Some caveats. This study is based on data for the last 15 years and focuses on financial multinationals only. This may affect the results in two ways.
Firstly, M&A can be understood as being the prevalent entry-mode unless market entry costs are offset by large cost differentials. According to the model by Goerg (2000) a firm's entry-mode decision will have effects on the market and/or industry it is penetrating, affecting its structure, as well as the total output generated by the sector and hence the price structure for its product. In his simulations M&A is the prevalent mode of entry, unless the parameters reflecting cost differentials are adjusted so that the costs of acquiring market knowledge are much lower than the adaption costs from an old to a new technology[42]. In the context of financial MNCs, adaption costs of a (financial) product are highly linked to accessing high skilled labor, and must not even be generated in the penetrated country, since it is easily transferrable knowledge. One could hence argue, that most costs associated with the decision of entering an offshore location, if it is motivated by the access to a new market, will be associated with marketing costs and the generation of a local brand, therefore biasing the results towards M&A.

Secondly, acquisitions are the preferred mode of entry in markets that are consoli-

[42]Using the additional market entry costs by Buckley and Casson (1998): marketing costs, adaption costs and costs of building new production facilities from scratch.

dating and where therefore competitive pressure is increasing[43], which was exactly the case in the financial industry during the period studied[44]. This is a further reason for probably having an over-representation of M&A in the sample.

Furthermore, although in the case of an M&A entry the demand elasticity for the new products offered by the MNC can be expected to matter – since it will determine how much the price of the product will vary through a new firm entering the market – it is difficult to establish the demand elasticity in the context of financial MNCs. The public's reaction with respect to a more varied offering of financial products is hence also difficult to observe, as well as to which degree the price can fall depending on elasticity only, since the price of money – assuming that credit is the main offering of financial MNCs – is also determined by the host-country's monetary policy. Determining the local market's elasticity of demand for financial products in a consistent way across countries turned out to be such a difficult enterprise due to data scarcity that I decided to model the penetrated market's competition only through size and growth rate, assuming that there was little effect on prices stemming through the increased offering of products by a new entrant as long as the market is growing fast and this growth implied to some extent that there was an increasing demand for these products to be served[45].

Furthermore, I think that the interesting idea of having variables at three different levels determining the mode of entry – i.e. including firm, industry and host-country attributes – becomes even more attractive if each model specification chosen includes variables at all three levels, so that characteristics of firm, host-country and industry are controlled for in each regression. Given the way the combinations of explanatory variables was performed in this paper, it was not controlled for the fact of having all three levels represented in all regressions. In future research this could be implemented by having an EBA analysis based on the combinations of three blocks of variables, where all possible combinations of variables are generated within each block, for the sub-set of regressors at each level, and then each of the combinations within one block are combined with all possible combinations of the other two blocks. This could even be extended, in case data are available, to include a fourth block accounting for subsidiary or target level information. In addition, the above idea of performing an EBA analysis based on the combination of variables within three (or

[43]See Bjorvatn (2001).
[44]See Dymski (2002) and European Central Bank (2007).
[45]In other words, industries growing very rapidly can be assumed to be less affected by the entry of new firms and the competitive reactions of other firms to a GI might be lower, than in slowly growing sectors. See Hennart and Park (1993).

four) blocks, can be extended to doing this for the 16 hypotheses as blocks and only varying their operationalization.

In this paper I tried to tackle most research-design related problems mentioned in Chapter 1 and in Slangen and Hennart's (2007) review of literature, by including a more accurate operationalization of MNC and host-country level variables and accounting for the institutional environment in the host-country. I also managed to include proxies for industry level variables in a multiple host-country setting, by restricting the sample to the financial sector and constructing a variable that measures the financial sector's growth in a consistent way for all host-countries. I also added hypotheses of entry-mode determinants at the host-country level. To perform this analysis a unique database was constructed, that includes information on over 4000 deals performed by 50 MNC in the last 15 years, and those deals were matched to country data stemming from over ten public and paid sources, to assess all possible explanatory dimensions. Finally, by performing the first EBA type of analysis on the determinants of entry-mode decisions by MNCs I found a set of around fifteen variables that are robust to model specification and can be understood as significantly affecting this type of decisions.

Bibliography

Amburgey, T. and A. Miner (1992). Strategic momentum: The effects of repetitive, positional and contextual momentum on merger activity. *Strategic Management Journal 13*(5), 335–348.

Andersson, T. and R. Svensson (1994). Entry Modes for Direct Investment Determined by the Composition of Firm-Specific Skills. *Scandinavian Journal of Economics 96*(4), 551–560.

Barkema, H. and F. Vermeulen (1998). International Expansion through start-up or acquisition: a learning perspective. *Academy of Management Journal 41*(7), 7–26.

Beach, W. and T. Kane. Methodology: Measuring the 10 Economic Freedoms. In *2008 Index of Economic Freedom*, 14th ed., Eds. K. Holmes, E. Feulner and M. O'Grady, 39-55. Washington, The Heritage Foundation.

Bertrand, O. and N. Madariaga (2003). U.S. Greenfield Investments and M&A location: impact of American continental integration and Insider vs. Outsider position. In *Royal Economic Society Annual Conference 2003*. Royal Economic Society. http://repec.org/res2003/Bertrand.pdf (accessed June 9, 2008).

Bjorvatn, K. (2001). Foreign Ownership and Market Entry. *Nordic Journal of Political Economy 27*, 13–32.

Botero, J., S. Djankov, R. La Porta, F. Lopez-de-Silanes, and A. Shleifer (2004). The Regulation of Labor. *The Quarterly Journal of Economics 119*(4), 1339–1382.

Brouthers, K. and L. Brouthers (2000). Acquisition or greenfield start-up? Institutional, cultural and transaction cost influences. *Strategic Management Journal 21*(1), 89–97.

Buckley, P. and M. Casson (1998). Analyzing Foreign Market Entry Strategies: Extending the Internalization Approach. *Journal of International Business Studies 29*(3), 539–562.

CBRE (2007). *Global Market Rents, Office Rents & Occupancy Costs Worldwide*. CB Richard Ellis Global Research and Consulting. Reports by year, period 2001-2007.

Cheng, S. (2007). Structure of Firm Location Choices: An Examination of Japanese Greenfield Investment in China. *Asian Economic Journal 21*(1), 47–73.

Cheng, Y.-M. (2006). Determinants of FDI mode Choice: Acquisition, Brownfield, and Greenfield Entry in Foreign Markets. *Canadian Journal of Administrative Sciences 23*(3), 202–220.

Cho, K. and P. Padmanabhan (1995). Acquisition versus new venture: The choice of foreign establishment mode by Japanese firms. *Journal of International Management 1*(3), 255–285.

Dikova, D. and A. van Witteloostuijn (2007). Foreign direct investment mode choice: entry and establishment modes in transition economies. *Journal of International Business Studies 38*(6), 1013–1033.

Djankov, S., O. Hart, C. McLiesh, and A. Shleifer (2006). Debt Enforcement around the World. *NBER* Working Paper 12807, National Bureau of Economic Research. http://www.nber.org/papers/w12807.pdf (accessed June 9, 2008).

Djankov, S., R. La Porta, F. Lopez-de-Silanes, and A. Shleifer (2002). The Regulation of Entry. *The Quarterly Journal of Economics 117*(1), 1–37.

Djankov, S., R. La Porta, F. Lopez-de-Silanes, and A. Shleifer (2003). Courts: The Lex Mundi Project. *The Quarterly Journal of Economics 118*(2), 453–517.

Dymski, G. (2002). The Global Bank Merger Wave: Implications for Developing countries. *The Developing Economies 40*(4), 435–466.

European Central Bank (2007). Financial Integration in Europe, March 2007. http://www.ecb.int/pub/pdf/other/financialintegrationineurope200703en.pdf (accessed March 17, 2008).

Goerg, H. (2000). Analysing foreign market entry: The choice between greenfield investment and acquisition. *Journal of Economic Studies 27*(3), 165–181.

Gupta, V. (2007). Are US Multinationals Making Rational Offshoring Decisions? A Gravity Model Approach. Watson Wyatt Technical Paper No. 2007-TR-02 http://ssrn.com/paper=975891 (accessed December 20, 2007).

Hennart, J. and S. Reddy (1997). The Choice between Mergers/Acquisitions and Joint Ventures: the Case of Japanese Investors in the United States. *Strategic Management Journal 18*(1), 1–12.

Hofstede, G. (1980). *Culture's Consequences: International Differences in Work Related Values*. Beverly Hills, CA: SAGE.

ICRG (2003). International Country Risk Guide. The PRS Group.

Kaufmann, D., A. Kraay, and M. Mastruzzi (2006). Governance Matters V: Aggregate and Individual Governance Indicators for 1996-2006. World Bank Policy Research Department Working Paper 4280, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=930847 (accessed November 11, 2007).

Kogut, B. and H. Singh (1988). The Effect of National Culture on the Choice of Entry Mode. *Journal of International Business Studies 19*(3), 411–432.

Lamont, B. and C. Anderson (1985). Mode of corporate diversification and economic performance. *Academy of Management Journal 28*(4), 926–934.

Larimo, J. (2003). Form of investment by Nordic firms in world markets. *Journal of Business Research 56*(10), 791–803.

Leamer, E. (1983). Let's take the con out of econometrics. *American Economic Review 73*(1), 31–43.

Leamer, E. (1985). Sensitivity Analysis Would Help. *American Economic Review 75*(5), 308–313.

Lopez-Duarte, C. and E. Garcia-Canal (2002). The Effect of Firm and Host Country Characteristics on the Choice of Entry Mode: Empirical Evidence from Spanish Firms. *Journal of Management and Governance 6*(2), 153–168.

Mayer, T. and S. Zignago (2006). Notes on CEPII's distances measures. Centre D'Etudes Prospectives et D'Informations Internationales, http://www.cepii.fr/anglaisgraph/bdd/distances.pdf (accessed February 14, 2008).

Meyer, K. and S. Estrin (1997). Privatisation acquisition and direct foreign investment: who buys state-owned enterprises? *MOCT-MOST: Economic Policy in Transnational Economies 7*(1), 159–172.

Nocke, V. and S. Yeaple (2004). An Assignment Theory of Foreign Direct Investment. *NBER Working Paper* 11003, National Bureau of Economic Research. http://www.nber.org/papers/w11003.pdf (accessed December 20, 2007).

O hUallacháin, B. and N. Reid (1997). Acquisition versus Greefield Investment: The location and growth of Japanese manufacturers in the United States. *Regional Studies 31*(4), 403–416.

Padmanabhan, P. and K. Cho (1999). Decision-specific experience in foreign ownership and establishment strategies: Evidence from Japanese firms. *Journal of International Business Studies 30*(1), 25–44.

Pitts, R. (1977). Strategies and structures for diversification. *Academy of Management Journal 20*(2), 197–208.

Pitts, R. (1980). Towards a contingency theory of multibusiness organization design. *Academy of Management Review 5*(2), 203–210.

Sala-i-Martin, X. (1997a). I Just Ran Four Million Regressions. NBER Working Paper 6252, National Bureau of Economic Research. http://www.nber.org/papers/w6252.pdf (accessed December 20, 2007).

Sala-i-Martin, X. (1997b). I Just Ran Two Million Regressions. *The American Economic Review 87*(2), 178–183.

Slangen, A. and J. Hennart (2008). Do Multinationals Really Prefer to Enter Culturally-Distant Countries Through Greenfields Rather than Through Acquisitions? The Role of Parent Experience and Subsidiary Autonomy. SSRN eLibrary, http://ssrn.com/paper=1021883, accessed November 30, 2008.

TOEFL (2007). Test and Score Data Summary for TOEFL Internet-based and Paper-based Tests. Test of English as a Foreign Language.

UNCTAD (2007). Total number of Bilateral Investment Agreements concluded, 1 june 2007. Reports by country.

Veugelers, R. (1991). Locational Determinants and Ranking of Host Countries: an Empirical Assessment. *Kyklos 44*(3), 363–382.

Watson Wyatt Worldwide (2008). Global 50 Remuneration Planning Reports. Reports by country and by year, period 1999/00-2007/08.

Wei, Y., B. Liu, and X. Liu (2005). Entry modes of foreign direct investment in China: a multinomial logit approach. *Journal of Business Research 58*(11), 1495–1505.

Wernerfelt, B. and C. Montgomery (1986). What is an Attractive Industry? *Management Science 32*(10), 1223–1230.

Wilson, B. (1980). The Propensity of Multinational Companies to Expand through Acquisitions. *Journal of International Business Studies 11*(1), 59–65.

World Bank (2008). Doing business 2008 report. http://www.doingbusiness.org/, accessed December 31, 2008.

Xu, D., Y. Pan, and P. Beamish (2004). The effect of regulative and normative distances on MNE ownership and expatriate strategies. *Management International Review 44*(3), 285–307.

Zejan, M. (1990). New Ventures or Acquisitions: The Choice of Swedish Multinational Enterprises. *Journal of Industrial Economics 38*(3), 349–355.

Appendix A: Methodology

This section describes the Sala-i-Martin (1997b) sensitivity methodology applied in a multinomial logit regression framework as used in this paper.

Let us have three fixed explanatory variables ϕ_i, $i = 1, \ldots, 3$, constituting the baseline model. Let us further have a pool of other N explanatory variables z_i, $i = 1, \ldots, N$ to be tested. To assess if a variable z is significantly determining the decision process faced by an MNC with respect to the mode of entry, I estimate multinomial logistic regressions of the form:

$$\ln\left(\frac{\Pr\left[Y_i = j\right]}{\Pr\left[Y_i = 1\right]}\right) = \alpha_{jk} + \beta_{\phi jk}\phi_j + \beta_{zjk}z_j + \beta_{xjk}\mathbf{x}_{jk} \tag{2.7}$$

where j is the choice outcome, $j = 2, \ldots, J$, J is the number of choice outcomes, k is indexing the model run (given by a specific combination of regressors), and where ϕ is the vector $\phi = (\phi_1\, \phi_2\, \phi_3)'$ containing the fixed variables of the baseline model. z is the explanatory variable under scrutiny and $\mathbf{x}_k \in X$ is a three dimensional vector taken from the set of all possible combinations of three of the pool of $N-1$ remaining explanatory variables once z is excluded.

This regression is estimated for all z_i, $i = 1, \ldots, N$ and all its associated K possible models k, each one with a different combination of explanatory variables, i.e. $\mathbf{x}_k \in X$.

For one variable z each estimated model k, $k = 1, \ldots, K$ will deliver a coefficient estimate β_{zk} and its corresponding standard deviation σ_{zk}.

The lower extreme bound[46] is the lowest value taken by $\beta_{zk} - 2\sigma_{zk}$,

$$\min_k\{\beta_{zk} - 2\sigma_{zk}\}.$$

Analogously the upper extreme bound is:

$$\max_k\{\beta_{zk} - 2\sigma_{zk}\}.$$

Leamer's EBA test classifies a variable as non robust if the sign of the two extreme

[46] See Leamer (1983) and Leamer (1985).

bounds differs. In other words, it suffices to have a single regression k in which the sign of β_{zk} changes or is non-significant to catalogue z as not robust[47]. I also perform the less extreme test as suggested by Sala-i-Martin (1997b) where variables are assigned a level of confidence by looking at the distribution of all estimated β_{zk}. I introduce some minor changes in the weighting scheme proposed by the author.

Sala-i-Martin (1997b) distinguishes between two cases:

(1) The distribution of the estimated coefficients $\hat{\beta}_{zk}$ across all models is assumed to be normal.

(2) The distribution of the estimated coefficients $\hat{\beta}_{zk}$ across all models is assumed to be not normal.

In case (1), for each z and each of the K models I compute the log-likelihood function ll_{zk} and the point estimates for $\hat{\beta}_{zk}$ and $\hat{\sigma}_{zk}$. Once all K models have been estimated, I construct two mean estimates for $\hat{\beta}_{zk}$:

(a) a log-likelihood weighted average of all K estimates $\hat{\beta}_{zk}$:

$$\hat{\beta}_z^W = \sum_{k=1}^{K} w_{zk} \hat{\beta}_{zk} \tag{2.8}$$

where the weights w_{zk} stem from the log-likelihood function values obtained for each model and are calculated as:

$$w_{zk} = \frac{\frac{1}{ll_{zk}}}{\sum_{i=1}^{K} \frac{1}{ll_{zi}}} \tag{2.9}$$

to account for the fact that the log-likelihood function values are negative and the weighting scheme should assign higher weights to models with a lower absolute value of the log-likelihood function. As argued by Sala-i-Martin (1997b) this weighting scheme will provide more weight to models (regressions) with higher likelihood and thus more likely to be the true model. Since all regressions have a maximum number of regressors of 7, no model should have a better fit just because of having more explanatory variables[48]. I propose using weights based on the inverse of the log-likelihood as opposed to the integrated

[47] See Sala-i-Martin (1997b), p.4.

[48] In any case it could have a worse fit for models with only 5 or 6 regressors. Those models account for less than 6% pf all regressions.

likelihood proposed by Sala-i-Martin (1997b) to reduce the computational burden, although still honoring the idea behind the weighting scheme suggested by the author.

(b) a non weighted average of all K estimates $\hat{\beta}_{zk}$:

$$\hat{\beta}_z^{NW} = \frac{1}{K}\sum_{k=1}^{K}\hat{\beta}_{zk} \tag{2.10}$$

Analogously, I compute the mean variance as:

$$\hat{\sigma}_z^{2^W} = \sum_{k=1}^{K} w_{zk}\hat{\sigma}_{zk}^2 \tag{2.11}$$

$$\hat{\sigma}_z^{2^{NW}} = \frac{1}{K}\sum_{k=1}^{K}\hat{\sigma}_{zk}^2 \tag{2.12}$$

Since I assume under (1) that the estimates across models are normally distributed with (2.8) and (2.11) – or respectively with (2.10) and (2.12) – I am able to compute the normal cumulative distribution function at zero (CDF(0)) for both cases, the weighted and the unweighted one[49], using the notation: $\Phi_z^{W,N}(0)$ and $\Phi_z^{NW,N}(0)$ respectively.

For case (2) and since the assumption of the $\hat{\beta}_{zk}$ not being normally distributed across models does not allow to calculate the CDF(0) as explained above, one can calculate the CDF(0) using the individual $\hat{\beta}_{zk}$ and $\hat{\sigma}_{zk}^2$ for each model k:

$$\Phi_{zk}^{\hat{\beta}_{zk},\hat{\sigma}_{zk}^2}(0) = \frac{1}{\hat{\sigma}_{zk}^2\sqrt{2\pi}}\int_{-\infty}^{0}\exp\left\{-\frac{\left(u-\hat{\beta}_{zk}\right)^2}{2\hat{\sigma}_{zk}^2}\mathrm{d}u\right\}$$

and aggregate all $\Phi_{zk}^{\hat{\beta}_{zk},\hat{\sigma}_{zk}^2}$ using the same weighting scheme presented before:

$$\Phi_z^{W,NN}(0) = \sum_{k=1}^{K} w_{zk}\Phi_{zk}^{\hat{\beta}_{zk},\hat{\sigma}_{zk}^2}(0) \tag{2.13}$$

[49] Note that CDF(0) is used in the same fashion as by Sala-i-Martin (1997b), denoting the largest of the two areas next to the zero, irrespective of it being above or below zero. It will therefore range between 0.5 and 1.

$$\Phi_z^{NW,NN}(0) = \frac{1}{K}\sum_{k=1}^{K}\Phi_{zk}^{\hat{\beta}_{zk},\,\hat{\sigma}^2_{zk}}(0) \tag{2.14}$$

Although I can control for differences in the goodness of fit produced by a differing number of regressors, it still has to be noted that endogenous variables may generate a spurious better fit. Hence, to be able to spot cases where better fit is being generated by endogeneity bias and weights are monopolized by spurious regressions, the non-weighted averages are presented.

I depart from a total of 59 variables, of which 3 constitute the baseline model. N is therefore 56. For each variable z_i I combine the remaining 55 variables in terns, therefore estimating $K = \frac{55!}{52!3!} = 26235$ regressions for each z_i, $i = 1, \ldots, N$. Together with the regressions only including the baseline model plus z_i plus either duples of variables or single variables, the total number of regressions adds up to 27775. Given that 56 variables are tested, this implies over 1.5 million regressions for z variables only, i.e. not including the regressions testing the baseline model's variables.

Appendix B: Description of Variables

Table 2.1: Description of dependent variables

Variable	Description	Source
	Dependent variable - Mode and moment of Entry	
Greenfield Investment Indicator (GII)	This variable takes the value of two if the entry-mode chosen was based on previously existing firms (pooling together all M&A (full or partial acquisitions) and JV events) and it takes the value of one if the entry-mode chosen was a Greenfield Investment.	Offshoring Event Study
Entry-mode Indicator (EMI)	This is a qualitative variable taking the values one, two and three for the entry modes Greenfield Investment, Joint Venture and M&A, respectively. JV are shared ownership GI. It is assumed that if the press release on a GI does not expressly state that there is a joint venture, the GI is assumed as fully owned.	Offshoring Event Study
Entry-mode Control Indicator (EMCI)	This is a qualitative variable taking the values one, two and three for Greenfield Investment, partial acquisition modes (M&A and/or JV) and full acquisition M&A, respectively.	Offshoring Event Study

Notes: For the multinomial logit regression the category assuming the highest value is taken as the base outcome: "Target exists", for the GII, "M&A" for the EMI and "Full acquisition" for the EMCI.

Table 2.2: Description of MNC-specific explanatory variables

Variable	Description	Source
	Explanatory variables at the MNC level	
MNC International Experience	The MNC's international experience is proxied by the number of the MNC's worldwide subsidiaries abroad.	OneSource
MNC Host-country Experience	The MNC's host-country experience is proxied by the number of the MNC's subsidiaries in the host economy.	OneSource
MNC Host-country Experience Squared	To account for a curvilinear effect the square of MNC Host-country Experience is generated.	OneSource
MNC Sales	Total annual Sales/Revenue/Turnover as defined by Bloomberg at the MNC's fiscal year's end.	Bloomberg
MNC Size (Market Capitalization)	The MNC's size is proxied through its market capitalization, measured as the number of listed shares outstanding times its stock price. This measure is used with an annual frequency and taken for the MNC's fiscal year's end.	Bloomberg
MNC Size (Market Capitalization) Squared	To account for a curvilinear effect the square of MNC Market Cap is generated.	Bloomberg
MNC Size (Number of Employees)	Total number of employees at the MNC's fiscal year's end.	Bloomberg
MNC Price to Earnings Ratio	The price to earnings ratio is calculated as the ratio between the MNC's stock price (daily, last price) and its earnings per share (trailing twelve months).	Bloomberg
MNC R&D Intensity	This variable is proxied through the amount of patents the MNC owns or has registered worldwide (184 countries)	World Intellectual Property Organization
MNC Efficiency	The efficiency ratio used equals total non-interest expense divided by net revenue, where the latter does not include any trading account profits or losses. Non-interest expense includes paid fees and commissions, as well as operating expenses in general. Net revenue is the sum of net interest income, earned fees and commissions and other operating income plus taxable equivalent basis (teb) adjustment.	Bloomberg
MNC Labor Productivity	This variable is calculated as MNC Sales over MNC Size (Number of Employees).	Bloomberg
MNC Product Diversification	This variable is proxied through 1 minus a normalized Herfindahl index ranging between 0 and 1. The Herfindahl index was calculated as a concentration index based on the number of products the MNC offers and their relative size (in revenues) with respect to total revenues. The normalization was done to account for the number of products offered.	OneSource
MNC Product Diversification Squared	To account for a curvilinear effect the square of MNC Product Diversification is generated.	OneSource
MNC M&A Experience	Previous experience in M&A deals is proxied through accumulated number of M&A deals completed by the MNC previous to the event. The variable is lagged to avoid endogeneity.	Own calculation
MNC M&A over GI Experience	More experience in M&A deals than in GI is proxied through the ratio of the cumulated number of M&A deals over the cumulated number of GI deals completed by the MNC previous to the event. The variable is lagged to avoid endogeneity.	Own calculation

Notes: The Price to Earnings ratio stems from a variable of daily frequency and is matched for the deal's actual date. The MNC's Diversification, Efficiency Ratio, R&D Intensity, Host-country Experience and International Experience have a unique value per MNC and do not vary for all events in which that MNC plays the decisive role. All other MNC variables – Sales, Employees, Market Cap. and Labor Productivity – are annual.

Table 2.3: Description of industry-specific explanatory variables

Variable	Description	Source
	Explanatory variables at the Industry level	
Sector Size	To account for the industry's relative size in the host economy I use liquid liabilities (as a percentage of GDP) as a proxy for the size of the financial sector. This measure is far from being perfect, but it is a homogeneous figure that can be found for almost every country in the sample.	International Financial Statistics
Sector Growth	Average annual growth of the sector size in the previous five years to the offshoring event.	International Financial Statistics
Sector Growth Squared	To account for a curvilinear effect the square of Sector Growth is generated.	International Financial Statistics

Notes: All three variables are annual.

Table 2.4: Description of host-country-specific explanatory variables

Variable	Description	Source
	Explanatory variables at the host-country level	
Macroeconomic Environment Indicators		
MEI - Political Stability	Aggregate index according to the methodology explained above with the following subindicators: Political stability [1] [Reversed]; government stability [2] [Reversed]; socioeconomic conditions [2] [Reversed]; internal conflict [2] [Reversed]; external conflicts [2] [Reversed]; democratic accountability [2] [Reversed]; ethnic tensions [2] [Reversed].	[1] Kaufmann, Kraay, and Mastruzzi (2006); [2] ICRG (2003)
MEI - Economic Stability	Aggregate index according to the methodology explained above with the following subindicators: exchange rate vulnerability (calculated as local currency exchange rate annual volatility against the US dollar over US dollar annual volatility against a basket of currencies); purchasing power parity volatility (five previous years); Inflation, consumer prices (annual %); Inflation, GDP deflator (annual %).	World Development Indicators
MEI - Dependence	Aggregate index according to the methodology explained above with the following subindicators: total trade as a percentage of GDP (Exports plus imports of goods and services); net energy imports (as a percentage of energy use).	World Development Indicators
MEI - Development Degree	Aggregate index according to the methodology explained above with the following subindicators: Gross Domestic Product (at constant 2000 USD)[Reversed].	World Development Indicators
MEI - Welfare Sustainability	Aggregate index according to the methodology explained above with the following subindicators: Gross Domestic Savings as a percentage of GDP [Reversed].	World Development Indicators
Infrastructure Indicators		
ICT Infrastructure	This index proxies ICT infrastructure as the major type of infrastructure relevant to services. It pools the following subindicators according to the methodology explained above: Information and communication technology expenditure (as a percentage of GDP) [Reversed]; number of personal computers per 1,000 people [Reversed]; number of telephone subscribers [Reversed].	World Development Indicators
Market Potential Indicators		
Market Potential	The market potential index proxies to which extent the local market is attractive in terms of its purchasing power as well as size. The aggregate index is built according to the methodology explained above with the following subindicators: domestic purchasing power [Reversed]; household final consumption and gross national expenditure (as a percentage of GDP) [Reversed]; as well as the income share held by the highest 10% of the population to proxy the market's development in terms of its consumption behavior [Reversed].	World Development Indicators
Global Market	I proxy the extent to which the market is global in its consuming behavior through the number of bilateral agreements the host-country has signed. The reasoning behind this is to account for openness to international trade in the host-country and hence local market relatedness to other markets.	Own calculation based on UNCTAD (2007)

Notes: [Reverse] means that the z-score was reversed to make sure all variables get worse for higher values.

Table 2.5: Description of host-country-specific explanatory variables (Cont.)

Variable	Description	Source
	Explanatory variables at the host-country level	
Specialization Indicators		
Specialization	According to agglomeration theories a host-country's specialization as an offshoring spot for high end services may act as a magnet for further investments in the same area. In order to proxy the degree to which the host-country has a bias towards providing these type of services, the aggregate index includes the following sub-indicators: two labor productivity measures – value added in services [Reversed] and value added in industry (as percentage of GDP)[Reversed] – accounting for the accumulated experience effect one should find in more specialized countries; the number of patents applications in that country, both by residents and by non-residents [Reversed], to account for both the level and amount of research done in the host-country, as well as the value of intellectual property; amount of high-technology exports [Reversed]; services exports [Reversed]; foreign direct investment, net inflows (as a percentage of GDP) [Reversed].	World Development Indicators
Talent Pool Indicators		
TPI - Size	This indicator accounts for the size of the local talent pool in absolute terms and in its growth/shrinking potential. The index is built according to the methodology explained above with the following subindicators: total population[Reversed]; size of the labor force[Reversed]; labor force forecast[50] for 2025[Reversed]; net migration figures (to allow for potential shrinkages or growth through brain drain or gain)[Reversed]; Unemployment with tertiary education (as a percentage of total unemployment)[Reversed].	World Development Indicators
TPI - Quality	This indicator accounts for the level of the labor supply's skills. The index is built according to the methodology explained above with the following subindicators: Researchers in R&D (per million people) [Reversed]; Research and development expenditure (% of GDP) [Reversed]; tertiary enrollment (as a percentage of school gross enrolment)[Reversed]; number of internet users (as a percentage of total population) to account for e-literacy[Reversed].	World Development Indicators
TPI - English	The index is built as a z-score according to the methodology explained above, using the average score of TOEFL tests (as a percentage of the maximum score obtainable) [Reversed]. For countries having English as first language, a 100% score was assumed.	TOEFL (2007)
Labor Cost Indicators		
TCI - GGS 9	Normalized z-score following methodology explained above, of the mean base salary in constant 2000 USD for employment grade 9 according to Watson Wyatt's Global Grading System. Employment grade 9 corresponds to a position of junior management and professional advisor.	Watson Wyatt Worldwide (2008)
TCI - GGS 14	Normalized z-score following methodology explained above, of the mean base salary in constant 2000 USD for employment grade 14 according to Watson Wyatt's Global Grading System. Employment grade 14 corresponds to middle managers below heads of function in medium to large organisations, as well as to top management positions in small organisations or business units.	Watson Wyatt Worldwide (2008)
TCI - GGS 18	Normalized z-score following methodology explained above, of the mean base salary in constant 2000 USD for employment grade 18 according to Watson Wyatt's Global Grading System. Employment grade 18 corresponds to a position of chief executive officer in medium to large organizations, to business units managers and to heads of functions or divisions below the firm group's board level.	Watson Wyatt Worldwide (2008)

Notes: [Reverse] means that the z-score was reversed to make sure all variables get worse for higher values.

Table 2.6: Description of host-country-specific explanatory variables (Cont.)

Variable	Description	Source
	Explanatory variables at the host-country level	
Business Environment Indicators		
BEI - Starting a Business	Aggregate index according to the methodology explained above with the following subindicators: number of procedures required to register a firm; total time spent in completing those procedures; total official costs needed for those procedures.	Doing Business Indicators
BEI - Dealing with Licenses	Aggregate index according to the methodology explained above with the following subindicators: number of procedures required to build a warehouse; total time spent in completing those procedures; total official costs needed for those procedures.	Doing Business Indicators
BEI - Registering Property	Aggregate index according to the methodology explained above with the following subindicators: number of procedures required to register property; total time spent in completing those procedures; total official costs needed for those procedures such as fees, transfer taxes, stamp duties and any other payments needed to register property (including lawyers, notaries and public agencies).	Doing Business Indicators
BEI - Closing a Business	Aggregate index according to the methodology explained above with the following subindicators: total time spent in completing the procedures required to close a firm; total cost of the bankruptcy proceedings; recovery rate calculated as the amount (in cents per dollar) that claimants recover from an insolvent firm [Reversed].	Doing Business Indicators
BEI - Employing Workers	Aggregate index according to the methodology explained above with the following subindicators: difficulty of hiring a new worker; restrictions on expanding or contracting the number of working hours; difficulty and expense of dismissing a redundant worker.	Doing Business Indicators
BEI - Enforcing Contracts	Aggregate index according to the methodology explained above with the following subindicators: number of procedures from start of lawsuit to the moment of payment; time in calendar days to resolve dispute; cost in court fees and attorney fees.	Doing Business Indicators
BEI - Labor associated costs	Aggregate index according to the methodology explained above with the following subindicators: firing costs of a redundant worker expressed in weeks of wages; social security payments and payroll taxes associated with hiring an employee (as a percentage of salary).	Doing Business Indicators
BEI - Institutional Environment	Aggregate index according to the methodology explained above with the following subindicators: corruption within the political system (3) [Reversed]; corruption in institutions in general (2) [Reversed]; impartiality and strength of legal system (2) [Reversed]; institutional strength and quality of bureaucracy (2) [Reversed].	(3) Transparency International; (2) ICRG (2003)
BEI - Investment Environment	Aggregate index according to the methodology explained above with the following subindicators: Investment freedom indicator (4) [Reversed]; Financial freedom indicator (4) [Reversed]; Investment profile (2) [Reversed].	(2) ICRG (2003); (4) Beach and Kane (2008)

Notes: Most BEI indicators are constructed with the Doing Business indicators database from the World Bank. For the methodology of each Doing Business indicator used see The World Bank Group, Doing Business, www.doingbusiness.org/MethodologySurveys/ (accessed February, 24th 2008). In particular for Starting a business see Djankov et al. (2002), for Employing workers see Botero et al. (2004), for Enforcing contracts see Djankov et al. (2003) and for Closing a business see Djankov et al. (2006). Note that although most assumptions to construct these indices are for local, medium sized firms, they are able to rank countries in terms of their business environment and can be thus considered the best possible – homogeneous – proxy for business environment.

Table 2.7: Description of host-country-specific explanatory variables (Cont.)

Variable	Description	Source
	Explanatory variables at the host-country level	
Other Costs Indicators		
OCI - ICT	Aggregate index according to the methodology explained above with the following subindicators: Price basket for Internet (USD per month).	World Development Indicators
OCI - Occupancy	Aggregate index that accounts for occupancy costs and its inflation according to the methodology explained above with the following subindicators: Total occupation cost USD per squared meter per annum (at constant 2000 USD); total occupation cost inflation (change in last 12 months, in constant 2000 USD).	CBRE (2007)
OCI - Taxes	Aggregate index according to the methodology explained above with the following subindicators: Taxes on income, profits and capital gains (percentage of revenue) (5); Total tax rate (percentage of profit) (6).	(5) World Development Indicators ; (6) Doing Business Indicators

Notes: [Reverse] means that the z-score was reversed to make sure all variables get worse for higher values.

Table 2.8: Description of explanatory variables accounting for distance between home- and host-country

Variable	Description	Source
	Explanatory variables accounting for Distance	
Distance Indicators		
Distance	Distance between two countries measured as a weighted average of the distances between the largest cities, weighted by their population (as a percentage of the country's total population).	Mayer and Zignago (2006)
Neighborhood	Dummy variable that takes the value 1 if both countries are neighbors and 0 if they are not.	Mayer and Zignago (2006)
Common Language	Categorical variable for common language, taking 1 if both countries share the first language, 0.5 if the host-country speaks the home-country's language at least as a second language and 0 otherwise.	Mayer and Zignago (2006)
Colony	Dummy variable for a pre-existing home-host-country colonial relationship, i.e. the variable is 1 if the host-country was a colony of the home-country in the past, and 0 otherwise.	Mayer and Zignago (2006)

Notes: [Reverse] means that the z-score was reversed to make sure all variables get worse for higher values.

Table 2.9: Description of regional and country dummies

Variable	Description
	Regional and Country dummies
Host Brazil	Dummy variable that equals 1 if the host-country is Brazil and 0 otherwise.
Host Russia	Dummy variable that equals 1 if the host-country is Russia and 0 otherwise.
Host India	Dummy variable that equals 1 if the host-country is India and 0 otherwise.
Host China	Dummy variable that equals 1 if the host-country is China and 0 otherwise.
Region Asia	Dummy variable that equals 1 if the host-country is from Asia and 0 otherwise. China and India are assigned a 0 in this dummy, since they are considered separately and thus not included in the Asian region.
Region Latin America	Dummy variable that equals 1 if the host-country is from Latin America and 0 otherwise. Brazil is assigned a 0 in this dummy, since it is considered separately and thus not included in the Latin American region.
Region Eastern Europe	Dummy variable that equals 1 if the host-country is from Eastern Europe and 0 otherwise. The definition of the region includes all CIS countries, except for Russia, which is assigned a 0 in this dummy, since it is considered separately and thus not included in the Eastern European region.
Region European Union	Dummy variable that equals 1 if the host-country is part of the European Union and 0 otherwise. New EU members (joining the EU after 2004) are considered within Eastern Europe.
Region North America	Dummy variable that equals 1 if the host-country is Canada or the United States and 0 otherwise.
Region MENA	Dummy variable that equals 1 if the host-country is part of the World Bank's definition of the Middle East and North Africa (MENA)countries and 0 otherwise.

Notes: All dummies were constructed based on the data collated within the context of the Offshoring Event Study Database. The BRIC countries are considered separately and are hence not included in their respective regions.

Appendix C: Econometric Results

Table 2.10: Significance of differences between $\hat{\beta}_z^{NW}$ and $\hat{\beta}_z^{W}$

Variable	Model 1 (Full)	Model 1 (EM)	Model 2 (GI)	Model 2 (JV)	Model 3 (GI)	Model 3 (FA)
BEI - Closing a Business	3.245***	1.653**	3.4***	2.157**	3.686***	3.386***
BEI - Enforcing Contracts	1.725**	0.898	1.629*	3.269***	0.911	1.463*
BEI - Employing Workers	12.38***	5.467***	10.11***	-0.009	10.41***	2.807***
BEI - Institutional Environment	1.586*	1.917**	1.536*	0.112	2.579***	2.538***
BEI - Investment Environment	-1.043	-0.124	-0.748	0.322	0.079	3.083***
BEI - Labor associated costs	-1.524*	-1.528*	-0.842	0.708	-1.386*	-0.554
BEI - Dealing with Licenses	-5.022***	-4.756***	-4.187***	-1.078	-3.272***	2.35***
BEI - Registering Property	0.631	0.247	0.436	1.241	0.135	1.046
BEI - Starting a Business	-1.364*	-1.874**	-0.562	5.612***	-2.02**	1.781**
Global Market	-2.172**	-1.877**	-1.863**	0.158	-1.402*	-0.887
Distance	-4.045***	-2.155**	-3.638***	2.504***	-3.829***	1.176
Colony	2.344***	0.573	2.089**	2.418***	3.011***	5.419***
Common Language	0.737	-1.998**	-0.135	-1.514*	-0.002	-0.273
Neighborhood Dummy	12.13***	7.222***	-3.377***	0.942	10.7***	1.574*
Host Brazil	87.68***	70.68***	80.45***	242.3***	97.42***	1.83**
Host China	-2.135**	-0.645	-2.447***	-1.651**	-1.121	0.468
Host India	-0.645	0.015	-0.491	2.454***	-0.638	5.677***
Host Russia	-0.384	-1.541*	-0.513	-1.597*	0.831	2.931***
ICT Infrastructure	7.159***	2.591***	5.471***	-0.676	4.551***	0.313
MEI - Dependence	-4.48***	-2.518***	-3.597***	2.383***	-3.322***	1.976**
MEI - Development Degree	3.643***	4.533***	2.758***	1.039	4.287***	3.508***
MEI - Political Stability	-1.497*	-1.621*	-0.49	5.123***	0.018	2.229**
MEI - Economic Stability	4.465***	3.324***	4.406***	4.111***	3.335***	-3.314***
Market Potential	-5.452***	-3.513***	-4.475***	1.935**	-4.293***	3.736***
MNC Product Diversification	0.259	0.227	-0.121	-1.437*	-0.231	-0.915
MNC Product Diversification Squared	1.06	1.519*	0.554	-3.024***	0.641	-0.764
MNC Labor Productivity	3.004***	2.895***	2.801***	2.294**	3.189***	2.293**
MNC Efficiency	7.601***	5.319***	7.482***	3.485***	7.418***	-0.905
MNC Size (Number of Employees)	-4.564***	-1.6*	-3.674***	-1.831**	-3.082***	3.802***
MNC M&A over GI Experience	15.25***	12.46***	14.28***	9.778***	14.92***	-0.542
MNC Size (Market Capitalization)	-3.219***	-1.005	-2.646***	0.742	-2.219**	3.678***
MNC Size (Market Capitalization) Squared	-3.576***	-1.155	-3.525***	-2.136**	-5.399***	-4.199***
MNC R&D Intensity	-4.022***	-1.748**	-3.497***	2.104**	-4.092***	1.23
MNC Price to Earnings Ratio	0.684	0.26	0.81	3.953***	0.755	3.435***
MNC Sales	-3.361***	-0.327	-3.046***	-0.982	-1.621*	3.447***
MNC Host-country Experience	2.672***	2.441***	2.975***	3.373***	2.774***	-2.667***
MNC Host-country Experience Squared	3.308***	3.977***	3.366***	3.59***	3.92***	-2.434***
MNC International Experience	-1.002	0.539	-0.985	0.167	-1.579*	-2.243**
OCI - Occupancy	-1.029	0.17	-0.969	-1.021	0.034	3.802***
OCI - Taxes	-0.954	-0.027	-0.369	0.687	-1.102	-1.213
Region Asia	-4.808***	-2.179**	-4.416***	1.325*	-5.011***	0.276
Region Eastern Europe	8.119***	5.741***	7.443***	11.74***	6.15***	-2.999***
Region European Union	115.1***	ND	95.81***	-0.181	116.1***	-1.772**
Region Latin America	-1.068	-0.955	-1.91**	-4.376***	-1.055	3.367***
Region MENA	4.418***	ND	5.665***	144.9***	4.703***	-1.159
Region North America	193.3***	ND	173***	3.282***	181.8***	-6.788***
Sector Growth	5.484***	4.01***	4.625***	-1.066	5.326***	0.527
Sector Growth Squared	3.869***	2.966***	3.308***	-1.69**	5.181***	2.626***
Sector Size	21.54***	-0.098	20.31***	4.085***	23.21***	-2.886***
Specialization	10.56***	4.188***	8.963***	3.059***	8.687***	2.528***
TCI - GGS 14	3.607***	1.334*	2.944***	-2.055**	4.858***	0.679
TCI - GGS 18	2.704***	1.381*	1.684**	-2.157**	3.766***	1.829**
TCI - GGS 9	4.597***	2.854***	4.151***	-1.107	5.334***	-1.865**
TPI - English	-6.701***	-2.576***	-5.574***	0.9	-6.026***	4.373***
TPI - Quality	-0.464	0.369	-0.306	3.048***	-0.503	2.218**
TPI - Size	3.81***	2.111**	3.742***	1.512*	3.237***	-2.207**
Baseline Variables						
MEI - Welfare Sustainability	7.221***	.	5.621***	-4.039***	4.98***	-1.508*
MNC M&A Experience	-0.818	.	-0.671	1.155	0.861	4.243***
OCI - ICT	5.519***	.	4.829***	-1.721**	5.908***	2.792***

Notes: Reported values are t-statistics. t-test significance levels are noted by * for 1%, ** for 5% and * for 10%.**

Table 2.11: Correlation between coefficient vectors under the normality and non-normality assumptions

	Correlation	Model 1 (Full)	Model 1 (EM)	Model 2 (GI)	Model 2 (JV)	Model 3 (GI)	Model 3 (FA)
Tested Variables	Weighted Normal vs. Weighted NonNormal	0.941	0.951	0.939	0.931	0.934	0.969
	NonWeighted Normal vs. NonWeighted NonNormal	0.946	0.948	0.944	0.933	0.941	0.968
Baseline model	Weighted Normal vs. Weighted NonNormal	0.737	0.517	0.691	0.999	0.923	0.997
	NonWeighted Normal vs. NonWeighted NonNormal	.	.	0.672	0.999	0.917	0.998

Notes: Correlation coefficients are only reported for the vectors including all tested variables and not including the baseline variables.

