

Universität Konstanz  
Fachbereich Politik- und Verwaltungswissenschaft

# MARKET RESPONSE TO EUROPEAN COMMISSION'S MERGER DECISIONS

Diplomarbeit  
April 2006

Erstgutachter: Prof. Dr. Gerald Schneider  
Zweitgutachter: Prof. Dr. Christoph Knill

**Anna Kalbhenn**

Brückengasse 1a  
78462 Konstanz

Matrikelnummer: 01/496956

# Acknowledgements

I am indebted to my supervisors Prof. Dr. Gerald Schneider and Prof. Dr. Christoph Knill for guidance, patience and support. Special thanks go to Alexander Wohlwender for recoding large parts of my newspaper analysis. Further, I would like to thank Matthias Ganninger for the provision of his L<sup>A</sup>T<sub>E</sub>X-style file and acknowledge his enormous help with managing the data provided by the European Commission's Directorate General Competition. Tim Thomay deserves a big thank for preventing me from struggling with labour-intensive L<sup>A</sup>T<sub>E</sub>X-graphics. Warm thanks also go to Christoph Albrecht, Laurie Baggott, Matthias Ganninger, Antje Kirchner, Juliane Krüger, Gabriele Ruoff, and Alexander Wohlwender for useful comments. Any remaining errors are of my own responsibility. Last but not least, I thank my parents for continuous support.

# Zusammenfassung

Welche Auswirkungen haben Entscheidungen der Europäischen Kommission über Unternehmenszusammenschlüsse auf Finanzmärkte? Inwiefern ist der abnormale Gewinn<sup>1</sup> von Aktien der betroffenen Unternehmen auf (unerwartete) Entscheidungen der Europäischen Kommission im Rahmen der EG-Fusionskontrollverordnung<sup>2</sup> zurückzuführen? Diesen Fragen wird in meiner Diplomarbeit mittels einer empirischen Analyse der Aktienmarktreaktionen auf entsprechende Kommissionsentscheidungen nachgegangen.

Das theoretische Modell dieser Diplomarbeit geht von der Annahme aus, dass Aktienhändler insofern auf die Entscheidungen der Europäischen Kommission, eine Fusion zu genehmigen bzw. zu verbieten, reagieren, als dass diese Entscheidungen zukünftige Wettbewerbsbedingungen der jeweiligen Unternehmen bestimmen. Effiziente Märkte vorausgesetzt, gehe ich des weiteren davon aus, dass sich die Erwartung zukünftiger Wertentwicklungen in aktuellen Aktienpreisentwicklungen widerspiegeln. Dieser Zusammenhang hat nicht nur das Medien-, sondern auch ein breites akademisches Interesse an der EG-Fusionskontrollverordnung geweckt. Die vorhandene Literatur gibt jedoch nur bedingt Aufschluss darüber, wie Finanzmärkte auf die Entscheidungen der Europäischen Kommission reagieren. Entsprechend setzt sich diese Arbeit damit auseinander, wie Aktienhändler Nachrichten (über bestimmte Entscheidungen der Europäischen Kommission) aufnehmen und diese in ihre Handelsstrategie einfließen lassen. Ausgehend von rationalen, nutzenmaximierenden Aktienhändlern, unterstelle ich, dass sie ihre a-priori Wahrscheinlichkeit über zukünftige Unternehmensleistungen aufgrund entsprechender Wettbewerbsentscheidungen der Europäischen Kommission aktualisieren und ihr Portfolio entsprechend anpassen. Dabei kann schon die reine Erwartung einer bestimmten Entscheidung für Kauf- bzw. Verkaufsentscheidungen ausschlaggebend sein. Basieren die Spekulationen vieler Börsenmakler auf derselben Erwartung über die Zulässigkeit von angekündigten Unternehmenszusammenschlüssen, sollte sich dies in Preisveränderungen der Aktien der jeweils betroffenen Unternehmen niederschlagen. Außerdem gehe ich davon aus, dass gesteigerte Unsicherheit über den möglichen Ausgang eines Fusionskontrollverfahrens Marktvolatilität erhöht.

Damit baut diese Arbeit auf den einschlägigen Studien von Brady und Feinberg (2000) und Aktas et al. (2004) auf. Die Autoren beider Studien untersuchen Marktreaktionen auf Kommissionsentscheidungen zu Unternehmenszusammenschlüssen. Die vielversprechenden Ergebnisse beider Studien bilden die Grundlage und rechtfertigen gleichzeitig weitere Forschung auf diesem Gebiet.

---

<sup>1</sup> Der abnormale Gewinn bezieht sich auf Gewinnschwankungen, die auf bestimmte Ereignisse zurückzuführen, und nicht den generellen Marktschwankungen oder zufälligen Abweichungen zuzurechnen sind.

<sup>2</sup> Verordnung Nr. 4064/89(EG) geändert durch die Verordnung Nr. 139/2004(EG) über die Kontrolle von Unternehmenszusammenschlüssen.

In dieser Arbeit versuche ich, die Lücke zwischen beiden Studien zu schließen, indem ich die empirische Untersuchung auf eine größere Fallauswahl stütze als Brady und Feinberg (2000) und sie in einen erweiterten theoretischen Rahmen bette als Aktas et al. (2004). Letzteres beinhaltet vor allem die explizite Modellierung von Antizipationseffekten.

Untersucht wird im Rahmen dieser Diplomarbeit, ob und inwiefern Informationen einen spürbaren Einfluss auf Aktiengewinne und Marktvolatilität haben. Die Untersuchung stützt sich auf empirische Aktienmarktdaten, die den Zeitraum seit Inkrafttreten der Fusionskontrollverordnung im Jahr 1990 bis heute abdecken. Mithilfe einer Ereignisanalyse gelingt es zu zeigen, dass bestimmte Entscheidungstypen durchaus einen spürbaren Einfluss auf Finanzmärkte haben, obgleich nicht alle Fälle diese Hypothese bestätigen. Außerdem sind Volatilitätsschwankungen in Zusammenhang mit dem Ausmaß der Vorhersehbarkeit von bestimmten Entscheidungen zu vermerken; allerdings ist dieser Zusammenhang weniger stark ausgeprägt.

Die Diplomarbeit gliedert sich wie folgt: Einer kurzen Einführung (Kapitel 1) folgt ein Abriss über die wichtigsten Punkte der Fusionskontrollverordnung (Kapitel 2). Im nächsten Kapitel stelle ich den aktuellen Forschungsstand zum Thema dar (Kapitel 3). Dieses Kapitel ist die Grundlage für Kapitel 4, das den theoretischen Rahmen absteckt. Kapitel 5 stellt das theoretische Modell und entsprechende empirisch überprüfbare Hypothesen vor. Dem Theorieteil folgt Kapitel 6, in dem ich mein Forschungsdesign darstelle und auf einige methodische Fragen eingehe. In Kapitel 7 werden die Datenbeschaffung und -aufbereitung zusammengefasst, und Kapitel 8 erklärt die verwendeten statistischen Verfahren. Der empirische Teil wird mit einer Ergebnisdiskussion in Kapitel 9 abgeschlossen. Kapitel 10 fasst die wichtigsten Ergebnisse der Studie zusammen und gibt Anregungen für mögliche zukünftige Forschung auf diesem Gebiet.

# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
<b>2</b>	<b>The Merger Regulation</b>	<b>4</b>
<b>I</b>	<b>Theoretical Background</b>	<b>7</b>
<b>3</b>	<b>State of the Art</b>	<b>8</b>
<b>4</b>	<b>Financial Theory</b>	<b>14</b>
4.1	The Efficient Market Hypothesis . . . . .	14
4.2	Behavioural Finance . . . . .	18
4.3	Impact of Information and News . . . . .	21
<b>5</b>	<b>Model and Hypotheses</b>	<b>24</b>
5.1	Stock Returns . . . . .	24
5.2	Market Volatility . . . . .	27
5.3	Alternative Explanations . . . . .	28
<b>II</b>	<b>Empirical Application</b>	<b>30</b>
<b>6</b>	<b>Research Design</b>	<b>31</b>
6.1	Case Selection and Period of Investigation . . . . .	31
6.2	Event Study . . . . .	34
6.3	Volatility Analysis . . . . .	37
6.4	Variables and their Operationalisations . . . . .	38
6.4.1	Dependent Variable . . . . .	38