Table 2.12: Regression results for Model 1 - Full sample

Variable	B^L	B^U	$\hat{\beta}_z^{NW}$	$\hat{\sigma}_z^{2NW}$	$\hat{\beta}_z^{W}$	$\hat{\sigma}_z^{2W}$	**% Sign.**	W,N $\Phi_z(0)$	NW,N $\Phi_z(0)$	W,NN $\Phi_z(0)$	NW,NN $\Phi_z(0)$	**Avg. Obs.**
Neighborhood Dummy	-47.26	-29.15	-34.80	1211	-34.85	0.241	0.970	1.000	1.000	1.000	1.000	567
Region North America	-53.67	17.65	-19.24	370.1	-20.67	0.866	0.547	1.000	1.000	1.000	1.000	567
Region European Union	-47.88	0.493	-21.50	462.1	-22.07	0.349	0.982	1.000	1.000	1.000	1.000	567
Host Brazil	-46.87	1.862	-3.179	10.11	-3.711	0.512	0.388	0.999	0.999	1.000	1.000	567
Market Potential	-3.929	20.09	6.787	46.07	6.893	5.512	0.956	0.998	0.999	0.995	0.995	567
Host China	-2.395	9.842	1.399	1.956	1.405	0.145	0.937	0.999	0.999	0.994	0.994	567
TCI - GGS 9	-18.40	3.867	-2.777	7.711	-2.811	0.846	0.877	0.999	0.999	0.983	0.983	553
BEI - Dealing with Licenses	-3.947	7.894	2.106	4.437	2.137	0.543	0.818	0.998	0.998	0.982	0.981	493
MNC Sales	0.000	0.000	0.000	0.000	0.000	0.000	0.757	0.990	0.991	0.981	0.981	567
MNC Size (Number of Employees)	0.000	0.000	0.000	0.000	0.000	0.000	0.795	0.990	0.991	0.976	0.975	567
TPI - English	-3.787	7.877	1.612	2.597	1.645	0.385	0.810	0.996	0.998	0.975	0.977	566
MNC Size (Market Capitalization) Squared	0.000	0.000	0.000	0.000	0.000	0.000	0.798	0.974	0.987	0.966	0.964	567
BEI - Labor associated costs	-6.570	8.645	2.335	5.453	2.349	1.122	0.652	0.987	0.988	0.957	0.957	500
BEI - Investment Environment	-3.683	7.425	1.675	2.807	1.681	0.413	0.745	0.996	0.997	0.957	0.958	567
Global Market	-0.028	0.038	0.011	0.000	0.011	0.000	0.806	0.997	0.998	0.954	0.955	564
MNC Host-country Experience	-0.570	2.021	-0.087	0.008	-0.088	0.003	0.534	0.949	0.962	0.953	0.952	445
TCI - GGS 14	-10.32	12.70	-1.639	2.687	-1.661	0.544	0.723	0.988	0.992	0.950	0.951	553
Sector Size	0.000	0.000	0.000	0.000	0.000	0.000	0.478	0.922	0.977	0.949	0.951	567
BEI - Institutional Environment	-5.684	9.807	2.097	4.399	2.084	0.979	0.602	0.982	0.985	0.944	0.945	567
MNC Size (Market Capitalization)	0.000	0.000	0.000	0.000	0.000	0.000	0.669	0.941	0.962	0.944	0.942	567
Region Latin America	-4.169	2.351	-0.909	0.826	-0.904	0.255	0.493	0.963	0.968	0.939	0.943	567
MNC Host-country Experience Squared	-0.362	0.050	-0.007	0.000	-0.007	0.000	0.152	0.922	0.942	0.937	0.936	445
MNC M&A over GI Experience	-6.230	1.509	-1.209	1.462	-1.290	0.418	0.412	0.977	0.977	0.935	0.929	567
BEI - Registering Property	-11.07	7.515	-2.797	7.821	-2.805	2.479	0.426	0.963	0.966	0.928	0.930	529
TPI - Size	-8.268	18.44	-1.641	2.694	-1.669	0.793	0.647	0.970	0.975	0.923	0.923	537
TCI - GGS 18	-7.422	7.004	-1.276	1.628	-1.293	0.546	0.549	0.960	0.965	0.918	0.918	553
BEI - Employing Workers	-9.513	4.091	-1.547	2.394	-1.625	0.554	0.491	0.985	0.983	0.915	0.910	549
TPI - Quality	-6.564	8.207	1.532	2.348	1.535	0.646	0.541	0.972	0.975	0.914	0.913	567
ICT Infrastructure	-12.81	8.634	-1.781	3.172	-1.839	0.952	0.511	0.970	0.973	0.905	0.904	563
MNC International Experience	-0.001	0.000	0.000	0.000	0.000	0.000	0.221	0.933	0.937	0.902	0.904	532
Colony	-1.580	3.609	0.756	0.572	0.746	0.307	0.107	0.911	0.918	0.893	0.899	567
BEI - Closing a Business	-5.026	7.665	1.223	1.497	1.204	0.522	0.480	0.952	0.961	0.891	0.894	549
MEI - Political Stability	-6.329	11.11	1.460	2.130	1.471	0.888	0.460	0.941	0.948	0.888	0.889	567
Sector Growth Squared	-25.04	40.74	4.120	16.98	4.017	10.15	0.245	0.896	0.910	0.882	0.886	567
Specialization	-27.97	14.48	-1.825	3.329	-1.948	2.036	0.413	0.914	0.917	0.873	0.870	541
OCI - Occupancy	-9.013	5.225	-1.403	1.968	-1.393	1.276	0.141	0.891	0.896	0.863	0.864	496
MNC Price to Earnings Ratio	-0.026	0.075	0.015	0.000	0.015	0.000	0.005	0.868	0.872	0.859	0.861	524
BEI - Enforcing Contracts	-16.73	5.043	-1.572	2.472	-1.590	1.418	0.221	0.909	0.913	0.859	0.858	549
MEI - Development Degree	-23.35	38.66	0.859	0.737	0.820	1.804	0.282	0.729	0.766	0.854	0.856	567
MEI - Dependence	-6.173	12.06	1.213	1.472	1.249	0.895	0.224	0.907	0.910	0.832	0.829	566
Host Russia	-3.422	4.105	0.526	0.277	0.528	0.381	0.034	0.804	0.807	0.830	0.827	567
Sector Growth	-11.48	6.204	0.915	0.837	0.867	1.077	0.143	0.798	0.816	0.824	0.829	567
Common Language	-1.242	2.247	0.205	0.042	0.203	0.042	0.151	0.839	0.854	0.822	0.825	567
Region MENA	-2.978	4.452	0.341	0.116	0.326	0.164	0.154	0.790	0.811	0.816	0.822	567
BEI - Starting a Business	-6.417	9.121	-0.403	0.162	-0.393	0.724	0.253	0.678	0.689	0.815	0.815	549
MNC R&D Intensity	-0.054	0.036	0.005	0.000	0.006	0.000	0.001	0.768	0.763	0.813	0.810	567
Region Asia	-2.701	2.964	-0.122	0.015	-0.110	0.092	0.158	0.642	0.664	0.810	0.813	567
Region Eastern Europe	-2.751	2.611	0.281	0.079	0.257	0.130	0.148	0.762	0.792	0.805	0.811	567
OCI - Taxes	-9.333	6.931	-1.181	1.395	-1.170	1.808	0.139	0.808	0.817	0.796	0.796	407
MNC Product Diversification Squared	-33.99	15.81	-1.320	1.742	-1.336	3.897	0.000	0.751	0.775	0.774	0.773	556
MNC Product Diversification	-10.39	18.43	-0.664	0.441	-0.667	1.900	0.000	0.686	0.705	0.749	0.750	556
Host India	-3.326	7.837	-0.342	0.117	-0.338	0.465	0.006	0.690	0.696	0.731	0.732	567
Distance	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.651	0.642	0.718	0.714	567
MEI - Economic Stability	-18.31	18.45	0.669	0.447	0.579	5.906	0.001	0.594	0.615	0.704	0.707	562
MNC Labor Productivity	-3.580	2.172	-0.069	0.005	-0.079	0.169	0.002	0.576	0.568	0.659	0.656	567
MNC Efficiency	-0.037	0.029	0.000	0.000	-0.001	0.000	0.000	0.530	0.505	0.646	0.637	472
Baseline Variables												
MEI - Welfare Sustainability	-10.22	6.332	-4.141	17.15	-4.198	0.972	0.952	1.000	1.000	0.993	0.993	567
MNC M&A Experience	-0.055	0.134	0.042	0.002	0.042	0.000	0.879	0.997	0.998	0.990	0.990	568
OCI - ICT	-10.43	0.713	-4.207	17.70	-4.244	0.684	1.000	1.000	1.000	1.000	1.000	563
Regressions:	27755											

Notes: EBA results performed on a binomial logit. Base outcome is "Target". Averaged coefficients are in log-odds units and refer to the likelihood of choosing GI over an entry involving a partner or target.

Table 2.13: Regression results for Model 1 - Emerging Markets sub-sample

Variable	B^L	B^U	$\hat{\beta}_z^{NW}$	$\hat{\sigma}_z^{2\,NW}$	$\hat{\beta}_z^{W}$	$\hat{\sigma}_z^{2\,W}$	**% Sign.**	W,N $\Phi_z(0)$	NW,N $\Phi_z(0)$	W,NN $\Phi_z(0)$	NW,NN $\Phi_z(0)$	**Avg. Obs.**
Neighborhood Dummy	-46.58	-28.54	-34.57	0.367	-34.61	0.384	0.972	1.000	1.000	1.000	1.000	468
Host Brazil	-46.13	1.694	-3.390	0.494	-3.850	0.501	0.563	1.000	0.999	1.000	1.000	468
Sector Size	0.000	0.000	0.000	0.000	0.000	0.000	0.924	0.996	0.997	0.991	0.992	468
Host China	-3.339	9.946	1.233	0.172	1.235	0.217	0.874	0.996	0.999	0.986	0.986	468
Region Latin America	-4.872	1.492	-1.118	0.234	-1.114	0.249	0.752	0.987	0.990	0.975	0.977	468
Specialization	-25.30	22.05	-5.706	4.151	-5.788	4.979	0.804	0.995	0.997	0.969	0.967	445
Market Potential	-7.175	18.44	5.366	5.675	5.444	6.023	0.687	0.987	0.988	0.968	0.969	468
MNC Size (Market Capitalization) Squared	0.000	0.000	0.000	0.000	0.000	0.000	0.769	0.969	0.984	0.967	0.966	468
MNC Sales	0.000	0.000	0.000	0.000	0.000	0.000	0.575	0.980	0.982	0.967	0.968	468
MNC Size (Number of Employees)	0.000	0.000	0.000	0.000	0.000	0.000	0.697	0.981	0.983	0.966	0.965	468
ICT Infrastructure	-15.03	12.09	-2.989	1.156	-3.016	1.382	0.792	0.995	0.997	0.962	0.963	465
BEI - Employing Workers	-9.200	4.742	-2.062	0.605	-2.102	0.644	0.749	0.996	0.996	0.960	0.960	455
BEI - Registering Property	-10.68	6.537	-3.356	2.544	-3.359	2.664	0.639	0.980	0.982	0.954	0.955	439
MNC M&A over GI Experience	-6.784	1.306	-1.361	0.427	-1.439	0.494	0.409	0.980	0.981	0.950	0.946	468
MNC International Experience	-0.001	0.000	0.000	0.000	0.000	0.000	0.335	0.970	0.971	0.948	0.948	440
MEI - Development Degree	-43.02	36.55	-5.673	9.323	-5.809	11.89	0.667	0.954	0.968	0.941	0.942	468
Global Market	-0.028	0.044	0.010	0.000	0.010	0.000	0.694	0.985	0.989	0.940	0.941	468
MNC Size (Market Capitalization)	0.000	0.000	0.000	0.000	0.000	0.000	0.521	0.913	0.940	0.935	0.934	468
BEI - Dealing with Licenses	-4.536	7.176	1.446	0.598	1.480	0.627	0.509	0.969	0.969	0.934	0.932	410
TPI - English	-7.096	7.863	1.325	0.973	1.349	1.068	0.391	0.904	0.910	0.905	0.905	468
BEI - Labor associated costs	-6.539	8.442	1.545	1.250	1.561	1.336	0.395	0.912	0.916	0.888	0.888	416
BEI - Investment Environment	-3.905	7.029	1.011	0.396	1.012	0.437	0.454	0.937	0.946	0.882	0.883	468
BEI - Enforcing Contracts	-15.05	6.456	-1.701	1.537	-1.712	1.603	0.207	0.912	0.915	0.879	0.878	455
TPI - Size	-9.270	16.83	-1.146	0.933	-1.166	1.062	0.427	0.871	0.882	0.877	0.878	439
BEI - Starting a Business	-7.039	9.338	-1.213	0.885	-1.196	0.955	0.295	0.890	0.901	0.868	0.871	455
TCI - GGS 9	-15.92	5.373	-1.162	0.880	-1.187	0.965	0.212	0.887	0.892	0.857	0.855	455
Colony	-1.576	3.635	0.665	0.358	0.661	0.369	0.012	0.862	0.867	0.851	0.854	468
MNC Price to Earnings Ratio	-0.027	0.079	0.014	0.000	0.014	0.000	0.002	0.844	0.847	0.836	0.836	433
Sector Growth Squared	-26.89	47.81	3.382	9.658	3.295	10.66	0.113	0.844	0.862	0.835	0.840	468
MNC Host-country Experience Squared	-0.327	0.066	-0.004	0.000	-0.004	0.000	0.091	0.808	0.842	0.826	0.822	362
MNC R&D Intensity	-0.047	0.038	0.007	0.000	0.008	0.000	0.001	0.819	0.819	0.825	0.822	468
MNC Host-country Experience	-0.691	1.939	-0.048	0.003	-0.049	0.003	0.121	0.811	0.831	0.821	0.817	362
Region Asia	-2.841	2.811	-0.185	0.115	-0.179	0.122	0.092	0.696	0.708	0.795	0.795	468
MNC Product Diversification Squared	-37.97	13.06	-1.408	3.005	-1.434	3.922	0.000	0.765	0.792	0.792	0.790	459
TCI - GGS 14	-7.453	12.28	-0.625	0.589	-0.635	0.635	0.064	0.787	0.792	0.790	0.788	455
MEI - Dependence	-7.040	11.11	0.581	0.925	0.604	1.047	0.111	0.722	0.727	0.774	0.772	468
BEI - Institutional Environment	-7.781	9.186	0.463	1.064	0.444	1.158	0.069	0.660	0.673	0.770	0.768	468
MNC Product Diversification	-10.27	20.22	-0.747	1.563	-0.750	2.003	0.000	0.702	0.725	0.768	0.768	459
Host Russia	-2.928	4.025	0.384	0.383	0.393	0.397	0.004	0.733	0.732	0.764	0.760	468
TPI - Quality	-9.216	5.936	-0.647	0.887	-0.651	0.939	0.064	0.749	0.754	0.763	0.764	468
MEI - Political Stability	-7.483	9.763	0.076	0.903	0.091	0.997	0.093	0.536	0.532	0.762	0.760	468
Common Language	-1.155	2.447	0.136	0.045	0.140	0.049	0.070	0.736	0.739	0.754	0.752	468
Host India	-3.137	7.868	-0.375	0.496	-0.375	0.519	0.005	0.699	0.703	0.754	0.754	468
TCI - GGS 18	-5.238	7.641	-0.382	0.495	-0.391	0.518	0.018	0.707	0.707	0.753	0.751	455
Region Eastern Europe	-3.083	2.879	0.089	0.131	0.070	0.140	0.061	0.574	0.597	0.750	0.751	468
OCI - Occupancy	-8.569	5.112	-0.672	1.222	-0.673	1.262	0.004	0.726	0.728	0.746	0.747	404
Sector Growth	-12.47	4.580	0.204	1.121	0.164	1.203	0.027	0.560	0.577	0.735	0.735	468
OCI - Taxes	-8.592	10.73	-0.355	2.213	-0.354	2.326	0.033	0.592	0.594	0.731	0.730	354
BEI - Closing a Business	-6.315	6.847	0.016	0.709	0.003	0.745	0.062	0.501	0.508	0.723	0.722	455
MEI - Economic Stability	-15.30	15.52	0.177	4.816	0.107	5.449	0.000	0.518	0.532	0.695	0.694	464
Distance	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.508	0.500	0.685	0.684	468
MNC Efficiency	-0.037	0.034	0.002	0.000	0.002	0.000	0.000	0.588	0.609	0.667	0.667	389
MNC Labor Productivity	-3.457	2.046	-0.101	0.185	-0.112	0.191	0.002	0.601	0.593	0.667	0.663	468
Baseline Variables												
MEI - Welfare Sustainability	-10.54	7.047	-3.215		-3.265	1.222	0.840	0.998		0.981	0.981	469
MNC M&A Experience	-0.054	0.131	0.042		0.041	0.000	0.857	0.997		0.989	0.989	469
OCI - ICT	-9.289	2.543	-3.218		-3.257	0.641	0.994	0.999		0.999	0.999	466
Regressions:	23478											

Notes: EBA results performed on a binomial logit. Base outcome is "Target". Averaged coefficients are in log-odds units and refer to the likelihood of choosing GI over an entry involving a partner or target.

Table 2.14: Regression results for Model 2 - Outcome GI

Variable	B^L	B^U	$\hat{\beta}_z^{NW}$	$\hat{\sigma}_z^{2NW}$	$\hat{\beta}_z^{W}$	$\hat{\sigma}_z^{2W}$	**% Sign.**	W,N $\Phi_z(0)$	NW,N $\Phi_z(0)$	W,NN $\Phi_z(0)$	NW,NN $\Phi_z(0)$	**Avg. Obs.**
Neighborhood Dummy	-46.89	-29.09	-35.25	0.243	-35.23	0.256	0.970	1.000	1.000	1.000	1.000	567
Region North America	-53.65	21.10	-19.34	0.674	-20.64	0.884	0.558	1.000	1.000	1.000	1.000	567
Region European Union	-47.64	0.463	-22.00	0.340	-22.48	0.354	0.981	1.000	1.000	1.000	1.000	567
Host Brazil	-47.36	1.860	-3.210	0.512	-3.699	0.516	0.494	0.999	0.999	1.000	1.000	567
Host China	-2.214	10.45	1.601	0.155	1.609	0.175	0.967	0.999	0.999	0.997	0.997	567
Market Potential	-3.707	20.61	7.343	5.315	7.433	5.746	0.972	0.999	0.999	0.996	0.996	567
MNC Sales	0.000	0.000	0.000	0.000	0.000	0.000	0.846	0.993	0.994	0.987	0.987	567
TCI - GGS 9	-19.54	3.970	-2.988	0.776	-3.020	0.902	0.897	0.999	0.999	0.985	0.985	553
BEI - Dealing with Licenses	-4.485	8.109	2.181	0.535	2.207	0.563	0.821	0.998	0.999	0.980	0.980	493
TPI - English	-4.208	8.116	1.650	0.364	1.680	0.428	0.788	0.995	0.997	0.973	0.974	566
MNC Size (Number of Employees)	0.000	0.000	0.000	0.000	0.000	0.000	0.757	0.987	0.989	0.972	0.971	567
BEI - Investment Environment	-3.591	7.802	1.812	0.396	1.816	0.447	0.760	0.997	0.998	0.962	0.964	567
Global Market	-0.029	0.040	0.013	0.000	0.013	0.000	0.814	0.998	0.999	0.961	0.962	564
MNC Size (Market Capitalization) Squared	0.000	0.000	0.000	0.000	0.000	0.000	0.751	0.963	0.980	0.956	0.954	567
MNC Host-country Experience	-0.523	2.019	-0.089	0.003	-0.091	0.003	0.531	0.950	0.961	0.954	0.953	445
BEI - Labor associated costs	-6.976	8.940	2.377	1.113	2.385	1.166	0.649	0.986	0.988	0.954	0.954	500
TCI - GGS 14	-11.18	13.76	-1.740	0.505	-1.759	0.603	0.736	0.988	0.993	0.952	0.953	553
Sector Size	0.000	0.000	0.000	0.000	0.000	0.000	0.509	0.926	0.979	0.950	0.952	567
BEI - Institutional Environment	-5.793	10.09	2.199	0.989	2.186	1.037	0.618	0.984	0.986	0.947	0.948	567
MNC Size (Market Capitalization)	0.000	0.000	0.000	0.000	0.000	0.000	0.610	0.932	0.956	0.938	0.936	567
MNC Host-country Experience Squared	-0.363	0.050	-0.007	0.000	-0.007	0.000	0.151	0.925	0.943	0.938	0.937	445
TPI - Size	-8.614	19.22	-1.910	0.826	-1.940	0.934	0.670	0.978	0.982	0.933	0.933	537
BEI - Registering Property	-11.46	7.192	-2.921	2.415	-2.927	2.549	0.459	0.967	0.970	0.932	0.933	529
TPI - Quality	-6.938	8.482	1.640	0.613	1.642	0.654	0.576	0.979	0.982	0.921	0.922	567
MNC M&A over GI Experience	-6.378	1.639	-1.136	0.379	-1.213	0.432	0.321	0.968	0.967	0.921	0.914	567
Region Latin America	-4.237	2.633	-0.861	0.273	-0.853	0.292	0.362	0.943	0.950	0.917	0.922	567
TCI - GGS 18	-7.562	7.864	-1.247	0.557	-1.258	0.620	0.510	0.945	0.953	0.914	0.915	553
BEI - Employing Workers	-9.860	4.016	-1.582	0.552	-1.646	0.579	0.490	0.985	0.983	0.913	0.909	549
Colony	-1.593	3.744	0.807	0.314	0.797	0.327	0.127	0.918	0.925	0.901	0.907	567
ICT Infrastructure	-13.30	8.828	-1.806	0.891	-1.851	0.994	0.511	0.968	0.972	0.901	0.901	563
MEI - Political Stability	-6.588	11.23	1.576	0.855	1.580	0.941	0.482	0.948	0.956	0.893	0.894	567
BEI - Closing a Business	-5.314	7.806	1.216	0.498	1.195	0.540	0.473	0.948	0.958	0.889	0.892	549
Sector Growth Squared	-24.31	38.90	4.175	9.059	4.089	9.749	0.292	0.905	0.917	0.887	0.890	567
MNC International Experience	-0.001	0.001	0.000	0.000	0.000	0.000	0.191	0.918	0.923	0.886	0.889	532
OCI - Occupancy	-9.175	5.093	-1.466	1.187	-1.457	1.223	0.216	0.906	0.911	0.874	0.875	496
Specialization	-28.34	15.08	-1.860	1.810	-1.966	2.114	0.426	0.912	0.917	0.873	0.870	541
MEI - Development Degree	-23.86	39.29	0.861	1.482	0.831	1.915	0.291	0.726	0.760	0.858	0.860	567
BEI - Enforcing Contracts	-17.13	5.180	-1.568	1.386	-1.584	1.465	0.222	0.905	0.909	0.852	0.851	549
Sector Growth	-10.90	6.252	1.064	0.997	1.025	1.048	0.210	0.842	0.857	0.843	0.847	567
Host Russia	-3.591	4.113	0.502	0.354	0.505	0.367	0.043	0.798	0.801	0.834	0.831	567
Common Language	-1.192	2.480	0.232	0.043	0.232	0.048	0.155	0.856	0.868	0.830	0.833	567
Region MENA	-3.013	4.633	0.314	0.140	0.295	0.155	0.173	0.774	0.799	0.822	0.827	567
MNC Price to Earnings Ratio	-0.029	0.073	0.013	0.000	0.013	0.000	0.002	0.827	0.831	0.818	0.819	524
BEI - Starting a Business	-7.031	9.620	-0.404	0.720	-0.400	0.781	0.259	0.674	0.683	0.814	0.815	549
Region Asia	-2.827	2.833	-0.126	0.092	-0.114	0.101	0.147	0.641	0.661	0.807	0.809	567
MNC R&D Intensity	-0.054	0.035	0.005	0.000	0.005	0.000	0.000	0.751	0.747	0.803	0.800	567
MEI - Dependence	-6.884	12.08	1.024	0.892	1.054	0.966	0.176	0.858	0.861	0.795	0.792	566
Region Eastern Europe	-2.870	2.541	0.205	0.123	0.182	0.133	0.112	0.691	0.721	0.786	0.790	567
OCI - Taxes	-9.149	7.543	-0.934	1.782	-0.930	1.890	0.116	0.751	0.758	0.771	0.770	407
MNC Product Diversification Squared	-33.65	15.71	-1.236	2.833	-1.244	3.650	0.000	0.743	0.769	0.765	0.765	556
Distance	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.708	0.703	0.740	0.736	567
MNC Product Diversification	-10.36	18.49	-0.572	1.438	-0.571	1.826	0.000	0.664	0.683	0.735	0.736	556
MEI - Economic Stability	-18.79	18.09	0.762	5.235	0.674	5.880	0.002	0.609	0.630	0.719	0.722	562
Host India	-3.400	8.159	-0.285	0.484	-0.282	0.506	0.008	0.654	0.659	0.714	0.713	567
MNC Efficiency	-0.036	0.029	0.001	0.000	0.000	0.000	0.000	0.511	0.536	0.659	0.653	472
MNC Labor Productivity	-3.626	2.203	-0.029	0.178	-0.039	0.188	0.003	0.536	0.527	0.644	0.642	567
Baseline Variables												
MEI - Welfare Sustainability	-10.73	5.973	-4.482	0.912	-4.527	0.997	0.954	0.999	0.999	0.994	0.994	567
MNC M&A Experience	-0.053	0.137	0.043	0.000	0.044	0.000	0.897	0.998	0.998	0.992	0.992	568
OCI - ICT	-10.54	0.945	-4.157	0.633	-4.189	0.688	1.000	0.999	0.999	0.999	0.999	563
Regressions:	27775											

Notes: EBA results performed on a multinomial logit. Base outcome is "M&A". Averaged coefficients are in log-odds units and refer to the likelihood of choosing GI over an M&A entry.

Table 2.15: Regression results for Model 2 - Outcome JV

Variable	B^L	B^U	$\hat{\beta}_z^{NW}$	$\hat{\sigma}_z^{2^{NW}}$	$\hat{\beta}_z^{W}$	$\hat{\sigma}_z^{2^{W}}$	**% Sign.**	W,N $\Phi_z(0)$	NW,N $\Phi_z(0)$	W,NN $\Phi_z(0)$	NW,NN $\Phi_z(0)$	**Avg. Obs.**
Region North America	-211.0	119.5	-34.03	0.494	-34.06	1.043	0.963	1.000	1.000	1.000	1.000	567
Host Brazil	-46.51	2.892	-13.82	0.608	-15.45	0.656	0.364	1.000	1.000	1.000	1.000	567
Region MENA	-45.60	4.102	-3.713	0.636	-4.699	0.651	0.102	1.000	0.999	1.000	1.000	567
Region Eastern Europe	-45.48	1.769	-1.392	0.666	-1.475	0.699	0.040	0.961	0.956	1.000	1.000	567
Market Potential	-7.463	15.85	5.781	4.958	5.744	5.158	0.899	0.994	0.995	0.989	0.990	567
Host China	-2.253	20.05	1.429	0.422	1.439	0.477	0.697	0.981	0.986	0.970	0.970	567
TCI - GGS 9	-14.41	5.214	-2.387	1.525	-2.375	1.767	0.563	0.963	0.973	0.952	0.954	553
MNC Sales	0.000	0.000	0.000	0.000	0.000	0.000	0.295	0.955	0.957	0.941	0.940	567
BEI - Investment Environment	-3.820	7.336	1.543	0.710	1.541	0.775	0.478	0.960	0.966	0.940	0.942	567
TPI - Size	-15.34	32.25	-2.392	2.103	-2.411	2.256	0.343	0.946	0.950	0.935	0.935	537
MNC Price to Earnings Ratio	-0.435	0.103	-0.096	0.004	-0.098	0.004	0.176	0.942	0.947	0.932	0.931	524
MEI - Dependence	-15.43	5.651	-2.741	2.961	-2.776	3.131	0.211	0.942	0.944	0.930	0.930	566
Global Market	-0.045	0.040	0.011	0.000	0.011	0.000	0.456	0.954	0.956	0.928	0.929	564
MNC Efficiency	-0.033	0.026	0.007	0.000	0.006	0.000	0.306	0.926	0.936	0.908	0.912	472
Distance	0.000	0.000	0.000	0.000	0.000	0.000	0.130	0.907	0.915	0.892	0.897	567
MNC Size (Market Capitalization) Squared	0.000	0.000	0.000	0.000	0.000	0.000	0.055	0.795	0.874	0.862	0.865	567
MNC M&A over GI Experience	-3.567	4.187	1.072	0.563	1.008	0.607	0.433	0.902	0.923	0.857	0.875	567
Region European Union	-5.463	2.457	-1.221	1.261	-1.219	1.273	0.002	0.860	0.861	0.853	0.854	567
Colony	-1.906	4.096	0.755	0.475	0.741	0.493	0.000	0.854	0.863	0.850	0.856	567
MNC Labor Productivity	-3.066	2.037	0.385	0.128	0.378	0.136	0.019	0.848	0.859	0.839	0.846	567
OCI - Taxes	-8.303	12.25	2.261	4.875	2.248	4.952	0.005	0.844	0.847	0.834	0.836	407
BEI - Institutional Environment	-6.663	7.275	1.192	1.384	1.191	1.472	0.057	0.837	0.845	0.827	0.828	567
TCI - GGS 14	-11.12	11.55	-1.083	1.493	-1.061	1.708	0.080	0.791	0.812	0.820	0.825	553
Neighborhood Dummy	-2.006	3.869	0.659	0.437	0.654	0.449	0.023	0.835	0.841	0.820	0.823	567
TPI - Quality	-6.849	9.375	1.305	1.819	1.270	1.914	0.050	0.821	0.833	0.815	0.821	567
Sector Size	0.000	0.000	0.000	0.000	0.000	0.000	0.044	0.844	0.852	0.814	0.815	567
Host India	-5.581	13.75	0.549	0.299	0.537	0.330	0.064	0.825	0.842	0.813	0.817	567
MNC Host-country Experience	-0.677	0.789	-0.028	0.002	-0.030	0.004	0.035	0.672	0.713	0.811	0.808	445
MEI - Political Stability	-12.19	12.81	1.288	2.091	1.224	2.218	0.048	0.795	0.814	0.804	0.812	567
MNC Product Diversification	-9.822	13.78	0.882	1.158	0.896	1.531	0.006	0.766	0.794	0.801	0.799	556
MNC Host-country Experience Squared	-0.061	0.035	-0.003	0.000	-0.003	0.000	0.048	0.791	0.830	0.798	0.794	445
Sector Growth	-6.238	20.67	1.572	3.262	1.589	3.533	0.006	0.801	0.808	0.787	0.784	567
MNC Product Diversification Squared	-14.62	12.38	0.711	1.406	0.743	1.874	0.002	0.706	0.726	0.777	0.774	556
BEI - Registering Property	-15.98	8.471	-1.214	2.615	-1.231	2.726	0.030	0.772	0.774	0.775	0.773	529
MNC Size (Market Capitalization)	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.594	0.618	0.764	0.763	567
BEI - Dealing with Licenses	-12.00	8.568	0.618	1.268	0.629	1.349	0.003	0.706	0.709	0.764	0.763	493
Region Latin America	-3.801	3.275	0.426	0.408	0.450	0.429	0.020	0.754	0.748	0.753	0.745	567
MNC R&D Intensity	-0.054	0.033	-0.003	0.000	-0.004	0.000	0.005	0.710	0.714	0.732	0.728	567
Common Language	-1.376	3.216	0.295	0.212	0.301	0.218	0.001	0.740	0.739	0.730	0.727	567
BEI - Labor associated costs	-13.02	7.257	0.323	2.218	0.314	2.272	0.036	0.582	0.586	0.729	0.729	500
MEI - Development Degree	-24.22	56.29	0.348	3.098	0.332	3.518	0.019	0.570	0.578	0.729	0.726	567
Specialization	-18.48	37.08	-0.053	5.222	-0.114	5.953	0.019	0.519	0.509	0.728	0.723	541
BEI - Enforcing Contracts	-15.82	9.698	0.131	1.114	0.102	1.213	0.007	0.537	0.550	0.724	0.724	549
BEI - Starting a Business	-18.98	8.049	0.027	1.561	-0.034	1.670	0.017	0.510	0.509	0.714	0.711	549
ICT Infrastructure	-12.54	17.56	-0.169	3.278	-0.158	3.491	0.013	0.534	0.537	0.705	0.703	563
BEI - Closing a Business	-10.02	5.371	-0.054	0.977	-0.073	1.053	0.007	0.528	0.522	0.702	0.704	549
MEI - Economic Stability	-32.13	18.47	0.734	9.547	0.622	11.10	0.007	0.574	0.594	0.700	0.694	562
TPI - English	-8.706	7.655	0.420	1.363	0.411	1.472	0.000	0.633	0.641	0.682	0.681	566
BEI - Employing Workers	-7.311	5.342	-0.302	1.151	-0.302	1.201	0.001	0.609	0.611	0.680	0.679	549
MNC Size (Number of Employees)	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.515	0.509	0.679	0.677	567
TCI - GGS 18	-7.696	9.911	0.208	2.052	0.235	2.151	0.008	0.564	0.558	0.672	0.672	553
Region Asia	-3.466	2.833	-0.040	0.263	-0.046	0.279	0.002	0.535	0.531	0.670	0.670	567
OCI - Occupancy	-7.332	5.856	-0.668	2.918	-0.653	2.962	0.000	0.648	0.652	0.659	0.661	496
Sector Growth Squared	-55.12	30.55	0.401	37.52	0.491	40.74	0.000	0.531	0.526	0.652	0.649	567
MNC International Experience	-0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.627	0.629	0.640	0.640	532
Host Russia	-5.187	7.464	-0.214	1.003	-0.201	1.019	0.000	0.579	0.585	0.620	0.620	567
Baseline Variables												
MEI - Welfare Sustainability	-12.56	9.225	-3.163	1.534	-3.121	1.643	0.824	0.993	0.995	0.968	0.970	567
MNC M&A Experience	-0.057	0.115	0.018	0.000	0.018	0.000	0.024	0.888	0.898	0.881	0.882	568
OCI - ICT	-6.354	11.28	0.565	1.620	0.583	1.644	0.001	0.675	0.672	0.699	0.695	563
Regressions:	27775											

Notes: EBA results performed on a multinomial logit. Base outcome is "M&A". Averaged coefficients are in log-odds units and refer to the likelihood of choosing a JV over an M&A entry.

Table 2.16: Regression results for Model 3 - Outcome full GI

Variable	B^L	B^U	$\hat{\beta}_z^{NW}$	$\hat{\sigma}_z^{2\,NW}$	$\hat{\beta}_z^{W}$	$\hat{\sigma}_z^{2\,W}$	**% Sign.**	W,N $\Phi_z(0)$	NW,N $\Phi_z(0)$	W,NN $\Phi_z(0)$	NW,NN $\Phi_z(0)$	**Avg. Obs.**
Neighborhood Dummy	-47.04	-27.46	-34.49	0.306	-34.54	0.315	0.983	1.000	1.000	1.000	1.000	567
Region North America	-54.60	19.71	-19.07	0.786	-20.52	0.983	0.559	1.000	1.000	1.000	1.000	567
Region European Union	-47.39	0.447	-21.51	0.382	-22.12	0.390	0.987	1.000	1.000	1.000	1.000	567
Host Brazil	-46.41	1.996	-2.859	0.605	-3.502	0.608	0.066	0.999	0.999	1.000	1.000	567
MNC Sales	0.000	0.000	0.000	0.000	0.000	0.000	0.970	0.998	0.998	0.994	0.995	567
Host China	-2.775	9.078	1.321	0.138	1.325	0.161	0.912	0.999	0.999	0.991	0.992	567
Market Potential	-4.516	19.03	6.046	4.840	6.128	5.197	0.900	0.996	0.997	0.991	0.991	567
BEI - Dealing with Licenses	-3.876	8.740	2.021	0.529	2.042	0.567	0.794	0.997	0.997	0.981	0.981	493
MNC Size (Number of Employees)	0.000	0.000	0.000	0.000	0.000	0.000	0.812	0.992	0.993	0.977	0.976	567
TPI - English	-3.608	7.446	1.625	0.326	1.656	0.398	0.804	0.996	0.998	0.975	0.977	566
TCI - GGS 9	-17.49	4.403	-2.336	0.674	-2.375	0.801	0.790	0.996	0.998	0.969	0.970	553
Region Latin America	-4.132	2.070	-0.994	0.240	-0.989	0.253	0.592	0.975	0.979	0.957	0.960	567
MNC Host-country Experience	-0.570	2.019	-0.088	0.002	-0.089	0.003	0.540	0.950	0.963	0.954	0.952	445
BEI - Labor associated costs	-6.608	8.461	2.238	1.205	2.251	1.268	0.606	0.977	0.979	0.951	0.951	500
MNC Size (Market Capitalization)	0.000	0.000	0.000	0.000	0.000	0.000	0.706	0.952	0.973	0.949	0.948	567
MNC Size (Market Capitalization) Squared	0.000	0.000	0.000	0.000	0.000	0.000	0.765	0.950	0.972	0.948	0.945	567
Sector Size	0.000	0.000	0.000	0.000	0.000	0.000	0.366	0.913	0.970	0.938	0.939	567
Global Market	-0.028	0.039	0.009	0.000	0.009	0.000	0.757	0.987	0.991	0.938	0.940	564
BEI - Investment Environment	-4.145	7.121	1.496	0.415	1.496	0.470	0.691	0.985	0.990	0.937	0.940	567
MNC Host-country Experience Squared	-0.362	0.050	-0.007	0.000	-0.007	0.000	0.151	0.921	0.942	0.936	0.935	445
BEI - Registering Property	-10.94	8.712	-2.938	2.834	-2.940	2.973	0.376	0.956	0.960	0.928	0.929	529
ICT Infrastructure	-12.55	7.861	-2.171	0.941	-2.209	1.031	0.596	0.985	0.987	0.927	0.927	563
BEI - Institutional Environment	-5.924	9.682	1.917	1.050	1.895	1.108	0.491	0.964	0.969	0.925	0.927	567
TCI - GGS 14	-8.953	12.25	-1.226	0.468	-1.255	0.552	0.525	0.954	0.963	0.915	0.916	553
MNC M&A over GI Experience	-6.148	1.678	-1.077	0.412	-1.161	0.465	0.236	0.956	0.953	0.906	0.898	567
Colony	-1.588	3.404	0.779	0.272	0.766	0.282	0.183	0.925	0.933	0.904	0.911	567
TPI - Size	-8.386	17.02	-1.229	0.744	-1.254	0.857	0.507	0.912	0.923	0.896	0.898	537
BEI - Enforcing Contracts	-16.18	5.190	-1.924	1.633	-1.934	1.712	0.227	0.930	0.934	0.893	0.892	549
Specialization	-29.04	15.73	-2.160	1.980	-2.269	2.337	0.438	0.931	0.938	0.890	0.889	541
BEI - Employing Workers	-9.509	5.147	-1.394	0.611	-1.464	0.640	0.387	0.966	0.963	0.887	0.882	549
TCI - GGS 18	-7.350	6.667	-1.080	0.527	-1.104	0.570	0.388	0.928	0.932	0.885	0.884	553
OCI - Occupancy	-9.682	5.060	-1.580	1.359	-1.580	1.395	0.136	0.910	0.912	0.881	0.881	496
Common Language	-1.244	2.417	0.347	0.063	0.347	0.068	0.193	0.908	0.917	0.880	0.884	567
Sector Growth Squared	-28.84	39.75	3.828	10.17	3.685	11.00	0.145	0.867	0.885	0.862	0.869	567
TPI - Quality	-6.631	8.246	1.169	0.708	1.172	0.758	0.335	0.911	0.918	0.861	0.861	567
BEI - Closing a Business	-5.283	7.387	1.093	0.584	1.068	0.635	0.365	0.910	0.924	0.859	0.864	549
MEI - Dependence	-6.258	11.81	1.281	0.748	1.306	0.844	0.256	0.922	0.931	0.858	0.857	566
Region Eastern Europe	-2.557	2.932	0.478	0.137	0.458	0.150	0.255	0.881	0.902	0.857	0.867	567
OCI - Taxes	-9.831	6.618	-1.859	2.005	-1.846	2.090	0.207	0.899	0.905	0.855	0.857	407
MEI - Development Degree	-23.35	38.71	0.651	1.390	0.605	1.804	0.235	0.674	0.710	0.843	0.841	567
MNC R&D Intensity	-0.050	0.037	0.006	0.000	0.007	0.000	0.008	0.826	0.823	0.842	0.839	567
MEI - Political Stability	-6.707	10.33	0.886	0.901	0.886	1.005	0.256	0.811	0.825	0.840	0.842	567
Host Russia	-3.812	4.626	0.564	0.370	0.559	0.382	0.035	0.817	0.823	0.832	0.831	567
Host India	-3.721	6.995	-0.656	0.490	-0.652	0.511	0.022	0.819	0.825	0.817	0.819	567
BEI - Starting a Business	-6.223	9.238	-0.361	0.771	-0.346	0.837	0.183	0.647	0.659	0.799	0.799	549
Region MENA	-2.890	4.106	0.244	0.142	0.228	0.159	0.101	0.716	0.741	0.797	0.801	567
Region Asia	-2.703	2.938	-0.112	0.097	-0.098	0.107	0.112	0.618	0.640	0.791	0.794	567
MNC International Experience	-0.001	0.001	0.000	0.000	0.000	0.000	0.083	0.795	0.803	0.772	0.776	532
Sector Growth	-11.69	6.199	0.532	1.293	0.480	1.367	0.020	0.659	0.680	0.766	0.770	567
MNC Price to Earnings Ratio	-0.029	0.067	0.010	0.000	0.010	0.000	0.000	0.774	0.778	0.765	0.767	524
MNC Product Diversification Squared	-32.18	17.87	-1.218	3.257	-1.228	4.054	0.000	0.729	0.750	0.752	0.752	556
MNC Product Diversification	-10.52	18.03	-0.700	1.536	-0.698	1.896	0.000	0.694	0.714	0.745	0.746	556
MEI - Economic Stability	-17.81	17.35	0.811	5.253	0.745	5.923	0.000	0.620	0.638	0.704	0.707	562
Distance	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.576	0.565	0.681	0.679	567
MNC Efficiency	-0.036	0.028	-0.001	0.000	-0.001	0.000	0.000	0.556	0.532	0.639	0.630	472
MNC Labor Productivity	-3.592	2.032	0.021	0.170	0.010	0.177	0.007	0.509	0.521	0.639	0.637	567
Baseline Variables												
MEI - Welfare Sustainability	-10.19	6.114	-3.887	0.878	-3.927	0.947	0.953	0.999	0.999	0.994	0.994	567
MNC M&A Experience	-0.068	0.141	0.043	0.000	0.043	0.000	0.859	0.993	0.995	0.986	0.986	568
OCI - ICT	-10.10	1.292	-3.843	0.864	-3.889	0.916	0.997	0.999	0.999	0.999	0.999	563
Regressions:	27775											

Notes: EBA results performed on a multinomial logit. Base outcome is "Shared Ownership" (Partial M&A or JV). Averaged coefficients are in log-odds units and refer to the likelihood of choosing a full GI over a shared ownership entry.

Table 2.17: Regression results for Model 3 - Outcome full M&A

Variable	B^L	B^U	$\hat{\beta}_z^{NW}$	$\hat{\sigma}_z^{2\,NW}$	$\hat{\beta}_z^{W}$	$\hat{\sigma}_z^{2\,W}$	**% Sign.**	W,N $\Phi_z(0)$	NW,N $\Phi_z(0)$	W,NN $\Phi_z(0)$	NW,NN $\Phi_z(0)$	**Avg. Obs.**
Host India	-6.004	0.249	-1.724	0.263	-1.749	0.269	0.999	0.999	0.999	0.999	0.998	567
MNC International Experience	0.000	0.001	0.000	0.000	0.000	0.000	0.856	0.991	0.992	0.987	0.987	532
MNC Price to Earnings Ratio	-0.250	0.064	-0.038	0.000	-0.038	0.000	0.861	0.986	0.988	0.985	0.985	524
Market Potential	-9.448	4.561	-2.443	1.069	-2.477	1.154	0.745	0.989	0.991	0.975	0.975	567
TCI - GGS 14	-3.731	8.339	1.345	0.337	1.342	0.388	0.720	0.984	0.990	0.970	0.971	553
TCI - GGS 9	-2.844	6.286	1.403	0.437	1.414	0.468	0.684	0.981	0.983	0.961	0.960	553
OCI - Taxes	-8.194	4.317	-2.334	1.452	-2.322	1.487	0.555	0.972	0.974	0.953	0.955	407
Host Brazil	-0.970	3.015	0.755	0.145	0.749	0.157	0.557	0.971	0.976	0.948	0.953	567
Global Market	-0.029	0.025	-0.008	0.000	-0.007	0.000	0.579	0.969	0.973	0.938	0.943	564
TPI - Size	-10.95	6.830	1.533	0.746	1.549	0.787	0.452	0.960	0.962	0.933	0.934	537
BEI - Enforcing Contracts	-5.914	6.870	-1.315	0.656	-1.326	0.698	0.410	0.944	0.948	0.929	0.930	549
Region Eastern Europe	-0.915	2.525	0.574	0.128	0.583	0.137	0.224	0.943	0.945	0.925	0.925	567
MEI - Political Stability	-9.366	6.797	-1.979	1.688	-2.004	1.819	0.221	0.931	0.936	0.917	0.917	567
TPI - Quality	-6.120	2.945	-1.128	0.600	-1.143	0.632	0.250	0.925	0.927	0.898	0.898	567
MNC Host-country Experience Squared	0.000	0.000	0.000	0.000	0.000	0.000	0.115	0.881	0.905	0.896	0.895	445
MNC Host-country Experience	-0.012	0.018	-0.001	0.000	-0.001	0.000	0.122	0.898	0.915	0.896	0.898	445
Common Language	-1.098	1.830	0.476	0.144	0.477	0.147	0.018	0.893	0.895	0.885	0.887	567
Sector Size	0.000	0.000	0.000	0.000	0.000	0.000	0.254	0.894	0.909	0.879	0.880	567
TCI - GGS 18	-8.486	3.671	0.604	0.399	0.594	0.463	0.224	0.808	0.830	0.869	0.872	553
MNC Sales	0.000	0.000	0.000	0.000	0.000	0.000	0.030	0.882	0.890	0.867	0.874	567
MNC Size (Market Capitalization) Squared	0.000	0.000	0.000	0.000	0.000	0.000	0.256	0.882	0.950	0.861	0.859	567
ICT Infrastructure	-9.010	6.545	-1.243	1.119	-1.246	1.216	0.144	0.871	0.880	0.841	0.843	563
MNC Labor Productivity	-1.476	1.806	0.279	0.067	0.274	0.069	0.026	0.850	0.859	0.838	0.844	567
Sector Growth	-10.32	7.906	-1.277	1.850	-1.283	1.906	0.008	0.824	0.826	0.810	0.809	567
BEI - Institutional Environment	-4.172	3.931	-0.552	0.407	-0.566	0.447	0.127	0.801	0.806	0.809	0.806	567
BEI - Investment Environment	-4.180	3.042	-0.574	0.503	-0.593	0.531	0.010	0.792	0.791	0.789	0.784	567
BEI - Closing a Business	-4.580	4.657	-0.423	0.421	-0.442	0.457	0.074	0.743	0.743	0.789	0.787	549
MNC R&D Intensity	-0.019	0.030	0.004	0.000	0.004	0.000	0.043	0.793	0.801	0.781	0.785	567
MNC M&A over GI Experience	-2.809	5.890	0.490	0.388	0.493	0.453	0.000	0.768	0.784	0.780	0.788	567
MEI - Development Degree	-7.665	8.594	-0.552	0.913	-0.582	1.024	0.017	0.717	0.718	0.770	0.767	567
BEI - Employing Workers	-3.729	4.779	0.510	0.475	0.493	0.512	0.010	0.755	0.770	0.759	0.763	549
MNC Size (Number of Employees)	0.000	0.000	0.000	0.000	0.000	0.000	0.031	0.626	0.644	0.752	0.754	567
Host China	-6.163	3.333	-0.272	0.289	-0.275	0.305	0.009	0.690	0.694	0.749	0.750	567
BEI - Dealing with Licenses	-5.177	5.431	-0.268	0.435	-0.282	0.460	0.037	0.661	0.658	0.749	0.746	493
OCI - Occupancy	-6.331	3.494	-0.624	0.840	-0.653	0.852	0.045	0.761	0.752	0.747	0.742	496
Specialization	-12.51	19.80	-1.008	3.133	-1.047	3.394	0.018	0.715	0.716	0.743	0.740	541
BEI - Registering Property	-6.534	6.066	-0.492	1.075	-0.501	1.123	0.015	0.682	0.682	0.740	0.739	529
Region MENA	-3.249	2.456	-0.355	0.308	-0.349	0.335	0.000	0.727	0.738	0.736	0.741	567
BEI - Labor associated costs	-4.221	5.504	-0.290	0.642	-0.286	0.681	0.018	0.635	0.641	0.735	0.735	500
Region Latin America	-3.978	1.959	-0.306	0.224	-0.321	0.266	0.000	0.733	0.741	0.728	0.728	567
BEI - Starting a Business	-4.955	7.579	0.132	0.803	0.118	0.877	0.033	0.550	0.559	0.727	0.727	549
Distance	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.723	0.723	0.725	0.723	567
MNC Efficiency	-0.027	0.013	-0.002	0.000	-0.002	0.000	0.000	0.703	0.711	0.720	0.719	472
Region North America	-4.678	4.004	-0.284	0.433	-0.245	0.476	0.027	0.639	0.667	0.712	0.712	567
MNC Size (Market Capitalization)	0.000	0.000	0.000	0.000	0.000	0.000	0.060	0.605	0.644	0.708	0.699	567
Host Russia	-2.935	3.303	0.138	0.165	0.128	0.172	0.005	0.621	0.633	0.687	0.684	567
Colony	-1.523	1.349	0.085	0.088	0.071	0.091	0.001	0.593	0.612	0.683	0.686	567
Region Asia	-2.027	1.716	0.029	0.102	0.028	0.111	0.004	0.533	0.536	0.677	0.672	567
Sector Growth Squared	-28.80	25.32	-1.064	16.61	-1.155	16.96	0.004	0.610	0.603	0.676	0.672	567
MNC Product Diversification Squared	-9.365	13.78	0.314	0.587	0.320	1.006	0.000	0.625	0.659	0.658	0.656	556
MEI - Dependence	-6.656	4.942	0.208	0.778	0.193	0.840	0.001	0.583	0.593	0.658	0.659	566
TPI - English	-5.667	2.687	0.034	0.417	0.010	0.436	0.013	0.506	0.521	0.645	0.638	566
Region European Union	-1.868	1.809	0.052	0.204	0.059	0.206	0.000	0.552	0.546	0.642	0.638	567
MEI - Economic Stability	-13.69	15.63	0.426	5.544	0.494	6.095	0.002	0.579	0.572	0.640	0.635	562
Neighborhood Dummy	-2.145	1.439	-0.053	0.287	-0.061	0.290	0.000	0.545	0.540	0.587	0.584	567
MNC Product Diversification	-11.80	9.342	-0.117	0.829	-0.109	1.166	0.000	0.540	0.551	0.586	0.585	556
Baseline Variables												
MEI - Welfare Sustainability	-8.566	5.283	0.869	0.694	0.880	0.748	0.098	0.846	0.852	0.856	0.856	567
MNC M&A Experience	-0.080	0.066	0.005	0.000	0.004	0.000	0.000	0.613	0.628	0.662	0.670	568
OCI - ICT	-3.865	5.398	1.168	0.967	1.146	0.973	0.013	0.877	0.883	0.863	0.868	563
Regressions:	27775											

Notes: EBA results performed on a multinomial logit. Base outcome is “Shared Ownership” (Partial M&A or JV). Averaged coefficients are in log-odds units and refer to the likelihood of choosing a full M&A over a shared ownership entry.

Chapter 3

Innovation, R&D Investment and Productivity in Uruguayan Manufacturing Firms

3.1 Introduction

The literature devoted to the analysis of the existence of effective constraints to growth, both theoretical and empirical, has signalled at alternative and/or complementary explanations for describing the mechanisms at work. Some of the causes that have gained consensus are linked to the existence of low human capital endowments, insufficient provision of public goods, financial market failures, and shortcomings in the regulatory framework or overall business environment, among others.

In the case of Uruguay, the analysis of the above features is relevant given that the levels of growth rates registered along the period 1960-2000 are far from that of the technological frontier. Focusing on the nineties, the most salient feature underlying this meagre performance is the extremely low level of investment demand[1].

Relative to other Latin American countries, the Uruguayan institutional framework is adequate for investors, while its population schooling level is high enough to discard the existence of human capital restrictions[2]. The low returns to capital are usually associated to macroeconomic factors, such as a high degree of volatility of public policies, especially those related to the exchange rate and tax levels; and the sensitivity of the economy to its neighbors' economic performance.

[1]See Bértola et al. (2005) and Hausmann et al. (2005).

[2]At least in terms of the talent pool's quality, although its size could still be an issue.

The country's diversification of exports – that diminished its dependence on Argentinean and Brazilian demand – and the notable increase in investment rates in the last 5 years, especially driven by the public sector, have allowed for quite higher rates of growth than in the past. However, given the Uruguayan *per capita* income level, the observed dynamics of growth are still slower than expected.

A different and complementary explanation that has recently been suggested relates to the innovation behavior of private agents as a key explanation of the above stylized facts. Resources invested in R&D and other innovation activities within existing firms have been scarce, while the so-called 'self-discovering efforts' – that is, the efforts devoted to finding new activities with a high-potential profitable level – are yet far from widespread. Although it is likely that this behavior derives from agents being risk averse, it is also probable that there are insufficient financial aid institutions, inadequate information channels, and insufficient public policies directly supporting innovation activities.

Generating incentives to increase R&D and other innovation strategies in order to allow for a better performance in the future has become a growing concern in the country. Consequently, the creation of institutions devoted to the analysis of the expected impact of innovation on different areas, has been recently promoted.

Furthermore, in 2005 the new government created an institutional stance called the *Ministerial Bureau for Innovation*, in which four ministries (Industry and Energy; Agriculture and Livestock; Economy and Finance; Education and Culture) interact together with the Office of Budget and Planning aiming at the promotion of innovation activities. One particular goal pursued is the definition of general policies regarding innovation, in line with those of the National Innovation System that is, policies that support scientific research in the country. Actions related to designing and implementing innovation strategies are coordinated by the recently created National Agency of Research and Innovation (ANII, in Spanish).

There are other institutions devoted to different aspects of innovation practices' viability. This is the case of institutions that aim at strengthening the links between the academic research and the productive sector, such as the Sectoral Commission of Scientific Research (CSIC), dependant of the *Universidad de la República* (Uruguayan Public University) or some relevant organizations that are mixed ventures between the government and the *Universidad de la República*, such as the Programme for the Development of Basic Sciences (PEDECIBA); or the Pasteur Institute, focused on innovating in the biotech-health area in cooperation with French agents that provide physical and knowledge capital. There are also public entities that in collaboration with other agents were designed to develop research in some specific economic sectors, as is the case of the National Institute of Research in Agriculture and Livestock (INIA); or the Programme for Technological Development (PDT), an international cooperation programme to fund technological research through the partial financing of technological developments proposed by the private sector, that are in most cases donations based on projects' competitions.

The current institutional framework for the design of policies seeking to promote innovation activities is such that the analysis on the innovation mechanisms and the required incentives are most in place. The research summarized below attempts to be a contribution in that direction.

In what follows we outline a brief review of the theoretical and applied literature on the innovative behavior of firms and its impact on productivity, so as to depict the setting within which the models estimated for Uruguay are specified. We describe the main characteristics of the data in Section 3.3, thus setting a benchmark for a better understanding of the descriptive analysis afterwards summarized in Section 3.4. The results obtained from the econometric models estimated are reported in Section 3.5. A summary of the main conclusions arising from the overall analysis are included in the final section.

3.2 Determinants of innovation and its impact on productivity growth

3.2.1 Motivation and previous studies

The literature on the effects of innovation on economic growth may be traced back to 1957 with the work done by Solow. The main obstacles faced by researchers at the time were linked to the measurement of technical progress, which was surmounted by estimating it as a residual factor. Later on, researchers have proxied innovation by means of the level of expenditure devoted to R&D or else as a percentage of total revenue. The latter was used as a proxy variable of an additional production factor so that its coefficient in a total productivity equation would account for the returns of innovation[3].

[3] For an extensive survey, see Mairesse and Sassenou (1997).

Before the eighties, most studies on innovation behavior and technical change used aggregated data, thus suffering from the well known aggregation bias[4]. Once firm level information started to be available, the analysis was readily performed using microdata[5].

In the nineties, several country studies were done while relatively more complex theoretical/ methodological frameworks started to be used. Crépon et al. (1998) is one of the earliest references, being their theoretical setting in line with that proposed by Griliches (1979) and used in Pakes and Griliches (1984). The authors first noted that the inclusion of R&D expenditure in the productivity equation was incorrect, as the actual production factor to be taken into account should be the output that resulted from having invested in R&D instead. Under such circumstances, it became necessary to propose a way of modeling the mechanisms giving rise to the generation of the innovation output, as well as analyzing the determinants of the size of the effort devoted to it once decided to engage in innovation activities. One of the main findings of the empirical work performed under this scheme relates to its detecting the existence of significant biases in the returns of innovation as estimated by the previous applied literature.

Thus, soon Crépon et al. (1998) (hereafter referred to as CDM) became the most widely used benchmark. Indeed, CDM's theoretical framework generated a unification of posterior empirical research looking at innovation and productivity in terms of the applied econometric models, allowing for the comparability of results across studies and between countries.

Recent European studies that have used firm level data to analyze the innovative behavior of firms in European Union countries within the CDM framework are Llorca-Vivero (2002); Lööf and Heshmati (2002); Griffith et al. (2004),Griffith et al. (2006); Janz et al. (2004); Van Leeuwen and Klomp (2006) Mohnen et al. (2006); Castellani and Zanfei (2007); Czarnitzki and O'Byrnes (2007); and Cainelli (2008). Further, Stoevsky (2005); Roud (2007); and Masso and Vahter (2008) use the Community Innovation Surveys to analyze the applicability of the CDM framework in Eastern European countries – Bulgaria, Russia and Estonia, respectively.

Several country studies have also been done for Asian countries – China, South Korea, Taiwan, Japan, and others – among which the most recent examples are Chang

[4]See Theil (1954).

[5]A survey on the topic is found in Hall and Mairesse (2006).

and Robin (2004); Tsai and Wang (2004); Jefferson et al. (2006); and Lee and Kang (2007).

Tang and Le (2007) also perform an analysis on Canadian manufacturing data, but developing a multidimensional innovation index, to account for different objectives behind the innovation effort. Other studies worth mentioning for North America are Los and Verspagen (2000), who look at manufacturing firms in the U.S. and Rao et al. (2002) who use Canadian manufacturing data to analyze the relationship between innovation and productivity, specially focusing on the generation of skills and the role of tertiary education.

Certain studies have attempted to compare the results for different countries, as is the case of Griffith et al. (2006) using French, German, Spanish and British data, or Raffo et al. (2007), who compare the relative performance of three European countries – France, Spain and Switzerland – to three Latin-American countries – Argentina, Brazil and Mexico. Janz et al. (2004) pool German and Swedish data in a common regression, to compare the links between innovation and productivity in those two countries. Their results suggest that although there are certain country specific effects affecting the non-core parameters, the main estimates for the elasticities of interest in both the productivity and the input-output equations do not significantly differ among developed countries.

Finally, a few studies have approached the topic from the perspective of multinationals, as Castellani and Zanfei (2007) and Alexander et al. (1995). The latter focus on the pharmaceutical sector in order to investigate to which extent R&D and innovation have had an impact on multinationals global market shares.

Most of the above mentioned studies obtain results that are consistent to those of CDM, in terms of finding a positive relationship between the innovation effort – innovation expenditure – and the resulting innovation output, as well as between the innovation output and the firm's productivity level[6]. Still, there are some exceptions, like Benavente (2004), that does not find a significant relationship between efforts in R&D and the innovation output – proxied by innovative sales –, nor between the latter and productivity. Although this may be related to the absence of time lags of R&D allowing for non instantaneous effects on productivity[7], it can also be linked to the fact that Chile, as a rather small developing country, may have more innovation in processes than in products, making innovative sales a mediocre proxy

[6]See Arundel et al. (2003) for an extensive survey.
[7]See Hall and Mairesse (2006).

for innovation output, as will be explained later on. On the opposite, he does find effects from other innovation inputs on productivity, such as investing in training programmes or in innovative capital, pointing at the inadequacy of restricting the analysis to including R&D only as a measure of innovation input, at least for the research involving less developed economies.

Lee and Kang (2007) distinguish between product innovation and process innovation in the case of South Korea, and their findings suggest that innovative processes have a higher impact on firm productivity in the short run, when compared to the impact of product innovation. This supports the model by Huergo and Jaumandreu (2004) where process innovation has an extra impact on the growth rate of productivity that although persistent has effects only in the short-run. Even some of the studies for small European countries Czarnitzki and O'Byrnes (2007) find that process innovation is the main driver behind productivity growth, while product innovation has a non-significant impact.

Masso and Vahter (2008) results are also interesting, since they find that product innovation and process innovation have different effects on productivity, depending on the underlying macroeconomic conditions in which they are generated. The fact of process innovation probably being a main driver for productivity growth at least for small and/or non-developed countries is further supported by the absence of significant results in the mentioned link in the studies for developing countries neglecting process innovation in their specification (e.g. Benavente 2004, 2006). As will be argued further on, this finding is key in determining the way the econometric model is specified in this study for the case of Uruguay.

Although recently catching up, the research on innovation impacts on firm performance in Latin America is still scarce. Notable exceptions are Chudnovsky et al. (2006) and Lopez and Orlicki (2006) for Argentina; Cassiolato et al. (2003) and Goedhuys (2007) for Brazil; Benavente (2004) and Benavente (2006) for Chile; Hernandez (2005) for Colombia and Pérez et al. (2005) for Mexico[8]. As was highlighted before, the results obtained for Latinamerican countries are not always consistent with the CDM's predictions[9].

[8]A good survey on the results obtained for several Latin American countries can be found in Hall and Maffioli (2008).

[9]See Goedhuys (2007), Pérez et al. (2005) and Benavente (2004). As a counterexample to the non-significance of coefficients for the core variables found in the input-output and productivity equations of the cited individual studies on the topic for Latin American countries, one can cite Raffo et al. (2007), who compare the relative performance of three European countries – France, Spain and Switzerland – to three Latin-American countries – Argentina, Brazil and Mexico. Sur-

While no research following these lines has yet been done for Uruguay, some evidence on the extent of the innovation efforts can be found in Hausmann et al. (2005) and in Hall and Maffioli (2008). Both papers conclude, although with some mixed evidence in the latter case, that the Uruguayan performance is far away from the expected standards regarding innovation practices, while the absence of economic incentives may be one of its underlying main causes. Arocena and Sutz (2008) arrive at similar conclusions regarding the size and evolution of the innovation intensity gap between Uruguay and the most developed countries, while Bianchi and Gras (2005) also point in that direction. Further, Bianchi et al. (2008) analyze some of the distinct characteristics of firms undertaking innovation that may explain the mentioned gap, concluding that some of the factors underlying the phenomenon are linked to scarce public support, both financial and operational; and to the lack of cooperation among firms. Further, their analysis suggests that a high technical average level of the firm's workforce is one of the key requirements for successfully undertaking innovation activities in Uruguay.

The consistency of results among European countries studies and the differing results obtained for less developed economies motivates a thorough analysis of the applicability of the CDM framework to them, especially in the case of Latin America. One of the likely explanations is related to these countries devoting a large extent of their innovation efforts to innovation in processes rather than in products, making the use of innovative sales as a proxy for innovation output less applicable.

In order to find evidence on the determinants of innovation in Uruguay we here analyze the behavior of manufacturing firms within the CDM framework. Partly motivated by the above results we use the standard proxy variables but also additional indicators that intend to better model the specificities of innovation practices in the country, particularly focusing on the differences in explaining innovation products and processes.

3.2.2 Analytical Framework: the CDM model

Crépon et al. (1998) are the first to formalize the innovation behavior of firms as a multi-step decision process. An initial step consists of understanding the factors

prisingly, significant effects on both the input-output and the productivity equations are found in this paper for Argentina, Brazil and Mexico. Particularly they find that in developing countries, firms' innovative behavior is negatively affected by insufficient interaction with NIS agents and that this is counteracted through links with international partners in the case of firms belonging to an international group of firms or of foreign ownership.

that determine the decision of engaging in innovative activities, assumed related to firm and market characteristics. As such, not all firms should be expected to innovate, the rationale giving support to the stylized fact revealing that there is a large number of non-innovative firms in all economies, irrespective of their level of development.

Once a firm has decided to innovate, it has to decide on the amount of resources to be devoted to innovative activities. The assumption in CDM is that firms invest an exogenously set percentage of total sales or revenue that varies according to certain firm, market and macroeconomic characteristics. As such, it is not viewed as the optimum strategy for achieving certain goals in terms of firm performance or profitability. However, the assumption is compatible with diverse alternative scenarios, as when firms innovate in order to accomplish regulations related to health, safety and environmental issues; or when seeking to attain certain national/international standards in terms of product and process quality. Moreover, it may well be the case that the decision to invest in innovation inputs is not even taken by the firm itself but by related agents, such as partners of an economic group/network or the parent company of which the firm is a local branch or subsidiary.

Under the assumption that there is only one innovative input – R&D – once having decided on the amount to be spent, the model suggests a feasible mechanism – the so called *knowledge production function* – by which the innovative input is transformed into an innovation output that is assumed to alter the firm's technology of production, entering as an additional production factor. As a consequence of the new production technology, the level and rate of growth of productivity, as well as most other indicators of the economic performance of the firm, are expected to vary accordingly. Hence, of additional interest is to quantify the relative impact that the innovation output has on the overall observed change.

The basic structure of the CDM model may be described as having three distinct blocs of equations: The first two equations refer to the determinants of investing in innovation activities, both with respect to a firm's propensity to innovate and to the extent of its innovation effort in case it decides to innovate. These equations will be referred to as innovation-effort-decision equations. The second block of equations models the input-output relationship, i.e. the way in which innovation inputs translate into a certain amount or type of innovation output. Equations of these type will be called input-output equations. Finally, the last block looks at how innovation output affects the firm's multifactor productivity, the so-called productivity equations.

3.2.2.1 The innovation-effort-decision equations

A firm's decision of pursuing innovation activities can be modeled in two steps. In a first step the firm decides if it invests in innovation or not. Once having taken the decision of engaging in innovative activities it decides, in a second step, the extent of the effort it will devote, i.e. the magnitude of the resources to be diverted to invest in innovation activities.

Let g_i^* be a latent variable denoting a firm i's propensity to innovate, the equation

$$g_i^* = X_{0i}\beta_{0i} + \varepsilon_{0i} \tag{3.1}$$

will model the first decision step, where X_{0i} will be a vector of explanatory variables that pool firm and market characteristics acting as drivers for the decision of pursuing innovative activities.

When g_i^* is larger than a certain threshold C, interpretable as a decision criterion or incentive threshold to innovate, one observes g_i. In case the decision is not to innovate, g_i would not be observable:

$$g_i = \begin{cases} 1, & \text{if } g_i^* \geq C; \\ 0, & \text{if } g_i^* < C. \end{cases} \tag{3.2}$$

For the observable g_i, one may also observe the effort's size or intensity. Defining r_i as the magnitude of a firm i's innovation effort

$$r_i = \begin{cases} r_i^* = X_{1i}\beta_{1i} + \varepsilon_{1i}, & \text{if } g_i = 1; \\ 0, & \text{if } g_i = 0. \end{cases} \tag{3.3}$$

where X_{1i} is a vector of variables explaining the size of the innovation effort.

Given that one can only observe r_i^* if $g_i^* \geq C$ a joint distribution of both random variables has to be specified in order to have an estimable model. Following the literature we specify a normal joint distribution of ε_{0i} and ε_{1i} according to:

$$\begin{pmatrix} \varepsilon_{0i} \\ \varepsilon_{1i} \end{pmatrix} \overset{\text{iid}}{\sim} \mathrm{N}\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_0^2 & \rho\sigma_0\sigma_1 \\ \rho\sigma_0\sigma_1 & \sigma_1^2 \end{pmatrix}\right) \tag{3.4}$$

where ρ is the correlation coefficient between ε_{0i} and ε_{1i}, and σ_0 and σ_1 their standard deviations. This block of equations is estimated through a generalized Tobit, with σ_0 normalized to one to allow for identifying equation (3.2).

The model as above stated is equivalent to specifying a behavioral relation for the size of the innovative effort conditional on having taken the decision, so as to depurate the estimates from selectivity bias (Heckman, 1978).

It is worth to mention that the structure of the model is such that it takes for granted that the decision to invest in innovation activities as well as the extent of the effort to be done are determined only by a set of exogenous or given factors, and not as the result of the firm optimizing certain expected revenue or gain. This might be the case of the firm having to attain certain regulations and standards, both national and international, in terms of product and process quality, as well as with respect to health, safety and environmental issues. It may also be the case when firms are part of an economic group or network, or are a subsidiary or branch of a multinational, so that the decision is not taken at the firm level itself.

3.2.2.2 The input-output equations

Once the size of the expenditure on innovative activities has been set, the firm has to decide the adequate or preferred mix of innovative inputs depending on their relative prices, the firm and market characteristics and the innovation output it intends to obtain.

A second stage involves determining the input-output equations depending on the type of theoretical model one wants to rely upon to explain the firm's knowledge production function. The knowledge production function proposed in CDM, that may be linear or not, is stated in equation (3.5), as a one factor production function – the previously estimated expenditure on R&D. It is assumed that t_i, the innovation output, also depends on a set of firm, market and macroeconomic characteristics included below in vector $\mathbf{X}_{2i}$:

$$t_i = \begin{cases} r_i\alpha + X_{2i}\beta_{2i} + \varepsilon_{2i}, & \text{if } g_i = 1 \Rightarrow r_i \neq 0; \\ 0, & \text{if } g_i = 0 \Rightarrow r_i = 0. \end{cases} \tag{3.5}$$

Among the variables included in X_{2i} are usually firm size – to capture scale effects in the generation of knowledge capital –, firm age, the existence of previous innovation efforts, the existence of formal R&D units, the skill composition of the firm's talent base, technology push indicators, links with external institutions generating knowledge, and the firm's access to information.

Note that determining the input-output equations depends on the type of theoretical model one wants to rely upon to explain the firm's knowledge production function. The standard approach followed in the literature[10] is to assume that knowledge capital is generated in a linear way through R&D expenditure, i.e.

$$K_t = RD_t + (1 - \delta)K_{t-1} \tag{3.6}$$

where K is the stock of knowledge capital, RD is R&D expenditure and δ is the knowledge capital's depreciation rate, generally assumed to be zero.

3.2.2.3 The productivity equation

The final step in the analysis of the innovative behavior of firms refers to the results on the economic performance of the firm observed once the innovation output is obtained. A priori one would expect that an innovation output is translated into enhanced firm performance. One of the most popular indicators used in the literature is labor productivity, generally proxied by means of the average value of sales per worker.

If knowledge-capital is considered as an additional production factor, its effects on the level or the rate of growth of labor productivity (q_i) may be proxied by estimating equation (3.7) or either equation (3.8), where $\boldsymbol{Z}_i$ is a vector containing the other production factors – labor, physical capital and eventually intermediate consumption – and another vector of explanatory variables $\mathbf{X}_{3i}$ including specificities that are assumed to have a scale effect on the firm's productivity level or rate of growth:

$$q_i = \sigma t_i + \mathbf{Z}_i\lambda + \mathbf{X}_{3i}\beta_{3i} + \varepsilon_{3i} \tag{3.7}$$

or else

$$\Delta q_i = \sigma \Delta t_i + \lambda' \Delta \mathbf{Z}_i + \beta'_{3i} \Delta \mathbf{X}_{3i} + \varepsilon_{3i} \tag{3.8}$$

The applied literature using the CDM model as a benchmark has generally used datasets that stem from surveys performed only to innovative firms, so that equation (3.3)can only be estimated for the case $g_i^* \geq C_i^*$, for which innovating units are observable. To take into account this restriction and hence avoid the consequent selectivity bias of estimates, the first bloc has to be modeled as a generalized Tobit[11].

[10] See e.g. Mairesse and Sassenou (1991) and Crépon et al. (1998).
[11] See Heckman (1978).

In case information for non-innovative firms is available from alternative sources or by survey design, equation (3.2) can be ignored. Under such circumstances the analysis of the determinants of the decision to innovate is embedded in equation (3.3), due to the fact that firms with nil expenditure correspond to non-innovative units, so that the model is specified conditional on the decision to innovate or not.

The empirical implementation of the theoretical CDM model has encountered several obstacles that have frequently been sorted out by using highly simplified estimable models. As such, the analysis of firms' innovation behavior and the potential policy recommendations on the matter are impoverished.

A first issue refers to neglecting the existence of other innovation inputs apart from R&D activities, a topic theoretically discussed in the CDM paper. It may be argued that accumulated R&D constitutes the innovative input *par excellence*, but engineering design or income spillovers are also typically knowledge-driven inputs. Further, as documented for example by Denison (1985), R&D can only account for a small proportion of the innovative practices. The introduction of novel IT tools, on the other hand, or the purchase of certain physical capital, may be considered as investment in innovative inputs of intrinsically different nature than research activities, as they also lead to obtaining innovation output[12].

Including other innovation inputs in the CDM model forces the specification of a distributional procedure by which the resources invested in innovation are allocated among the distinct inputs. Further, since it is most unlikely that a unique mix of innovation inputs generates any output, a further challenge relates to the specification of the path through which innovation inputs are combined to obtain each type of output.

The exclusion of other innovative inputs from the CDM model derive in undesirable consequences in terms of the empirically estimated relationships. If complementarities exist, adding up the resources spent in different inputs would be an incorrect measure of the resulting overall innovation input and also of its role in generating innovative output, so that the analysis performed using the intensity of innovation/knowledge production function model that ignore complementarities effects is

[12] For example, introducing new machinery would generally allow for producing a different type of products or to implement a novel production process. Further, in generating a different modality of production, its acquisition might imply that some training has to be undertaken by workers; or that engineering design is needed; while at times it also poses new challenges to the firm that have to be faced by further investment in R&D.

most likely to be misleading. The empirical consequences are yet to be quantified, so that it is highly desirable to start performing some research on the topic, despite the methodological difficulties it poses. We do not address the issue in depth in this research due to exceeding the goals of the project. However, we include an innovation input concentration indicator aiming at weighing the size of the effort by the degree in which innovation expenditure is diversified or concentrated among the different types of innovation input available.

A second shortcoming of empirical CDM models arises from the non-availability of the necessary data for the specification and estimation of the knowledge-capital production function as defined in the original CDM paper.

A strand of the literature has proxied investment in knowledge-capital (Δt_i) by the ratio of innovative to total sales, assuming that knowledge-capital is generated in a linear way through R&D expenditure with a nil depreciation rate[13]. Alternatively, researchers have empirically skipped the step of specifying an equation explaining how inputs are transformed into output, substituting it by modeling the odds of obtaining an innovation output conditional on the resources invested in innovation inputs[14].

The analysis of the effects of innovation output on the performance of firms has been mostly studied in terms of its impact on labor productivity, as reflected by equation (3.7). Given the above stated obstacles linked to correctly measuring knowledge-capital, researchers have included in the productivity level or rate of growth equation the predicted probability of obtaining an innovative output. In doing so, the impact of innovative output on the firm's production technology is reflected only as a scale effect.

If equation (3.5) is estimated using the share of innovative sales as a proxy variable for investment in knowledge-capital instead, equation (3.7) can only be specified in terms of the rate of growth of productivity. Innovative output enters the equation by means of the predicted value of the share of innovative sales, as stemming from equation (3.5). Although the strategy allows for quantifying marginal effects of innovation output on firm performance, the approximation is useful only when obtaining innovative products, thus neglecting the role played by innovative processes[15]. The

[13] See e.g. Mairesse and Sassenou (1997) and Crépon et al. (1998).

[14] This is implemented by means of using a binary variable accounting for the firm having or not obtained an innovation output.

[15] For further details please refer to Chapter 4.

restriction may not be substantially binding for most highly developed countries in which new products may be the focus of innovative practices[16], but it undoubtedly restrains the analysis in less developed or small economies. Furthermore, even firms in developed countries, should not be expected to display uniform innovation behavior along the business cycle, since process innovation is a widespread practice to reduce costs when faced to economic recessions.

As of today, whenever innovative processes have been considered explicitly in the production function, they have been included as a scale effect since its role has been proxied by means of a binary variable. However, there are no reasons to assume that new production processes or innovative organizational designs and commercialization strategies have no impact on the pre-existing mix of production factors. An additional undesired consequence of omitting process innovation or of restricting its impact to scale effects refers to the likely overestimation of the elasticity of product innovation when included in the model using the share of innovative sales as a proxy variable. The estimated elasticity for innovative products might be actually capturing the effects of both types of innovation output on total production, in which case conclusions on the impact of one specific type of innovation output on firm performance would be misleading.

3.3 Characteristics of the information set

3.3.1 The sample

Data used[17] stems from the matching of the three Innovation Surveys (IS) performed in 1998-2000; 2001-2003; and 2004-2006 and the Annual Economic Activity Surveys

[16] An exception can be found e.g. for Belgium in Czarnitzki and O'Byrnes (2007).

[17] The data referring to innovation activities in the manufacturing sector used in the analyses here summarized had not been available for researchers until now. We were able to obtain the information only because of the support we received from Fernando Amestoy, Executive Manager of the National Agency of Research and Innovation (ANII); Omar Macadar, Director of the Agency of Science and Technology for Development (DiCyT); Alicia Melgar, Director of the Institute of Statistics (INE); and Alvaro Fuentes, Head of the Statistics Division at INE. Moreover, because of our joint actions, a mechanism was designed for allowing the use of the data sets by individual researchers and research institutions from now on. We also want to pose special emphasis on the invaluable help of Griselda Charlo, Head of the Annual Activity Survey at the INE, without the help of whom many of our analyses would not have been possible. She not only provided us with unusual celerity all the Economic Activity Survey data, but also gave us advice and information unavailable elsewhere. Finally, we want to thank Nicolás Mazón at the INE and Ximena Usher at the ANII for their assistance in clarifying many of our queries when checking on the quality of the micro data, as well as in correcting the so many inconsistencies we found all along the extensive quality and consistency checks and analyses performed.

(EAS) along 1998-2006[18]. The same sampling model was used in both surveys, so that they report information on the same units[19]. The design of the Innovation Surveys follows the recommendations included in the Bogotá Handbook, so that the methodology used is consistent with the guidelines stated in the Oslo and Frascati Handbooks.

The samples are built in such a way that the establishments with less than 49 workers are selected using stratified sampling, while those hiring 50 workers and more are all included. The response rate is always higher than 90%, generally above 95%, with the exception of the stratum of the smallest firms in the first survey (88%)[20]. We work with sample data, given that sampling expansors are built so as to have a sample that is representative of employment and growth dynamics, but not necessarily representative in terms of the innovative behavior of manufacturing firms[21].

The number of firms finally included in the samples used in 1998-2000, 2001-2003 and 2004-2006 were 761, 814 and 839, respectively[22,23]. We further reduced the sample sizes by eliminating those firms with 5 or less workers all along the period since we considered that their data are not fully reliable (54, 21 and 25 cases in each survey, respectively)[24]. We thus ended with a benchmark dataset of 707, 793 and 814 units of observation in each respective period that was further reduced keeping only the firms for which data are available along the 10 years – that is, ignoring units that were not included in data all 3 surveys[25]. The final dataset consists of

[18] For that reason, these 3 years periods will be treated as three points in time, since most variables in the survey refer either to the last year of the period or to the whole 3 years.

[19] The innovation surveys were carried out by the National Institute of Statistics (INE), under request of the Agency of Science and Technology for Development (DiCyT) up to 2004 and of the National Agency of Research and Innovation (ANII) since then.

[20] "Encuesta de Actividades de Innovación 1998-2000", DiNaCyT (currently named DiCyT), INE; "Encuesta de Actividades de Innovación 2001-2003", DiCyT, INE; "Encuesta de Actividades de Innovación 2004-2006", ANII, INE.

[21] This hypothesis was confirmed by Susana Picardo, who was in charge of the Annual Industrial Survey (afterwards substituted by the Annual Economic Activity Survey) in 1998. She further pointed out that this was in fact a key issue largely discussed before conducting the Innovation Survey, given that no new sample could be designed by then.

[22] The number of total firms in the 1998-2000 survey was 762 according to official publications. However, one unit had missing values in all its observations and was hence dropped out in our study.

[23] In spite of the relatively small number of observations with respect to figures that are generally found in international studies, the sample is quite large given the small size of the Uruguayan economy. Moreover, we consider it is of an adequate size in terms of the significance of the analytical results based on it.

[24] This conclusion is based on that data not passing most quality and consistency checks we performed on the micro-dataset.

[25] In doing so, we are excluding the possibility of analyzing the effects of innovation practices on the firms' life cycle for those units that are of mandatory inclusion. In the case of firms belonging to

1482 observations corresponding to 494 firms.

Given the design of the sample, descriptive analyses are biased towards the behavior of large firms, excluded from the balanced panel only if there is an entry or an exit – both through merger or death. Firms with less than 50 workers, however, may not be surveyed in the 3 time periods not only as the reflection of an entry or an exit, but also because of just not being selected in previous/following stratified sampling processes[26]. Further, econometric models focused on the balanced panel of firms need to correct for two different sorts of selection bias – one related to the probability of entry/exit/survival and another linked to the probability of being selected as a sample unit[27].

We distinguish firms by size, according to the number of employees, and by economic sectors, according to the ISIC Revision 3 classification. In order to simplify the analyses, and taking into account that the number of units within classes is relatively balanced, we pool the original categories into four strata. Two strata are defined for firms selected by stratified sampling – 19-and-less and 20-to-49 workers. Firms of mandatory inclusion in the sample are grouped into two categories – 50-to-149 and 150-and-more workers. These classes were defined in order to correct for the inconvenience of pooling stratified sampling and mandatory inclusion units in one category, as is the case in the IS original strata definition. Analogously, we classify firms in 12 economic activities[28].

less than 50 workers strata, however, there are also units that have been excluded from the sample for other reasons related to the sampling process, hence not necessarily reflecting an entry or an exit.

[26] During 1998 to 2000, the sample used in all manufacturing surveys is one obtained from the 1997 Economic Census. The change in the classification of economic activities in sectors according to the ISIC, Revision 3, forced a correction of the sample in 2001. However, the financial breakdown of 2002 implied a so high rate of bankruptcy among firms that the existing sample became useless. Moreover, it was not possible by then to assert with an adequate degree of confidence neither the magnitude of the adverse effects nor their probable duration in time. In order to guarantee the representativeness of the samples used under any future scenario, the Institute of Statistics decided to update the sample yearly, starting in 2003. Consequently, units included by stratified sampling in the last two surveys may come in and out of the sample more frequently than before, despite not having exited the activity. Another consequence of the 2002 negative shock that is worth noting is that many firms started diversifying their production as a means of raising their odds of surviving. Hence, many units may answer the surveys classified in a distinct economic activity depending on the time period.

[27] In discussing the issue with the INE we agreed on analyzing the adequate variables that would allow for the calculus of correct expanding factors to be used with the IS data in the future. This, in turn, will guarantee the use of correct expanded data in the analyses while avoiding the introduction of undesirable biases in future work.

[28] Namely, Food; Beverage; Tobacco; Textiles; Wood; Printing; Chemical Products; Petroleum; Plastic & Rubber; Non-metallic minerals; Metal products; Equipment & machinery; Other manufacturing industries.

3.3.2 Innovation inputs and output

One can distinguish between indicators that relate to the willingness to innovate and the extent of the innovation effort – *innovation inputs* –, and those referring to the existence of an actual innovation output as a result of the aforementioned effort.

A large amount of applied research excludes some of the different types of innovation input/output from their analyses. In the case of innovation output, most of the applied work refers to new products and innovative production processes, while R&D has been the most studied innovative input. In the case of Uruguay, however, the omission of any category of innovation input or output is not in place given the particular innovation practices pursued by manufacturing firms.

Although very few firms invest in all inputs, the least preferred category among the nine defined in the surveys is chosen by 20% of firms. Regarding innovation output, until 2003 around 34% of all firms innovated in the four categories simultaneously. The inadequacy of excluding any type of input and output from the analyses, faced to the complexities that would be introduced in the econometric models with the available detailed classification, forced us to group them in 4 and 2 categories, respectively[29]. Inputs are classified in R&D (both internal and external); Physical Capital, Hardware and Software (K+H+S); Training Programmes, including those directed to managers (TP); and Engineering & Industrial Design, Technology Transfers and Consultancy Services (EID+TT+CS). The output categories defined are Products accompanied or not by innovation processes; and Only Processes, irrespective of whether they relate to production, commercialization or organizational practices. The frequency of firms in the here defined categorizations are depicted in Table 3.1, Table 3.2 and Figure 3.1 below.

Most innovative firms include physical capital, hardware and software among the inputs in which to invest, being training programmes the second preferred choice. It is worth noting that investing in just one innovative input is quite rare, while investing in all categories is also less observed than other mixes.

Consequently, it is not convenient to restrict the analysis to a sole input, nor to the aggregate innovation input, as the diverse mixes chosen by firms are most likely to be very informative. Particularly, deciding on studying firms' innovation expenditure

[29] The groupings were defined taking into account their theoretical adequacy, given the Uruguayan specificities (eg, TTP is not a representative category) and that the distribution of firms in the new classes is similar to that prevailing in the original categorization, both for the total sample and for the size and economic sectors strata.

focused on R&D would not be appropriate for Uruguay since although 50% of innovative firms invest in R&D, a much higher percentage devotes its efforts to other inputs (around 80% of firms invest in capital & hardware & software, while near 70% of firms do so in training programmes). Further, if comparing the frequency of firms investing only in one input, R&D is far from being one of the most widespread practices.