6.4.2	Independent Variables . . . . .	41
6.4.3	Control Variables . . . . .	43
<b>7</b>	<b>Data</b>	<b>44</b>
7.1	Data Sources . . . . .	44
7.1.1	Financial Series . . . . .	45
7.1.2	Other Variables . . . . .	45
7.2	Data Transformation . . . . .	51
<b>8</b>	<b>Statistical Method</b>	<b>53</b>
8.1	Event Study Methodology . . . . .	53
8.1.1	Calculation of Abnormal Returns . . . . .	53
8.1.2	Hypothesis Testing . . . . .	60
8.2	Estimating Volatility Effects . . . . .	63
8.3	Diagnostics . . . . .	65
<b>9</b>	<b>Discussion of Results</b>	<b>68</b>
9.1	Case Studies . . . . .	68
9.1.1	Impact of Commission's Decisions on Stock Returns . . . . .	68
9.1.2	Length of Event Window . . . . .	70
9.1.3	Equilibrium Model . . . . .	71
9.1.4	Summary . . . . .	72
9.2	Stock Returns . . . . .	72
9.2.1	Hypothesis 1 . . . . .	74
9.2.2	Hypotheses 2 and 2a . . . . .	78
9.2.3	Hypothesis 3 . . . . .	84
9.2.4	Summary . . . . .	85

9.3	Volatility Analysis . . . . .	85
9.3.1	Summary . . . . .	94
<b>10</b>	<b>Conclusion</b>	<b>96</b>
	<b>Bibliography</b>	<b>101</b>
	<b>Appendices</b>	<b>114</b>
<b>A</b>	<b>List of Final Sample</b>	<b>114</b>
<b>B</b>	<b>Data Sources and Codebook</b>	<b>118</b>
<b>C</b>	<b>Data CD</b>	<b>120</b>
<b>D</b>	<b>Additional Results</b>	<b>124</b>
<b>E</b>	<b>Correlation Matrices</b>	<b>130</b>
E.1	Bertelsmann . . . . .	130
E.2	General Electrics . . . . .	130
E.3	Honeywell . . . . .	131
E.4	Scania . . . . .	131
<b>F</b>	<b>Influential Cases</b>	<b>132</b>

# List of Figures

2.1	The Merger Review Process According to Regulation 4064/89/ECC	5
6.1	Timeline of an Event Study	35
7.1	Decision Scheme	49
8.1	OLS vs. Theil-fit (Bertelsmann, prohibition)	59
9.1	Abnormal Returns Metso; Decision Type 6(1)(c)	69
9.2	Returns Dow Chemical; Decision Type 6(1)(c)	70
9.3	CAR UPM-Kymmene (MM estimated with GARCH); Decision Type 8(2)	71
9.4	Abnormal Returns Electrabel; Decision Type 6(1)(a)	72
9.5	Abnormal Returns Merck; Decision Type 6(1)(a)	73
9.6	CAAR Decision Type 8(3)	74
9.7	CAAR Decision Type 8(2)	78
9.8	CAAR Decision Type 6(1)(b)	79
9.9	CAAR Decision Type 8(2) with conditions	81
9.10	CAAR Decision Type 6(1)(b) with conditions	82
9.11	CAAR Decision Type 6(1)(a)	85
F.1	CAAR without influential cases, Decision Type 8(3)	134
F.2	CAAR without influential cases, Decision Type 6(1)(c)	134
F.3	CAAR without influential cases, Decision Type 6(1)(b)	135
F.4	CAAR without influential cases, Decision Type 8(2)	135
F.5	CAAR without influential cases, Decision Type 6(1)(b) with conditions	136

F.6 CAAR without influential cases, Decision Type 8(2) with conditions . . . . .	136
--	-----

# List of Tables

6.1	Decisions within the scope of the Merger Regulation, September 21 <sup>st</sup> 1990 to September 30 <sup>th</sup> 2005 . . . . .	32
9.1	Test Statistics H1 . . . . .	76
9.2	Test Statistics H2 . . . . .	80
9.3	Test Statistics H2a . . . . .	83
9.4	Test Statistics H3 . . . . .	86
9.5	Volatility Analysis (GARCH/ EGARCH) Bertelsmann (Art. 8.3 decision) . . . . .	87
9.6	Volatility Analysis (EGARCH) General Electrics (Art. 8.3 de- cision) . . . . .	90
9.7	Volatility Analysis (EGARCH) Honeywell (Art. 8.3 decision) . .	92
9.8	Volatility Analysis (EGARCH) Scania (Art. 8.3 decision) . . . .	93
D.1	Volatility Analysis (GARCH) General Electrics (Art. 8.3 decision)	125
D.2	Volatility Analysis (GARCH) Honeywell (Art. 8.3 decision) . .	126
D.3	Volatility Analysis (GARCH) Scania (Art. 8.3 decision) . . . . .	127
D.4	Volatility Analysis with lags (EGARCH) Scania (Art. 8.3 deci- sion) . . . . .	128
D.5	Volatility Analysis with lags (GARCH) Scania (Art. 8.3 decision)	129
F.1	Influential Cases . . . . .	133