Looking at the data on innovation output, a first interesting fact arising from the data is that most firms that invest in innovative inputs are able to get innovation outputs within a 3 years period, given that between 97% and 99% of innovative firms report having obtained results in the three surveys. Although these figures could include current innovation outputs that are related to having invested in innovative inputs in previous periods, this is not the case for the samples analyzed. The proportion of firms reporting having obtained results derived from investing in each innovative input in the corresponding 3-years period is always around 90%[30]. Hence, the innovative behavior of firms relative to investing and getting results may be analyzed within each survey.

Table 3.1: Distribution of firms by innovation input according to firm size, 1998-2000 - 2001-2003 - 2004-2006 (number and % of firms)

	1998-2000		2001-2003		2004-2006	
Total firms	494	100	494	100	494	100
Innovative firms	333	67	270	55	244	49
R&D	182	55	142	52	106	44
K+H+S	286	86	217	80	199	82
EID+TT+CS	159	48	136	50	90	37
TP	229	69	182	67	167	69
Only R&D	5	2	10	4	8	3
Only K+H+S	46	14	36	13	41	17
Only EID+TT+CS	7	2	6	2	4	2
Only TP	10	3	16	6	14	6
All Inputs	82	25	62	23	41	17

Notes: R&D includes both internal and/or external; K+H+S refers to Physical Capital and/or Hardware and/or Software; EID+TT+CS gathers Engineering & industrial design and/or Technology transfers & Consultancy services; TP includes both management oriented and employees training programmes.

Source: own calculations based on the Innovation Surveys 1998-00; 2001-03, 2004-06; ANII/DiCyT /INE.

Two additional general comments are most in place. First, around 60% of Uruguayan innovative firms obtain innovative products as a result of their investment in innovative inputs, a figure that is much greater than expected, although at most 11% are focused only in products, being the percentage around 7% on average along the whole period. Nonetheless, the above figures might overestimate the actual frequencies, not only as a consequence of the highly subjective character of these surveys

[30] These figures are obtained by counting the positive answers to the question “Have you obtained results from having invested in... (each innovative input)?”.

but also because of some evidence found in analyzing the data in depth.

On the one hand, according to the proportion of firms reporting innovative sales, product innovation should be around 7% lower than the percentage resulting from just counting the affirmative responses to the first question in the questionnaire, which asks if an innovative product has been obtained[31]. These 7% units did not answer to the additional questions on the sort of innovative product obtained, but instead they did report the type of innovative processes they got, in a completely consistent manner if ignoring the answer to the first question on them innovating or not in products. An additional 3% of firms reported having innovative sales, despite the fact that they declared having innovated only in processes. Those innovative sales were thus not linked to innovative products but to products resulting from the innovative processes in action. This fact suggests that in general terms it is most likely that a percentage of firms classified as innovating in products are indeed processes-innovative establishments only[32].

Secondly, the design of the questionnaire is such that the first question the respondent faces relates to innovative products, an expression that in Spanish is very much similar to innovative output. This observation may explain why only when going ahead with the survey do respondents end answering correctly, differentiating innovative products from innovative output[33].

Innovation processes are the most frequent type of innovation output obtained, as around 90% of firms innovate in at least one process. The figures are still high if restricted to each type of innovative process, being those related to production the category with the highest proportion of firms (80% on average) while those linked to commercialization practices have the lowest frequency (45% on average). Further, the percentage of firms that innovate only in at least one type of process is similar to the lower bound of the individual groups.

[31]The dataset here used already contains the figures corrected by us.

[32]We did not correct many of these cases at this stage, despite having quite strong evidence on them being misreported, due to time restrictions. We will probably be able to do so together with the INE in the months to follow.

[33]"Output" and "product" in Spanish are both translated as "producto".

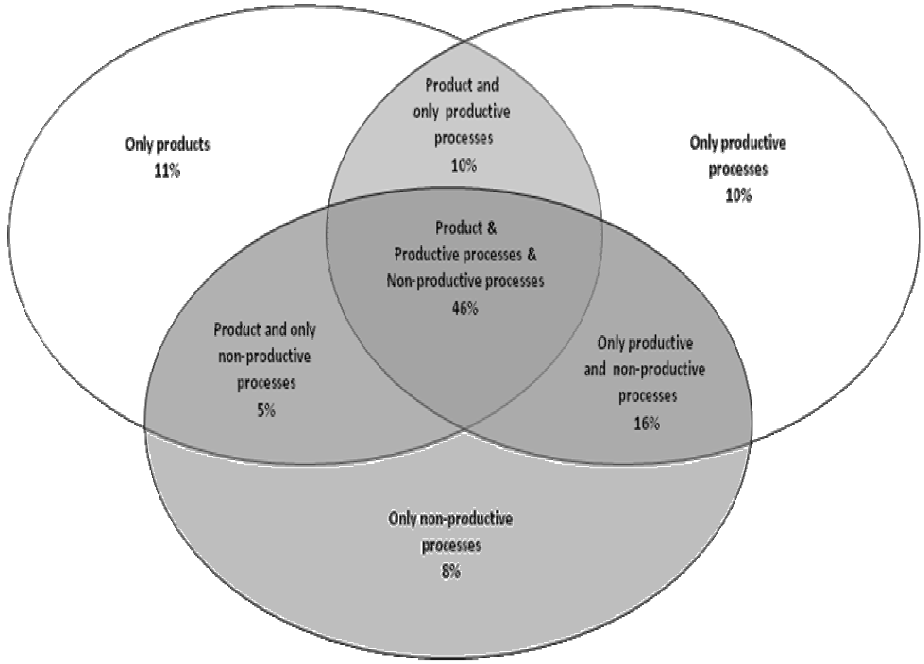

Figure 3.1: Frequency of firms according to different types of innovation output (Average percentage over all three surveys) The displayed figures do not add up to unity, given that they refer to the average percentage number of firms in each category, over all three surveyed periods.
Source: own calculations based on data from the Innovation Surveys 1998-00; 2001-03, 2004-06; ANII/DiCyT/INE.

The results are consistent with the stylized fact reported in the applied literature regarding the innovation behavior of firms in non-developed countries relative to what is generally seen in central economies.

From the above description, it is possible to state that the innovation behavior of manufacturing firms in Uruguay is more intensive in processes than in products, obtained by means of investing mainly in physical capital and training programmes for their employees. The most noteworthy result, however, relates to most Uruguayan firms obtaining a combined innovation output, both when new products are involved or not, by also combining inputs. This stylized fact thus strongly suggests the existence of complementarities among inputs and types of output. Nonetheless, the mix most frequently analyzed in the literature – products and production processes (TTP) – is surprisingly among the least observed (9% on average). This result support the hypothesis of developed and non developed countries displaying intrinsically different innovation behaviors.

The comparative statics analysis of the frequency of innovative output in time is not clear-cut. The only fact suggested by the data refers to product and production process innovation being increasing in time, its intensity especially going up with the recovery of the economy in 2004.

Table 3.2: Distribution of firms of different sizes by innovation output, 1998-2000 - 2001-2003 - 2004-2006 (Number and % firms)

	1998-2000		2001-2003		2004-2006	
Innovative firms	333	100	270	100	244	100
Firms with innovative output	322	97	266	99	240	98
Production Processes	268	83	224	84	171	71
Organizational Processes	212	66	182	68	104	43
Commercialization Processes	170	53	145	55	57	24
Processes	309	96	253	95	214	89
Products	206	64	172	64	136	57
Only Processes	116	36	94	36	104	43
Only Production Processes	34	10	20	7	43	18
Only Non- Production Processes	26	8	24	9	32	13
Only Products	13	4	13	5	26	11
Products & Production Processes	34	10	36	13	11	5
Products & Non-Production Processes	15	5	5	2	11	5
All Outputs	107	33	90	34	27	11

Notes: 'Production Processes' refer to new or improved productive methods. 'Only Processes' refers to innovating in at least one process and not in products, while 'Processes' include firms that innovate in at least one process, irrespective of whether they also innovate in products or not. 'Products' includes all firms innovating in products only and those that also innovate in any process. Thus, the categories 'Only Processes' and 'Products' add up to 100% and so do the categories 'Processes' and 'Only Products'.

Source: Own calculations based on data from the Innovation Surveys 1998-00; 2001-03 and 2004-06, ANII/DiCyT/INE.

The data only includes three data points on its time dimension, them being three three-year-periods: 1998-2000, 2001-2003 and 2004-2006. Although from a statistical point of view these constitute only three data points, they still mirror a full period of eight years. In addition, the period in question displays three very well defined moments of the country's economic cycle. The first period finds the Uruguayan business cycle at a peak, while during the second period the country faced one of its worse crises, reaching a trough in September 2002. In the third period the Uruguayan business cycle was undergoing a middle recovery. One could hence argue that given the three periods in time considered, firms' innovation behavior can be seen in the light of how they relate to the business cycle.

According to the analyzed dataset, firms seem to combine an increasing trend in product innovation with innovative production processes. This behavior appears to be pro-cyclical, which might be linked to the size and market structure in innovative economic sectors after the economic crisis. Similarly, regarding innovation inputs, an apparent decreasing trend is found in R&D investment and a not very pronounced pro-cyclical behavior of innovative investment in capital, hardware and software.

Finally, the data reveal an apparent negative time trend in the percentage of innovative firms. However, those that succeed in obtaining an innovation output are a constant share of innovative firms. As such, the result cannot be *a priori* associated to institutional obstacles for carrying on the activities, although the existence of restrictions for investing in innovation inputs cannot be discarded. Alternatively, this may just be reflecting the life-cycle of firms given that a large extent of the sample is fixed. Also, the decrease in the share of firms pursuing innovation may be linked to the changes in the composition of the firm sample that took place after 2002. If compared to previous periods with respect to the degree of market concentration or to the share of firms of specific sizes the firm landscape changed substantially, with more small sized firms and less concentrated markets. To shed light on possible underlying causes explaining the innovative behavior of firms, in what follows we add other dimensions to our descriptive analysis.

3.3.3 Who are the innovative firms and which output do they obtain?

Manufacturing innovative firms in Uruguay are concentrated in a few industries – Food, Textiles, Chemicals and Machinery & Equipment[34]. These four sectors account for around 75% of firms obtaining innovative outputs in products and processes; being the figure 80% if considering firms that innovate just in products and 70% when restricted those innovating only in processes (Table 3.3).

The time pattern exhibited by the proportion of innovative firms that innovate only in processes depends on the economic sector, being counter-cyclical if firms belong to the Food and the Textile industries, and to a lesser extent for those in the Machinery and Equipment sector, irrespective of whether the output is innovative relative to the firm, or to the local/international markets. The result suggests that these firms follow a costs reduction strategy when faced to a recession by means of innovating in processes. Firms in the Chemicals sector, on the contrary, exhibit a pro-cyclical pattern, since here the number of firms innovating only in processes decreases during the downturn.

The subset of firms getting innovative processes and products have a quite stable evolution if belonging to the Textiles industry, while those in the Food and Machinery & Equipment industries show a decreasing time trend that results exclusively from the pattern observed among firms innovating at the firm and local market levels. As such, the overall trend hides the significant and steady increase in the proportion of firms in these sectors that generate innovative products and processes relative to the

[34]The category includes many non-similar sub-sectors. The specific industries performing innovation activities are Vehicles; Spare parts & motors; and precision instruments.

international market. It is worth noting that the percentage of innovative firms in the Chemicals industry raises steadily during the whole period, irrespective of the level at which processes and products are innovative.

Table 3.3: Distribution of innovative firms by innovation output and economic sector, 1998-2000 - 2001-2003 - 2004-2006, (% firms)

	Year	Food	Bev.Tob.	Text.	Wood	Paper	Chem.	NMet.	Metal	Mach.
Only Products	2000	8	0	23	0	15	8	0	0	23
	2003	15	0	8	0	8	0	8	0	23
	2006	35	0	19	4	12	0	0	0	8
Firm Level	2000	17	0	33	0	0	17	0	0	0
	2003	20	0	10	0	0	0	10	0	10
	2006	35	0	24	6	6	0	0	0	6
Local Market	2000	0	0	0	0	40	0	0	0	40
	2003	20	0	20	0	20	0	0	0	20
	2006	33	0	7	7	13	0	0	0	7
International Market	2000	0	0	50	0	0	0	0	0	50
	2003	0	0	50	0	0	0	0	0	50
	2006	40	0	0	20	0	0	0	0	40
Products & Processes	2000	27	4	14	4	10	3	2	2	17
	2003	23	5	15	4	8	3	3	2	15
	2006	19	7	15	5	10	2	1	4	13
Firm Level	2000	27	5	13	4	11	4	1	0	18
	2003	23	1	15	3	7	3	3	1	16
	2006	21	8	12	4	9	2	0	4	14
Local Market	2000	29	3	8	4	12	2	1	1	21
	2003	24	5	14	4	4	5	1	3	15
	2006	18	4	14	3	7	2	1	6	18
International Market	2000	25	6	30	2	6	4	2	4	13
	2003	29	3	32	3	0	3	0	6	13
	2006	30	10	30	0	3	0	0	5	8
Only Processes	2000	31	3	14	5	9	9	3	1	9
	2003	36	5	16	3	9	6	3	1	7
	2006	29	4	13	4	10	8	4	0	15
Firm Level	2000	29	4	15	4	8	10	2	0	12
	2003	36	5	16	3	9	6	3	1	7
	2006	27	4	11	4	9	8	4	0	16
Local Market	2000	31	0	7	7	17	7	3	3	3
	2003	15	15	11	4	11	8	4	4	19
	2006	24	3	10	0	14	10	3	0	14
International Market	2000	63	0	13	0	6	0	0	0	0
	2003	29	0	29	0	0	0	0	0	29
	2006	55	0	0	0	9	9	0	0	9

Notes: Source: Own calculations based on data from the Innovation Surveys 1998-00; 2001-03, 2004-06; ANII/DiCyT/INE.

Finally, no pattern should be stated for innovative firms focused only in obtaining new products since the number of units in this category is too small to support any robust hypothesis (13, 13, and 26, respectively, being those belonging to the 4 sectors under analysis, 10, 10 and 25, respectively).

The distribution of product innovative units among the different levels for which products are innovative is very similar in all sectors except Chemicals, since firms in that industry declare to be product innovative only at the firm and the local market levels, and not at the international level.

Characteristics shared by most firms belonging to the above sectors are them being exporting units, with and export intensity over 40%, owned by national entrepreneurs (Table 3.4). The degree of market concentration[35] is another potential common market feature, not being among the highest observed in the industry as a whole and showing a decreasing time trend.

The extent of international exposure as measured by an openness indicator based on the sum of exports and imports over gross production value is high for all industries and increasing over time. On the other hand, the export intensity of these firms may explain the differentiated behaviors observed along the economic cycle.

Firms in the Chemicals industry have the local market as the main destiny of their production (only 17% of their total sales are exports, being the percentage stable in time). A pro-cyclical evolution of the percentage innovative firms in the sector can be thus expected, since their revenues and hence their ability to spend in innovation will be highly linked to the local economic cycle.

Units operating in the Textile industry are high intensity exporters up to 2006 (above 60% in 2000-2003 but going down in 14 percentage points by 2006), while those in the other two sectors are characterized by having a low but increasing export intensity, suggesting that their counter-cyclical behavior is related to displaying an international market penetration strategy to face the 2002 economic crisis, by means of generating innovative outputs.

Regarding the size of innovative firms, there is a clear positive association between innovation intensity and size – a fact that is sensible since large firms have a less effective constraint for spending in innovative inputs (see Table 3.5)[36]. The relation is non-linear, being its maximum attained in the 50-149 size strata, in line with the composition of firms by size. The change in the distribution of firms by size is matched by that among innovative firms, the gap between both strata having diminished (from 15pp in 1998 to 10pp in 2006).

[35]Market concentration is measured using the standard indicator, defined as the share in sector's total sales of the sum of the 4 largest firms' sales value.
[36]See Cohen and Keppler (1992) for stylized facts relating size and innovation intensity.

Table 3.4: Innovative economic sectors – Main characteristics, 1998-2000 - 2001-2003 - 2004-2006

Output	Sector	Average value	2000	2003	2006
Only Products	Food	Concentration	0.60	0.13	0.40
		Openness	0.40	0.51	0.59
		Exports over sales	0.00	0.00	0.25
	Textiles & Others	Concentration	0.42	0.32	0.20
		Openness	0.44	0.61	0.53
		Exports over sales	0.30	0.54	0.44
	Chemical products	Concentration	0.58	0.46	0.42
		Openness	0.51	0.58	0.61
		Exports over sales	0.00	0.11	0.05
	Mets., Mach. & Others	Concentration	0.28	0.20	0.17
		Openness	0.54	0.47	0.56
		Exports over sales	0.33	0.50	0.12
	Other sectors	Concentration	0.45	0.22	0.25
		Openness	0.49	0.54	0.58
		Exports over sales	0.19	0.25	0.23
Prods. & Procs.	Food	Concentration	0.39	1.02	0.23
		Openness	0.55	0.59	0.59
		Exports over sales	0.16	0.30	0.29
	Textiles & Others	Concentration	0.27	0.22	0.32
		Openness	0.54	0.55	0.57
		Exports over sales	0.63	0.69	0.59
	Chemical products	Concentration	0.30	0.14	0.35
		Openness	0.56	0.58	0.60
		Exports over sales	0.19	0.13	0.22
	Mets., Mach. & Others	Concentration	0.45	0.25	0.18
		Openness	0.50	0.53	0.55
		Exports over sales	0.16	0.22	0.30
	Other sectors	Concentration	0.37	0.32	0.26
		Openness	0.54	0.57	0.58
		Exports over sales	0.26	0.31	0.33
Only Processes	Food	Concentration	0.26	0.27	0.30
		Openness	0.57	0.55	0.58
		Exports over sales	0.31	0.27	0.39
	Textiles & Others	Concentration	0.23	0.19	0.20
		Openness	0.54	0.53	0.58
		Exports over sales	0.71	0.55	0.39
	Chemical products	Concentration	0.61	0.42	0.26
		Openness	0.56	0.58	0.58
		Exports over sales	0.16	0.29	0.11
	Mets., Mach. & Others	Concentration	0.26	0.49	0.33
		Openness	0.52	0.55	0.56
		Exports over sales	0.26	0.43	0.14
	Other sectors	Concentration	0.34	0.28	0.29
		Openness	0.56	0.55	0.58
		Exports over sales	0.35	0.35	0.28

Notes: "Textiles & Others" stands for Textiles, Apparel manufacturing & Leather; "Mets., Mach. & Others" stands for Metal products, Machinery and equipment & Others, Source: Own calculations based on data from the Innovation Surveys 1998-00, 2001-03, 2004-06; ANII/DiCyT/INE.

The share and number of innovative firms steadily decreases along the period, the final figure being 43% lower to that in 1998. However, the trend responds mostly to the evolution observed among firms with less than 50 employees, as the decline in their share of total firms is outdone by that of innovative firms. The opposite evolution is observed among large firms, especially if focused on the top stratum.

Similar trends are observed regarding firms getting an innovation output, independently of whether it involves new products or not. The magnitude of the decline must be taken with caution, as small firms in our sample are not representative of those in the population, so that the results are not accurate and may be even misleading. If observing only firms of mandatory inclusion, the negative trend is a lot smoother, being the total decline in the period of just 18%. The result points again at the risks of stating conclusions based on samples that are not representative as is the case for most innovation surveys datasets.

Table 3.5: Distribution of firms by innovative behavior according to size, 1998-2000 - 2001-2003 - 2004-2006, (number and % firms)

	1998-2000				2001-2003				2004-2006			
Firms	**Total**		**Innovative**		**Total**		**Innovative**		**Total**		**Innovative**	
Total	494	100	333	67	494	100	270	55	494	100	244	49
19-and-less	77	16	30	9	92	19	26	10	86	17	14	6
20 - 49	153	31	95	29	177	36	89	33	139	28	55	23
50 - 149	173	35	129	39	147	30	92	34	167	34	99	41
150 or more	91	18	79	24	78	16	63	23	102	21	76	31
Inn. Output	**Products**		**Only Processes**		**Products**		**Only Processes**		**Products**		**Only Processes**	
Total	206	77	116	23	172	64	94	36	136	55	104	45
19-and-less	23	17	5	4	16	12	10	11	8	6	5	5
20 - 49	60	44	31	27	53	39	34	36	28	21	25	24
50 - 149	74	54	52	45	61	45	31	33	58	43	41	39
150 or more	49	36	28	24	42	31	19	20	42	31	33	32

Notes: Source: Own calculations based on data from the Innovation Surveys 1998-00; 2001-03, 2004-06; ANII/DiCyT/INE.

A most interesting fact relates to the evolution in time of the distribution of innovative firms according to the type of output obtained. Firms innovating only in processes increase their share substantially (from 23% to 45% of firms obtaining an innovation output), so that the decrease in innovative firms stated above is driven by product innovative units. Although firms of all sizes behave similarly, the trend towards focusing only on innovation processes is led by large firms, especially those in the upper size stratum. The time pattern reveals that the share of innovative firms is pro-cyclical for the largest units while it is counter-cyclical for small firms (Table 3.6). The counter-cyclical pattern is linked to the behavior of small firms that innovate only in processes which also exhibit a decreasing trend in product innovation, as well as to that of the non-national exporting firms of large size that innovate in products.

Table 3.6: Distribution of innovative firms by innovative output and to size, 1998-2000 - 2001-2003 - 2004-2006, (% firms)

Output		2000			2003			2006		
		Small	Large	Total	Small	Large	Total	Small	Large	Total
Nat.Capital	Exporting	23	77	55	29	71	56	21	79	56
	Non exporting	60	40	45	71	29	44	47	53	44
	Total	25	60	85	33	53	81	27	67	78
Non-nat.Capital	Exporting	19	81	19	21	79	14	14	86	21
	Non exporting	36	64	81	41	59	86	31	69	79
	Total	37	63	15	42	58	19	27	73	22
Total	Exporting	23	77	50	17	83	48	17	83	48
	Non exporting	57	43	50	69	31	52	45	55	52
	Total	37	63	100	43	57	100	28	72	100
Products										
Nat.Capital	Exporting	21	79	58	20	80	62	20	80	61
	Non exporting	38	62	42	38	62	38	32	68	39
	Total	30	70	85	30	70	83	25	75	43
Non-nat.Capital	Exporting	20	80	80	14	86	83	25	75	84
	Non exporting	25	75	20	38	62	17	33	64	16
	Total	27	73	15	23	77	17	27	73	24
Total	Exporting	20	74	58	19	81	48	174	83	48
	Non exporting	37	40	42	41	59	52	30	70	52
	Total	29	71	64	29	71	65	21	79	57
Only Processes										
Nat.Capital	Exporting	19	81	56	37	63	47	15	85	48
	Non exporting	44	56	44	31	69	53	53	47	52
	Total	35	65	42	54	46	35	31	69	33
Non-nat.Capital	Exporting	16	84	72	27	73	90	13	87	71
	Non exporting	36	64	28	41	59	10	32	68	29
	Total	26	74	58	35	65	65	24	76	67
Total	Exporting	15	85	50	24	76	48	11	89	48
	Non exporting	33	67	50	40	60	52	32	68	52
	Total	35	65	36	54	46	35	39	61	43

Notes: Source: Own calculations based on data from the Innovation Surveys 1998-00; 2001-03, 2004-06; ANII/DiCyT/INE.

It is apparent that innovative firms of different size display distinct strategies along the business cycle, aiming small units and local market oriented firms to reduce costs by innovating in processes while large firms tend to diversify markets and concentrate in product innovation activities. Although non-national capital innovative firms are only 15% of total innovative firms, their share in both exporting and local market oriented units is always above 80% and 60%, respectively, as well as increasing in time. The same occurs among national exporting firms, so that it can be stated that large enterprises, especially if exporters, are the leaders of innovation activities in Uruguay.

Further, as it is seen in Table 3.7, they are also the core of innovative firms with respect to the international market. When restricted to firm and local market innovative outputs, on the contrary, the previously stated non linear relation with the maximum in the 50 to 149 employees stratum is observed, as opposed to internationally relevant innovation output that is steadily increasing in size strata.

Table 3.7: Innovative firms by size and relevance of the innovation output, 2000 - 2006, (% firms)

Relevance of Output		19 & less	20-49	50-149	150 & more
Firm Only	**2000**	10	33	34	22
	2003	9	30	24	24
	2006	7	24	38	31
Local Market	**2000**	8	36	39	17
	2003	11	26	36	27
	2006	8	22	38	32
Inernat. Market	**2000**	6	26	23	45
	2003	3	10	35	52
	2006	5	5	43	46

Notes: Source: own calculations based on the Innovation Surveys 1998-00; 2001-03, 2004-06; ANII/DiCyT /INE.

3.3.4 Innovative inputs mix and size of the innovation effort

As it was previously stated, a considerable number of innovative firms invest in all four categories of innovation inputs as here defined, while the percentage of firms investing in only one input is negligible, except in the case of capital, hardware and software. Preferred choices are not linked to the stage of the business cycle, as shown above in Table 3.1. However, the decrease in the proportion of firms investing in R&D and in EID+TT+CS, together with the stable pattern shown by K+H+S and Training, the most chosen innovative inputs, may be partially linked to the strategy of switching from product to process innovation displayed by most firms in order to face the economic crisis.

The distribution of firms investing in each input according to economic sector shows that those belonging to the Food industry were the leading investors in all inputs in 2000. However, in 2003 firms in the Chemical Products catch up and even surpass them in R&D investment, and by 2006 they also lead investment in Training programmes (Table 3.8).

Interesting differences arise when analyzing the composition of inputs according to the innovation output obtained by firms – products and only processes – classifying them according to destiny of sales; ownership; size; and economic sector (Table 3.9).

Firstly, a high percentage of product innovative firms innovate in all inputs, the figure being slightly lowest for EID+TT+CS. It is noteworthy that R&D investment is done by a significantly larger proportion of product innovative firms relative to the average (see figures in Table 3.1 for a comparison).

Table 3.8: Distribution of firms by innovative input according to economic sector, 1998-2000 - 2001-2003 - 2004-2006,(% firms)

Activity	Sector	2000	2003	2006
R&D	Food	32	25	21
	Textiles	15	14	14
	Printing & Editing	6	4	2
	Chemical Prods.	22	27	33
	Machinery & Equip.	13	14	15
	Rest of Industry	11	15	15
K+H+S	Food	28	30	26
	Textiles	15	17	15
	Printing & Editing	10	7	11
	Chemical Prods.	15	17	18
	Machinery & Equip.	14	11	12
	Rest of Industry	18	18	19
Training	Food	31	25	22
	Textiles	10	14	14
	Printing & Editing	11	9	11
	Chemical Prods.	19	20	25
	Machinery & Equip.	13	12	12
	Rest of Industry	15	19	17
EID+TT+CS	Food	33	27	22
	Textiles	12	15	18
	Printing & Editing	5	4	8
	Chemical Prods.	15	20	20
	Machinery & Equip.	13	12	12
	Rest of Industry	22	22	20

Notes: R&D includes both internal and/or external; K+H+S refers to Physical Capital and/or Hardware and/or Software; EID+TT+CS gathers Engineering & industrial design and/or Technology transfers & Consultancy services; TP includes both management oriented and employees training programmes.

Source: own calculations based on the Innovation Surveys 1998-00; 2001-03, 2004-06; ANII/DiCyT /INE.

On the contrary, if innovation efforts are materialized only in innovative processes, investment in physical capital is still high, training is an input in which many firms invest although in a significantly lower proportion with respect to product innovative firms, while the two most knowledge driven inputs are not a relevant dimension of their innovative efforts.

The trend of pro-cyclicality for investments in R&D, as well as the counter-cyclicality of investing in Training seen for the totality of firms is reproduced here by product innovating firms, while firms innovating only in processes display a behavior that is less related to the business cycle, at least with respect to its recovering stage in 2006.

Secondly, if classifying firms in exporting firms and fully domestic market oriented firms, there are no differences among both groups when firms obtain only innovative processes, except for the fact that exporting firms do not adjust to the business cycle and non-exporting units do, a behavior shared also by firms getting innovative products as well. It seems that among firms innovating in products exporters act pro-cyclically on R&D and K+H+S inputs and counter-cyclically on Training and EID+TT+CS. Contrarily, non-exporting firms are counter-cyclical on knowledge intensive inputs, i.e. in R&D and in EID+TT+CS, and pro-cyclical on K+H+S and training. Still, the most salient difference between firms selling in the international or local markets is that investment in knowledge intense inputs is a lot more frequent among exporters.

It can thus be stated that whenever firms operate in more competitive markets, they use a mix of innovative inputs that give a more important weight to research and design than when restricted to the local market, while they are a lot more protected from the domestic economic cycle so that they need not adjust their costs as much as the rest.

Until 2006, the share of locally owned product innovative firms that invest in all inputs was greater than that among foreign owned companies, as is also generally the case if focusing in innovative K+H+S and in Training irrespective of the type of innovation output obtained. In 2006 the picture changed slightly, as more non-national product innovative firms started investing in all inputs, catching up with the percentages observed among national companies and even surpassing them in the case of R&D and EID+TT+CS. Conversely, investment in these two inputs became more frequent among innovative national firms focused only in processes. The trends observed are undoubtedly linked to the behavior signalled above of the largest firms starting to innovate only in processes, together with the observed changes in the overall composition by size towards a higher share of large relative to small units.

In fact, a substantially higher proportion of large relative to small product innovative firms use a mix of inputs that combines with no significant differences R&D, Training and K+H+SIf only innovating in processes, the weight of Training increases while that of R&D decreases; a result that is quite expected.

Table 3.9: Innovative inputs mix by type of innovation output and firm characteristics, (% of firms investing in each type of input)

	Products				Only Processes			
	R&D	K+H+S	Training	EID +TT+CS	R&D	K+H+S	Training	EID +TT+CS
All Firms								
2000	71	95	80	56	32	83	58	36
2003	69	82	76	61	22	82	58	35
2006	69	90	75	45	14	78	67	31
Exporting Firms								
2000	75	92	81	60	34	81	54	38
2003	74	90	82	63	27	87	65	40
2006	78	92	79	51	16	75	75	36
Non Exporting Firms								
2000	52	100	80	51	31	86	63	33
2003	57	69	57	57	15	76	49	29
2006	51	86	68	32	12	82	59	24
National Ownership								
2000	68	92	78	57	29	82	55	33
2003	66	83	75	61	21	83	55	32
2006	66	90	79	43	13	77	66	29
Non-National Ownership								
2000	46	65	50	27	44	67	67	50
2003	44	56	52	41	25	60	45	35
2006	77	90	67	50	5	57	43	14
Large Firms - 50 & more workers								
2000	78	94	87	60	35	85	63	40
2003	77	88	82	62	28	86	68	42
2006	69	92	79	44	15	79	69	31
Small Firms - 49 & less workers								
2000	61	86	75	51	28	79	49	28
2003	56	73	67	59	15	78	48	28
2006	69	86	69	46	14	75	64	31
Food								
2000	77	91	89	62	47	75	61	47
2003	72	89	75	64	20	91	49	34
2006	67	86	71	48	13	90	53	27
Textiles								
2000	75	89	68	50	25	88	31	31
2003	54	88	79	71	27	87	40	13
2006	76	100	82	53	0	69	62	31
Chemical Products								
2000	94	84	94	48	47	84	68	47
2003	89	83	77	66	30	60	90	40
2006	89	89	85	41	36	64	93	36
Machinery and Equipment								
2000	64	88	76	76	100	91	55	27
2003	67	75	75	71	100	71	43	29
2006	79	79	57	43	31	69	69	19
Rest of the Industry								
2000	47	88	69	41	17	86	63	23
2003	40	73	70	38	21	72	69	48
2006	39	87	68	39	10	77	68	39

Notes: R&D includes both internal and/or external; K+H+S refers to Physical Capital and/or Hardware and/or Software; EID+TT+CS gathers Engineering & industrial design and/or Technology transfers & Consultancy services; TP includes both management oriented and employees training programmes.

Source: Own calculations based on data from the Innovation Surveys 1998-00; 2001-03 and 2004-06, ANII/DiCyT/INE.

Furthermore, while both small and large firms display the same behavior with respect to the business cycle when innovating in products, those innovating only in processes differ in their investments in Training, where large firms behave counter-cyclically, while small firms do it pro-cyclically.

Regarding the comparative behavior among economic sectors, the proportion of firms investing in training programmes is always higher when being product innovative than when innovating just in processes, with the apparent exception of firms in the Chemical Products industry after the business cycle downturn in 2002. This activity, mainly driven by the behavior of units in the pharmaceutical sector, is highly intensive in R&D, as is the case of firms innovating in processes in the Machinery and Equipment sector. Although the frequency of firms investing in innovative capital is always high, those in the Food sector have the largest figures along the period, both when innovating in products and when doing so only in processes.

A final dimension of innovation behavior that is worth describing refers to the subjective view of firm managers with respect to the role of agents associated to the activity, such as public institutions, NIS actors or other economic agents linked to the firm in diverse ways (competitors, suppliers, related enterprises, etc.). This role is evaluated from various perspectives, including financial aid received, information availability, existence of training programmes and others. Similarly, the mechanisms giving rise to innovative activities are also linked to the perception of managers on the obstacles faced, the goals they pursue by innovating and the eventual impacts observed by those undertaking innovation. These dimensions may be heterogeneous depending on specific characteristics of firms.

Table 3.10 summarizes firms' main reasons to innovate, the type of impact they expect from innovation, their main obstacles to innovate, as well as why they seek links with NIS agents, the sources of information they use to feed their innovation processes, the type of agreements sought with NIS agents with respect to innovation and the main sources to finance innovation efforts.

As can be derived from table 3.10, most firms investing in innovation inputs aim at reducing costs. Large firms also seek to increase their products' quality and maintaining or increasing their market share when pursuing innovative activities. Environmental concerns and related issues are not a goal for at least 60% of innovative firms, irrespective of their size. The motivations behind innovative activities as stated by firms are consistent with the impact they declare to obtain from innovative practices, which are mainly related to lowering labor costs by means of increasing the firm's production capacity and by maintaining and/or increasing their market share. As a further impact, small firms declare the increase in their production flexibility and the better use of their human capital resources, consistent with the declared aim of reducing costs. Large firms are also consistent with their stated objectives, since as a further impact they cite that quality gains are obtained.

Firms related to NIS agents are mainly looking for technological assistance and information, irrespective of their size or innovative character. This behavior is increasing in time for small firms. Large enterprises have also evolved towards associating with NIS agents looking for support in their training programmes. Financial aid is surprisingly not among the most important objectives sought through these links, neither for large nor for small firms.

There also has been a change in firms' behavior with respect to which type of agents they approach when looking for financial aid. While in 2000 "other related firms" was the most common answer, in 2006 financial agencies became the preferred option as main source of financing innovative behavior.

Table 3.10: Overview of main objectives, obstacles and links with NIS agents by size, 1998-2006

	Large firms	Small firms
Innovation objectives	Reduce costs	
	Keep/increase market share	Reduce costs
	Improve products' quality	
Innovation impact	Increase market share	Better use of the staff's capacities
	Increase productive capacity	Increase productive capacity
	Improve products' quality	Increase flexibility in production
Links to NIS seeking	Technology Assistance	
	Training	
	Information	
Information sources	Internal sources	
	Clients	
	Specific knowledge-generating agents (consulting firms, journals, conferences, fairs)	
Financing sources	Financial System	
	Other firms	
Agreements	Commercialization agreements	
	Training agreements	
Innovation obstacles	Small market	Small market
	Return horizon for investments	Market structure
		Access to financial aid & information

Notes: [1/] **Large firms: More than 50 employees; Small firms: 50 or less employees.**

Source: Own calculations based on data from the Innovation Surveys 1998-00; 2001-03 and 2004-06, ANII/DiCyT/INE.

This behavior is shared by innovative and non-innovative firms, although 70% of firms in the former group have applied for financial aid, while only 35% of non-innovative firms have done so. It is also noteworthy that small firms declare that the lack of financial aid is an important obstacle to innovation, but they do not relate to NIS agents seeking for financial aid. This could reflect the inability of small firms to fully access or make use of the tools provided by the NIS in terms of specific help, beyond information and technical assistance.

An additional limit is the perception, also shared by non-innovative large firms[37],

[37] Although probably for very different reasons, small firms may be more risk averse than large firms

that the time-horizon in which returns from innovation are obtained is too wide, a result that suggests these firms are more risk averse than the rest, at least in terms of innovation activities.

Small non-innovative firms also consider the lack of information, both technical and on market characteristics, as a main obstacle. This may further signal the need for a better design of information channels to reach small firms. Finally, the size of the market, as well as its structure in the case of small firms, are seen as further disadvantages for firms to engage in innovative practices.

Although data on cooperation agreements is available only for 2006, it is interesting to observe that these agreements relate to commercialization practices and training programmes, among both innovative and non-innovative firms. However only those in the first group have agreements for developing new technologies.

When analyzing the information sources used by innovative enterprises, the most important one declared by firms are internal sources, as well as the firm's clients. However, there is a time trend towards establishing links with both general and specific knowledge-generating agents, such as the university, consultants, and other stances like specialized journals, fairs and conferences. This fact points at a trend in time towards the professionalisation of the innovation activity and it may also suggest that firms have started to look at innovation as a means of economic development. It also reveals an improvement in the way innovation related information is publicized and communicated by public and private institutions.

Furthermore, it is absorbing to note that neither the lack of talent availability, nor the failure or poor development of public policies and technical institutions related to innovation are among the main obstacles declared by firms, a result in line with the conclusions stemming from Hausmann *et al.* (2005).

In what follows we first discuss the diverse indicators used to proxy innovation output and input and suggest additional measures that may be useful for capturing some non-modeled effects if using the most popular indices reported in the applied

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to face misinvestments and their financially associated problems, e.g. lack of liquidity and lack of sustainability of the innovation effort in the long run. On the other hand, large firms may be more able than small units to sustain a innovation effort for longer until it bears results, not necessarily being afraid of liquidity or sustainability issues. Their risk aversion could stem from the reputation side, from the accountability vis-à-vis stockholders or from the fact that those funds could have been invested in something else, yielding short-term results and therefore making management and firm look better.

literature. We also propose alternative strategies to model innovation processes.

3.4 Measures of innovation output and inputs

3.4.1 Innovation output indicators

Variables accounting for innovation output can be defined in several ways, being the most popular measures the number of patents applied for and/or already obtained during the period covered by the survey; the percentage sales of innovative products in total sales or in total non-financial revenue; and binary variables stating if the firm got an innovative output or not by output category. We use some of the above variables in order to compare their relative performance in the Uruguayan case, and to be able to compare results with those reported in the existent literature. However, we also use other indices, both because our data set allows us to define variables that are more closely related to the theoretical concepts involved in the analyses than the previously mentioned standard measures, or due to our considering them as suitable in the particular case of Uruguay. In what follows we discuss the above indicators for innovation output and propose other indicators to overcome their limitations.

3.4.1.1 The number of patents

A widely used index of innovation output is the number of patents[38]. However, small firms in non-central countries, despite performing innovation strategies and obtaining innovative results, are a lot less likely to apply for international patents with respect to large enterprises or to firms in developed countries. This is the case of several Latin American countries for which there is evidence that the use of patent applications as an indicator of innovation output leads to ambiguous results[39].

The main facts underlying this statement are the high associated costs, especially when applying for an international patent, and the generally insufficient available information on the matter. The number of patents requested and obtained by Uruguayan manufacturing firms is indeed negligible - 265 and 242, respectively, considering 494 firms along a 10 years period. That is, on average, only 26 patents are requested and 24 are obtained each year if considering all 494 manufacturing firms analyzed along the 10 years period (equivalently, 1 patent is requested/obtained annually by every set of 100 firms). If focusing on international patents, these annual

[38] See, e.g., Crépon et al. (1998).

[39] See Arocena and Sutz (2008). Consequently, we are not performing any analysis here based on this indicator of innovation output.

figures go down to 8 and 7, respectively, 1 patent *per* each set of 300 firms. The stylized fact further supports the hypothesis that the core of innovation activities in Uruguay, and probably in any less developed country, refers to processes and not to innovative products[40].

3.4.1.2 The share of innovative sales in total sales

A similar critique is in place, at least in the case of non-developed countries and of Uruguay in particular, for the indicator based on the share of innovative sales in total sales or revenue. Generally defined in surveys as the sales value of innovative products, the indicator is zero not only for non-innovative firms but also for those that innovate only in processes. As such, it is useless for analyzing the innovative output of all the latter subgroup of firms[41]. We use the indicator in the current analysis only in order to compare results with other empirical work.

The use of the above-mentioned indicator has been justified in the literature by noting that the share of innovative products in total products times the marginal product of knowledge-capital is almost equal to the rate of growth of knowledge-capital times the product elasticity with respect to this additional production factor However, the equivalence holds only under certain conditions related to innovative and standard products having equal rates of profits and the size of the knowledge-capital endowment in the previous period. Further, if used in a productivity equation, intermediate consumption should also be included or else the indices have to be defined in terms of value added. The indicators introducing those corrections are derived in Chapter 4 and will be noted here as Y_t^I/Y_t^T when accounting for mark-ups differentials[42] and Q_t^I/Q_t^T when expressed as the share of innovative products in total output. We here calculated the proposed alternative indicators, Y_t^I/Y_t^T and Q_t^I/Q_t^T, as well as the traditional share of innovative sales indicator S_t^I/S_t^T using the data of Uruguayan IS and EAS for the period 1997 to 2006, in which those surveys took place[43].

[40] See Hall and Maffioli (2008), Bianchi et al. (2008) and Arocena and Sutz (2008).

[41] The literature including new processes as one innovation output does not generally discuss the issue, being Van Leeuwen and Klomp (2006) one notable exception.

[42] Whenever no differences are found between the mark-ups of new and standard products, the proposed indicator will be equivalent to the one based on the monetary value of sales.

[43] To see the comparative performance of econometric analyses using the standard and the here proposed indicators please refer to Chapter 4.

3.4.1.3 Binary indicators for innovation output

Another strategy found in the literature to proxy innovation output is to substitute the knowledge-capital equation by redefining it as a function that relates the specified triggering factors of innovation to a binary variable stating whether or not the firm generated an innovative output. As such, the index is uninformative with respect to the value of the obtained output, nor to the size of its impact on firm performance. However, it may serve to analyze if there are differences between the diverse types of innovation output both in their relative impact on firm performance and in their determinants.

Furthermore, it is possible to combine the use of a dummy variable accounting for innovative processes with the share of sales proxy for innovative product, as performed by Van Leeuwen and Klomp (2006). Being a step forward, the impact of innovative processes is still restrained to scale effects. The analysis may be improved by creating binary variables that interact with the share of innovative sales whenever there exist innovative processes, so as to allow for the elasticity to vary with a diversified output. In doing so, some insight on the possibility of the existence of complementarities between diverse types of innovative output may be also obtained[44].

3.4.1.4 An alternative indicator for innovation output

An alternative improvement to the standard use of binary variables is to define an indicator of output that reveals when one or another type of output is obtained by means of weighing the diverse output classes. Defining weights according to the relevance of the innovation output should serve those purposes, as it would include both product and processes while also categorizing their degree of innovation. Relevance is defined in terms of the output being only firm level innovative – the lowest degree; innovative at the local market level; or at best innovative with respect to the international market, for all 4 types of output and as declared by the firm.