# List of Abbreviations

AR	Abnormal Return
ARCH	Autoregressive Conditional Heteroskedasticity
Art.	Article
AGARCH	Asymmetric Autoregressive Conditional Heteroskedasticity
BLUE	Best Linear Unbiased Estimate
cf.	<i>lat.:</i> confer (compare)
CM	Constant Mean
CAR	Cumulated Abnormal Return
CAAR	Cumulated Averaged Abnormal Return
CAPM	Capital Asset Pricing Model
CAR	Cumulated Abnormal Return
DAX	Deutscher Aktien Index
EC	European Communities
ECB	European Central Bank
e.g.	<i>lat.:</i> exempli gratia (for example)
EGARCH	Exponential Autoregressive Conditional Heteroskedasticity
EG	Europäische Gemeinschaften
EMH	Efficient Market Hypothesis
EEC	European Economic Community
EU	European Union
et al.	<i>lat.:</i> et alteri
etc.	<i>lat.:</i> et cetera
GARCH	Generalized Autoregressive Conditional Heteroskedasticity
GE	General Electrics
H1, . . . , H4	Hypothesis one, . . . , Hypothesis four
i.e.	<i>lat.:</i> id est (that is)
iid	independently and identically distributed
mds	martingale difference sequences
MM	Market Model
OLS	Ordinary Least Squares
SUR	Seemingly Unrelated Regressions
TARCH	Threshold Autoregressive Conditional Heteroskedasticity
US	United States

# Introduction

---

---

*This paper gives wrong solutions to trivial problems. The basic error, however, is not new.*  
(Clifford Truesdell)

Do financial markets react to decisions of the European Commission<sup>1</sup> on submitted mergers? To what extent are abnormal returns on the assets of the companies involved in a proposed merger due to (unexpected) Commission's decisions? Does anticipation of such decisions reduce uncertainty and lead to decreasing market volatility? These are the questions I am determined to answer within the scope of this diploma thesis by means of an empirical analysis of stock market reactions to merger decisions.

In 1989 the European Economic Community released a regulation on the control of concentrations between undertakings (Council Regulation (EEC) N° 4064/89) which was amended by the “EC Merger Regulation” (Council Regulation (EC) N° 139/2004) in 2004. In essence, the regulation aims at qualifying the compatibility of mergers with the Common Market. It is thus motivated by the protection of competition from companies assuming a market dominating position (cf. Duso et al. 2002, Evans & Padilla 2003, Geradin 2004, Hemmingsson 2002, Lundvall 2002, Neven et al. 1993).

There was a great hoo-ha when in 2001 the then-Commissioner for competition, Mario Monti, declared the fusion of Honeywell and General Electrics to be incompatible with the Common Market despite the fact that the US authorities had already cleared the merger. Was this overwhelming media reaction also reflected in financial markets? Do investors care whether EU officials impinge

---

<sup>1</sup> I will be using the terms ‘Commission’, ‘Commission of the European Communities’ and ‘European Commission’ interchangeably in this thesis. In fact, it is the competency of the Directorate General (DG) Competition to decide upon proposed mergers within the scope of the Merger Regulation.

on the rights of US companies?

According to the notion of efficient markets, investors are indeed expected to react to such decisions, because the latter hold information on possible future firm performance which largely determines current asset prices. This conjecture did not only raise media response but also called academic attention. Hitherto the scientific literature on the Merger Regulation has mainly dealt with the determinants of certain Commission's decisions, posing the question whether the latter can be explained rather by political or economic variables (Bergman et al. 2005, Duso et al. 2002, Morgan 2001, Neven et al. 1993, Schmittmann & Vonnemann 1992). In contrast to this literature, the focus of the current thesis is investor reactions to news. Based on the assumption that traders are rational utility-maximizers, I presume that they update their priors on future firm performance according to the decision taken (or anticipated to be taken) by the European Commission and adjust their portfolio accordingly. Assuming many such rational traders, changing trading strategies should be reflected by the market in terms of higher or lower stock returns, respectively. In this vein, this thesis builds on the pioneering empirical studies by Brady & Feinberg (2000) and Aktas et al. (2004). Both authors investigate market reactions to the Commission's decisions in the scope of the Merger Regulation. They yield promising results indicating market reactions to certain of the Commission's decisions and thus lay the foundation for –and at the same time justify– further research on this topic. With this study, I try to bridge the gap between those two studies, relying on a broader case selection than Brady & Feinberg (2000) and using a more refined theoretical background, including the explicit modelling of anticipation effects, than Aktas et al. (2004).