We use two sets of weights for building the indicator. Firstly, we assign increasing values ranging from 1 to 3 for each relevance category, so that the indicator may vary between 1 – when innovation refers to just one type of output and it is innovative only at the firm level – to 12, in case there is international market level innovation in the four categories of output reported. Analogously, we build an indicator just for innovative processes, by weighting the three types following the same procedure.

[44]See Milgrom and Roberts (1995) for a mathematical approach to complementarities, as well as for a brief survey on the applied literature on the topic.

The indicator ranges from 1 to 9, depending on its relevance and on its being referred to one, two or three types of the innovative processes considered in the surveys.

The indicators defined are expected to give more weight to innovative products relative to processes, and to productive with respect to non technological processes, under the assumption that it is more frequent that these types of output are innovative relative to the international market than the other classes.

However, the method implies that the relative increase in the innovation's relevance is the same among the 3 categories. To avoid this limitation, given the small size of Uruguayan markets, a further sophistication is to generate incremental differentials between weights. Assuming that an internationally relevant innovation in non-developed economies, especially those with small size markets as the Uruguayan, are much more relevant with respect to local market or firm level innovation, the weight is defined as the inverse of the share of firms that obtain a particular output and relevance among the total number of firms obtaining that output. As such, the indicator's lower bound is 1, in case all firms in the category innovate only at the firm level in just one type of output (so that both firm level innovation and the weight equal 1). It is theoretically unbounded, as its highest value would correspond to the case in which there is only one firm that innovates at the international market level in all 4 types of outputs and the number of firms innovating in that output is infinitely large[45].

3.4.2 Innovation input indicators

The indicators on innovation inputs that can be found in the literature are the amount of expenditure devoted to R&D and its share in total sales or total non-financial revenue; the existence of formal R&D units; the amount of expenditure in physical capital, hardware and software and its share in total sales/revenue; the number of employees engaged in innovation activities and its share in the firm's total workforce, as well as the amount of full-time equivalents in R&D+I activities over full-time equivalent employees (i.e. proportion of the firm's workforce devoted to innovation practices); the expenditure devoted to training programmes and its share in total sales/revenue; and the share of trained employees in total employment. Still, the most widely used measure is restricted to R&D expenditure.

Some studies also focus on the overall expenditure devoted to innovative activities.

[45] For a comparison and description of the above indicators, both in terms of the Uruguayan data and their performance please refer to Chapter 4.

However, the use of total expenditure or of a sole input may not be the optimal strategy, as both ignore that differences in nature among the diverse innovation inputs will most likely result in differing amounts and types of innovation output. It neither allows for analyzing whether concentrating expenditure in a particular input mix derives in attaining differentiated types of output nor whether it impacts the degree of novelty attained. As a first approach to the topic we build an overall input indicator taking into account the degree of diversification of the firm's innovative effort. The indicator is built as a normalized Herfindahl index using the expenditure in each type of input as a proportion of total expenditure in innovation inputs as the weighting factor.

The Innovation Input Concentration Indicator (IICI) used here is built based on our aggregation of inputs into 4 categories. For a thorough description of the IICI and a comparison of its relative performance, refer to Chapter 4.

The intuition behind using this indicator is to assert if a more concentrated effort with investments focused on few innovation inputs – say R&D – yields different results than a more diversified innovation effort, investing across several areas – e.g. R&D, capital and training[46]. One could therefore hypothesize that a more diversified innovation effort across different types of input should decrease the risk of not obtaining significant innovation results, in the same fashion diversification works for a financial portfolio. In fact, the risks associated with R&D innovation should decrease with diversification across inputs.

As we will see afterwards, this intuition is confirmed by the data, since diversifying across several innovation outputs seems to be helping firms to obtain more innovation output, as measured by our Overall Innovation Output Indicator (OIOI) indicator. The OIOI is an indicator that takes into account whether or not a firm had innovation output, and in case it had, it also accounts for the type of output and its degree of relevance. Details on this index's construction can be found in section 4.4.1.

[46]For example, R&D effects are considered to be highly uncertain, with an uncertainty very much linked to the sector in which R&D is pursued, and its impact occurs with time lags that vary given firm and sector characteristics. In addition, its overall impact may also suffer from the interaction or be dominated by investments in other production factors. In Mairesse and Sassenou (1997), the authors suggest looking at different innovation inputs or types of R&D, since their returns and time-horizon associated risks differ and may therefore affect the generation of innovation output differently.

3.5 Econometric Results

In this section we estimate the innovation behavior of Uruguayan firms by implementing the CDM approach using data from the 2006 Uruguayan IS. A first estimable model is framed in equations (3.2) to (3.7) depicted in section 3.2. We therefore measure innovation effort in financial terms and use our own innovation output indicator. We have proxied the theoretical variables included as follows[47]:

- Propensity to innovate - g_i: binary variable equal to 1 if the firm invested in any innovation input in the 2004 to 2006 period
- Size of the innovation effort - r_i: log of total expenditure in innovation inputs/R&D over value of sales in 2006
- Innovation output - t_i: log of the OIOI innovation output indicator
- Productivity - q_i: log value added in 2006 pesos over total employment (EAS)
- Independent variables - Z_i, X_{0i}, X_{1i}, X_{2i}, X_{3i} refer to firm level characteristics and characteristics of the firm's innovation activities. The variables are described in detail in Table 3.13. We also include industry dummies for 12 economic sectors at the ISIC 2-digit level
  - Z_i: Log of physical capital stock in 2006 Uruguayan pesos; number of employees;
  - X_{0i}: Size:20-49 workers; Size:50-149 workers; Size:150 workers & more; Foreign ownership; Full Foreign ownership; Belongs to an Economic group; Exports over sales (%); Average labor productivity - 1 lag (log); Capital/Labor - 1 lag (log); Engineers/Professionals in the firm (%); Productive capacity - % use; Formal R&D unit - 1 lag; Obstacles: firm level; Obstacles: market level; Obstacles: macro level; Information Sources High Relevance;
  - X_{1i}: R&D; K+H+S; Training Programmes; EID+CS+TT; Size:20-49 workers; Size:50-149 workers; Size:150 workers & more; Foreign ownership; Full Foreign ownership; Economic group; Export; Full export; Average labor productivity - 1 lag (log); Capital/Labor - 1 lag (log); Engineers/Professionals firm (%); Formal R&D unit - 1 lag; IICI; Financing: External resources; Financing: Related agents (%); Financing: Public sector (%); Financing: Banks (%); Financing: International (%);

[47] Descriptive statistics and a detailed description of variables are included in Tables 3.14 and 3.13 of the Appendix E.

- X_{2i}: IICI; Size:20-49 workers; Size:50-149 workers; Size:150 workers & more; Engineers/Professionals in the firm (%); Formal R&D unit - 1 lag; Share of foreign capital (%); Full Foreign ownership; Full exporter; Exports over sales (%); Capital/Labor - 1 lag (log); Link with NIS agents; Link: Technical assistance; Link: R&D; Link: Training; Link: Information;
- X_{3i}: Innovation in Products; Innovation only in Processes; Innovation only in non-productive Processes; Innovation in Productive Processes; Innovation in Commercialization Processes; Innovation in Organization Processes; Capital/Labor growth rate; Labor growth rate; Size:20-49 workers; Size:50-149 workers; Size:150 workers & more; Average labor productivity - 1 lag (log); Productive capacity - % use;

Regarding the statistical models specified, a first issue to be taken into account refers to the potential existence of selectivity bias of diverse origins. One of the most frequent causes encountered in the literature stems from having information only for innovative firms, as is the case in European surveys. We can ignore these biases due to the fact that the Uruguayan surveys do not share this characteristic, as non-innovative firms are also included in the sample. Additionally, in our case we have also matched the Innovation Surveys (IS) to the Economic Activity Survey (EAS). Nonetheless, it could be argued that self-selection may be present or else that there could be a censoring of firms since some firms may report zero expenditure, even if some innovation effort was actually done (e.g. when the magnitude of the resources invested is lower than a certain threshold). We thus estimate the model using the procedure proposed by Heckman (1979). The results, however, support the independence of the models.

In addition, there might also exist selectivity bias linked to the design of the sample. As already mentioned in previous sections, the Uruguayan sample is chosen every year since 2001, according to a stratified sampling model that includes all large firms (employing above 49 workers or reporting revenues above a certain threshold) plus units selected by random sampling within independent additional size strata. Further, even within the small strata there are two economic sectors that have a higher weight in the sample – Food and Chemical Products. As such, our sample design implies that there are firms that must be signalled as certainty sample units. A third possible bias may be present due to our using a balanced panel dataset, so that at least for units with mandatory inclusion the analyses are performed conditional on them having survived along the 10 years period. In this paper we ignore the survival selectivity bias, but we include the sample design correction.

We do not need to estimate a generalized tobit model for the first 2 equations since we have information for all firms irrespective of whether they have been innovative or not. We estimate the equation independently using a probit model as a means of shedding light on the factors that work as incentives to innovate for Uruguayan manufacturing firms from 1998 to 2006. The selection bias correction is performed estimating a weighted regression, as suggested in the recent literature on microeconometric procedures dealing with these issues[48].

In what follows we discuss sequentially the results stemming from the econometric models.

3.5.1 The importance of accounting for sample design

The sample design correction has a significant impact on the estimated coefficients, as can be seen in Tables 3.15 and 3.16 of Appendix F. The conclusions stemming from the estimated models would hence be misleading if the sample design is not accounted for. Even more relevant is that the effect of sample design – if not taken into account – directly impacts the estimated scale effects and returns of innovation output. We find that ignoring sample design corrections changes the significance of variables accounting for size, origin of firms' capital, exporting behavior, capital-labor intensity, productive capacity and labor productivity. The results are in line with the findings of Fazio et al. (2008) since we also find that the bias is larger for the coefficients of those variables that were used in the sample design (as is the case of size) or for those that are highly correlated with sample-design variables (as is the case of full exporting firms, full foreign ownership companies or firms belonging to an economic group). The bias does not disappear if one conditions on these variables, unless a multiplicative scheme is used. Other strongly biased coefficients are those linked to variables that suffer of a measurement error that differs significantly for firms in the different strata defined by the used sampling model (as is e.g. the case of physical capital for small firms).

In the case of the innovation output effects, the impact of ignoring sample design is such that no returns of innovation are found when the innovation output is restricted to processes. Differentiated scale effects between the impact of innovating in processes or in products also disappear. The result is explained by the fact that small firms in the Food and Chemical Products sectors, mostly product-innovative firms, are of mandatory inclusion, so that the weight of the random strata is only 5% in this

[48]See Fazio et al. (2008) and references therein.

case. On the contrary, randomly selected firms are 12% of those innovating only in processes, and there the relevance of the innovation output obtained is substantially lower than that of mandatory inclusion units (0.68 vs. 1.05). Consequently, the over-represented weight given to small random units prevents capturing the actual impact of innovation processes on productivity.

3.5.2 The propensity to innovate

According to our results (see Table 3.11), Uruguayan firms are more prone to innovate the larger their size, the higher the engineers-to-professionals ratio among their employees, the higher their past labor productivity level, the higher their past physical capital to labor intensity and the higher their percentage usage of installed capacity. A further triggering factors is the firm's ability to obtain relevant information from NIS agents. Contrarily, firms' propensity to innovate decreases for firms that are part of a larger economic group, as well as for exporting firms and for those declaring that obstacles at the market level restrain them from pursuing innovation activities. Further, the firm's capital being from national or foreign origin does not affect the company's propensity to innovate.

Regarding the effect of the scale of production – as measured by the firm's size – the evidence shows that larger firms have a greater propensity to innovate, although there are no relative differences among size strata (see marginal effects reported in Table 3.11). Our results find that the firm's capital intensity and the firm's previous labor productivity level are positively related to the propensity to innovate. This seems to point at an innovation behavior that is not triggered by lack of productivity or insufficient capital to labor intensity. On the contrary, those firms that already display high levels of capital to labor intensity and productivity are those seeing innovation activities as a further tool to improve their productivity. Indeed, firms with a highly productive workforce are probably better prepared to leverage and capitalize innovation efforts. This is also consistent with the positive link found between the proportion of engineers and innovation propensity. As expected, a further important factor that increases the odds of a firm seeking for innovation is a high level of usage of the installed capacity, given innovation activities may be understood as activities allowing for the expansion of the firm's productive capacity.

Table 3.11: Innovation Propensity and Innovation Intensity

	Innovation Propensity (dy/dx)	Innovation Intensity
Variables	**All firms**	**Innovative firms**
R&D - Dummy	——	0.8384***
K+H+S - Dummy	——	2.4659***
Training Programmes - Dummy	——	0.2760
EID+CS+TT - Dummy	——	0.4416*
Size: 20-49 workers – Dummy	0.1101	0.7110
Size: 50-149 workers – Dummy	0.2125**	-0.6137
Size: 150 workers & more – Dummy	0.4024***	-0.2417
Foreign ownership - Dummy	0.2150	-1.5979***
Full foreign ownership – Dummy	-0.1158	1.3401***
Economic group – Dummy	-0.1844***	0.5517
Export – Dummy	——	-0.2325
Full export – Dummy	——	0.9268
Exports over sales (%)	-0.1092*	——
Avg.labor productiv.- 1 lag (log)	0.1347***	-0.3412
Capital/Labor - 1 lag (log)	0.0663***	0.0826
Engineers/Professionals firm (%)	0.2078**	0.2793
Productive capacity - % use	0.2255*	——
Formal R&D unit - 1 lag – Dummy	-0.0067	0.5526*
IICI	——	1.7072***
Obstacles: firm - Dummy	0.0658	——
Obstacles: market - Dummy	-0.2633***	——
Obstacles: macro - Dummy	0.0385	——
Information High Relevance - Dummy	0.1300**	——
Financing: External resources - Dummy	——	0.3955
Financing: Related agents (%)	——	-0.3337
Financing: Public sector (%)	——	1.8258
Financing: Banks (%)	——	0.0690
Financing: International (%)	——	-1.6920**
PSUs/Strata[1/]	457/93	457/93
Censored Observ.	——	225
F(k,N-k)[2/]	15.71***	23.40***
Rho[3/]	-0.4233	

Notes: All observations are included in the Innovation Propensity equation, specified as a Probit model and estimated by FIML. Observations in the Innovation Intensity equation are the resulting self-selected innovative units, so that the equation was specified as a Tobit model corrected by selectivity bias and estimated by FIML. Both models used observations weighted by sample design factors. Dummy variables are 1 if the definition of the variable is registered (eg, Export-dummy =1 if exporter). Rates of growth are defined as the difference of logs. Unless stated, variables are ordinal. Dummy variables for economic sectors are included in all equations. *//*** mean coefficients are statistically significant at 90%, 95% and 99% confidence levels, respectively. [1/] "PSUs" are the primary sampling units; "Strata" are those defined in the sampling model used in the surveys. [2/] F-statistic for the overall significance of the model. [3/] "Rho" refers to the estimated correlation coefficient between the main equation and the selection function.**

Firms that are part of a larger – probably international – economic group are less prone to innovate, suggesting that these type of firms in Uruguay do not take part of R&D and innovation behavior decision processes, being the latter defined by other units within the group, probably outside the country. It may also be the case that these companies profit from the innovation output from other firms/units in the network they belong to, making it unnecessary to engage in innovation locally. Finally, the larger a firm's share of exports in total sales, the less its innovation propensity. This suggests that Uruguayan firms that heavily serve the international market have fewer incentives to innovate since they are less capable to generate innovation that is relevant at the international market level.

No industry level differences were found in the propensity to innovate with the exception of two industries – Oil & derivatives and Tobacco – that display larger odds of innovating than the rest. Given that both industry are highly oligopolistic in Uruguay they will have higher returns stemming from innovation and the results are hence aligned with what could be expected.

3.5.3 The intensity of the innovation effort

Once the decision to innovate has been made the resources to be invested in the innovation effort are decided according to several factors. Since the intensity or size of the innovation effort is here measured in terms of the value of sales, it reflects the financial pressure the firm is ready to bear. Implicitly it also accounts for the origin of the financial resources needed, particularly depending on whether these are partially or totally external to the firm.

Since choosing one innovation input over another may have a differentiated effect on the innovation effort – e.g. investing in machinery can be more capital intensive with respect to sales than investing in training – we also include binary variables accounting for the different types of innovation inputs. The degree of diversification/concentration of expenditure among the diverse types of innovative inputs (IICI) is added as a further control of the chosen mix. Binary variables for economic sectors are also included.

Once controlled for the costs of inputs – expected to be the highest for physical capital acquisitions and the lowest for training programmes – we find that a diversified investment lowers the size of the effort needed. In addition, other things being equal, the size of the effort done by firms that invest in R&D is smaller. In other words, firms concentrating their innovation effort in few innovation inputs are spending more than those diversifying their innovation efforts across several types of innovation inputs. This is in line with our initial finding that firms displaying this behavior are primarily investing in physical capital. The comparison of the coefficients for the dummies capturing investments in R&D, K+H+S and EID+TT+CS also support the above results, displaying a higher innovation effort for firms investing in K+H+S, followed by those investing in R&D and then by those investing in EID+TT+CS.

Moreover, once the decision of pursuing innovative activities has been taken, neither firm size, nor being part of a larger economic group, nor being an exporter, nor previous capital-to-labor intensity, nor the firm's talent composition or past productivity affect the extent of the firm's innovation effort. That is, the financial effort devoted to innovation activities does not depend on the production factors intensity, nor on their relative quality or the firm's scale of production (see Table 3.11). This can be interpreted as that once firms have decided to innovate, the size of the innovation effort becomes a fully financial decision that relates to the existence of a formal R&D unit, the concentration for the innovation expenditure and the type of innovation inputs chosen for the investment.

The only firm attribute that still plays a role in the determination of the innovation effort is the share of foreign in total capital. Being the effect negative, it disappears whenever the firm is fully foreign. The most likely explanation for this result is linked to the relatively greater expected complexity of the decision making process in mixed capital firms.

The results for the variables referring to financial sources for the innovation effort displayed show no differences between exclusively internal and external sources, unless the external source are international institutions. In the latter case the effort would be smaller the larger the share of international resources in total financial aid. This would contradict the findings by Raffo et al. (2008) that having access to foreign networks, capital or technology is key for firms in developing countries to pursue innovation activities.

3.5.4 Input-Output equations

The here estimated input-output equation reflects the impact of the innovation effort on the extent and relevance of the innovation output obtained, if any, taking into account firm-specific attributes. We also control for the role that NIS agents may have on the relevance of the innovation output attained, both regarding the type of link established and the providing agent. The effects found aim at capturing likely bottlenecks in the innovative behavior of firms, as well as the relative efficiency of the diverse NIS agents. Binary variables for economic sectors are also included.

All other things being equal, the size of the effort devoted to innovation activities has a positive effect on the relevance of the innovation output obtained – according to our results (see Table 3.12) the size of the effort should be increased by 11% in order to increase the relevance of the innovation output obtained by 1%. It is noteworthy that according to our findings, the relevance of the innovation output obtained after having devoted a certain financial effort is higher the more diversified the input mix chosen. This signals at the existence of technological complementarities and it supports the intuition that diversifying the innovation effort reduces the innovation risk of obtaining no or less relevant output, in analogy to portfolio diversification.

Having a formal R&D unit inside the firm or having established links with NIS agents, especially if seeking for R&D assistance, further enhance the degree of relevance of the innovation output obtained. Firms that are more capital intensive tend to attain innovation output of higher relevance than labor intensive units, as well as large and medium companies relative to small units. Unexpectedly, micro firms (with less than 19 workers) seem to obtain a more relevant innovation output in 2006, other things being equal, than small establishments (20 to 49 workers). A likely reason explaining the result is that in order to survive the 2002 financial crisis, micro firms were forced to reconvert by means of introducing novel products and/or procedures[49]. At the same time medium-sized innovative firms decided to innovate in processes – rather than in products – to e.g. improve cost efficiency and this may have reduced the relevance of their innovation output (from a market perspective).

[49]Note that we are only analyzing the behavior of those micro firms that report information for the whole 1998-2006.

Table 3.12: Innovation Output and Productivity

	Innovation Output	Productivity Growth
Variables	Firms with Innovative Output	All firms
Total Innov. Exp./Sales (log)	0.0909***	——
Innov. Output - Products (log)	——	0.0486***
Innov. Output - Only Process (log)	——	0.1328***
IICI	-0.3807**	——
Innovation in Products – Dummy	——	0.1208
Only Inn. Processes – Dummy	——	-0.1226
Only Inn. Non-product. Process – Dummy	——	-0.5510**
Inn. in Productive Process – Dummy	——	-0.2905*
Inn. in Commercialization Process – Dummy	——	0.2317**
Inn. in Organization Process – Dummy	——	-0.1974
Capital/Labor – Rate of Growth	——	0.0771*
Labor – Rate of Growth	——	-0.2758**
Size: 20-49 workers – Dummy	-0.6088***	0.1202
Size: 50-149 workers – Dummy	-0.3782***	0.2274**
Size: 150 workers & more – Dummy	-0.2846**	0.1865*
Engineers/Professionals firm (%)	0.0477	——
Formal R&D unit - 1 lag – Dummy	0.4591***	——
Share of foreign capital (%)	-0.2656	——
Full foreign ownership – Dummy	0.3987**	——
Full exporter – Dummy	0.6277**	——
Exports over sales (%)	0.1133	——
Avg.labor productivity - 1 lag (log)	——	-0.4424***
Capital/Labor - 1 lag (log)	0.0907***	——
Productive capacity – % use	——	-0.2600*
Link with NIS agents – Dummy	0.4185***	——
Link: Technical assistance – Dummy	0.1020	——
Link: R&D – Dummy	0.3246***	——
Link: Training – Dummy	-0.0350	——
Link: Information – Dummy	-0.0666	——
PSUs/Strata[1/]	233/69	453/93
F(k,N-k)[2/]	52.73***	42.48***

Notes: Observations included in the Innovation Output equation, specified as a Tobit model and estimated by FIML, refer only to innovative firms. In the Productivity growth equation all firms are included, the model being specified as a dynamic linear regression and estimated by FIML. Both models use observations weighted by sample-design factors. Rates of growth are defined as the difference in log values. Unless stated, variables are ordinal. Dummy variables for economic sectors are included in all equations. The first 3 variables in the Table refer to predicted values. *//*** mean coefficients are statistically significant at 90%, 95% and 99% confidence levels, respectively.**

[1/] "PSUs" are the primary sampling units; "Strata" are those defined in the sampling model used in the surveys. [2/] F-statistic for the overall significance of the model.

A final result shows that full-exporting firms reach a higher degree of relevance in the innovation output they obtain, an expected result since they operate only in the international market. Probably due to the same reason, the same result is observed for firms that are fully owned by foreign enterprises.

Individual effects by industry are significant, so that not only the effort displayed by firms is different according to industry, but also the degree of relevance of the output obtained is not homogeneous.

3.5.5 Productivity growth

The impact the innovative behavior of firms has on labor productivity growth is captured by specifying a Cobb-Douglas production technology, in which the accumulated innovation output enters exponentially as a third factor of production. The predicted value of the index accounting for the relevance of innovation output estimated in the input-output equation is added linearly to the log growth of productivity.

We split the index in two, depending on whether the innovation output involves products or on whether it only includes processes. We also control for scale effects of the diverse types of innovation output reported in the surveys and for the cases in which only innovative non-technological processes were obtained. The extent of productive capacity usage, the scale of production and individual effects associated to unobservable industry characteristics are also included as determinants of productivity growth. We add the level of labor productivity in the previous period in order to allow for adjustment costs.

The resulting technology exhibits decreasing returns to scale (see Table 3.12). However, the result may be an underestimation of the actual returns due to miss-measurement of the physical capital stock, which may explain the low resulting product elasticity (0.08). On the other hand, the result obtained for the labor elasticity is quite reliable (0.64). Nonetheless, a low elasticity of physical capital would reinforce the starring role of the workforce's skill-level, as a key driver for engaging in innovative activities. As expected, increases in productivity decelerate the closer the firm is to full capacity and the smaller the scale of production, given the relative labor intensity of units of different sizes. The growth rate of productivity is not identical, *ceteris paribus*, by industry.

The results reveal that the returns to innovation for Uruguayan firms are significantly positive and of a much larger size for only processes than for product innovation. A 10% increase in the degree of relevance of the innovative product, evaluated at the mean value – 6.15 – would generate an increase in the growth rate of labor productivity of 3%. In the case of firms innovating only in processes, the figure raises to 5% (the mean value of the indicator for processes is 3.7)[50]. This result further supports our initial hypothesis on the key role of accounting for process innovation, at least for a small, developing country like Uruguay. Regarding scale effects, the coefficients

[50] The difference between the effect on productivity for innovation in products and for innovation in processes is statistically significant.

show that the importance of product and of productive processes is smaller relative to that of commercialization practices. Still, only a small number of firms innovate in its commercialization strategies, suggesting that most Uruguayan firms pursue mediocre – non-innovative – strategies for commercializing their products. Given the important effect of innovating in commercialization processes Uruguayan firms should seek more this type of innovation. This would also allow them to overcome the – rather unfavorable – international positioning of Uruguay as a country and avoid that it constitutes a restriction for their firm's performance. On the opposite, innovating only in non-productive processes generates a negative impact on productivity growth.

Given the above results we consider that neglecting process-innovation when looking at innovation's impact on productivity, is very likely to be one of the reasons why previous research for developing countries has failed to find a significant effect of innovation on firm productivity.

3.6 Conclusions

It has been suggested that scarce investment, particularly if related to novel activities, is one likely cause explaining the meagre performance of the Uruguayan economy in terms of its *per capita* growth rates along the last decades. Some recent studies have hypothesized that risk aversion, lack of financial support and inadequate public policies may explain the gap between the state of the art in the country and the technology frontier. The evidence here summarized, however, points at a different explanation for the existence of the mentioned gap. Our explanation relates it to firms' low internal efficiency – as partially captured in Bianchi et al. (2008) with respect to human resources – and to the use of a sub-optimal innovation inputs mix. Given the latter, firms are probably disregarding the existence of complementarities among innovation inputs and hence missing the potential gains stemming from innovation diversification. Firms not taking advantage of the existence of complementarities among different types of innovation output may also explain the low frequency of firms exclusively innovating on product and productive processes (TPP). Moreover, according to our results the innovation in productive processes obtained by Uruguayan firms have a negative scale effect on labor productivity.

On the opposite, those firms that restrict innovation to processes do generally generate innovation on both productive and non-technological processes, generating gains in their labor productivity growth that are almost twice the size of the return to innovative products. Further, there are positive scale effects on the dynamics of productivity stemming from innovative commercialization practices. The fact that the share of innovative firms that innovate in commercialization processes is low, suggests that a likely obstacle Uruguayan firms face to achieve a better firm performance is the lack of optimal commercialization strategies. Data for 2006 further supports this hypothesis, as it shows that an increasing number of firms that are able to establish cooperation agreements do include the design of adequate commercialization practices among the issues of interest.

The relative lag shown by the innovation behavior of Uruguayan manufacturing industries with respect to firms in other countries is not a consequence of Uruguayan firms rarely engaging in innovative activities, but of the low degree of relevance that Uruguayan firms generally attain with their innovation output. A partial explanation for this relates to that the bulk of the innovation output obtained is process innovation. This behavior is probably linked to the goal sought by firms through innovation. Product innovation is mostly a means of increasing market share, while innovation in processes is intended to reduce costs maintaining the scale and level of production.

An additional contribution of this paper relates to unraveling that many of the results reported by the existing literature – signalling at no input-output relations and no returns to innovation in developing countries – are most likely the consequence of improperly specifying the mechanisms at work. Two major shortcomings relate to the joint treatment of processes and product innovation and to not accounting for the differences in the degree of relevance of the innovation output. In addition, given that those empirical studies lack a sample design correction – which is an omission that we demonstrated generates biases of significant size in many estimated parameters – it is difficult to assess which of these shortcomings(if not both) are affecting these studies' results.

Based on our descriptive analysis we find that the decreasing time trend registered in the propensity to innovate among firms surveyed from 1998 to 2006 is mainly driven by small units and by non-national firms that had formerly focused on innovative products. The share of product innovative firms in total firms diminishes in time, since large local units switch from innovation in products to innovation in processes. Contrarily, the number of exporting and non-nationally owned firms innovating in products increase during this period. Large enterprises, concentrated in a few industries – Food, Textiles, Chemicals and Machinery & Equipment – are the core innovators in terms of obtaining internationally relevant innovation output.

Further we find that most innovative firms do get an innovation output and in addition our findings shows there are significant returns to innovation in terms of labor productivity. The apparently counter-cyclical innovation behavior of small firms is the result of their strategy of innovating in processes during difficult times. Innovating in processes is used by most firms as a means of reducing costs to overcome the decline in local demand, given their inability to attain innovative products at the international level.

We find that the main firm attributes increasing the likelihood of a firm engaging in innovation activities are a high internal efficiency level, high skill and productivity levels of its workforce, a physical capital intensive technology, a large scale of production, having established links with NIS agents for information, and belonging to international networks that would ease the firm's access to high level technologies. The finding are aligned with the increasing trend in Uruguay seeking for a professionalisation of innovation activities, both in terms of sources of information and of financial aid agents. Contrarily to general belief, the exporting intensity of sales is negatively related to the propensity to innovate, possibly due to the inability of those firms to obtain an internationally relevant innovation output.

The evidence also suggests that firms are disregarding some potential key factors when investing in innovation inputs. According to our results, the financial effort needed to achieve the same type and amount of innovation output, could be reduced if firms would diversify the innovation input mix that they use, increasing the share of R&D in total innovation investment and relying less on physical capital as the main innovation input. This pattern may be also related to the degree of competitiveness of the market in which firms operate, the weight assigned to research and engineering and industrial design being larger the more concentrated the market. This result is also in line with the fact that firms are less prone to innovate when the main obstacles stem from the market.

Firms related to NIS agents are mainly looking for technological assistance and information, irrespective of their size or their innovative character. It is interesting to note that this behavior is increasing in time for small firms, while large enterprises have started to progressively associate with NIS agents looking also for support in their training programmes. This is consistent with the increase in the number of large firms that switched from product to process innovation. Moreover, we find that those firms that established a link to NIS agents, particularly when seeking for collaboration in their R&D efforts, are better able to generate a more relevant innovation output. Our results hence discard a failure of the NIS in terms of the quality of the advice provided.

Financial aid is surprisingly not among the most important objectives sought through links with NIS agents, neither for large nor for small firms. The behavior of small firms, however, suggests that they are not able to fully access or take advantage of NIS agents' assistance. In fact, although most small firms declare that the lack of financial aid is an important obstacle to innovation, they do not seek for financial aid through NIS agents.

Given the above, policy action should be focused on generating and spreading relevant information on the relative effects of innovative activities of different nature and on how to define an optimal input mix in order to obtain the needed type of innovation output. The generation and publication of this type of information may be done by existing public institutions devoted to research. An alternative recommendation is to focus on easing the channels through which information is transmitted from public and private agents devoted to research to the relevant productive actors.

Furthermore, and given that innovative processes are the most relevant type of innovation output to boost productivity, the evidence suggests that Uruguayan firms are below their optimum efficiency level, being unable to leverage their product innovation. This entails the recommendation for NIS agents of aiding local firms to improve their internal procedures before pursuing other type of innovation activities. Policy actions should therefore devote efforts to introducing incentives for improving process efficiency at the firm internal level before supporting any other innovative activities, as e.g. investing in innovative capital or R&D. One could think of developing conditioned loans for firms, compelling firms to first adjust and improve their processes before granting financial aid devoted to product innovation.

A further bottleneck is related to the inability of firms to develop adequate commercialization strategies, an obstacle that NIS agents can help to overcome, for example by easing the linkages between national entrepreneurs and foreign potential clients through commercial representatives in foreign countries.

As a first approach to the innovative behavior of Uruguayan firms, the research here summarized has made use of a simplified theoretical frame that prevents to capture several dimensions that may be key for thoroughly understanding the mechanisms at work. A first topic refers to the need of sophisticating the rationale underlying the decision to innovate, endogenizing it by means of linking it to the overall performance of the firm. The issue should not be disregarded in the case of Uruguay given the goals pursued with innovation, as declared by firms.

Secondly, future empirical models should include a formalization that explains how innovative inputs are combined for obtaining each type of output by means of the so called knowledge production function. In order to gain accuracy in the quantification of the magnitude of the actual returns of innovation, it would be highly recommended to investigate the mechanisms through which the diverse innovation processes and products interact to generate the additional production factor. Finally, more work has to be done regarding the use of methodologies that fully account for the actual sampling models and other characteristics of the available information sets. The results here obtained reveal that the effect of neglecting this dimension of the analysis is significant. A key facet relates to the modeling of the process as a simultaneous instead of as a recursive system, incorporating also the dynamics underlying innovation practices. These dynamics are linked both to analyzing the existence of an optimum time path depending on the input and output mixes observed, as well as to the eventual productivity gains in terms of the innovation output itself.

Bibliography

Alexander, D., L. Floyd, and L. Linkins (1995). Innovation, R&D Productivity, and Global Market Share in the Pharmaceutical Industry. *Review of Industrial Organization 10*(2), 197–207.

Arocena, R. and J. Sutz (2008). Uruguay: Higher Education, National System of Innovation and Economic Development in a Small Peripheral Country. Discussion Paper Series Paper no. 3, Research Policy Institute, Lund University, Swiden, UniDev http://ssrn.com/paper=975891 (accessed December 20, 2009).

Arundel, A., L. Chervenic-Poeth, and R. Kemp (2003). National Survey Results: The Dutch survey. In K. Rennings and T. Zwick (Eds.), *Employment Impacts of Cleaner Production*, ZEW Economic Studies 21, Chapter 4, pp. 229–266. Heidelberg, DL: Physica-Verlag.

Benavente, J. (2004). Innovación Tecnológica en Chile: Dónde Estamos y Qué se Puede Hacer. Documento de Trabajo no. 295, Banco Central de Chile.

Bianchi, C. and N. Gras (2005). Economic behaviour and economic performance in the Uruguayan Manufacturing Industry 2001-2003. Working Paper, CSIC, Uruguay.

Bianchi, C., N. Gras, and J. Sutz (2008). Make, buy and cooperate in innovation: evidence from Uruguayan manufacturing surveys and other innovation studies. Included in the report: R&D cooperation and appropriability in Latin American Innovation strategies: empirical evidence and policy implications from National Innovation Surveys, ECLA-IDRC.

Bértola, L., C. Bianchi, P. Darsht, A. Davyt, L. Pittaluga, N. Reig, C. Roman, M. Snoeck, and H. Willebald (2005). Ciencia, Tecnología e Innovación en Uruguay: diagnóstico, prospectiva y políticas. Documento de Trabajo del Rectorado no. 26, Universidad de la República, Uruguay.

Cainelli, G. (2008). Spatial Agglomeration, Technological Innovations, and Firm Productivity: Evidence from Italian Industrial Districts. *Growth and Change 39*(3), 414–435.

Cassiolato, J., H. Lastres, and M. Maciel (Eds.) (2003). *Systems of Innovation and Development: Evidence from Brazil*. Cheltenham, UK: Edward Elgar Publishing.

Castellani, D. and A. Zanfei (2007). Internationalisation, Innovation and Productivity: How Do Firms Differ in Italy? *World Economy 30*(1), 156–176.

Chang, C. and S. Robin (2004). Innovation Strategy and Total Factor Productivity Growth : Micro Evidence from Taiwanese Manufacturing Firms. IRES Discussion Paper no. 007, Institut de Recherches Economiques et Sociales, Universite catholique de Louvain, Belgium.

Chudnovsky, D., A. Lopez, and G. Pupato (2006). Innovation and productivity in developing countries: A study of Argentine manufacturing firms' behavior (1992-2001). *Research Policy 35*(2), 266–288.

Cohen, W. and S. Keppler (1992). The Anatomy of Industry R&D Intensity Distributions. *American Economic Review 82*(4), 773–799.

Crépon, B., E. Duguet, and J. Mairesse (1998). Research, Innovation, and Productivity: An Econometric Analysis at the Firm Level. NBER Working Paper 6696, National Bureau of Economic Research.

Czarnitzki, D. and N. O'Byrnes (2007). R&D, Innovation and the Impact on Productivity in Flanders. *Tijdschrift voor Economie en Management 52*(2), 199–216.

Denison, E. (1985). *Trends in American Economic Growth, 1929-1982*. Washington, D.C., US: Brookings Institution.

Fazio, G., H. Lam, and F. Ritchie (2008). Sample bias in microeconometric analyses of official data. Office for National Statistics, UK http://www.scientificcommons.org/40659044 (accessed April 1, 2009).

Goedhuys, M. (2007). The Impact of Innovation Activities on Productivity and Firm Growth: Evidence from Brazil. UNU-MERIT Working Papers no. 2, United Nations University - Maastricht Economic and social Research and training center on Innovation and Technology.

Griffith, R., E. Huergo, J. Mairesse, and B. Peters (2006). Innovation and Productivity Across Four European Countries. *Oxford Review of Economic Policy 22*(4), 483–498.

Griffith, R., S. Redding, and H. Simpson (2004). Foreign Ownership and Productivity: New Evidence from the Service Sector and the R&D Lab. *Oxford Review of Economic Policy 20*(3), 440–456.

Griliches, Z. (1979). Issues in Assessing the Contribution of Research and Development to Productivity Growth. *Bell Journal of Economics 10*(1), 92–116.

Hall, B. and A. Maffioli (2008). Evaluating the impact of technology development funds in emerging economies: evidence from Latin America. *European Journal of Development Research 20*(2), 172–198.

Hall, B. and J. Mairesse (2006). Empirical studies of innovation in the knowledge-driven economy. *Economics of Innovation and New Technology, Taylor and Francis Journals 15*(4-5), 289–299.

Hausmann, R., A. Rodríguez-Clare, and D. Rodrik (2005). Towards a Strategy for Economic Growth in Uruguay. Economic and Social Studies Series RE1-05-003, Inter-American Development Bank.

Heckman, J. (1979). Sample Selection Bias as a Specification Error. *Econometrica 47*(1), 153–161.

Hernandez, I. (2005). Legal Form, Innovation and Productivity of Firms within Colombian Manufacturing Industry. *Cuadernos de Economia (National University of Colombia) 24*(42), 135–60.

Huergo, E. and J. Jaumandreu (2004). Firms' Age, Process Innovation and Productivity Growth. *International Journal of Industrial Organization 22*(4), 541–59.

Janz, N., H. Lööf, and B. Peters (2004). Firm Level Innovation and Productivity : Is there a Common Story Across Countries? Discussion Paper no. 03-26, ZEW - Zentrum für Europäische Wirtschaftsforschung / Center for European Economic Research. http://opus.zbw-kiel.de/volltexte/2003/1020/pdf/dp0326.pdf.

Jefferson, G., B. Huamao, G. Xiaojing, and Y. Xiaoyun (2006). R&D Performance in Chinese Industry. *Economics of Innovation and New Technology 15*(4-5), 345–366.

Lee, K. and S. Kang (2007). Innovation Types and Productivity Growth: Evidence from Korean Manufacturing Firms. *Global Economic Review 36*(4), 343–359.

Lööf, H. and A. Heshmati (2002). Knowledge Capital and Performance Heterogeneity: a Firm-Level Innovation Study. *International Journal of Production Economics 76*(1), 61–85.

Llorca-Vivero, R. (2002). The Impact of Process Innovations on Firm's Productivity Growth: The Case of Spain. *Applied Economics 34*(8), 1007–1016.

Lopez, A. and E. Orlicki (2006). ¿quién patenta en la Argentina? Un análisis econométrico para el sector manufacturero. Proyecto OMPI-CEPAL, Sistemas de Propiedad Intelectual y Gestión Tecnológica en Economías Abiertas: una Visión Estratégica para América Latina y el Caribe.

Los, B. and B. Verspagen (2000). R&D Spillovers and Productivity: Evidence from U.S. Manufacturing Microdata. *Empirical Economics 25*, 127–148.

Mairesse, J. and M. Sassenou (1997). R&D Productivity: A Survey of Econometric Studies at the Firm Level. NBER Working Paper 3666, National Bureau of Economic Research. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=227437.

Masso, J. and P. Vahter (2008). Technological Innovation and Productivity in Late-Transition Estonia: Econometric Evidence from Innovation Surveys. Working Paper 61-2008, The University of Tartu Faculty of Economics and Business Administration.

Mohnen, P., J. Mairesse, and M. Dagenais (2006). Innovativity: A Comparison across Seven European Countries. *Economics of Innovation and New Technology, Taylor and Francis Journals 15*(4-5), 391–413.

Pakes, A. and Z. Griliches (1984). Patents and R&D at the Firm Level: A First Look. In G. Z (Ed.), *R&D, Patents, and Productivity*, pp. 55–72. Chicago, IL, US: University of Chicago Press.

Pérez, P., G. Dutrénit, and F. Barceinas (2005). Actividad Innovadora y Desempeño Económico: un análisis econométrico del caso mexicano. In M. Albornoz and D. Ratto (Eds.), *Indicadores de Ciencia y Tecnología en Iberoamerica. Agenda 2005*, pp. 299–318. Buenos Aires, AR: RICYT.

Raffo, J., S. Lhuillery, and L. Miotti (2007). Northern and southern innovativity: a comparison across European and Latin American countries. *The European Journal of Development Research 20*(2), 219–239.

Raffo, J., S. Lhuillery, and L. Miotti (2008). Northern and southern innovativity: a comparison across European and Latin American countries. *The European Journal of Development Research 20*(2), 219–239.

Rao, S., J. Tang, and W. Wang (2002). The Importance of Skills for Innovation and Productivity. *International Productivity Monitor 4*, 15–26.

Roud, V. (2007). Firm-level Research on Innovation and Productivity: Russian Experience. Institute of Statistical Studies and Economics of Knowledge, Higher School of Economics Moscow, Russian Federation.

Stoevsky, G. (2005). Innovation and Business Performance of Bulgarian Companies (structural econometric analysis at firm level). Economic Research and Projections Directorate Working Paper, Bulgarian National Bank.

Tang, J. and C. Le (2007). Multidimensional Innovation and Productivity. *Econ. Innov. New Techn. 16*(7), 501–516.

Theil, R. (1954). *Linear Aggregation of Economic Relations*. Amsterdam, NL: North-Holland Publishing Company.

Tsai, K. and J. Wang (2004). The R&D Performance in Taiwan's Electronics Industry: A Longitudinal Examination. *R&D Management 34*(2), 179–189.

Van Leeuwen, G. and L. Klomp (2006). On the contribution of innovation to multifactor productivity growth. *Economics of Innovation and New Technology, Taylor and Francis Journals 15*(4-5), 367–390.