This diploma thesis is interdisciplinary oriented, insofar as it combines findings from financial economics and political science in a unified theoretical framework on how rational traders incorporate (political) information into their trading strategies and thus induce market reactions (chapter 4 and 5). The theoretical model further stipulates that uncertainty about the outcome of a merger review process increases market volatility.

Resuming the above discussion, this thesis aims at exploring and examining whether the arrival of information has a sizeable impact on both stock returns and market volatility. This assertion is challenged by empirical stock market data covering the whole period since the entry into force of the Merger Regula-

tion in 1990 up to the present day. Using an event study approach, I can show that as far as stock returns are concerned there is a clear impact of certain types of decisions on financial markets. However, not all cases investigated support the hypotheses derived in chapter 5. Further, the application of exponential generalized autoregressive conditional heteroskedasticity (EGARCH) models reveals certain volatility reactions to uncertain decisions; the effect of anticipation on event induced volatility, however, being less distinct than level reactions.

The remainder of this thesis is structured as follows: the subsequent chapter briefly outlines the Merger Regulation. Only those details are discussed which are essential to gaining a grasp in the central concepts. This overview is followed by a discussion of the state of the art in the empirical research of market reactions to the European Commission's merger decisions and related topics (chapter 3), which also forms the basis for the theoretical framework delineated in chapter 4. Based on these considerations, chapter 5 presents the model and derives empirically testable hypotheses. Following the theoretical part, chapter 6 is dedicated to the research design and discussion of some methodological questions. Chapter 7 presents the data used for the empirical analysis and chapter 8 explains the statistical methods employed. The empirical part is completed by a discussion of results in chapter 9. Finally, chapter 10 takes stock and suggests directions for further research.

# The Merger Regulation

---

---

## Chapter Outline:

Before focusing on the theoretical basis underlying this diploma thesis in chapters 3 and 4, this chapter aims at briefly sketching the main features of the Merger Regulation (Council Regulation 4064/89/EEC, amended by Council Regulation 139/2004/EEC).

The primary motivation of the Merger Regulation is to check in how far mergers and acquisitions are compatible with the Common Market with respect to assuring fair competition. According to article 2 of the regulation, companies planning a business combination (takeover, exchange offer or acquisition of control) have to notify the European Commission of their intention “if the combined world-wide turnover of the merging parties is sufficiently high, if their combined intra-community sale is sufficiently high and if the intra-community sale is not too concentrated to one member state only” (Bergman et al. 2005, 20). Immediately after the notification, the Commission starts the reviewing process, investigating whether the proposed combination is within the scope of the regulation and if so, whether or not it is compatible with the Common Market (European Communities 1989, Art. 4(3)).

Depending on the extent of a proposed merger the investigation lasts one or two phases. In phase I the authorities examine whether the combination falls within the scope of the regulation, i.e. whether it constitutes a combination of “European dimension” (Art. 6(1)(a) of Regulation 4064/89). If the European Commission decides that the combination is subject to review, it can either declare the combination to be compatible with the Common Market or approve it under the condition that certain obligations are met (Art. 6(1)(b)). The Commission may also express serious doubts on the proposed combination and thus initiate a more detailed investigation, an “in-depth phase-II investigation” (Art. 6(1)(c)). Having finished the phase II review, the Commission may