Appendix E: Description of Variables

Table 3.13: List and definition of independent variables

Variable Name	Definition
R&D - Dummy	Binary variable equal to 1 if the firm invested in R&D
K+H+S - Dummy	Binary variable equal to 1 if the firm invested in Capital, Hardware or Software
Training Programmes - Dummy	Binary variable equal to 1 if the firm invested in Training Programmes
EID+CS+TT - Dummy	Binary variable equal to 1 if the firm invested in Engineering & Industrial Design, Technology Transfers or Consultancy Services
Innovation in Products– Dummy	Binary variable equal to 1 if the firm obtained an innovative product
Only Inn. Processes– Dummy	Binary variable equal to 1 if the firm only obtained innovative processes
Only Inn. Non-product. Process– Dummy	Binary variable equal to 1 if the firm only obtained non-productive innovative processes
Inn. in Productive Process– Dummy	Binary variable equal to 1 if the firm obtained productive processes
Inn. in Commercialization Process– Dummy	Binary variable equal to 1 if the firm obtained commercialization processes
Inn. in Organization Process– Dummy	Binary variable equal to 1 if the firm obtained organisation processes
Size: 20-49 workers – Dummy	Binary variable equal to 1 if the firm's workforce is between 20 and 49 workers
Size: 50-149 workers – Dummy	Binary variable equal to 1 if the firm's workforce is between 50 and 149 workers
Size: 150 workers & more – Dummy	Binary variable equal to 1 if the firm's workforce is above 150 workers
Foreign ownership – Dummy	Binary variable equal to 1 if the firm is partly or fully foreign owned
Share of foreign capital (%)	Percentage share of foreign capital in total capital
Full Foreign ownership – Dummy	Binary variable equal to 1 if the firm is fully foreign owned
Economic group – Dummy	Binary variable equal to 1 if the firm is part of a wider group of firms
Export – Dummy	Binary variable equal to 1 if the firm is an exporter (EAS)
Full export – Dummy	Binary variable equal to 1 if the firm is exports 100% of its production (EAS)
Exports over sales (%)	Proportion of exports over total sales in 2006 pesos (EAS)
Capital/Labor - Rate of Growth	Log growth of capital-labor intensity from previous to current period (EAS)
Labor - Rate of Growth	Log growth of employment from previous to current period
Average labor productivity - 1 lag (log)	Log average labor productivity in previous time period (EAS)
Capital/Labor - 1 lag (log)	Log of physical capital-labor intensity in 2006 pesos (EAS)
Engineers/Professionals firm (%)	Percentage of engineers in the total number of the firm's employed professionals
Productive capacity - % use	Percentage usage of the firm's installed capacity
Formal R&D unit - 1 lag – Dummy	Binary variable equal to 1 if the firm had a formal R&D unit in the previous period
IICI	Innovation Input Concentration Indicator as defined in Chapter 4
Obstacles: firm - Dummy	Binary variable equal to 1 if the firm considered any firm related obstacles as highly affecting its developing innovation activities (Scarce specialized labor; Organizational rigidity; Innovation associated risks; too wide time horizon to obtain returns on innovation)
Obstacles: macro - Dummy	Binary variable equal to 1 if the firm considered any macroeconomic obstacles as highly affecting its developing innovation activities (Small market size; Scarce technological opportunities in the firm's industry; Difficulty accessing financing sources; Scarce cooperation opportunities with other firms and institutions; Easy replicability of product by competitors)
Obstacles: market - Dummy	Binary variable equal to 1 if the firm considered any market related obstacles as highly affecting its developing innovation activities (Insufficient information on markets or on technological opportunities; Insufficient public policies promoting Science and Technology (S&T); Scarce development of institutions related to S&T; Inadequate physical infrastructure; Insufficient guarantees in Intellectual Property Rights; Macroeconomic instability)
Information High Relevance - Dummy	Binary variable equal to 1 if the firm marked a source of information as being highly relevant for its innovation activities (Internal information sources; Vendors; Clients; Related firms; Competitors; Universities, Technological R&D centers; Consultants and experts; Fairs and conferences; Journals; Databases; Internet; Parent company.)
Financing: External resources - Dummy	Binary variable equal to 1 if the firm financed its innovation activities through external financing sources
Financing: Related agents (%)	Percentage of resources stemming from related agents in total resources used for innovation activities
Financing: Public sector (%)	Percentage of resources stemming from the public sector in total resources used for innovation activities
Financing: Banks (%)	Percentage of resources stemming from banks and financial institutions in total resources used for innovation activities
Financing: International (%)	Percentage of resources stemming from international institutions in total resources used for innovation activities
Link with NIS agents – Dummy	Binary variable equal to 1 if the firm had a link with any NIS agent
Link: Technical assistance - Dummy	Binary variable equal to 1 if the firm had a link with NIS agents seeking technical assistance
Link: R&D – Dummy	Binary variable equal to 1 if the firm had a link with NIS agents seeking R&D
Link: Training – Dummy	Binary variable equal to 1 if the firm had a link with NIS agents seeking training
Link: Information - Dummy	Binary variable equal to 1 if the firm had a link with NIS agents seeking information

Table 3.14: Descriptive Statistics

Variables - All firms	**Mean**	**Std.Dev.**	**Min**	**Max**	**Obs.**
Total Innov. Exp./Sales (log)	-4.297	1.684	-9.291	0.060	239
Innovation output (log)	1.499	0.761	0.288	3.586	240
Productivity Growth	0.196	0.801	-3.299	5.086	494
Engineers/Professionals firm	0.225	0.288	0	1	494
Export intensity	0.216	0.337	0	1	494
Share of foreign capital	0.132	0.332	0	1	494
Avg.labor productivity (log)	0.012	0.914	-3.694	5.095	459
Capital/Labor (log)	0.012	0.801	-3.299	5.095	455
Labor - Rate of Growth	0.138	0.351	-2.833	1.804	494
Capital/Labor - Rate of Growth	12.376	1.159	7.007	17.225	494
Productive capacity - % use	0.760	0.221	0.010	1	494
IICI	0.216	0.404	0	1	494
Product innovative firms	**Mean**	**Std.Dev.**	**Min**	**Max**	**Obs.**
Total Innov. Exp./Sales (log)	-4.016	1.545	-8.148	-1.370	134
Innovation output (log)	1.874	0.607	0.888	3.586	136
Productivity Growth	0.101	0.758	-1.386	4.465	136
Engineers/Professionals firm	0.326	0.289	0	1	136
Export intensity	0.256	0.338	0	1	136
Share of foreign capital	0.217	0.405	0	1	136
Avg.labor productivity (log)	12.818	1.170	7.007	17.225	136
Capital/Labor (log)	12.886	1.114	9.353	15.731	131
Labor - Rate of Growth	0.241	0.257	-0.422	1.184	136
Capital/Labor - Rate of Growth	0.065	0.737	-1.737	2.596	131
Productive capacity - % use	0.771	0.205	0.010	1	136
IICI	0.619	0.306	0	1	136
Only Process innovative firms	**Mean**	**Std.Dev.**	**Min**	**Max**	**Obs.**
Total Innov. Exp./Sales (log)	-4.632	1.811	-9.292	0.060	101
Innovation output (log)	1.009	0.659	0.288	2.903	104
Productivity Growth	0.082	0.672	-2.818	1.938	104
Engineers/Professionals firm	0.294	0.289	0	1	104
Export intensity	0.261	0.366	0	0.990	104
Share of foreign capital	0.165	0.357	0	1	104
Average labor productivity (log)	12.725	0.910	10.606	14.920	104
Capital/Labor (log)	12.683	1.247	9.168	15.488	102
Labor - Rate of Growth	0.152	0.339	-1.022	1.804	104
Capital/Labor - Rate of Growth	-0.046	0.819	-2.504	3.208	102
Productive capacity - % use	0.793	0.191	0.300	1	104
IICI	0.766	0.286	0	1	104

Notes: A Detailed description of IICI characteristics follows in Chapter 4.

Appendix F: Effects on the estimation of ignoring sample design corrections

Table 3.15: Innovation Propensity and Innovation Intensity equations

	Innovation Propensity (dy/dx)	Innovation Propensity (dy/dx)	Innovation Intensity	Innovation Intensity
Variables	**Model 1**	**Model 2**	**Model 1**	**Model 2**
R&D - Dummy	——	——	0.6434***	0.8384***
K+H+S - Dummy	——	——	1.9141***	2.4659***
Training Programmes - Dummy	——	——	0.0509	0.2760
EID+CS+TT - Dummy	——	——	0.7756***	0.4416*
Size: 20-49 workers – Dummy	**0.1745****	**0.1101**	-0.7176	0.7110
Size: 50-149 workers – Dummy	0.2608***	0.2125**	**-1.4452****	**-0.6137**
Size: 150 workers & more – Dummy	0.3753***	0.4024***	**-1.4518***	**-0.2417**
Foreign ownership- Dummy	0.0880	0.2150	-1.3270***	-1.5979***
Multinational Firm– Dummy	-0.0074	-0.1158	1.1842**	1.3401***
Economic group – Dummy	**-0.0565**	**0.1844*****	0.4779	0.5517
Export – Dummy	——	——	-0.3601	-0.2325
Full export – Dummy	——	——	**1.0944***	**0.9268**
Exports over sales (%)	**0.0748**	**-0.1092***	——	——
Avg.labor productiv.- 1 lag (log)	**0.0459**	**0.1347*****	-0.1340	-0.3412
Capital/labor - 1 lag (log)	**0.0296**	**0.0663*****	0.0801	0.0826
Engineers/Professionals firm (%)	0.2442**	0.2078**	-0.3875	0.2793
Productive capacity - % use	**0.0844**	**0.2255***	——	——
Formal R&D unit - 1 lag – Dummy	0.0499	-0.0067	0.4346*	0.5526*
IICI	——	——	1.1861**	1.7072***
Obstacles: firm - Dummy	0.0442	0.0658	——	——
Obstacles: market - Dummy	**-0.1074**	**-0.2633*****	——	——
Obstacles: macro - Dummy	-0.0291	0.0385	——	——
Information High Relevance - Dummy	0.1678**	0.1300**	——	——
Financing: External resources - Dummy	——	——	0.4685	0.3955
Financing: Related agents (%)	——	——	-0.3028	-0.3337
Financing: Public sector (%)	——	——	1.3701	1.8258
Financing: Banks (%)	——	——	-0.3543	0.0690
Financing: International (%)	——	——	-2.3024***	-1.6920**
PSUs/Strata[3/]	457/—-	457/93	457/—-	457/93
Censored Observ.	——	——	225	225
F(k,N-k)[4/]	52.73***	15.71***	143.9***	23.40***
Rho[5/]	**-0.898****	**-0.4233**	——	——

Notes: Coefficients that are statistically significant in one model and non-significant in its counterpart are highlighted in bold. "Model 1" refers to the equation estimated with HCSE (White, 1980) and no sample design correction; "Model 2" is the same equation but including the sample design correction; "PSUs" are the primary sampling units; "Strata" are those defined in the sampling model used in the surveys; "F-statistic" for the overall significance of the model/ Chi-2 in column 3; "Rho" refers to the estimated correlation coefficient between the main equation and the selection function.

Table 3.16: Innovation Output and Productivity equations

	Innovation Output	Innovation Output	Productivity Growth	Productivity Growth
Variables	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Total Innov. Exp./Sales (log)	0.1312	0.0909***	——	——
Innov. Output – Products (log)	——	——	0.0369**	0.0486***
Innov. Output – Only Process (log)	——	——	**0.0451**	**0.1328*** **
IICI	-0.3618**	-0.3807**	——	——
Innov. Products – Dummy	——	——	-0.0115	0.1208
Only Inn. Processes – Dummy	——	——	0.0509	-0.1226
Only Inn. Non-product. Process – Dummy	——	——	**-0.0577**	**-0.5510*** *
Inn. Product. Process – Dummy	——	——	**-0.0546**	**-0.2905***
Inn. Commerc. Process – Dummy	——	——	0.2029*	0.2317**
Inn. Organisat. Process – Dummy	——	——	**-0.2029*** *	**-0.1974**
Capital/Labor – Rate of Growth	——	——	0.0972**	0.0771*
Labor – Rate of Growth	——	——	-0.2743**	-0.2758**
Size: 20-49 workers – Dummy	**-0.2839**	**-0.6088*** **	-0.0478	0.1202
Size: 50-149 workers – Dummy	**-0.1928**	**-0.3782*** **	**-0.0048**	**0.2274*** *
Size: 150 workers & more – Dummy	**-0.0247**	**-0.2846*** *	**-0.0534**	**0.1865***
Engineers/Professionals firm (%)	0.2124	0.0477	——	——
Formal R&D unit - 1 lag – Dummy	0.3652***	0.4591***	——	——
Share of foreign capital (%)	-0.3294	-0.2656	——	——
Multinational Firm– Dummy	0.4786**	0.3987**	——	——
Full exporter – Dummy	0.5841**	0.6277**	——	——
Exports over sales (%)	0.1323	0.1133	——	——
Average labor productivity- 1 lag (log)	——	——	-0.4128***	-0.4424***
Capital/Labor - 1 lag (log)	**0.0422**	**0.0907*** **	——	——
Productive capacity - % use	——	——	**0.1052**	**-0.2600***
Link with NIS agents – Dummy	0.3162*	0.4185***	——	——
Link: Technical assistance – Dummy	**0.1870***	**0.1020**	——	——
Link: R&D – Dummy	0.2030*	0.3246***	——	——
Link: Training – Dummy	-0.0137	-0.0350	——	——
Link: Information – Dummy	-0.0109	-0.0666	——	——
PSUs/Strata	233/—	233/69	453/—	453/93
F(k,N-k)	9.07***	52.73***	9.33***	42.48***

Notes: Coefficients that are statistically significant in one model and non-significant in its counterpart are highlighted in bold. "Model 1" refers to the equation estimated with HCSE (White, 1980) and no sample design correction; "Model 2" is the same equation but including the sample design correction; "PSUs" are the primary sampling units; "Strata" are those defined in the sampling model used in the surveys; "F-statistic" for the overall significance of the model/ Chi-2 in column 3;

Chapter 4

Innovative indicators for assessing innovation effects

4.1 Introduction

A firm's innovation investments encompass a certain amount of risk related to both the uncertainty of the extent to which the firm will be able to generate innovation output, in which time-horizon the innovation output will be achieved – if at all – and the impact such innovation output will have on the firm's revenue and productivity.

Firms facing an investment decision related to innovation will therefore have to be able to quantify those risks. Clearly all those risks are highly interrelated: an innovation effort not being intensive enough or being spent in the wrong innovation inputs will probably lead to no innovation output or to an innovation output whose nature does not produce the expected impact on production or productivity.

Given that risk will be associated to the uncertainty surrounding the processes generating the innovation decision, those generating the innovation output, as well as a firm's production processes, the initial step to assess innovation risk is to go a step back and look at the available measures to quantify and empirically analyze those processes and their determinants, as otherwise the true uncertainty will not be distinguishable from the mismeasurement of those processes. Obviously, if no such measures are available or if their measurement is not reflecting the complexity and richness of innovation decisions and processes, the assessment of how innovation is generated and affects a firm's productivity will be handicapped from the very beginning through the use of mediocre proxies to account for investments in innovation inputs, as well as for innovation output. In this paper we analyze the existing measures for assessing the innovation behavior of firms, highlighting their shortcomings and proposing alternative measures to overcome those shortcomings.

To disentangle those risks so as to assess their determinants and interrelations, we distinguish among three types of risk: firstly, one can define the risk of diminished economic impact as the risk of obtaining an innovation output that has no or too little impact on the firm's revenue or productivity. This risk will be related to the innovation output being of the wrong nature or to the firm not having the necessary channels in place to capitalize the innovation output translating it into increased productivity and/or revenue. A second type of risk is embedded in the knowledge production function and relates to the fact that innovation expenditure will not necessarily translate into innovation output, both in terms of the amount and the nature of the innovation output expected. We will call this innovation input-output risk. The innovation input-output risk embeds two dimensions: a physical and a temporal dimension. The physical dimension refers to the process in which innovation inputs are transformed into innovation output. The time dimension refers to the time horizon in which the above process takes place. Finally, there is an innovation adequacy risk, which captures the risk of investing in the wrong amount or combination of innovation inputs.

The overall innovation risk will include the innovation adequacy risk, the innovation input-output risk and the economic impact risk. All sub-classes of risks are clearly interrelated. The economic impact risk will depend on the nature of the innovation output obtained and the mismatch between the needed output to improve performance and the obtained output will depend on the physical innovation input-output risk, while the latter will depend on the innovative adequacy risk.

Measuring innovation risk is therefore a hard enterprise since it involves understanding how firm attributes, industry characteristics and determinants at the overall economy's level come into play together and affect the way knowledge production and overall production work, but also because of the uncertainty related to the innovation effort itself being appropriate, correctly directed and well defined.

The literature on the effects of innovation on economic growth can be traced back to 1957 with the work done by Solow. It is only in the last decade, however, that a rationalization of the mechanisms underlying the innovative behavior of firms was proposed by Crépon et al. (1998), its formalization being currently known as the CDM model. Since then, and together with the recent generalized availability of data at the firm level in a vast number of countries, an outburst of empirical analysis on innovation practices has been registered worldwide, most of which have used the CDM model as benchmark[1].

The novelty of the CDM approach is the recognition of innovation as a multi-step decision process that is backwards solved in order to determine the value of the resulting innovation output. The first step relates to the firm deciding whether to engage in innovative activities or not, a decision taken only under certain specific conditions associated to firm, sector, and macroeconomic characteristics. If innovative practices are to be developed, the available amount of monetary resources to be there invested is decided, being the size of the innovation effort dependant on the previously mentioned characteristics. The firm has afterwards to decide on the most convenient composition of innovative inputs that would in turn generate the different types of innovation output at a third stage. The determination of the optimum mixture of the diverse types of innovation output that can be obtained conditional on the precedent decisions is decided according to what is known in the literature as the *knowledge production function*. In a final stage, the generated innovation output enters a production function as a further production factor and can hence be linked to productivity.

The above stated mechanisms, although quite enlightening and sensible, have proven to be impossible to be fully replicated empirically, due to the necessary data relative to the production value of innovative output not being available. Researchers have made use of the share of innovative products in total sales for proxying this type of output, but no analogous information is available for innovative processes[2]. Consequently, it is not possible to perform empirical analysis using the knowledge production function as it is theoretically specified. Moreover, if no distinction among the diverse types of innovation output is made, the eventual existence of complementarities among them cannot be accounted for.

An alternative widely used strategy that aims at explicitly including innovative processes in the analysis is the specification of models using binary response variables. Although framed in the CDM benchmark, these models are unable to capture all

[1] See amongst others Los and Verspagen (2000); Llorca-Vivero (2002); Lööf and Heshmati (2002); Rao et al. (2002); Griffith et al. (2004); Janz et al. (2004); Tsai and Wang (2004); Griffith et al. (2006);Jefferson et al. (2006); Mohnen et al. (2006); Tang and Le (2007); Van Leeuwen and Klomp (2006); Castellani and Zanfei (2007); Czarnitzki and O'Byrnes (2007); Cainelli (2008); and Masso and Vahter (2008).

[2] For an extensive survey see Hall and Mairesse (2006). It may be argued that the value of innovative processes is in fact reflected in that of innovative products. However, this assumption excludes the possibility of both using innovative processes in the production of non-innovative products and of measuring the value of the innovative output when the firm innovates only in processes.

the richness that the CDM proposal encompasses.

Our study intends to contribute to surmount some of the above stated shortcomings. Regarding the indicators proxying the diverse innovation activities, we propose the use of two different types of measures. A first set of indicators are defined in terms of categorical proxies that are built so as to reflect the diverse combinations of different types of innovation input/output that may be observed. They are thus thought so as to capture different degrees of diversification among types of both innovation input and output, while also allowing for the existence of complementarities in the feasible mixes of inputs. The indices may all be built using information stemming exclusively from innovation surveys. These indices will improve the way in which innovation adequacy and physical innovation input-output risk can be assessed.

The second set of indicators requires the matching of innovation and economic activity surveys, due to them using information on profits and unit costs. The strategy results in the measurement of variables that proxy the production value of innovative products and processes. As such, they provide the empirical counterparts of the diverse types of innovation output necessary for estimating the knowledge production function as originally specified in the CDM model. The comparison of the results obtained by using these variables and models with respect to those found in the empirical literature would shed light not only on the appropriateness of these measures but also on the magnitude of the analytical improvement in studying the innovative behavior of firms. Through a more accurate measure of the value of innovation, the extent to which it affects a firm's performance can be better understood, improving the assessment of innovation's economic impact risk.

In the next section of this chapter we review the empirical literature dealing with the innovative behavior of firms. Section 4.3 summarizes the rationale behind the CDM and how innovation effort is usually proxied in empirical studies operationalizing the CDM model. Section 4.4 is devoted to the discussion of existing indices and construction of new ones that require information stemming only from innovation surveys. In section 4.5 we suggest a further measures to proxy the value of innovation output that allow for implementing empirically the theoretical CDM model. Given that to construct these variables one also requires the use of information that usually stems from economic activity surveys, we present them in a separate section. We also suggest variables with which the role of product and process innovation in the models can be differentiated. In section 4.6, we briefly discuss the new indicators' performance and illustrate the consequences of using the proposed alternative indicators and models, using data from Uruguayan manufacturing firms along 1998 to 2006, stemming both from Uruguayan innovation surveys (IS) and econometric activity surveys (EAS), which we matched in order to be able to perform this analysis. Finally, section 4.7 concludes.

4.2 Review of the literature

In the sixties, the empirical research on innovation was done within the framework of Development Economics. One of the main obstacles faced in that early time was linked to the measurement of technical progress, being the generalized final consensus to quantify it as a residual factor of the estimated models. Later on, researchers started analyzing the different components of technical progress, associating it to the innovative behavior of firms. These analysis gave rise to an independent line of economic analysis, closely linked to the literature of Industrial Organization.

Within the above framework, innovation activities were initially proxied by means of the level of expenditure devoted to R&D. The new strategy involved the estimation of a production function, usually of a Cobb-Douglas type, in which R&D as a percentage of total expenditure was included as a proxy variable for technical change. Further, its estimated coefficient in a total productivity equation would reflect the size of the returns of innovation[3]. The procedure, however, is not able to account for all types of innovative practices nor for the use of diverse mixes of inputs to obtain each type of innovation output. Moreover, R&D may not be an adequate measure of the innovative effort since it generally reflects only a small proportion of all innovative activities, as documented for example by Denison (1985).

In the nineties country studies applying more complex theoretical and/or methodological frameworks boomed. Crépon et al. (1998) is the main used and earliest reference, being their theoretical setting in line with that proposed by Griliches (1979) and used in Pakes and Griliches (1984). Their rationale involved modeling the impact of innovation on productivity jointly with the overall mechanisms giving rise to innovation output. The model also captures the mechanisms explaining the decision of investing in innovation inputs.

One of the main findings of this strand of research relates to its detecting the existence of significant biases in the estimated returns to innovation, as reported in the previous applied literature. Consequently, Crépon et al.'s (1998) seminal work

[3]See Mairesse and Sassenou (1997) for an extensive survey.

became the most widely used benchmark for the research afterwards carried on. Indeed, the CDM's theoretical framework generated a unification of posterior empirical research looking at innovation and productivity - in terms of the applied econometric models – allowing for the comparability of results across studies and between countries.

Most of the studies performed for European countries, for the US and Canada and for some Asian countries obtain results that are consistent to those of CDM, finding a positive relationship between the innovation effort and the obtained innovation output, as well as between the innovation output and the changes in firm productivity[4,5].

The empirical literature has mainly focused attention on innovative products, but some recent research has started analyzing also innovation processes. Lee and Kang (2007) distinguish among them in the case of South Korea, and their findings suggest that innovative processes have a higher impact on firm productivity in the short run, when compared to the impact of product innovation. This supports the model by Huergo and Jaumandreu (2004) where process innovation has an extra impact on the growth rate of productivity that although persistent has effects only in the short-run. Even some of the studies for small European countries Czarnitzki and O'Byrnes (2007) find that process innovation is the main driver behind productivity growth, while product innovation has a non-significant impact. Masso and Vahter's (2008) results also support the existence of differentiated effects of innovation output on productivity depending on being related to product or process innovation and on the underlying macroeconomic conditions in which they are generated. In this sense, it can be stated that there is evidence for the need of innovation output measures that not only look at product innovation, but that include the extent and nature of process innovation obtained.

Regarding Latin America, the research on innovation impacts on firm performance

[4]See Arundel et al. (2003) for an extensive survey.

[5]Some of the recent European studies that have used firm level data to analyze innovation behavior within the CDM framework are Llorca-Vivero (2002); Lööf and Heshmati (2002); Griffith et al. (2004),Griffith et al. (2006); Janz et al. (2004); Van Leeuwen and Klomp (2006) ; Mohnen et al. (2006); Castellani and Zanfei (2007); Czarnitzki and O'Byrnes (2007); and Cainelli (2008). Further, Stoevsky (2005); Roud (2007); and Masso and Vahter (2008) use the Community Innovation Surveys to analyze the applicability of the CDM framework in Eastern European countries – Bulgaria, Russia and Estonia, respectively. Among the most recent Asian country studies – performed for China, South Korea, Taiwan, Japan, and others – it is worth mentioning Chang and Robin (2004); Tsai and Wang (2004); Jefferson et al. (2006); and Lee and Kang (2007). Research focused on US and Canada have been performed by Los and Verspagen (2000); Rao et al. (2002); and Tang and Le (2007).

is still scarce[6]. The results obtained, however, are not always in line with the CDM's predictions, as is the case of Goedhuys (2007), Pérez et al. (2005) and Benavente (2004).

The consistency of results among European countries studies and the differing results obtained for less developed economies motivates a thorough analysis of the applicability of the CDM framework to the latter, especially in the case of emerging countries.

Motivated partly by these results but also seeking to incorporate the effect of complementarities among different types of innovative input/output into the analysis to fully assess the complexity of the innovation process and the risks embedded in it, we propose the use of new proxies for innovation input and output, as explained in the following sections.

4.3 Departing point: the CDM model

Crépon et al's (1998) formalization of the innovation behavior of firms is structured as a multi-step decision process. The authors starting point is the observation that it is not the value of innovation inputs – R&D expenditure – that has to be included in the production function of the firm as an additional production factor, but the value of the result of investing in such inputs instead. That is, the adequate variable accounting for the effects of innovation on the firm's technology is the amount of innovation output obtained from having incurred in certain inputs used for generating it. Once the above statement is accepted, the underlying mechanisms giving rise to the innovative output need to be specified.

The model looks at innovation as a sequential process. First a firm decides whether to engage in innovative activities or not. This decision is assumed to be a function of firm and market characteristics. As such, not all firms should be expected to innovate, the rationale giving support to the stylized fact revealing that there are a large number of non-innovative firms in all economies, irrespective of their level of development.

At a second stage and conditional on having decided to innovate, the firm decides

[6]Notable exceptions are Chudnovsky et al. (2006) and Lopez and Orlicki (2006) for Argentina; Cassiolato et al. (2003) and Goedhuys (2007) for Brazil; Benavente (2004; 2006) for Chile; Hernandez (2005) for Colombia and Pérez et al. (2005) for Mexico. A good survey on the results obtained for several Latin American countries can be found in Hall and Maffioli (2008).

the amount of resources devoted to innovative activities relative to its revenue, again assumed to be dependant only on firm, sector and macroeconomic characteristics. As such, the propensity to innovate and the size of the innovation effort is not viewed as the result of analyzing the optimum strategy for attaining certain goals in terms of the firm's economic performance, but instead, it is viewed as being independent of the firm's production technology. The allocation of these resources among different innovation inputs is not taken into account in the original model, as the only innovation input considered is R&D intensity.

The third and final step in the understanding of innovation activities refers to stating a mechanism by which innovation inputs generate an innovation output of diverse nature, being new products and innovative production processes, the categories most analyzed in the literature.

The impact that the innovation output has on the performance of the firm is afterwards analyzed independently of the previous steps, generally by means of looking at the effects on average labor productivity.

The existing empirical applications of the theoretical CDM model suffer from several shortcomings that impoverish its potential role in understanding firms' innovation behavior, and as such significantly limit at the firm level the assessment of innovation risks and its determinants, as well as at the overall economy's level, the design of policies aimed at promoting the activity.

4.3.1 Measurement of the innovation effort

A first issue relates to the model neglecting the existence of other innovation inputs apart from R&D activities. It may be argued that accumulated R&D constitutes knowledge capital *par excellence*, but engineering design or consultancy services are also knowledge driven inputs, while the introduction of novel IT or innovative physical capital may lead to obtaining an innovation output, irrespective of whether their nature is intrinsically different to that of research and development activities.

It is most unlikely that a unique mix of innovation inputs generates any output, so that the alternative strategy of substituting R&D by total expenditure in innovative inputs is not the best either. Thus, a further challenge that needs to be faced relates to the specification of the mechanisms through which innovation inputs are transformed into different types of innovation output which in turn implies the existence of a technology that has been formalized in the theoretical literature by means of the so called *knowledge production function*.

The applied research, on the contrary, has not been able to estimate the so specified technology due to non availability of the necessary data. In order to surmount the obstacle, the theoretical step of obtaining each type of innovation output from a certain combination of innovation inputs has been skipped, and the effects of the (unobservable) value of innovation output on production/productivity has been estimated by using binary variables capturing the existence or not of an innovation output or else by using the ratio of innovative sales to total sales as proxy variable for the value of innovation output.

A second topic that has to be addressed is the infeasibility of existing models of fully accounting for the effect of innovative processes on the firm's technology and hence on any indicator of firm's performance. Although this restriction may not be substantially binding for most highly developed countries in which new products may be the focus of innovative practices, it undoubtedly restrains the analysis in less developed economies. Furthermore, the innovative behavior of firms, even those in developed countries, should not be expected to be uniform along the business cycle, being process innovation a widespread practice to reduce costs when faced to economic recessions.

As of today, whenever innovative processes have been considered explicitly in the production function, they have been included as a scale effect since its role has been proxied only by means of a binary variable. However, there are no reasons to assume that new production processes or innovative organizational designs and commercialization strategies have no impact on the pre-existing mix of production factors. An additional undesired consequence of omitting process innovation or of restricting its impact to scale effects, refers to the likely overestimation of the elasticity of product innovation when included in the model using the share of innovative sales as a proxy variable. The estimated elasticity for innovative products actually captures the effects of both types of innovation output on total production, in which case conclusions on the impact of one specific type of innovation output would be misleading.

Finally, it may be most enlightening to derive an extension of the CDM model that allows for rationalizing the innovation process when the decision to innovate is linked to attaining a certain economic gain. The CDM model implicitly assumes that the firm decides to innovate depending on its own characteristics and those of the economic environment in which it operates, so that no link to the profit maximizing behavior of the firm is postulated. The assumption is most in place when the trigger of innovation is related to regulations, such as environmental or sanitary standards or even when quality or specific characteristics of products are imposed by the firm's clients. However, firms engage in innovative activities also in search of increasing profits, either by introducing a new product or penetrating new markets, or by reducing unit costs or increasing factor productivity. In such a context, the model should include another equation stating the optimum level of expenditure to be devoted to innovation activities as derived from maximizing profits or other relevant indicator of firm performance.

In what follows we propose different strategies that aim to overcome the above mentioned obstacles in the empirical application of the CDM benchmark for analyzing the innovative behavior of firms.

4.4 Measures of innovation output and inputs

4.4.1 An alternative indicator for innovation output

As an alternative to binary indicators accounting for the existence of each type of innovation output – innovation in productive processes, innovation in commercialization processes, innovation in organizational processes and product innovation –, we propose to define an overall innovation output indicator (IOIO) that reveals when one or another type of output is obtained and accounts for their degree of innovativeness. By means of weighing the diverse output classes. Defining weights according to the relevance of the innovation output should serve both purposes, as it would include both product and processes while also categorizing their degree of innovation. Relevance is defined in terms of the output being only firm level innovative – the lowest degree –, innovative at the local market level, or at best innovative with respect to the international market, for all 4 types of output and as declared by the firm in IS.

We use two sets of weights for building the OIOI. Firstly, we assign increasing values ranging from 1 to 3 for each relevance category, so that the indicator may vary between 1 – when innovation refers to just one type of output and it is innovative only at the firm level – to 12, in case there is international market level innovation in the four categories of output reported (OIOI_1^{All}). Analogously, we build an indicator just for innovative processes, by weighting the three types following the same procedure (OIOI_1^{Procs}). The indicator ranges from 1 to 9, depending on its relevance and on its being referred to one, two or three types of the innovative processes considered in the surveys.

The indicators defined are expected to give more weight to innovative products relative to processes, and to productive with respect to non-technological processes, under the assumption that it is more frequent that these types of output are innovative relative to the international market than the other classes.

However, the method implies that the relative increase in the innovation's relevance is the same among the 3 categories. To avoid this limitation, given the small size of Uruguayan markets, a further sophistication is used so as to generate incremental differentials between weights. Based on this rationale the $OIOI_2$ is built. Assuming that an internationally relevant innovation in non-developed economies, especially those with small size markets as the Uruguayan, are much more relevant with respect to local market or firm level innovation, the weight is defined as the inverse of the share of firms that obtain a particular output and relevance among the total number of firms obtaining that output. As such, the indicator's theoretical lower bound is 1, in case all firms in the category innovate only at the firm level in just one type of output (so that both firm level innovation and the weight equal 1). It is theoretically upwards unbounded, as its highest value would correspond to the case in which there is only one firm that innovates at the international market level in all 4 types of outputs and the number of firms innovating in that output is infinitely large. In our sample the theoretical upper bound would be 2796, in the case of only one firm innovating at the international level in all four types of output. The actual maximum reached in our sample (when considering all three periods) is 41.8. Given the fact that the three periods included mirror very differing stages of the business cycle and therefore the obtaining of innovation output may be affected, the weighting scheme is calculated per year.

As can be observed in Table 4.1, it appears that, on average, the most rare type of innovation to achieve according to our sample is internationally relevant innovation in organization processes, followed by internationally relevant commercialization processes. The large decline observed in the frequency of firms when restricting these processes to be innovative at the local market level, signals either at firms inability to develop internationally revolutionary procedural practices or else devoting less efforts to these practices relative to other types of innovation output. Product innovation at the international level is around twice as rare as at the local level, the narrower gaps supporting the last hypothesis.

Table 4.1: Indices for Innovation Output and Innovation Processes - Weighing scheme

	2000	2003	2006	1998-2006
Product				
Firm level	1.89	1.85	2.96	2.07
Local Market	3.32	3.37	2.52	3.08
International Market	5.89	6.14	3.78	5.19
Production Processes				
Firm level	1.74	1.62	1.86	1.73
Local Market	3.57	3.29	3.35	3.42
International Market	6.87	12.44	6.11	7.80
Commercialization Processes				
Firm level	1.81	1.51	2.11	1.71
Local Market	2.98	3.45	2.85	3.13
International Market	8.95	20.71	5.70	10.33
Organization Processes				
Firm level	1.30	1.24	1.42	1.30
Local Market	6.24	6.28	4.16	5.66
International Market	14.13	30.33	17.33	18.44

Notes: Own calculations based on data from the Innovation Surveys 1998-00; 2001-03, 2004-06; ANII/DiCyT/INE.

Table 4.2: Summary statistics for OIOI weights

1998 - 2006	Product	Production	Commercialization	Organization
Mean	3.000	2.998	2.999	3.000
SD	1.304	2.172	2.990	4.345
Min	1.85	1.62	1.51	1.24
Max	6.14	12.44	20.71	30.33
Obs	514	663	372	498

Notes: Own calculations based on data from the Innovation Surveys 1998-00; 2001-03, 2004-06; ANII/DiCyT/INE.

On the other hand, it is also more difficult to catalogue a process as being relevant at the international market level, which can further explain that less firms define their process innovation as being relevant beyond borders.

When looking at the evolution in time, there is greater stability in the frequency of firms attaining process innovation if compared to product innovation, a slight decline being observed in 2006, especially for the latter. Firm level process innovation, irrespective of its character, is pro-cyclical[7], while an increase is observed in 2006 for product innovation.

Standard deviations of the weights further show that firms that innovate in products and in productive processes display less variation in the relevance of these two output types, while innovation output of non-technical processes varies more in terms

[7]Note that the three periods analyzed correspond to three different stages of the business cycle. Given the major crisis the country suffered in 2002 and the country's recovery since then, one can catalogue the first period as a downswing period, the second period as the bottom of the business cycle and the last period as an upswing period.

of its declared relevance.

The weighting scheme reproduces the intuition that while innovation output is easy to achieve at the firm level, high relevance novel procedures and products are a hard enterprise for Uruguayan firms. In fact, for all four types of innovation output minimum and maximum weights are obtained in the 2001-2003 period, highlighting the fact that during the crisis it was more difficult or rare for firms to obtain internationally relevant output and them tending to focus on obtaining firm relevant innovation as a survival strategy.

Regarding the innovation output indicators, those with non-equally distant weights ($OIOI_2$) display more variation, as expected. Weights with incremental differences differ by output and are higher than original weights due to them capturing the relative relevance that innovation products and processes ought to have (see Table 4.3). Furthermore, the decrease in the difference between the variances of the product and only processes indicators, in turn, reflects the role of the degree of difficulty of high relevance innovation, irrespective of the type of output considered.

Table 4.3: OIOI - Summary statistics

	Mean	S.Dev.	Min	Max	Obs.
$OIOI^{All}$					
Constant Weights	3.7	2.3	1	12	828
Incremental Weights	7.0	7.4	1.2	69.6	828
$OIOI^{Prod}$					
Constant Weights	4.7	2.3	1	12	514
Incremental Weights	9.2	7.4	1.2	69.6	514
$OIOI^{Procs}$					
Constant weights	2.2	1.4	1	9	314
Incremental Weights	4.9	4.9	1.2	42.8	314

Notes: Firms with zero innovation output are not considered for the above statistics.

Source: Own calculations based on data from the Innovation Surveys 1998-00; 2001-03, 2004-06; ANII/DiCyT/INE.

Most noteworthy is the fact that although the highest weights correspond to non-technical processes, the maximum value of the indicators is attained by the index built for innovation products (irrespective of whether the firm innovates or not also in processes) and not by the $OIOI^{Procs}$. Thus, our indicators do reflect the role of complementarities, especially when innovating in products.

By defining three tranches for the above indicator we are able to look at which type of firms achieve low, medium or high innovation output. The share of firms that obtain innovation output, differentiated by size, in each of three defined ranges of the indicator[8] is shown in Table 4.4.

Table 4.4: Indices for Innovation Output and Innovation Processes by firm size and IOIO level

2000	**Low**	**Medium**	**High**
Products	**(0, 6.74]**	**(6.74, 16.11]**	**(16.11, 35.84]**
Small firms	51%	45%	5%
Large firms	37%	46%	16%
Only Processes	**(0, 4.85]**	**(4.85, 12.79]**	**(12.79, 29.95]**
Small firms	94%	3%	3%
Large firms	66%	25%	9%
2003	**Low**	**Medium**	**High**
Products	**(0, 6.22]**	**(6.22, 16.39]**	**(16.39, 69.62]**
Small firms	54%	43%	3%
Large firms	40%	45%	16%
Only Processes	**(0, 4.37]**	**(4.37, 13.02]**	**(13.02, 63.48]**
Small firms	82%	11%	7%
Large firms	64%	30%	6%
2006	**Low**	**Medium**	**High**
Products	**(0, 8.35]**	**(8.35, 12.88]**	**(12.88, 32.92]**
Small firms	83%	17%	0%
Large firms	59%	28%	13%
Only Processes	**(0, 5.39]**	**(5.39, 10.36]**	**(10.36, 29.14]**
Small firms	93%	7%	0%
Large firms	74%	23%	3%

Notes: Firms with zero innovation output are not considered in the above frequencies. Source: Own calculations based on data from the Innovation Surveys 1998-00; 2001-03, 2004-06; ANII/DiCyT/INE.

As expected, small firms tend to achieve output in the two lower tranches, both when including and excluding innovation output in products, while on average 15% of large firms are able to generate innovative output that is internationally relevant when innovating in products. If looking at processes only, this average drops to 6% and it seems that large firms obtained less innovation in processes since the economic crisis in 2002, and have still not been able to return to their process innovation level previous to the crisis.

Furthermore, when comparing the innovation output indicator for all types of output and the one for processes only one main conclusion arises: while the higher range is relatively difficult to obtain in both cases, for processes only it appears that the medium range is less difficult to achieve than in the case of products, especially for large enterprises. In other words, Uruguayan firms tend to be more inclined to reach process innovation that allows them to beat local market practices, while in product innovation they tend just to adjust to keep pace with the local market.

The proposed OIOI allow for capturing better the differences among firms and the type of innovation they obtain than purely binary variables which are traditionally

[8] Tranches are defined theoretically by setting the thresholds so that the maximum output that can be obtained in the lower tranche is equivalent to an OIOI for a firm that has innovated in all four outputs but at the firm level only. The medium tranche reaches its maximum at the OIOI value of a firm that achieves innovation in all four outputs but at the local market level only.

used in the literature, since it integrates the existence of various types of innovation output, to which extent they co-exist in the same firm, as well as the output's innovative relevance. Moreover, these indicators allow for a better use of IS information and adjust for the relevance or rareness of an output, which should translate into the effect of the innovation output on firm performance and also help to understand better the extent and type of innovation inputs mix needed to achieve innovation output.

4.4.2 Innovation input indicators

Both using a total expenditure measure or restricting the analysis to a sole input, say R&D, would be restrictive and does not reflect the innovation expenditure activities in developing countries. While the literature usually approximates innovation output through R&D expenditure, we propose to use the total expenditure in innovation inputs together with an expenditure concentration measure. In fact not only the differences in nature among different innovation inputs will account for differing amounts and types of innovation output, but also the allocation of total expenditure in innovative activities among the types of innovation input and to which extent that allocation is concentrated around specific inputs or diversified across several inputs. Consequently, we build an overall input indicator taking into account the degree of diversification of the firm's innovative effort. Used together with total innovation expenditure would hence allow to capture for the size and the input mix of the overall innovation effort.

Our indicator is built as a normalized Herfindahl index using the expenditure in each type of input as a proportion of total expenditure in innovation inputs as the weighting factor. The intuition behind using this indicator is to assert if a more concentrated effort with investments focused on few innovation inputs – say R&D – yields different results than a more diversified innovation effort, investing across several areas – e.g. R&D, capital and training.

One could hypothesize that a more diversified innovation effort across different types of input, conditional on the effort being of adequate size, should decrease the risk of not obtaining significant innovation results, in the same fashion diversification works for a financial portfolio. In fact, the risks associated with R&D innovation should decrease with diversification across inputs. As can be seen in Chapter 3, this intuition is confirmed by the data, since diversifying across several innovation outputs seems to be helping firms to obtain more innovation output, as measured by our OIOI indicator.

We calculate the degree of concentration of expenditure in innovation inputs in three different ways. Firstly, we construct the Innovation Input Concentration Indicator (IICI) as a normalized Herfindahl index based on the original IS distinction of innovation inputs in 9 categories. A second indicator - IICI2 - is built based on our aggregation of inputs in 4 groups. Given the relative high frequency observed in firms' investment in novel physical capital, hardware and software, we also construct the IICI3 indicator excluding this type of input to avoid potential upwards biases, that may arise due to the fact that the 62 firms that concentrate their innovation expenditure in only one innovation input, did so in capital, hardware or software (K+H+S).