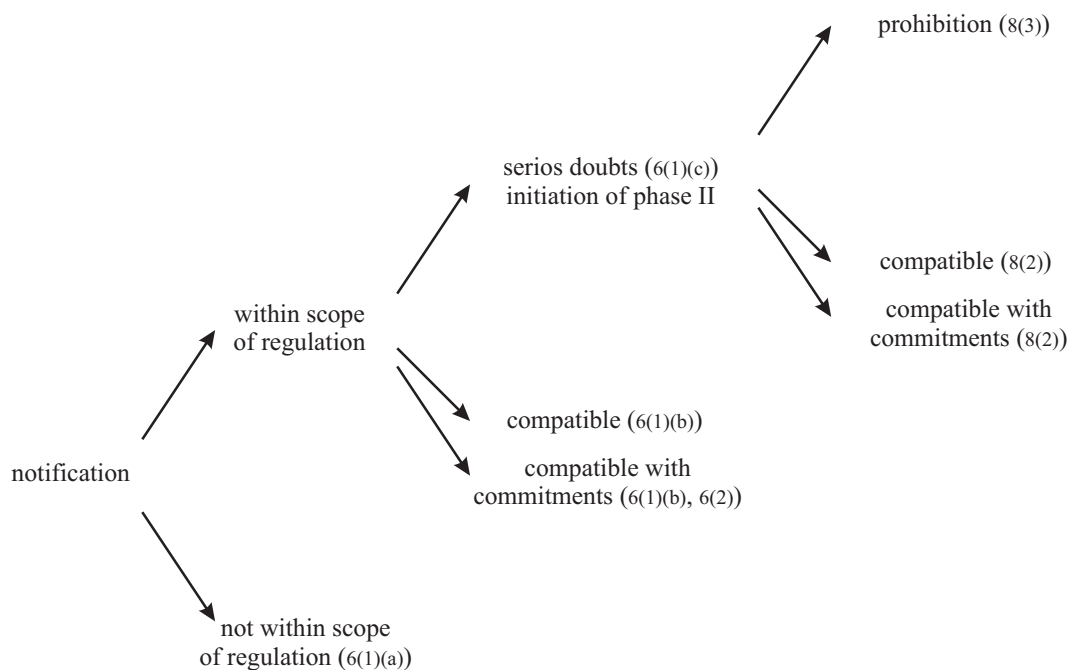


Figure 2.1: *The Merger Review Process According to Regulation 4064/89/ECC*

again issue three different types of decision. It may either approve the combination (Art. 8(2)), approve the combination subject to certain conditions and obligations or declare it to be incompatible with the Common Market (Art. 8(3)). Both decisions according to Art. 6(1)(a), 6(1)(b) and 8(2) can be revoked (Art. 6(3) or Art. 8(5), respectively) if the companies do not comply with the Commission's allegations. Finally, in case that a business combination was performed against the regulation's requirements, the Commission may nullify this combination and rule the separation of the companies in question (Art. 8(4)) or impose a fine (Art. 14). All decisions can be reviewed by the European Court of Justice (Art. 16). Figure 2.1 visualises the investigation process.

The Regulation was amended in 2004 by Council Regulation 139/2004. The main changes brought about by the reforms are jurisdictional and procedural issues (Bergman et al. 2005, 720).

The substantive test for the assessment of mergers has been reworded. The mechanism for reallocating cases from the Commission to Member States and vice versa has been revamped. Procedural changes have been made to make the regulation more flexible (European Commission 2004).

---

To sum up, four different types of Commission decisions can be distinguished; namely positive (approval), negative (rejection), uncertain (initiation of phase II) and procedural decisions. Due to different informational content, these are expected to lead to different reactions of financial markets. This aspect is stressed in more detail in the following sections (part I).

# **Part I**

## **Theoretical Background**

# State of the Art

---

---

*Theory is important, at least in theory.*  
(Keith Martin)

## Chapter Outline:

The aim of this chapter is to give a brief literature overview on market reactions to European Commission's merger decisions and related topics relevant for the model presented in chapter 5.

In order to provide an encompassing overview of relevant literature and the state of the art in research on market reactions to European Commission's merger decisions, it is inevitable to foreshadow some basic considerations underlying the model presented in chapter 5. Let us assume that rational investors expect possible distortions of competition linked to certain Commission's decisions. If investors include these considerations in their trading strategy, financial markets should accordingly react to Commission's decisions within the scope of the Merger Regulation. Up to now, there is little empirical evidence on market response to such decisions. However, two studies merit a closer look, namely Brady & Feinberg (2000) and Aktas et al. (2004). Brady & Feinberg's (2000) study is based on a rather limited case selection (27 companies), such that Aktas et al. (2004, 732) claim their study to be the first systematic, global analysis in this area. They exploratively investigate market response to 874 business combinations from 1990 to 2000. Both yield promising results indicating market reactions to certain Commission's decisions and thus lay the foundation for –and at the same time justify– further research on this topic. With this study, I try to bridge the gap between those two studies, relying on a broader case selection than Brady & Feinberg (2000) and using a more refined theoretical background, including the explicit modelling of anticipation effects, than Aktas et al. (2004).