Table 4.5: Innovation Input Concentration Indicators - Summary Statistics

Indicator - All	Num.Obs.	Mean	Std.Dev.	Min	Max
IICI	2314	0.303	0.377	0	1
IICI2	2314	0.326	0.401	0	1
IICI3	2314	0.259	0.398	0	1
Indicator > 0	Num.Obs.	Mean	Std.Dev.	Min	Max
IICI	1122	0.625	0.302	0.048	1
IICI2	1122	0.673	0.312	0.015	1
IICI3	901	0.666	0.344	0.000	1
0< Indicator <1	Num.Obs.	Mean	Std.Dev.	Min	Max
IICI	815	0.485	0.232	0.048	0.948
IICI2	727	0.497	0.250	0.015	0.949
IICI3	509	0.410	0.242	0.000	0.949

Notes: Own calculations based on data from the Innovation Surveys 1998-00; 2001-03, 2004-06; ANII/DiCyT/INE

The two concentration measures IICI and IICI2 do not significantly differ neither in terms of their mean nor in their standard deviation, which yields support for our choice of innovation inputs aggregation. Further, when excluding capital, hardware and software as inputs, the degree of average concentration decreases by 5 percentage points, as expected. In any case, all three measures have a mean around 0.30, which is far above the usual threshold of 0.18 for normalized Herfindahl indices. Thus, regardless of the way of aggregating innovation inputs, the innovation expenditure is highly concentrated. Even more, when excluding firms that do not have any expenditure (concentration zero) and those who spend all their innovation effort only in one input (concentration one), the indices attain an even larger mean (around 0.5).

According to our data, it seems that large firms concentrate their expenditure in innovation inputs slightly more than small firms. A further interesting insight is the fact that the average concentration for non-surviving firms[9] does not significantly differ from those of surviving firms. The temporal trend is towards increased concentration although its pace slows down after the economic crisis, as supported by the difference between the mean value of the IICI in 2003 and 2006 being no longer statistically significant (Table 4.6).

Table 4.6: Innovation Input Concentration Indicators by firm size and year

IICI2	Num.Obs.	Mean	Std.Dev.	Min	Max
Small firms	263	0.468	0.244	0.030	0.949
Large firms	464	0.513	0.252	0.015	0.949
Survivors	372	0.516	0.250	0.015	0.949
Non-Survivors	92	0.500	0.258	0.068	0.943
2000	268	0.469	0.250	0.015	0.949
2003	231	0.505	0.248	0.030	0.949
2006	228	0.520	0.249	0.027	0.949

Notes: Own calculations based on data from the Innovation Surveys 1998-00; 2001-03, 2004-06; ANII/DiCyT/INE

If we look at the link between innovation output and input, innovative firms obtaining only products as innovation output are far more concentrated in their innovation input expenditure than those innovating in both processes and products. Moreover, among the firms with lower concentrated innovation expenditure 21% is able to achieve high relevance innovation output, supporting the intuition that diversification among innovation inputs increases the odds of obtaining a significant innovation output, i.e. reduces the output risk embedded in innovation decisions. In fact, only 3% of the firms fully concentrated in one innovation input achieve a high value in their innovation output indicator, while for those highly concentrated the percentage is 13%.

[9] These numbers only include large firms since only for size strata above 50 employees firms are amandatorily included in the sample and hence their disappearing from the sample can truly be linked to their non-survival. For firms with less than 50 employees the sampling method used by IS/EAS does not allow for that conclusion.

Table 4.7: OIOI performance by IICI tranches

	OIOI - All Outputs			
IICI2	Low	Medium	High	Total
Low	0.41	0.38	0.21	1
High	0.57	0.30	0.13	1
Full	0.84	0.13	0.03	1

Notes: Note: Tranches for IICI are defined as: "Low", HHI less than or equal to 18, "High" HHI higher than 18, "Full", expenditure in one only input. Source: Own calculations based on data from the Innovation Surveys 1998-00; 2001-03, 2004-06; ANII/DiCyT/INE

Finally, as per Table 4.8, 61% of firms in our sample are highly or fully concentrated firms obtaining a low output indicator and further 22% obtain a medium range output indicator while being highly of fully concentrated in their innovation effort across inputs.

Table 4.8: IICI and OIOI performance - Full sample distribution

	OIOI - All Outputs		
IICI2	Low	Medium	High
Low	0.03	0.03	0.01
High	0.35	0.18	0.08
Full	0.26	0.04	0.01

Notes: Note: Tranches for IICI are defined as: "Low", HHI less than or equal to 18, "High" HHI higher than 18, "Full", expenditure in one only input. Source: Own calculations based on data from the Innovation Surveys 1998-00; 2001-03, 2004-06; ANII/DiCyT/INE

4.5 New approach to proxy the value of innovation output

4.5.1 Usual not-categorical indices for innovation output

As an attempt to measure the value of innovation output instead of just including its existence by the means of a binary variable, the literature proxies the value of innovation output by the percentage of innovative to total sales, or else by the stock of patents[10]. As such, these indicators allow to obtain an estimate of the product elasticity and the returns of innovation output. Given that no measure for the value of innovation in processes has been developed and/or implemented yet, most models do not account for process innovation at all, or only include it as a scale

[10] See for example Crépon et al. (1998).

effect, through a binary variable accounting for the existence of process innovation, as performed by Van Leeuwen and Klomp (2006). For those studies not working with data stemming from economic activity surveys it would at least be desirable, though, to combine these binary variables with the percentage of innovative sales or the patents indicators, so as to allow for the existence of an additional impact to product innovation stemming from innovation processes.

Based on the results from the previous Chapter, as well as on the lack of significant results in studies using these two measures in the context of small or developing countries, we argue that the two indicators above are not suited to analyze the behavior of small firms and/or of enterprises in non-central countries. The underlying reason in the case of patents is that those firms, despite performing innovation strategies and obtaining an innovative output, are a lot less likely to apply for patents given their high associated cost, especially if internationally requested for, and the generally insufficient available information on the matter. Regarding the use of the share of innovative sales indicator, its inadequacy is linked to the fact that it takes the value zero not only for non-innovative firms but also for those that innovate only in processes, which is the core of the innovation effort of firms in emerging economies[11] as well as of small enterprises[12].

As a consequence, the analysis of the innovation practices is incomplete if not misleading when based on these indices, while the comparison of the results obtained for emerging countries may be uninformative or even senseless[13]. This is the case of several Latin American countries, for which there is evidence that the use of some of the traditional indicators leads to ambiguous and inconsistent results[14].

4.5.2 The share of innovative sales and its shortcomings

Further criticism related to the index based on the share of innovative to total sales as a proxy for the production value of the innovation output is in place. The use of the indicator has been justified in the literature by noting that the rate of growth of knowledge capital times the product elasticity with respect to this additional production factor is almost equal to the marginal product of knowledge capital times

[11] See Hall and Maffioli (2008); Bianchi et al. (2008); Arocena and Sutz (2008).

[12] It is worth to mention that the literature including new processes as one innovation output do not generally discuss the issue, being Van Leeuwen and Klomp (2006) one notable exception.

[13] See Goedhuys (2007), Pérez et al. (2005) and Benavente (2004) for Latin America, as well as Goedhuys et al. (2006) for Tanzania and Lee and Kang (2007) for South Korea or Masso and Vahter (2008) for Bulgaria.

[14] See Arocena and Sutz (2008).

the rate of knowledge investment. However, the result holds only under certain conditions as shown below.

Following Mairesse and Sassenou (1991), most studies specify a production function which includes knowledge capital K as a further production factor,

$$Q_{it} = A_Q e^{\lambda t} C_{it}^{\alpha} L_{it}^{\beta} K_{it}^{\gamma} e^{\varepsilon_{it}} \tag{4.1}$$

where A_Q is an efficiency parameter, Q is gross output, C is physical capital, L is labor and K is knowledge capital. The parameter of relevance is clearly γ, the elasticity for knowledge capital. Linearizing equation (4.1) yields

$$q_{it} = a_{it} + \lambda\, t + \alpha c_{it} + \beta l_{it} + \gamma k_{it} + \varepsilon_{it} \tag{4.2}$$

where $\ln X_{it} = x_{it}$.
If one focuses on annualized growth rates instead of levels, defining $\Delta x_{it} := x_{it} - x_{i(t-1)} = \ln\left(\frac{X_t}{X_{t-1}}\right)$. Equation (4.1) can be linearized into the first difference of the logs, yielding:

$$\Delta q_{it} = \lambda + \alpha \Delta c_{it} + \beta \Delta l_{it} + \gamma \Delta k_{it} + \Delta \varepsilon_{it} \tag{4.3}$$

being Δq_{it} the rate of change in production.
Given that the growth rate of a variables X_{it} for little variations of X can be approximated using $\Delta x_{it} = \ln\left(\frac{X_t}{X_{t-1}}\right) \cong \frac{X_{it} - X_{i(t-1)}}{X_{i(t-1)}}$ one can approximate (dropping the $_{it}$ subscript for simplicity):

$$\Delta k \cong \frac{\Delta K}{K_{t-1}} \tag{4.4}$$

The term $\gamma \Delta k$ can be hence approximated by

$$\gamma \Delta k = \frac{\partial Q}{\partial K} \frac{K_t}{Q_t} \frac{\Delta K}{K_{t-1}} = \frac{\partial Q}{\partial K} \frac{\Delta K}{Q_t} \frac{K_t}{K_{t-1}} \tag{4.5}$$

given that γ is the elasticity for knowledge capital. By substituting $\rho = \frac{\partial Q}{\partial K}$ for the rate of return of knowledge capital, $\gamma \Delta k$ can be approximated by

$$\gamma \Delta k \cong \rho \frac{\Delta K}{Q_t} \frac{K_t}{K_{t-1}} \tag{4.6}$$

Instead of using equation (4.6), the literature approximates $\gamma \Delta k \cong \rho \frac{\Delta K}{Q_t}$ thus neglecting the possibility of the last term $\frac{K_t}{K_{t-1}}$ being different from one. This assumption is only sensible when the knowledge capital stock is sufficiently large. In addition, K_t is usually defined as $K_t = I_t + (1-\delta) I_{t-1} + (i-\delta)^2 I_{t-2} + \ldots$, where I_t is innovation expenditure. By assuming that the rate of depreciation is nil, $\delta = 0$, one can express ΔK as $\Delta K = K_t - K_{t-1} = I_t$. Usually, and following the CDM model, $\frac{\Delta K}{Q_t} = \frac{I_t}{Q_t}$ is approximated through the share of innovative sales in total sales, $\frac{S_t^I}{S_t^T}$, where S_t^I are innovative sales and S_t^T are total sales.

The literature hence uses the following equation to estimate the effect of innovation on firm productivity:

$$\Delta q_t = \lambda + \alpha \Delta c_t + \beta \Delta l_t + \rho \frac{S_t^I}{S_t^T} + \Delta \varepsilon_t \tag{4.7}$$

However, the theoretical equivalence (4.7) holds empirically only if innovative and standard products have equal rates of profits and also whenever no changes in inventories are registered. Otherwise, the product elasticity of knowledge capital will be under/overestimated. Although it is probable that these conditions are observed, there are many reasons that suggest differences in both dimensions. Hence, no *a priori* statement should be asserted on the matter when possible.

A second desirable correction of the indicator relates to its use if intending to link its evolution to that of productivity indices or to use it as a proxy for knowledge capital in a model for estimating the parameters of a production function. Whenever intermediate consumption is excluded from the production function as is the case in most of the applied work on innovation, product and labor productivity should be defined in terms of value added and not in terms of gross production. The use of the value of sales as a proxy variable for product is thus not adequate, unless the ratio of intermediate consumption to gross production for innovation output and total output are proportional to each other, an assumption that is not necessarily sensible. Otherwise, the elasticity parameter would be under/overestimated. The absence of this simple correction in empirical studies is due to the fact that information on production is not collected in innovation surveys.

As already noted when deriving equation (4.7) it is worth recalling that according to the mathematical equalities used in justifying the use of the share of sales as equivalent to the rate of growth of innovation output, the literature neglects the fact that the adequate variable dividing the investment in knowledge capital is the accumulated knowledge capital of the *previous period*, and not its current accumulated value, hence assuming that $\frac{K_t}{K_{t-1}}$ is equal to one. The omission is obviously the consequence of not having the necessary data that, if available, would render unnecessary the approximation. However, unless the value of knowledge capital is sufficiently large, the magnitude of the estimated elasticities from models using the share of sales indicator would be overestimated.

4.5.3 Possible corrections

We here suggest different strategies for surmounting some of the above shortcomings, given data availability. No matter the result obtained, the exercise is worth doing at least to perform some sensitivity analysis that allows to shed light on the magnitude of eventual biases.

The matching of the economic activity surveys with innovation surveys provides with the necessary tools for correcting the share of sales indicator in terms of the first two shortcomings. Data on gross production and value added at the firm level, as well as of the components of value added, makes it possible to estimate both the eventual increase in the average mark-up due to new products' sales under certain assumptions, as well as the indicator itself in terms of value added instead of gross production.

4.5.3.1 Differentiated mark-ups for innovative and non-innovative products

Given that innovative output is defined in innovation surveys as with respect to production in the previous time period, one may assume that non-innovative products are sold with the mark-up that prevailed in the previous time period. The currently observed mark-up would then be an average of innovative and non-innovative products rates of profits[15]. Denoting the monetary value of innovative, non-innovative and total sales by S_t^I; S_t^{NI}; and S_t^T, respectively; being g_t^I; g_t^{NI}; and g_t^T the respective rates of profits – defined as the ratio of profits to production costs; and Y_t^I;Y_t^{NI}; and Y_t^T the monetary value of innovative, non-innovative and total production, the following equality holds:

[15] New products may have a higher mark-up if being of better quality than non-innovative products or if a differentiation market-penetration strategy is designed. However, the opposite may also hold if the market-penetration strategy followed for new products is based on lowering prices.

$$
\begin{aligned}
\frac{Y_t^I}{Y_t^T} &= 1 - \frac{Y_t^{NI}}{Y_t^T} \\
&= 1 - \frac{\frac{S_t^{NI}}{(1+g_t^{NI})}}{\frac{S_t^T}{(1+g_t^T)}} \\
&= 1 - \frac{(1+g_t^T)}{(1+g_t^{NI})}\frac{S_t^{NI}}{S_t^T} \\
&= 1 - \frac{(1+g_t^T)}{(1+g_t^{NI})}\left(1 - \frac{S_t^I}{S_t^T}\right)
\end{aligned} \tag{4.8}
$$

since non-innovative sales and innovative sales add up to total sales, $S_t^T = S_t^I + S_t^{NI}$. Defining $g_t^{NI} := g_{t-1}^T$, the following equivalence holds:

$$
\frac{Y_t^I}{Y_t^T} = 1 - \frac{(1+g_t^T)}{(1+g_{t-1}^T)}\left(1 - \frac{S_t^I}{S_t^T}\right) \tag{4.9}
$$

Whenever no differences are found between the mark-ups of new and standard products, the new proposed indicator $\frac{Y_t^I}{Y_t^T}$ will be equivalent to the one based on the monetary value of sales.

4.5.3.2 Expressing the share of innovative sales in terms of value added

Given data availability, the new indicator can be further corrected so as to express the share of innovative products in total output, assuming as before that the value-added to total sales ratio for non-innovative products is equal to the one observed in the previous period, i.e. previous to obtaining the current innovative output. Defining Q_t^I; Q_t^{NI}; and Q_t^T as the product value of innovative; non-innovative; and total products, respectively, in time period t, the following equality holds:

$$
\begin{aligned}
\frac{Q_t^I}{Q_t^T} &= 1 - \frac{\frac{Q_t^{NI}}{S_t^{NI}}}{\frac{Q_t^T}{S_t^T}}\frac{S_t^{NI}}{S_t^T} \\
&= 1 - \frac{\frac{Q_t^{NI}}{S_t^{NI}}}{\frac{Q_t^T}{S_t^T}}\left(1 - \frac{S_t^I}{S_t^T}\right) \\
&= 1 - \frac{\frac{Q_{t-1}^T}{S_{t-1}^T}}{\frac{Q_t^T}{S_t^T}}\left(1 - \frac{S_t^I}{S_t^T}\right)
\end{aligned} \tag{4.10}
$$

here again, if the ratio of value-added to total sales is equal for innovative and non-innovative products, the above indicator $\frac{Q_t^I}{Q_t^T}$ would be equivalent to the share of innovative sales in total sales.

4.5.4 Comparison of old and new indicators

Based on equations (4.9) and (4.10) we calculated the two new indicators – $\frac{Y_t^I}{Y_t^T}$ and $\frac{Q_t^I}{Q_t^T}$ – using Uruguayan data for 1997 to 2006, i.e. for the period in which the three Uruguayan innovation surveys were performed (2000; 2003; 2006). Based on the same data we further computed the share of innovative sales. Their comparative performance is depicted in the table and charts below. Table 4.9 includes the mean and standard deviation of the three measures for innovative sales that include products, either when innovating only in products and when the innovative output also includes innovation in processes, irrespective of whether the latter refer to productive processes or also to organization and commercialization processes. In Figure 4.1 we depict the traditional innovative sales indicator against the two suggested alternative proxies.

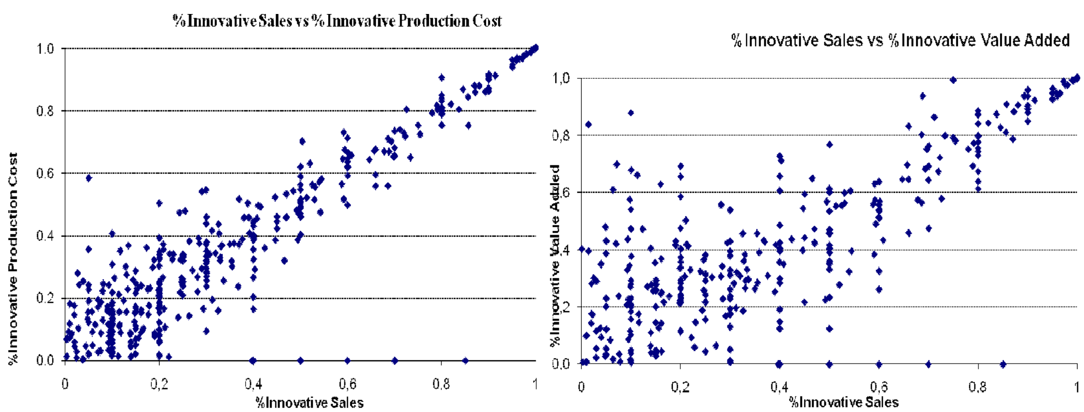

Figure 4.1: Innovation Output Indicators Source: own calculations based on the Innovation Surveys 1998-00; 2001-03; 2004-06; ANII/DiCyT/INE.

The correlation between the innovative sales indicator and the alternative two measures here proposed are high enough to validate the method used to build the indices. The differences in their mean value, especially when using the value added index, further support the existence of biases in the estimated elasticities when using the share of innovative sales instead[16].

[16]The indicators need still to be given further precision in terms of their practical applicability to microeconomic data, as 55 out of 514 observations were lost due to data being missing (7) or negative.

Looking at the average percentage share of total production costs of innovative products *vis à vis* that of sales, the differences are negligible when processes are included. However, if restricting practices to innovative products the data show that the mean share of innovative sales is statistically higher than the share of innovative production costs. The result reveals that the rate of profits of new products is indeed larger than that of non-innovative products. Further, given that in the case of Uruguay the weight of processes with respect to products in total innovation output is larger, the results also show that the reduction in unit costs generated by innovative processes offsets the increased mark-up of innovative products.

On the contrary, the mean value of the sales indicator is lower than its value added counterpart in all cases, partially due to products exhibiting a larger mark-up when innovative, as already mentioned. However, given the observed mean value of the production costs indicator, the result shows that other components of the value added to innovative products are larger than those corresponding to standard products.

Table 4.9: Innovation Output Indicators - Summary statistics

Innovation in:	Variable	Obs.	Mean	Std.Dev.	Min.	Max.
Products	$\frac{S_t^I}{S_t^T}$	354	54.90	0.3352	0.30	100
	$\frac{Y_t^I}{Y_t^T}$	354	54.42	0.3434	0.47	100
	$\frac{Q_t^I}{Q_t^T}$	354	56.04	0.3297	1.00	100
Only Products	$\frac{S_t^I}{S_t^T}$	33	56.72	0.3816	5.00	100
	$\frac{Y_t^I}{Y_t^T}$	33	52.71	0.3919	2.27	100
	$\frac{Q_t^I}{Q_t^T}$	33	58.18	0.3522	3.54	100
Products & Processes	$\frac{S_t^I}{S_t^T}$	321	54.71	0.3279	0.30	100
	$\frac{Y_t^I}{Y_t^T}$	321	54.14	0.3386	0.47	100
	$\frac{Q_t^I}{Q_t^T}$	321	58.81	0.3278	0.60	100

Notes: 'Products' refers to innovative output that is related both to product and processes or only to product innovation. 'Only Products' refers to innovative output that only relates to product innovation. 'Products&Processes' refers to innovative output that accounts for the presence of both product and processes. Processes include not only productive processes but also commercialization and organization innovative processes. S_t^I/S_t^T is the share of innovative sales; Y_t^I/Y_t^T is the share of innovative production costs; and Q_t^I/Q_t^T is the share of innovative value added.

Source: own calculations based on the Uruguayan Innovation Surveys 1998-00; 2001-03;2004-06; ANII/DiCyT/INE.

The wage bill is a most likely candidate for the observed differences, since novel products may require relatively more qualified employees with respect to standard production, but depreciation may also be larger if more expensive physical capital is used for producing new products.

The gap between the sales and value added indicators doubles whenever process innovation is observed, although the level of the value added indicator remains stable, thus revealing that the increase in value added is similar, irrespective of the type of innovation output obtained.

The above analysis shows that using the sales indicator in the productivity equation is most likely to generate a positive bias in the estimated product elasticity of innovation output. The overestimation is larger the higher the relative weight of processes in the innovation output, but the bias is still significant when innovation is focused on generating new products. As such, the existent estimated elasticities reported in the empirical literature may be largely overestimated.

Regarding standard deviations, the sales and production costs indicators exhibit no difference irrespective of the type of output considered, so that firms' behavior regarding mark-ups are quite homogeneous. Regarding the value added indicator, the diversity observed among firms is different – smaller – only if innovation is restricted to products. The result suggests that the share of value added to innovative products in total output is more homogeneous among firms, as opposed to their behavior regarding raw materials or mark-ups. Thus, the use of the proper proxy variable for innovation output should result in a smaller estimated elasticity, especially when process innovation has a significant weight, while if the weight of product innovation is large it should also help to obtain more accurate estimators.

4.5.5 A new indicator for the value of innovative products and processes

The rationalization underlying the firm's innovation behavior as proposed in Crépon et al. (1998) departs from the assumption that in order to produce all goods, the firm uses a new production technology that results from combining standard and innovative inputs. This is due to the fact that although the production of standard products may still be represented by the non-innovative technology, it could be too restrictive to assume that there are no spillovers from the new technology to the whole production process within the firm. Similarly, it is not likely that the production process of the innovative product is independent from that of the goods already supplied by the firm.

Equivalently, it is possible to define a new factor of production – known in the literature as knowledge capital – that reflects the overall innovation output obtained as the result of *combining*, instead of just adding up, the different types of innovative output – products and processes. The new production input enters the production function interacting with all other inputs, as in equation (4.1). The strategy further includes the possibility of capturing the existence of complementarities among different types of innovation output.

All of the above indices, despite not being accurate proxies to the theoretical variable needed to account for knowledge capital in a broad sense, are generally the best feasible indicators given data availability. Moreover, they do not allow for incorporating the fact that innovative processes and products need not to result from identical combinations of innovative inputs, as no measures of the monetary value of these outputs is generally available.

4.5.5.1 Firms innovating only in products

An exception can be found in the case of firms that innovate just in products, since here the share of sales indicator, corrected by the mark-up and the value added to gross production ratios above defined, may act as a good proxy variable, at least for firms that already have a significant knowledge-capital endowment. This is because for firms innovating only in products, no innovation in processes has to be taken into account to value the overall innovation output, and the monetary value of innovative products can be approximated by the monetary value of innovative sales, or alternatively its production costs or value-added. Given that for firms innovating only in products all innovation output is produced in form of tangible goods, the problem of valuating innovation output is reduced to deciding if it should be approximated by the value of sales, by production costs or by value-added.

We thus propose to approximate the value of innovation products, defined as $p_O O_t$, where p_O is the implicit price of total innovation output and O_t is total innovation output in period t by defining the overall production costs of innovative products as the difference in total production costs and production costs of non-innovative products, and hence deriving:

$$
\begin{aligned}
p_O O_t &:= Y_t^T - Y_t^{NI} \\
&= \frac{S_t^T}{1+g_t^T} - \frac{S_t^{NI}}{1+g_t^N I} \\
&= \frac{S_t^T}{1+g_t^T} - \frac{S_t^T - S_t^I}{1+g_t^N I}
\end{aligned}
$$

This allows for the following approximation of the value of innovation output for firms innovating only in products:

$$p_O O_t = \frac{S_t^T}{1+g_t^T} - \frac{S_t^T - S_t^I}{1+g_{t-1}^T} \tag{4.11}$$

4.5.5.2 Firms innovating only in processes

Whenever innovative processes are the only output, the sales indicator would be equal to zero and no effect on the firm production technology and/or any indicator on firm performance would be captured through the above measures. As was explained before, this may be a severe limitation in the case of developing countries in general and of Uruguay in particular, since the innovation output is largely associated to processes. Besides, knowledge capital has been even defined as the result of improved processes by part of the literature – Llorca-Vivero (2002) calls it *learning-by-doing-successfully* – and in fact according to Griliches and Mairesse (1984) the generation of knowledge capital would stem entirely from R&D efforts on productivity, i.e. on processes. It is therefore clear that one cannot restrict the proxy of innovation output to innovative sales – reflecting innovation in products only – since theory argues that changes in productivity and the generation of in-house knowledge rather stem from process innovation, than from innovative products[17].

In order to surmount this limitation, we propose to build a proxy variable for the monetary value of innovative processes, not only for the last mentioned case but also to separate the effects of innovative product and processes on the firm's technology when both types of output are obtained and complementarities among them are to be expected.

The strategy is further useful for modeling the mechanism through which innovative inputs result in different types of innovative output, as it allows for using two differentiated equations linking innovative output to inputs depending on the output being in new products or in innovative process.

According to the answers reported in the Uruguayan innovation surveys, firms introduce innovative processes – not only those directly linked to production, but also processes associated to the overall operative organization of the firm and to the commercialization of products – mainly aiming at reducing unit costs. Under this assumption, the production cost of all products, once having innovated in processes, should be lower than the production cost if no innovation in processes had been

[17] See also Griliches and Mairesse (1984) and Huergo and Jaumandreu (2004).

introduced. Consequently, the value of innovation processes in period t – $p_p P_t$ – could be proxied by the reduction in unit costs from period $t-1$ to period t, times the product obtained in period t.

Let unit costs be defined as $UC_t = \frac{TC_t}{VA_t}$, where TC and VA are total costs and value added respectively. Then, if we understand the total costs of production in t as the difference between the production costs the firm would have had if unit costs had remained the same – i.e. under the absence of innovation in processes – minus the actual value of process innovation:

$$TC_t = UC_{t-1}VA_t - p_P P_t \tag{4.12}$$

one can derive the value of innovative processes for firms only innovating in processes as:

$$\begin{aligned} p_P P_t &= UC_{t-1}VA_t - TC_t && (4.13) \\ &= UC_{t-1}VA_t - UC_t VA_t && (4.14) \\ &= \triangle UC \cdot VA_t && (4.15) \end{aligned}$$

To calculate the value of innovative processes, we measure unit production costs as the gross value of production minus profits, over value added, making use of data stemming from Uruguayan EAS.

4.5.5.3 Firms innovating both in products and in processes

In case the firm has an innovation output related both to products and processes, then the value of overall innovation will be a combination of the value of innovative products and the decrease in costs generated by the value of innovative processes. Still, the value of each output may also be calculated making use of the reasonings above, by decomposing the observed production value into value stemming from innovation in products and stemming from innovation in processes.

Let the implicit price of innovative products in case no innovation had been made in processes be p_O, so that the value of innovation in products under no process innovation is noted by $p_O O_t$. Given that there was process innovation, the observed value of innovative products will not be $p_O O_t$, but instead $p_O^\sharp O_t$. One can therefore express the sales value of innovative products with and without innovation in processes, $S_t^{I\sharp}$ and S_t^{IO} respectively, as:

$$S_t^{I\sharp} = p_O^{\sharp} O_t (1 + g_t^I) \tag{4.16}$$

$$S_t^{IO} = p_O O_t (1 + g_t^I) \tag{4.17}$$

where $S_t^{I\sharp}$ corresponds to the actually observed value of innovative sales S_t^I.

Given that the firm also innovated in processes, the actual price of new products is the one it would have had under no process innovation, diminished by the effect on process innovation. Assuming the effect of process innovation reduces unit costs of innovative and non-innovative products in the same proportion, one can express the observed innovative sales, as the actual value of innovative products times a reduction factor that stems from the innovation in processes:

$$\begin{aligned} S_t^I := S_t^{I\sharp} &= S_t^{IO} \frac{UC_t}{UC_{t-1}} && (4.18) \\ &= p_O O_t (1 + g_t^I) \frac{UC_t}{UC_{t-1}} && (4.19) \end{aligned}$$

We therefore obtain the following equalities for the value of total innovation output in firms innovating in both types of output:

$$\begin{aligned} p_O O_t &= \frac{S_t^I}{(1 + g_t^I)} \frac{UC_{t-1}}{UC_t} && (4.20) \\ p_P P_t &= \frac{S_t^I}{(1 + g_t^I)} \left(1 - \frac{UC_{t-1}}{UC_t}\right) && (4.21) \end{aligned}$$

since per definition $p_P P_t = Y_t^I - p_O O_t$.

The rate of profits for innovative products, $1 + g_t^I$, is also known, since it can be derived from the inverse of $\frac{Y_t^I}{Y_t^T}$ using equation (4.9) and:

$$1 + g_t^I = \frac{Y_t^T}{Y_t^I} \left(g_t^T - g_{t-1}^T\right) + (1 + g_{t-1}^T) \tag{4.22}$$

Finally, defining the total value of innovation for firms innovating both in products and processes, $p_I I_t$, as the sum of the value of process and product innovation as defined above, i.e. accounting for the interaction between both, one can define a variable that will reproduce the value of innovation output for all types of firms as follows:

$$p_I I_t = \begin{cases} \frac{S_t^T}{1+g_t^T} - \frac{S_t^T - S_t^I}{1+g_{t-1}^T}, & \text{if firm innovates only in products;} \\ \nabla UC \cdot VA_t, & \text{if firm innovates only in processes;} \\ \frac{S_t^I}{1+g_t^I}, & \text{if firm innovates both in products and processes.} \end{cases} \tag{4.23}$$

with $1 + g_t^I$ defined as in equation (4.22).

Using (4.23) and data stemming from both the Uruguayan IS and EAS, we calculated $P_I I_t$. Figure 4.2 depicts $p_I I_t$ against the traditional measure of innovative sales, as a means of illustrating the performance of the proposed proxy with respect to the innovative sales share indicator.

The behavior of the indicator is indeed similar to that of the share of innovative sales, thus rendering the suggested index as quite reliable.

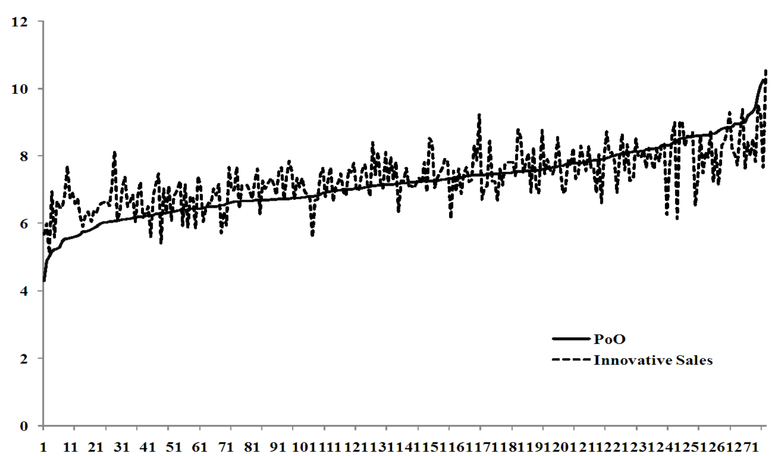

Figure 4.2: Innovation Output Value Indicator against Innovative Sales
Source: own calculations based on the Innovation Surveys 1998-00; 2001-03;2004-06; ANII/DiCyT/INE.

It has to be noted that the mentioned effect of differentiated mark-ups imposed by firms on innovative products is highly undesired when being part of an innovation output value measure – as is the case in $\frac{S_t^I}{S_t^T}$ – as it distorts the analysis of a phenomenon that will be as such contaminated by other economic decisions taken by the firm related exclusively to their sales and marketing strategies and the way profit rates are defined. That is, if the goal of the analysis is to look at the technological impact of innovation, then including the market penetration strategies of firms in the innovation output proxy is not adequate since the estimated parameters would reflect elasticities that are not the ones being sought. Further, control variables would probably have a role to play in deciding on these marketing strategies, rendering it even more difficult to distinguish between the actual mechanisms at work for each of the two processes in action.

4.6 Comparing the performance of the indicators

The following exercise illustrates the magnitude of the eventual mismeasurement of elasticities and scale effects when applying the approach currently used in the literature to estimate the effects of innovation on productivity. Using the Uruguayan IS and EAS dataset for the three periods 1998-2000; 2001-2003; and 2004-2006 we estimate the productivity growth equation in a panel framework. All regressions are found to have significant random effects and are estimated by generalized least squares with robust standard errors.

Rewriting equation (4.1) in terms of output per worker:

$$\frac{Q_t}{L_t} = A_Q e^{\lambda t} \left(\frac{C_t}{L_t}\right)^{\alpha} L_t^{\beta+\alpha-1} K_t^{\gamma} e^{\varepsilon_t} \tag{4.24}$$

and linearizing and expressing it in terms of growth yields:

$$\Delta\frac{q}{l} = \lambda + \alpha\Delta\frac{c}{l} + (\beta+\alpha-1)\Delta l + \gamma\Delta k + \Delta\varepsilon \tag{4.25}$$

As already explained, following Crépon et al. (1998) the literature approximates $\gamma\Delta k$ by $\rho\frac{\Delta K}{Q_t}$ and the latter term by $\frac{S_t^I}{S_t^T}$, where S_t^I are innovative sales, S_t^T are total sales and $\rho = \frac{\partial Q}{\partial K}$ is the rate of return of knowledge capital in terms of output.

The estimated equation relating a firm's labor productivity growth between $t-1$ and t to its in the same period obtained innovation output is hence:

$$\Delta\frac{q}{l} = \lambda + \alpha\Delta\frac{c}{l} + (\beta+\alpha-1)\Delta l + \rho\frac{S_t^I}{S_t^T} + \Delta\varepsilon \tag{4.26}$$

Given that most previous studies do not have access to economic activity survey data that is matched to their IS data, they estimate (4.26) measuring labor productivity as sales per employee. Since sales as a variable includes the effect of other firm strategic decisions, as pricing or sales strategies, it is not accurately reflecting the firm's productivity. A more accurate measure of labor productivity would be to use a measure on value added per employee. We will therefore estimate the equation above in terms of sales per employee growth and also in terms of value added per employee growth. Furthermore, we will estimate the analogous equation using our suggested measures of $\frac{Y_t^I}{Y_t^T}$ and $\frac{Q_t^I}{Q_t^T}$.

In addition, given that the approximation of $\gamma\Delta k$ actually stems from $\gamma\Delta k \cong \rho\frac{\Delta K}{Q_t}$, where ΔK is understood as I_t, i.e. the value of the innovation obtained in the period in question, we also estimate the performance of our approximation for the value of innovation output $p_I I_t$, through:

$$\Delta\frac{q}{l} = \lambda + \alpha\Delta\frac{c}{l} + (\beta + \alpha - 1)\Delta l + \rho\frac{p_I I_t}{Q_t} + \Delta\varepsilon \tag{4.27}$$

Finally and in order to assess the separate effects of product innovation and process innovation on productivity growth, we further estimate:

$$\Delta\frac{q}{l} = \lambda + \alpha\Delta\frac{c}{l} + (\beta + \alpha - 1)\Delta l + \rho\frac{p_O O_t}{Q_t} + \Delta\varepsilon \tag{4.28}$$

$$\Delta\frac{q}{l} = \lambda + \alpha\Delta\frac{c}{l} + (\beta + \alpha - 1)\Delta l + \rho\frac{p_P P_t}{Q_t} + \Delta\varepsilon \tag{4.29}$$

where α is the elasticity of value added with respect to physical capital, $(\alpha+\beta-1)$ is the deviation from constant returns to scale and ρ is the marginal product of knowledge capital. Note that since returns to scales are defined with respect to physical capital and labor, γ captures the contribution of knowledge capital to multifactor productivity.

The general equation will hence take the form of:

$$\Delta\frac{q}{l} = a + \rho I_t + \mathbf{X_t}b + \upsilon_t \tag{4.30}$$

where $\mathbf{X} = \left(\Delta\frac{c}{l}, \Delta l, S_1, \ldots, S_{11}, \Omega, \Psi\right)$, where S_1 to S_{11} are sector dummies, Ω are macroeconomic control variables including the stage of the business cycle and the degree of concentration of the industry, Ψ are control variables for firm characteristics, including a dummy for having more than 150 employees, having established links with NIS agents, the skill composition of the firm proxied by the share of professionals in total employees, as well as the previous period's labor productivity[18].

The results are summarized in Tables 4.10 and 4.11.

[18] The detailed description for the above variables can be found in Chapter 3.

Table 4.10:Effect of Innovation Output on Productivity Growth (Sales per empl.)

Variable	Value added per employee growth					
	SI/ST	**YI/YT**	**QI/QT**	**pIIt /Q**	**pOOt/Q**	**pPPt/Q**
Innovation Output	**-0.067**	**-0.091****	**-0.087****	**-0.005**	**-0.007*****	**-0.006**
Size: 50 & more	0.045	0.041	0.044	0.047	0.044	0.044
Average labor productivity ($t-1$)	-0.125***	-0.123***	-0.123***	-0.141***	-0.125***	-0.124***
Professionals to Employees Ratio	0.002**	0.002**	0.002**	0.002*	0.002**	0.002**
Capital to Labor - Rate of Growth	0.222***	0.218***	0.229***	0.214***	0.222***	0.222***
Labor - Rate of Growth	-0.124**	-0.136**	-0.121*	-0.14**	-0.128**	-0.127**
Linked with NIS	0.049	0.048	0.05	0.016	0.041	0.04
Business cycle sector	2.9***	2.985***	3.081***	2.656***	2.906***	2.891***
Concentration market	0.143**	0.15**	0.127*	0.159**	0.139**	0.141**
Sector - Food	0.002	-0.008	-0.008	-0.06	0.01	0.01
Sector - Beverages	0.171	0.135	0.152	0.114	0.186	0.18
Sector - Textiles	-0.093	-0.103	-0.1	-0.17	-0.087	-0.088
Sector - Wood	0.008	-0.004	0.002	-0.079	0.011	0.012
Sector - Paper	0.074	0.073	0.055	0.038	0.08	0.078
Sector - Chemicals	0.132	0.129	0.119	0.102	0.138	0.137
Sector - Oil & Deriv.	-0.056	-0.028	-0.052	0.069	-0.056	-0.06
Sector - Plastic	0.041	0.036	0.03	-0.023	0.051	0.051
Sector - Non-metal	-0.027	-0.027	-0.032	-0.071	-0.015	-0.015
Sector - Metal basic	0.103	0.097	0.133	0.043	0.11	0.111
Sector - Metal prods	-0.001	-0.017	0.006	-0.114	0.003	0.001
R^2 - within	0.253	0.258	0.260	0.305	0.254	0.254
R^2 - between	0.135	0.138	0.134	0.070	0.133	0.132
R^2 - overall	0.204	0.207	0.209	0.212	0.203	0.203
Obs.	1369	1322	1264	1145	1369	1369
χ^2	188***	183.3***	176.2***	226.5***	194.6***	188.4***
σ_i	0	0	0	0	0	0
σ_v	0.460	0.464	0.473	0.450	0.460	0.459
$\sigma_i^2/(\sigma_i^2+\sigma_v^2)$	0	0	0	0	0	0

Notes: All models were estimated by GLS with random effects and robust standard errors. All model reject the existence of fixed effects, and although yielding statistically significant random effects, σ_i is found to be zero and the regression degenerates to pooled OLS. *//*** mean coefficients are statistically significant at 90%, 95% and 99% confidence levels, respectively. Source: Own calculation using data from the Innovation Surveys and Economic Activity Surveys, 1998-2000; 2001-2003 and 2004-2006, Anii/DiCyT/INE.**

Table 4.11: Effect of Innovation Output on Productivity Growth (Val.Added per empl.)

Variable	Value added per employee growth					
	SI/ST	YI/YT	QI/QT	pIIt /Q	pOOt/Q	pPPt/Q
Innovation Output	**-0.014**	**-0.093**	**0.129****	**0.014***	**-0.004*****	**0.021*****
Size: 50 & more	0.061	0.058	0.058	0.101*	0.062	0.056
Average labor productivity $(t-1)$	-0.328***	-0.315***	-0.319***	-0.339***	-0.328***	-0.33***
Professionals to Employees Ratio	0.004***	0.004***	0.003**	0.004**	0.004***	0.004***
Capital to Labor - Rate of Growth	0.161***	0.161***	0.172***	0.161***	0.161***	0.161***
Labor - Rate of Growth	0.007	-0.008	0.011	-0.006	0.005	0
Linked with NIS	0.11**	0.093**	0.109**	0.063	0.11**	0.091**
Business cycle sector	3.946***	4.241***	4.035***	4.201***	3.944***	3.985***
Concentration market	0.242***	0.256***	0.219***	0.257***	0.241***	0.227***
Sector - Food	-0.142	-0.172	-0.099	-0.226	-0.14	-0.146
Sector - Beverages	0.367	0.332	0.445*	0.294	0.377	0.378
Sector - Textiles	-0.209	-0.215	-0.176	-0.28	-0.207	-0.21
Sector - Wood	-0.276	-0.294	-0.224	-0.359	-0.277	-0.277
Sector - Paper	0.054	0.051	0.072	0.048	0.055	0.064
Sector - Chemicals	0.128	0.105	0.189	0.08	0.131	0.137
Sector - Oil & Deriv.	-0.031	0.001	0	-0.013	-0.027	0.012
Sector - Plastic	0.029	0.022	0.058	0.046	0.03	0.043
Sector - Non-metal	-0.143	-0.201	-0.101	-0.218	-0.142	-0.124
Sector - Metal basic	0.086	0.031	0.183	-0.114	0.087	0.069
Sector - Metal prods	-0.035	-0.056	0.024	-0.12	-0.032	-0.031
R^2 - within	0.431	0.401	0.433	0.473	0.432	0.425
R^2 - between	0.029	0.035	0.040	0.029	0.029	0.032
R^2 - overall	0.199	0.197	0.202	0.210	0.200	0.207
Obs.	1369	1322	1264	1145	1369	1369
χ^2	206.0***	211.1***	265.0***	197.2***	210***	222.7***
σ_i	0	0	0	0.085	0	0
σ_v	0.560	0.562	0.572	0.555	0.560	0.560
$\sigma_i^2/(\sigma_i^2+\sigma_v^2)$	0	0	0	0.023	0	0

Notes: All models were estimated by GLS with random effects and robust standard errors. All model reject the existence of fixed effects, and although yielding statistically significant random effects, σ_i is found to be zero and the regression degenerates to pooled OLS. *//*** mean coefficients are statistically significant at 90%, 95% and 99% confidence levels, respectively. Source: Own calculation using data from the Innovation Surveys and Economic Activity Surveys, 1998-2000; 2001-2003 and 2004-2006, Anii/DiCyT/INE.**

Several conclusions arise from the above results. Firstly and independently of the proxy used for innovation output, results for the control variables are consistent across models in all six models. The growth in productivity appears to be pro-cyclical and higher for firms operating in concentrated markets. Size does not affect the firm's ability to increase productivity and the higher the previous period's labor productivity, the lower the productivity gains in the current period – which is consistent with a non-explosive process. Furthermore, the higher the skill endowment of a firm the better it will be able to generate productivity increases.