The principal aim of this thesis is to show, whether Commission's decisions on proposed mergers (or their anticipation) are perceived as new information by the market and consequently lead to respective stock return- and volatility reactions. Hitherto existing studies on this topic<sup>1</sup> either deal with market reactions to mergers (Agrawal & Jaffe 1999*b,a*, Harrison & Liu 2004, Hemmingsson 2002, Feinberg 1980, Jensen 1987, Lindqvist 2003*a,b*, Rosen 2006), general reactions to the implications of antitrust<sup>2</sup> law (Bishop & Lofaro 2004, Block et al. 1981, Bulmer 1994, Büthe 2005, DeYoung 1994, Feinberg 1980, 1986, Feinberg & Harper 1999), or with the determinants of antitrust decisions by the European Commission (e.g. Bergman et al. 2005, Duso et al. 2002, Morgan 1997, 2001, Neven et al. 1993, Schmittmann & Vonnemann 1992). In contrast to this literature, my diploma thesis is based on the assumption that traders have different expectations about the probability of a business combination depending on the respective Commission's decision and adapt their trading strategy accordingly. This study thus builds on above mentioned studies by Brady & Feinberg (2000) and Aktas et al. (2004). Still, many concepts are derived from other literature loosely related to the research question or one of its subtopics. These are briefly sketched out below.

Despite the fact that there is an enormous and ever growing body of literature on the effects of mergers on the respective firms stocks (e.g. Healy et al. 1992, Henehan 2002, Jensen 1987, Lundvall 2002, Pautler 2003, Travlos & Waagelein 1992), less evidence exists on effects prior to the actual merger, such as regulatory decisions. The literature dealing with implications of EU antitrust law comprises several studies investigating the impact of the Merger Regulation on financial markets and firm values. For instance Rosen (2006) notices that the regulation has had a negative impact on corporations' values. Bris & Cabolis (2002) come to a similar conclusion and Feinberg & Harper (1999) find out that the same applies for the banking sector. Bris & Cabolis (2002) examine whether merger laws are value-increasing for an economy. With respect to European merger control, they resume that "both domestic, as well as cross-border acquisitions, have risen as a consequence of the Directive", but still the regulation had a "negative impact on corporate value" (Bris & Cabolis 2002, 02–03).

Other scholars concentrate on the factors motivating the European Commis-

---

<sup>1</sup> For a summary the reader is referred to Pautler (2003, 10ff).

<sup>2</sup> In Europe 'antitrust' law is often denoted by competition law. I use both terms interchangeably in this thesis.

sion in its assessment of proposed mergers. The determinants of the Commission's decisions are of crucial interest in this diploma thesis, presuming that the market will only reflect the impact of Commission's decisions, if investors deal with information on these decisions in similar ways. Such uniform behaviour is only possible, if the Commission's decisions are based on rational considerations such that they imply predictable consequences for competition. For instance Bergman et al. (2005) find out that the Commission's decisions do not depend on political reasons, such as the nationality of the merging firms. They go further into the question what types of mergers are typically prohibited and whether the Commission's decisions are compatible with economic theory (Bergman et al. 2005, 721). Focussing on the factors explaining the probability of a phase II investigation or the prohibition of a proposed merger, they find that both probabilities increase with the parties' market shares. This result is rather trivial, since the regulation itself stipulates certain thresholds based on parties' market shares, to assess compatibility with the Common Market. Duso et al. (2002), however, conclude that "the commission's decisions cannot be solely accounted for by the motive of protecting consumer surplus" (Duso et al. 2002, 01), but find that it is rather the institutional and political environment that matters. Further, both country- and industry effects and procedural aspects play an important role in explaining certain decisions. In line with Duso et al. (2002), Hemmingsson (2002) finds that politics and subjectivity played a role in some merger cases. More precisely, Hemmingsson (2002) investigates the Volvo Scania merger, which is one of the most studied cases of prohibition. If the results by Duso et al. (2002) and Hemmingsson (2002) are robust, they will have important implications for this thesis' analysis. In line with the theory of efficient markets outlined below (section 4.1), I would expect to observe a major impact on stock price volatility if the Commission's decisions were not solely related to distortion of competition and thus difficult to anticipate. However, findings by Lindsay et al. (2003) confirm the same hypothesis as Bergman et al. (2005), namely that high market shares and barriers to entry are the main causes of prohibitions. Political variables such as whether the merging companies are of US or scandinavian origin do not show a significant effect. In the same realm, Bütthe & Swank (2005) qualify the decisions by DG Competition as apolitical and "impartial to national 'identity' of the firms in question" (Bütthe & Swank 2005, 50).