A second interesting point is the difference in results obtained when estimating the increase in productivity growth as the log change in sales per employee and when estimating it as the log change in value added per employee. As was already mentioned, using the change in sales per employee is a mediocre proxy for productivity growth since it is polluted by further factors, as could be the firm's decision of a different sales' strategy. Not necessarily a firm having improved its productivity in terms of value added will translate this fully to sales. In particular firms being able to reduce costs, may increase their profits without modifying their sales and the productivity effect would not be captured by the sales-per-employee proxy. This intuition finds support in the fact that the firm having established links with NIS agents does not affect productivity growth as proxied by sales, but is significantly affecting productivity growth as proxied by value added. In addition, when looking at the $(\alpha + \beta - 1)$ coefficient, constant returns to scale are obtained in the regressions using the value added per employee measure, while in the sales-per-employee specification there seem to exist decreasing returns to scale. This again, would speak for a downward bias of estimates in the latter specification, while economically, the results obtained for the value added specification are more in line with the expected, with an elasticity for physical capital of 16 percent on average and a labor elasticity of 84 percent. In terms of the explanatory power of the model while the sales-per-employee models account for around 25 percent of the variation from the mean, the value-added-per-employee specifications account for more than 40 percent.

Still, the most interesting insights from this exercise are to be found in the different performance of the innovation output indicators. When measuring productivity growth as the change in sales per employee – as usually done in the literature given that most innovation surveys do not count with information on production – the traditional innovative to total sales indicator is non-significant. As already mentioned this result is in line with the results obtained by most studies for developing countries, where most studies fail to find a significant effect of innovation on productivity. Still, once the measure is corrected for differential mark-ups and to be expressed in terms of value added, both coefficients are significant, being the rate of return to innovation of minus nine percent. In other words, our corrected indicators do capture an effect, but at first sight it seems that innovation output decreases productivity as measured by sales per employee. On the other hand, when using our proposed measure for the value of innovation, while there is no effect of the overall indicator – that takes innovation in processes into account – there is a negative effect on the growth of sales per employee stemming from the innovation in products. The innovation in processes does not affect the growth of sales per employee. As per these results the innovation in products has a negative effect on sales per employee and innovation in processes has no effect at all. These seem to be discouraging results.

If we now observe the results in Table 4.11 the picture above changes. Here, S_t^I/S_t^T and Y_t^I/Y_t^T are not significant – which is in line with the expected since they are not expressed in terms of value added – while Q_t^I/Q_t^T is significantly positive. This confirms our hypothesis of traditional models being underestimating the effect of innovation on productivity, at least for firms in small and/or developing countries. According to the regression using Q_t^I/Q_t^T as the proxy for innovation output, the gross rate of return of innovation is as large as 13 percent.

Finally, results concerning our measures for the value of innovation $p_I I_t, p_O O_t$ and $p_P P_t$ are also encouraging. According to our estimates, there is an overall positive effect of innovation on productivity growth, mainly stemming from the innovation in processes. This supports the findings of chapter 3 and is in accordance with process innovation being mainly pursued to reduce costs. According to the obtained coefficients, innovating in processes and hence improving firm efficiency is the main generator of productivity growth for Uruguayan firms. The effect of product innovation is here too negative. This would imply that innovation in products is rather undermining the ability of Uruguayan firms of increasing their productivity in terms of value added per employee, at least from one period to the next one. This is aligned with the fact that most firms declare that the main obstacles to innovation are internal to the firm and would highlight the inability of these firms to effectively implement and capitalize product innovation, given their efficiency weakness in terms of internal processes.

4.7 Conclusions and recommendations

The risks faced by a firm deciding if and how to implement innovation are associated to the adequacy of the innovation decision itself and to the firm's a priori assessment of how innovation will impact on its economic performance. This assessment needs to be accurate enough and the available measures to quantify and empirically analyze the innovation processes within a firm and how they impact in overall firm performance must be truly capturing their complexity, as otherwise the true innovation outcome uncertainty will not be distinguishable from the mismeasurement of those processes. If those measures are not reflecting the complexity and richness of innovation decisions and processes, they will be unable to capture the right determinants for innovation risks and the assessment of how innovation should be implemented, if at all, will be handicapped from the very beginning through the use of mediocre proxies to account for investments in innovation inputs, as well as for innovation output.

This paper thus departs from traditionally used measures for approximating the effort of innovation output, as well as the extent or value of the obtained innovation output, and suggests further measures to better account for the complexity embedded in those dimensions. We introduce two types of measures, those based exclusively on IS data and that can therefore be applied by any study looking at the innovation behavior of firms, and further measures that are more sophisticated in their construction and that need EAS data to be calculated.

We show that the Overall Innovation Output Indicator (OIOI) we propose is much richer as traditionally used binary variables, and that it accounts better for the complexity behind innovation since it weights innovation output by relevance, taking into account how difficult it is to obtain different types of innovation output. This measure is not only simple to calculate but should be also available to most researchers studying innovation since it is exclusively based on IS data. We also propose to use an innovation expenditure concentration index (IICI), so that the effort in innovation can be capture by two dimensions, the one related to its size – using total innovation expenditure – and the one related to the mix of innovation inputs chosen. According to a preliminary look at the data, it seems that firms concentrating their innovation expenditure in one or only a few inputs, are less able to generate high relevance output.

But overall, the most important contribution of this paper relates to its criticism to the empirical implementation of the CDM model and to its suggestion of improvements for continuous measures assessing the (monetary) value of innovation output. We suggest two corrections to the traditionally used share of innovative sales to total sales, by accounting for (1) the fact that mark-ups for innovative and non-innovative products must not be the same and (2)the fact that innovation and its effects on productivity should be looked at in terms of value added and not in terms of sales. Finally, we construct a measure of innovation output, that allows to include the value of process innovation, usually neglected in literature as it does not translate into the innovative sales. All three measures perform better as determinants of productivity growth and their differences suggest that to truly assess the effect of innovation on firm productivity, productivity should be proxied by value added per employee and not by sales per employee, and that our innovation output measures accounting for process innovation are better able to capture the effect on productivity, than those measures neglecting process innovation because of not being able to approximate its value.

Finally, our results show that there is an overall positive effect of innovation on productivity growth, mainly stemming from the innovation in processes. and that innovating in processes and hence improving firm efficiency is the main generator of productivity growth for Uruguayan firms. The effect of product innovation is found to be negative, meaning that innovation in products is eroding firms' capacity of increasing their productivity in terms of value added per employee. This is aligned with the fact that most firms declare that the main obstacles to innovation are firm internal and depicts the inability of these firms of an effective implementation and leverage of product innovation.

The results suggest that for the future design of innovation surveys these effects should be taken into account, by including questions assessing the production processes of the firm and allowing to distinguish between sales, production value and value added.

Bibliography

Arocena, R. and J. Sutz (2008). Uruguay: Higher Education, National System of Innovation and Economic Development in a Small Peripheral Country. Discussion Paper Series Paper no. 3, Research Policy Institute, Lund University, Swiden, UniDev http://ssrn.com/paper=975891 (accessed December 20, 2009).

Arundel, A., L. Chervenic-Poeth, and R. Kemp (2003). National Survey Results: The Dutch survey. In K. Rennings and T. Zwick (Eds.), *Employment Impacts of Cleaner Production*, ZEW Economic Studies 21, Chapter 4, pp. 229–266. Heidelberg, DL: Physica-Verlag.

Benavente, J. (2004). Innovación Tecnológica en Chile: Dónde Estamos y Qué se Puede Hacer. Documento de Trabajo no. 295, Banco Central de Chile.

Bianchi, C., N. Gras, and J. Sutz (2008). Make, buy and cooperate in innovation: evidence from Uruguayan manufacturing surveys and other innovation studies. Included in the report: R&D cooperation and appropriability in Latin American Innovation strategies: empirical evidence and policy implications from National Innovation Surveys, ECLA-IDRC.

Cainelli, G. (2008). Spatial Agglomeration, Technological Innovations, and Firm Productivity: Evidence from Italian Industrial Districts. *Growth and Change 39*(3), 414–435.

Cassiolato, J., H. Lastres, and M. Maciel (Eds.) (2003). *Systems of Innovation and Development: Evidence from Brazil.* Cheltenham, UK: Edward Elgar Publishing.

Castellani, D. and A. Zanfei (2007). Internationalisation, Innovation and Productivity: How Do Firms Differ in Italy? *World Economy 30*(1), 156–176.

Chang, C. and S. Robin (2004). Innovation Strategy and Total Factor Productivity Growth : Micro Evidence from Taiwanese Manufacturing Firms. IRES Discussion Paper no. 007, Institut de Recherches Economiques et Sociales, Universite catholique de Louvain, Belgium.

Chudnovsky, D., A. Lopez, and G. Pupato (2006). Innovation and productivity in developing countries: A study of Argentine manufacturing firms' behavior (1992-2001). *Research Policy 35*(2), 266–288.

Crépon, B., E. Duguet, and J. Mairesse (1998). Research, Innovation, and Productivity: An Econometric Analysis at the Firm Level. NBER Working Paper 6696, National Bureau of Economic Research.

Czarnitzki, D. and N. O'Byrnes (2007). R&D, Innovation and the Impact on Productivity in Flanders. *Tijdschrift voor Economie en Management 52*(2), 199–216.

Denison, E. (1985). *Trends in American Economic Growth, 1929-1982*. Washington, D.C., US: Brookings Institution.

Goedhuys, M. (2007). The Impact of Innovation Activities on Productivity and Firm Growth: Evidence from Brazil. UNU-MERIT Working Papers no. 2, United Nations University - Maastricht Economic and social Research and training center on Innovation and Technology.

Griffith, R., E. Huergo, J. Mairesse, and B. Peters (2006). Innovation and Productivity Across Four European Countries. *Oxford Review of Economic Policy 22*(4), 483–498.

Griffith, R., S. Redding, and H. Simpson (2004). Foreign Ownership and Productivity: New Evidence from the Service Sector and the R&D Lab. *Oxford Review of Economic Policy 20*(3), 440–456.

Griliches, Z. (1979). Issues in Assessing the Contribution of Research and Development to Productivity Growth. *Bell Journal of Economics 10*(1), 92–116.

Hall, B. and A. Maffioli (2008). Evaluating the impact of technology development funds in emerging economies: evidence from Latin America. *European Journal of Development Research 20*(2), 172–198.

Hall, B. and J. Mairesse (2006). Empirical studies of innovation in the knowledge-driven economy. *Economics of Innovation and New Technology, Taylor and Francis Journals 15*(4-5), 289–299.

Hernandez, I. (2005). Legal Form, Innovation and Productivity of Firms within Colombian Manufacturing Industry. *Cuadernos de Economia (National University of Colombia) 24*(42), 135–60.

Huergo, E. and J. Jaumandreu (2004). Firms' Age, Process Innovation and Productivity Growth. *International Journal of Industrial Organization 22*(4), 541–59.

Janz, N., H. Lööf, and B. Peters (2004). Firm Level Innovation and Productivity : Is there a Common Story Across Countries? Discussion Paper no. 03-26, ZEW - Zentrum für Europäische Wirtschaftsforschung / Center for European Economic Research. http://opus.zbw-kiel.de/volltexte/2003/1020/pdf/dp0326.pdf.

Jefferson, G., B. Huamao, G. Xiaojing, and Y. Xiaoyun (2006). R&D Performance in Chinese Industry. *Economics of Innovation and New Technology 15*(4-5), 345–366.

Lee, K. and S. Kang (2007). Innovation Types and Productivity Growth: Evidence from Korean Manufacturing Firms. *Global Economic Review 36*(4), 343–359.

Lööf, H. and A. Heshmati (2002). Knowledge Capital and Performance Heterogeneity: a Firm-Level Innovation Study. *International Journal of Production Economics 76*(1), 61–85.

Llorca-Vivero, R. (2002). The Impact of Process Innovations on Firm's Productivity Growth: The Case of Spain. *Applied Economics 34*(8), 1007–1016.

Lopez, A. and E. Orlicki (2006). ¿quién patenta en la Argentina? Un análisis econométrico para el sector manufacturero. Proyecto OMPI-CEPAL, Sistemas de Propiedad Intelectual y Gestión Tecnológica en Economías Abiertas: una Visión Estratégica para América Latina y el Caribe.

Los, B. and B. Verspagen (2000). R&D Spillovers and Productivity: Evidence from U.S. Manufacturing Microdata. *Empirical Economics 25*, 127–148.

Mairesse, J. and M. Sassenou (1997). R&D Productivity: A Survey of Econometric Studies at the Firm Level. NBER Working Paper 3666, National Bureau of Economic Research. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=227437.

Masso, J. and P. Vahter (2008). Technological Innovation and Productivity in Late-Transition Estonia: Econometric Evidence from Innovation Surveys. Working Paper 61-2008, The University of Tartu Faculty of Economics and Business Administration.

Mohnen, P., J. Mairesse, and M. Dagenais (2006). Innovativity: A Comparison across Seven European Countries. *Economics of Innovation and New Technology, Taylor and Francis Journals 15*(4-5), 391–413.

Pakes, A. and Z. Griliches (1984). Patents and R&D at the Firm Level: A First Look. In G. Z (Ed.), *R&D, Patents, and Productivity*, pp. 55–72. Chicago, IL, US: University of Chicago Press.

Pérez, P., G. Dutrénit, and F. Barceinas (2005). Actividad Innovadora y Desempeño Económico: un análisis econométrico del caso mexicano. In M. Albornoz and D. Ratto (Eds.), *Indicadores de Ciencia y Tecnología en Iberoamerica. Agenda 2005*, pp. 299–318. Buenos Aires, AR: RICYT.

Rao, S., J. Tang, and W. Wang (2002). The Importance of Skills for Innovation and Productivity. *International Productivity Monitor 4*, 15–26.

Roud, V. (2007). Firm-level Research on Innovation and Productivity: Russian Experience. Institute of Statistical Studies and Economics of Knowledge, Higher School of Economics Moscow, Russian Federation.

Stoevsky, G. (2005). Innovation and Business Performance of Bulgarian Companies (structural econometric analysis at firm level). Economic Research and Projections Directorate Working Paper, Bulgarian National Bank.

Tang, J. and C. Le (2007). Multidimensional Innovation and Productivity. *Econ. Innov. New Techn. 16*(7), 501–516.

Tsai, K. and J. Wang (2004). The R&D Performance in Taiwan's Electronics Industry: A Longitudinal Examination. *R&D Management 34*(2), 179–189.

Van Leeuwen, G. and L. Klomp (2006). On the contribution of innovation to multifactor productivity growth. *Economics of Innovation and New Technology, Taylor and Francis Journals 15*(4-5), 367–390.

Bibliography

Agarwal, S. (1994). Socio-cultural distance and the choice of joint ventures: A contingency perspective. *Journal of International Marketing 2*(2), 63–80.

Alexander, D., L. Floyd, and L. Linkins (1995). Innovation, R&D Productivity, and Global Market Share in the Pharmaceutical Industry. *Review of Industrial Organization 10*(2), 197–207.

Amburgey, T. and A. Miner (1992). Strategic momentum: The effects of repetitive, positional and contextual momentum on merger activity. *Strategic Management Journal 13*(5), 335–348.

Andersson, T. and R. Svensson (1994). Entry Modes for Direct Investment Determined by the Composition of Firm-Specific Skills. *Scandinavian Journal of Economics 96*(4), 551–560.

Arocena, R. and J. Sutz (2008). Uruguay: Higher Education, National System of Innovation and Economic Development in a Small Peripheral Country. Discussion Paper Series Paper no. 3, Research Policy Institute, Lund University, Swiden, UniDev http://ssrn.com/paper=975891 (accessed December 20.

Arundel, A., L. Chervenic-Poeth, and R. Kemp (2003). National Survey Results: The Dutch survey. In K. Rennings and T. Zwick (Eds.), *Employment Impacts of Cleaner Production*, ZEW Economic Studies 21, Chapter 4, pp. 229–266. Heidelberg, DL: Physica-Verlag.

Barkema, H. and F. Vermeulen (1998). International Expansion through start-up or acquisition: a learning perspective. *Academy of Management Journal 41*(7), 7–26.

Beach, W. and T. Kane. Methodology: Measuring the 10 Economic Freedoms. In *2008 Index of Economic Freedom*, 14th ed., Eds. K. Holmes, E. Feulner and M. O'Grady, 39-55. Washington, The Heritage Foundation.

Benavente, J. (2004). Innovación Tecnológica en Chile: Dónde Estamos y Qué se Puede Hacer. Documento de Trabajo no. 295, Banco Central de Chile.

Bergstrand, J. and P. Egger (2007). A knowledge-and-physical-capital model of international trade flows, foreign direct investment, and multinational enterprises. *Journal of International Economics 73*(2), 278–308.

Bertrand, O., K. Hakkala, and P. Norbäck (2007). Cross-Border Acquisition or Greenfield Entry: Does it Matter for Affiliate R&D. IFN Working Paper No. 693, Research Institute of Industrial Economics.

Bertrand, O. and N. Madariaga (2003). U.S. Greenfield Investments and M&A location: impact of American continental integration and Insider vs. Outsider position. In *Royal Economic Society Annual Conference 2003*. Royal Economic Society. http://repec.org/res2003/Bertrand.pdf (accessed June 9, 2008).

Bianchi, C. and N. Gras (2005). Economic behaviour and economic performance in the Uruguayan Manufacturing Industry 2001-2003. Working Paper, CSIC, Uruguay.

Bianchi, C., N. Gras, and J. Sutz (2008). Make, buy and cooperate in innovation: evidence from Uruguayan manufacturing surveys and other innovation studies. Included in the report: R&D cooperation and appropriability in Latin American Innovation strategies: empirical evidence and policy implications from National Innovation Surveys, ECLA-IDRC.

Bjorvatn, K. (2001). Foreign Ownership and Market Entry. *Nordic Journal of Political Economy 27*, 13–32.

Botero, J., S. Djankov, R. La Porta, F. Lopez-de-Silanes, and A. Shleifer (2004). The Regulation of Labor. *The Quarterly Journal of Economics 119*(4), 1339–1382.

Brouthers, K. and L. Brouthers (2000). Acquisition or greenfield start-up? Institutional, cultural and transaction cost influences. *Strategic Management Journal 21*(1), 89–97.

Bértola, L., C. Bianchi, P. Darsht, A. Davyt, L. Pittaluga, N. Reig, C. Roman, M. Snoeck, and H. Willebald (2005). Ciencia, Tecnología e Innovación en Uruguay: diagnóstico, prospectiva y políticas. Documento de Trabajo del Rectorado no. 26, Universidad de la República, Uruguay.

Buckley, P. and M. Casson (1976). *The Future of the Multinational Enterprise*. New York: Holmes & Meier.

Buckley, P. and M. Casson (1998). Analyzing Foreign Market Entry Strategies: Extending the Internalization Approach. *Journal of International Business Studies 29*(3), 539–562.

Buiter, W., R. Lago, and H. Rey (1998). Financing in transition: investing in enterprises during macroeconomic transition. EBRD Working Paper 35, (London: European Bank for Reconstruction and Development), mimeo.

Cainelli, G. (2008). Spatial Agglomeration, Technological Innovations, and Firm Productivity: Evidence from Italian Industrial Districts. *Growth and Change 39*(3), 414–435.

Cassiolato, J., H. Lastres, and M. Maciel (Eds.) (2003). *Systems of Innovation and Development: Evidence from Brazil*. Cheltenham, UK: Edward Elgar Publishing.

Castellani, D. and A. Zanfei (2007). Internationalisation, Innovation and Productivity: How Do Firms Differ in Italy? *World Economy 30*(1), 156–176.

Caves, R. and S. Mehra (1986). Entry of foreign multinationals into US manufacturing industries. In *Competition in Global Industries*, Ed. M. Porter, 449-481. Boston, MA: Harvard Business School Press.

CBRE (2007). *Global Market Rents, Office Rents & Occupancy Costs Worldwide*. CB Richard Ellis Global Research and Consulting. Reports by year, period 2001-2007.

Chang, C. and S. Robin (2004). Innovation Strategy and Total Factor Productivity Growth : Micro Evidence from Taiwanese Manufacturing Firms. IRES Discussion Paper no. 007, Institut de Recherches Economiques et Sociales, Universite catholique de Louvain, Belgium.

Chen, S.-F. and J. Hennart (2002). Japanese Investors' Choice of Joint Ventures Versus Wholly-owned Subsidiaries in the US: The Role of Market Barriers and Firm Capabilities. *Journal of International Business Studies 33*(1), 1–18.

Chen, S.-F. and M. Zeng (2004). Japanese investors' choice of acquisitions vs. startups in the US: the role of reputation barriers and advertising outlays. *International Journal of Research in Marketing 21*(2), 123–136.

Cheng, S. (2007). Structure of Firm Location Choices: An Examination of Japanese Greenfield Investment in China. *Asian Economic Journal 21*(1), 47–73.

Cheng, Y.-M. (2006). Determinants of FDI mode Choice: Acquisition, Brownfield, and Greenfield Entry in Foreign Markets. *Canadian Journal of Administrative Sciences 23*(3), 202–220.

Cho, K. and P. Padmanabhan (1995). Acquisition versus new venture: The choice of foreign establishment mode by Japanese firms. *Journal of International Management 1*(3), 255–285.

Chudnovsky, D., A. Lopez, and G. Pupato (2006). Innovation and productivity in developing countries: A study of Argentine manufacturing firms' behavior (1992-2001). *Research Policy 35*(2), 266–288.

Cohen, W. and S. Keppler (1992). The Anatomy of Industry R&D Intensity Distributions. *American Economic Review 82*(4), 773–799.

Crépon, B., E. Duguet, and J. Mairesse (1998). Research, Innovation, and Productivity: An Econometric Analysis at the Firm Level. NBER Working Paper 6696, National Bureau of Economic Research.

Czarnitzki, D. and N. O'Byrnes (2007). R&D, Innovation and the Impact on Productivity in Flanders. *Tijdschrift voor Economie en Management 52*(2), 199–216.

Davies, S. and B. Lyons (1996). *Industrial Organization in the European Union*. Oxford: Clarendon Press.

Denison, E. (1985). *Trends in American Economic Growth, 1929-1982*. Washington, D.C., US: Brookings Institution.

Dikova, D. and A. van Witteloostuijn (2007). Foreign direct investment mode choice: entry and establishment modes in transition economies. *Journal of International Business Studies 38*(6), 1013–1033.

Djankov, S., O. Hart, C. McLiesh, and A. Shleifer (2006). Debt Enforcement around the World. *NBER* Working Paper 12807, National Bureau of Economic Research. http://www.nber.org/papers/w12807.pdf (accessed June 9, 2008).

Djankov, S., R. La Porta, F. Lopez-de-Silanes, and A. Shleifer (2002). The Regulation of Entry. *The Quarterly Journal of Economics 117*(1), 1–37.

Djankov, S., R. La Porta, F. Lopez-de-Silanes, and A. Shleifer (2003). Courts: The Lex Mundi Project. *The Quarterly Journal of Economics 118*(2), 453–517.

Dunning, J. (1981). Explaining the International Direct Investment Position of Countries: Towards a dynamic and development approach. *Weltwirtschaftliches Archiv 117*(1), 30–64.

Dunning, J. (1993). *Multinational Enterprises and the Global Economy*. Reading, MA and Wokingham, UK: Addison Wesley.

Dymski, G. (2002). The Global Bank Merger Wave: Implications for Developing countries. *The Developing Economies 40*(4), 435–466.

Erramili, M. and C. Rao (1993). Service firms' international entry-mode choice: a modified transaction-cost analysis approach. *Journal of Marketing 57*(3), 19–38.

European Central Bank (2007). Financial Integration in Europe, March 2007. http://www.ecb.int/pub/pdf/other/financialintegrationineurope200703en.pdf (accessed March 17, 2008).

Fazio, G., H. Lam, and F. Ritchie (2008). Sample bias in microeconometric analyses of official data. Office for National Statistics, UK http://www.scientificcommons.org/40659044 (accessed April 1, 2009).

Ferrett, B. (2003). Greenfield Investment versus Acquisition: Positive Analysis. GEP Research Paper 2003/02, http://search.ssrn.com/sol3/papers.cfm?abstract_id=408922 (accessed June 9, 2008).

Forsgren, M. (1989). Foreign acquisitions: Internalization or network interdependency? *Advances in International Marketing 3*(1), 141–159.

Fujita, M., P. Krugman, and A. Venables (1999). *The Spatial Economy: Cities, Regions and International Trade*. Cambridge, Mass.: MIT Press.

Fujita, M. and J. Thisse (2002). *Economics of Agglomeration: Cities, Industrial Location, and Regional Growth*. Cambridge, UK ; New York : Cambridge University Press.

Gatignon, H. and E. Anderson (1988). The Multinational Corporation's Degree of Control over Subsidiaries: An Empirical Test of a Transaction Cost Explanation. *Journal of Law, Economics and Organization 4*(2), 305–336.

Goedhuys, M. (2007). The Impact of Innovation Activities on Productivity and Firm Growth: Evidence from Brazil. UNU-MERIT Working Papers no. 2, United Nations University - Maastricht Economic and social Research and training center on Innovation and Technology.

Goerg, H. (2000). Analysing foreign market entry: The choice between greenfield investment and acquisition. *Journal of Economic Studies 27*(3), 165–181.

Goodnow, J. and J. Hansz (1972). Environmental determinants of overseas market entry strategies. *Journal of International Business Studies 3*, 33–50.

Griffith, R., E. Huergo, J. Mairesse, and B. Peters (2006). Innovation and Productivity Across Four European Countries. *Oxford Review of Economic Policy 22*(4), 483–498.

Griffith, R., S. Redding, and H. Simpson (2004). Foreign Ownership and Productivity: New Evidence from the Service Sector and the R&D Lab. *Oxford Review of Economic Policy 20*(3), 440–456.

Griliches, Z. (1979). Issues in Assessing the Contribution of Research and Development to Productivity Growth. *Bell Journal of Economics 10*(1), 92–116.

Gupta, V. (2007). Are US Multinationals Making Rational Offshoring Decisions? A Gravity Model Approach. Watson Wyatt Technical Paper No. 2007-TR-02 http://ssrn.com/paper=975891 (accessed December 20, 2007).

Hall, B. and A. Maffioli (2008). Evaluating the impact of technology development funds in emerging economies: evidence from Latin America. *European Journal of Development Research 20*(2), 172–198.

Hall, B. and J. Mairesse (2006). Empirical studies of innovation in the knowledge-driven economy. *Economics of Innovation and New Technology, Taylor and Francis Journals 15*(4-5), 289–299.

Harzing, A.-W. (2002). Acquisitions versus greenfield investments: international strategy and management of entry modes. *Strategic Management Journal 23*(3), 211–227.

Hausmann, R., A. Rodríguez-Clare, and D. Rodrik (2005). Towards a Strategy for Economic Growth in Uruguay. Economic and Social Studies Series RE1-05-003, Inter-American Development Bank.

Heckman, J. (1979). Sample Selection Bias as a Specification Error. *Econometrica 47*(1), 153–161.

Hennart, J. (1982). *A Theory of the Multinational Enterprise*. Ann Arbor: University of Michigan Press.

Hennart, J. (1988). A transaction cost theory of equity joint ventures. *Strategic Management Journal 9*(4), 316–374.

Hennart, J. (1991). The Transaction Costs Theory of Joint Ventures: An Empirical Study of Japanese Subsidiaries in the United States. *Management Science 37*(4), 483–497.

Hennart, J. and J. Larimo (1998). The Impact of Culture on the Strategy of Multinational Enterprises: Does National Origin Affect Ownership Decisions? *Journal of International Business Studies 29*(3), 515–538.

Hennart, J., J. Larimo, and S.-F. Chen (1996). Does National Origin Affect the Propensity of Foreign Investors to Enter the United States through Acquisitions? Discussion Paper no. 189, University of Vaasa, Finland.

Hennart, J. and Y. Park (1993). Greenfield vs Acquisition: The Strategy of Japanese Investors in the United States. *Management Science 39*(9), 1054–1070.

Hennart, J. and S. Reddy (1997). The Choice between Mergers/Acquisitions and Joint Ventures: the Case of Japanese Investors in the United States. *Strategic Management Journal 18*(1), 1–12.

Hennart, J. and S. Reddy (2000). Digestibility and Asymetric Information in the Choice between Acquisitions and Joint Ventures: Where's the Beef? *Strategic Management Journal 21*(2), 191–193.

Hernandez, I. (2005). Legal Form, Innovation and Productivity of Firms within Colombian Manufacturing Industry. *Cuadernos de Economia (National University of Colombia) 24*(42), 135–60.

Hofstede, G. (1980). *Culture's Consequences: International Differences in Work Related Values*. Beverly Hills, CA: SAGE.

Huergo, E. and J. Jaumandreu (2004). Firms' Age, Process Innovation and Productivity Growth. *International Journal of Industrial Organization 22*(4), 541–59.

ICRG (2003). International Country Risk Guide. The PRS Group.

Janz, N., H. Lööf, and B. Peters (2004). Firm Level Innovation and Productivity : Is there a Common Story Across Countries? Discussion Paper no. 03-26, ZEW - Zentrum für Europäische Wirtschaftsforschung / Center for European Economic Research. http://opus.zbw-kiel.de/volltexte/2003/1020/pdf/dp0326.pdf.

Jefferson, G., B. Huamao, G. Xiaojing, and Y. Xiaoyun (2006). R&D Performance in Chinese Industry. *Economics of Innovation and New Technology 15*(4-5), 345–366.

Kaufmann, D., A. Kraay, and M. Mastruzzi (2006). Governance Matters V: Aggregate and Individual Governance Indicators for 1996-2006. World Bank Policy Research Department Working Paper 4280, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=930847 (accessed November 11, 2007).

Kogut, B. and H. Singh (1988). The Effect of National Culture on the Choice of Entry Mode. *Journal of International Business Studies 19*(3), 411–432.

Lamont, B. and C. Anderson (1985). Mode of corporate diversification and economic performance. *Academy of Management Journal 28*(4), 926–934.

Larimo, J. (2003). Form of investment by Nordic firms in world markets. *Journal of Business Research 56*(10), 791–803.

Le Gall, S. (2007). La localisation de I'investissement internationalement mobile: le choix du cluster. *Économies et Sociétés 17*(4), 803–832.

Leamer, E. (1983). Let's take the con out of econometrics. *American Economic Review 73*(1), 31–43.

Leamer, E. (1985). Sensitivity Analysis Would Help. *American Economic Review 75*(5), 308–313.

Lee, K. and S. Kang (2007). Innovation Types and Productivity Growth: Evidence from Korean Manufacturing Firms. *Global Economic Review 36*(4), 343–359.

Lee, L. (1982). Specification error in multinomial logit models. *Journal of Econometrics 20*, 197–209.

Lööf, H. and A. Heshmati (2002). Knowledge Capital and Performance Heterogeneity: a Firm-Level Innovation Study. *International Journal of Production Economics 76*(1), 61–85.

Llorca-Vivero, R. (2002). The Impact of Process Innovations on Firm's Productivity Growth: The Case of Spain. *Applied Economics 34*(8), 1007–1016.

Lopez, A. and E. Orlicki (2006). ¿quién patenta en la Argentina? Un análisis econométrico para el sector manufacturero. Proyecto OMPI-CEPAL, Sistemas de Propiedad Intelectual y Gestión Tecnológica en Economías Abiertas: una Visión Estratégica para América Latina y el Caribe.

Lopez-Duarte, C. and E. Garcia-Canal (2002). The Effect of Firm and Host Country Characteristics on the Choice of Entry Mode: Empirical Evidence from Spanish Firms. *Journal of Management and Governance 6*(2), 153–168.

Los, B. and B. Verspagen (2000). R&D Spillovers and Productivity: Evidence from U.S. Manufacturing Microdata. *Empirical Economics 25*, 127–148.

Louri, H. (2001). Entry through Acquisition: Determinants of Multinational Firm Choices. *Review of Industrial Organization 19*(2), 199–209.

Mairesse, J. and M. Sassenou (1997). R&D Productivity: A Survey of Econometric Studies at the Firm Level. NBER Working Paper 3666, National Bureau of Economic Research. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=227437.

Masso, J. and P. Vahter (2008). Technological Innovation and Productivity in Late-Transition Estonia: Econometric Evidence from Innovation Surveys. Working Paper 61-2008, The University of Tartu Faculty of Economics and Business Administration.

Mayer, T. and S. Zignago (2006). Notes on CEPII's distances measures. Centre D'Etudes Prospectives et D'Informations Internationales, http://www.cepii.fr/anglaisgraph/bdd/distances.pdf (accessed February 14, 2008).

Meyer, K. and S. Estrin (1997). Privatisation acquisition and direct foreign investment: who buys state-owned enterprises? *MOCT-MOST: Economic Policy in Transnational Economies 7*(1), 159–172.

Mohnen, P., J. Mairesse, and M. Dagenais (2006). Innovativity: A Comparison across Seven European Countries. *Economics of Innovation and New Technology, Taylor and Francis Journals 15*(4-5), 391–413.

Mueller, T. (2001). Analyzing Modes of Foreign Entry: Greenfield Investment versus Acquisition. *University of Munich* Discussion Papers in Economics 2001-1, http://epub.ub.uni-muenchen.de/13/1/0101_mueller.pdf (accessed June 9, 2008).

Newburry, W. and Y. Zeira (1997). Generic Differences Between Equity International Joint Ventures (EIJVs), International Acquisitions (IAs) and International Greenfield Investments (IGIs): Implication for Parent Companies. *Journal of World Business 32*(2), 87–102.

Nocke, V. and S. Yeaple (2004). An Assignment Theory of Foreign Direct Investment. *NBER Working Paper* 11003, National Bureau of Economic Research. http://www.nber.org/papers/w11003.pdf (accessed December 20, 2007).

Norbäck, P. and L. Persson (2003). Cross-Border Acquisitions and Greenfield Entry: Profitability and Stock Market Value. *Centre of Economic Policy Research*, Discussion Paper No. 3998: 1-31.

Norbäck, P. and L. Persson (2007). Globalization and Profitability of Cross-Border Mergers & Acquisitions. *Centre of Economic Policy Research*, Discussion Paper No. 6102: 1-42.

O hUallacháin, B. and N. Reid (1997). Acquisition versus Greefield Investment: The location and growth of Japanese manufacturers in the United States. *Regional Studies 31*(4), 403–416.

Padmanabhan, P. and K. Cho (1999). Decision-specific experience in foreign ownership and establishment strategies: Evidence from Japanese firms. *Journal of International Business Studies 30*(1), 25–44.

Pakes, A. and Z. Griliches (1984). Patents and R&D at the Firm Level: A First Look. In G. Z (Ed.), *R&D, Patents, and Productivity*, pp. 55–72. Chicago, IL, US: University of Chicago Press.

Pitts, R. (1977). Strategies and structures for diversification. *Academy of Management Journal 20*(2), 197–208.

Pitts, R. (1980). Towards a contingency theory of multibusiness organization design. *Academy of Management Review 5*(2), 203–210.

Pérez, P., G. Dutrénit, and F. Barceinas (2005). Actividad Innovadora y Desempeño Económico: un análisis econométrico del caso mexicano. In M. Albornoz and D. Ratto (Eds.), *Indicadores de Ciencia y Tecnología en Iberoamerica. Agenda 2005*, pp. 299–318. Buenos Aires, AR: RICYT.

Raffo, J., S. Lhuillery, and L. Miotti (2007). Northern and southern innovativity: a comparison across European and Latin American countries. *The European Journal of Development Research 20*(2), 219–239.

Raffo, J., S. Lhuillery, and L. Miotti (2008). Northern and southern innovativity: a comparison across European and Latin American countries. *The European Journal of Development Research 20*(2), 219–239.

Rao, S., J. Tang, and W. Wang (2002). The Importance of Skills for Innovation and Productivity. *International Productivity Monitor 4*, 15–26.

Reuer, J. and M. Koza (2000). On Lemons and Indigestibility: Resource Assembly through Joint Ventures. *Strategic Management Journal 21*(2), 195–197.

Roud, V. (2007). Firm-level Research on Innovation and Productivity: Russian Experience. Institute of Statistical Studies and Economics of Knowledge, Higher School of Economics Moscow, Russian Federation.

Rugman, A. (1981). *Inside the Multinationals: The Economics of Internal Markets*. London: Croom Helm.

Ruud, P. (1983). Sufficient conditions for the consistency of maximum likelihood estimation despite misspecification of distribution in multinomial discrete models. *Econometrica 51*, 225–228.

Sala-i-Martin, X. (1997a). I Just Ran Four Million Regressions. NBER Working Paper 6252, National Bureau of Economic Research. http://www.nber.org/papers/w6252.pdf (accessed December 20, 2007).

Sala-i-Martin, X. (1997b). I Just Ran Two Million Regressions. *The American Economic Review 87*(2), 178–183.

Slangen, A. and J. Hennart (2007). Greenfield or Acquisition Entry: A Review of the Empirical Foreign Establishment Mode Literature. ERIM Report Series Reference ERS-2007-059-ORG. http://ssrn.com/abstract=1021882 (accessed May 28, 2008).

Slangen, A. and J. Hennart (2008a). Do Foreign Greenfields Outperform Foreign Acquisitions or Vice Versa? An Institutional Perspective. SSRN eLibrary, http://ssrn.com/paper=1117786, accessed November 30, 2008.

Slangen, A. and J. Hennart (2008b). Do Multinationals Really Prefer to Enter Culturally-Distant Countries Through Greenfields Rather than Through Acquisitions? The Role of Parent Experience and Subsidiary Autonomy. SSRN eLibrary, http://ssrn.com/paper=1021883, accessed November 30, 2008.

Stigler, G. (1961). The economics of information. *Journal of Political Economy 69*(3), 213–225.

Stoevsky, G. (2005). Innovation and Business Performance of Bulgarian Companies (structural econometric analysis at firm level). Economic Research and Projections Directorate Working Paper, Bulgarian National Bank.

Tang, J. and C. Le (2007). Multidimensional Innovation and Productivity. *Econ. Innov. New Techn. 16*(7), 501–516.

Theil, R. (1954). *Linear Aggregation of Economic Relations*. Amsterdam, NL: North-Holland Publishing Company.

TOEFL (2007). Test and Score Data Summary for TOEFL Internet-based and Paper-based Tests. Test of English as a Foreign Language.

Tsai, K. and J. Wang (2004). The R&D Performance in Taiwan's Electronics Industry: A Longitudinal Examination. *R&D Management 34*(2), 179–189.

UNCTAD (2007). Total number of Bilateral Investment Agreements concluded, 1 june 2007. Reports by country.

Van Leeuwen, G. and L. Klomp (2006). On the contribution of innovation to multifactor productivity growth. *Economics of Innovation and New Technology, Taylor and Francis Journals 15*(4-5), 367–390.

Venables, A. (1996). Equilibrium Locations of Vertically Linked Industries. *International Economic Review 32*(2), 341–359.

Veugelers, R. (1991). Locational Determinants and Ranking of Host Countries: an Empirical Assessment. *Kyklos 44*(3), 363–382.

Watson Wyatt Worldwide (2008). Global 50 Remuneration Planning Reports. Reports by country and by year, period 1999/00-2007/08.

Wei, Y., B. Liu, and X. Liu (2005). Entry modes of foreign direct investment in China: a multinomial logit approach. *Journal of Business Research 58*(11), 1495–1505.

Wernerfelt, B. and C. Montgomery (1986). What is an Attractive Industry? *Management Science 32*(10), 1223–1230.

Wes, M. and H. Lankes (2001). FDI in Economies in Transition: M&As versus Greenfield Investment. *UNCTAD Trasnational Corporations 10*(3), 113–129.

Wilson, B. (1980). The Propensity of Multinational Companies to Expand through Acquisitions. *Journal of International Business Studies 11*(1), 59–65.

World Bank (2008). Doing business 2008 report. http://www.doingbusiness.org/, accessed December 31, 2008.

Xu, D., Y. Pan, and P. Beamish (2004). The effect of regulative and normative distances on MNE ownership and expatriate strategies. *Management International Review 44*(3), 285–307.

Zejan, M. (1990). New Ventures or Acquisitions: The Choice of Swedish Multinational Enterprises. *Journal of Industrial Economics 38*(3), 349–355.

Erklärung

Ich versichere hiermit, dass ich die vorliegende Arbeit mit dem Thema

Four Essays on Firm Offshoring and Innovation Behavior

ohne unzulässige Hilfe Dritter und ohne Benutzung anderer als der angegebenen Hilfsmittel angefertigt habe. Die aus anderen Quellen direkt oder indirekt übernommenen Daten und Konzepte sind unter Angabe der Quelle gekennzeichnet. Weitere Personen, insbesondere Promotionsberater, waren an der inhaltlich materiellen Erstellung dieser Arbeit nicht beteiligt.[19] Die Arbeit wurde bisher weder im In- noch im Ausland in gleicher oder ähnlicher Form einer anderen Prüfungsbehörde vorgelegt.

Konstanz, den 24. Juni 2009

(Magdalena Ramada Sarasola)

[19]Siehe hierzu die Abgrenzung zu Kapiteln 3 und 4 auf der folgenden Seite.

Abgrenzung

Ich versichere hiermit, dass ich Kapitel 1 und 2 der vorliegenden Arbeit ohne Hilfe Dritter und ohne Benutzung anderer als der angegebenen Hilfsmittel angefertigt habe.

Kapitel 3 entstammt einer gemeinsamen Arbeit mit Frau Dr. Adriana Cassoni. Die individuelle Leistung bei der Erstellung dieser Arbeit gliedert sich wie folgt:

1. Introduction: 50% Cassoni / 50% Ramada
2. Determinants of innovation and its impact on productivity growth: 50% Cassoni /50% Ramada
3. Characteristics of the information set: 50% Cassoni / 50% Ramada
4. Measures of innovation output and inputs: 50% Cassoni / 50% Ramada
5. Econometric Results: 50% Cassoni / 50% Ramada
6. Conclusions: 50% Cassoni / 50% Ramada

Kapitel 4 entstammt einer gemeinsamen Arbeit mit Frau Dr. Adriana Cassoni. Die individuelle Leistung bei der Erstellung dieser Arbeit gliedert sich wie folgt:

1. Introduction: 50% Cassoni / 50% Ramada
2. Review of the literature: 60% Cassoni /40% Ramada
3. Departing point: the CDM model: 60% Cassoni / 40% Ramada
4. Measures of innovation output and inputs: 40% Cassoni / 60% Ramada
5. New approach to proxy the value of innovation output: 50% Cassoni / 50% Ramada
6. Comparing the performance of the indicators: 10% Cassoni / 90% Ramada
7. Conclusions and recommendations: 20% Cassoni / 80% Ramada

Konstanz, den 24. Juni 2009

(Magdalena Ramada Sarasola)