Neven & Röller (2002) review the first ten years of EU merger control im-

plementation and find that whereas the Commission usually allows mergers that are not expected to distort competition, it does less well in prohibiting anti-competitive mergers. They relate these inefficiencies to the “multiple roles played by the Commission, which essentially acts as investigator, judge and jury” (Neven & Röller 2002, 16). They conclude that the Commission does not always decide in line with competitive reasons, but rather strives at protecting consumer welfare (Neven & Röller 2002, 22; Neven & Röller 2005a, 829). Also Neven et al. (1993) and Geradin (2004) investigate determinants of Commission’s decisions, arriving at similar conclusions. Especially, Geradin (2004) points out that the yardstick for assessing whether a merger is admissible is often based on an ill-defined notion of efficiency. In a review process the Commission verifies whether possible distortions of competition are outweighed by efficiency gains<sup>3</sup> in terms of better products or economies of scale (Geradin 2004, 02). In line with this argument Neven & Röller (2005b, 667) distinguish gross and net merger effects, where

a gross merger effect [...] is the effect that a merger will have on prices if efficiencies are not taken into account and the net merger effect [...] is the effect a merger will have if efficiencies are considered<sup>4</sup> (Neven & Röller 2005b, 667).

Apparently, it is difficult to judge a decision’s quality as long as the underlying decision criteria are unclear. Ignoring this lack of a clear definition, Evans & Padilla (2003) stress that there are certain deficiencies considering demand-side efficiency, such that the Commission tends to make “efficiencies an ‘offence’ rather than a ‘defence’” (Evans & Padilla 2003, 167). Another point of criticism, also mentioned by Neven & Röller (2002), is the asymmetric treatment of mergers in large and small member states, meaning that the probability of prohibiting a proposed merger is larger in small than in large countries (Horn & Stennek 2002). Comparing US and European antitrust enforcement, Muris (2001) finds that the Commission’s decisions are not always solely led by questions of competition. In line with these arguments, Jin (2002) posits that in blocking the GE/ Honeywell merger in 2001, the Commission put “too much weight on speculative long-term anticompetitive possibilities at

<sup>3</sup> Note that, in contrast to this argumentation, Motta & Vasconcelos (2005, 779) claim that the European Commission has never cleared a merger on efficiency grounds. Lagerlöf & Heidhues (2005) simulate the desirability of an efficiency defence using an equilibrium analysis.

<sup>4</sup> The terminology is based on Froeb et al. (2005).

the expense of definite short-term gains for consumers” (Jin 2002, 188). Holland (2003), also investigating the GE/ Honeywell case, emphasizes the fact that the Commission apparently based its position on prior practices of both enterprises and expresses doubts, whether such a process is legitimate. Finally, Zweifel (2003) follows the often expressed concern that the EU suffers from a ‘democratic deficit’. Comparing European to US and Swiss merger regulation, he finds that European merger regulation is less democratic than American –, but more democratic than Swiss regulation. In the same realm, Muris (2001, 456) argues that there is controversy about the discrimination in treatment of proposed mergers with different expected impact on competition.

Although it can be concluded that there is some controversy as to whether the Commission’s decisions are only driven by the aim of guaranteeing free competition, most authors agree that there are at least some points of possible improvement. Suggestions how to improve European merger analysis can be found in Ivaldi & Verboven (2005a,b)<sup>5</sup>.

Whereas these authors critically investigate the way the Commission arrives at a certain decision, other authors criticize the basic concepts underlying any decision. For instance, Kühn (2002) argues that the ‘joint dominance’ principle of the Merger Regulation is not well specified and might lead to bad decisions. He claims that the assessment of ‘unilateral effects’ of mergers is a far better defined concept and as such would probably yield better decisions.

Further relevant for the research topic at hand are the findings of financial theorists on the effect of mergers and acquisitions on stock returns. As Commission’s decisions can be simplified to reflect the anticipation of a certain merger<sup>6</sup>, market reaction should be very similar to the reaction expected by a merger. Asquith & Kim (1982) provide evidence that mergers have a favourable effect on the market value of the common stocks of merging firms, “the acquired firm’s stockholders earn large positive abnormal returns from the merger and the acquiring firms’ stockholders are effected little if at all” (Asquith & Kim 1982, 1209). Mandelker (1974) arrives at similar results. Still, Agrawal & Jaffe (1999b) attribute such effects to the short term effect of merger announcements,

<sup>5</sup> The revision is due to some critical comments by Hausman & Leonard (2005).

<sup>6</sup> That is, a positive decision by DG Competition indicates that a merger is about to take place and vice versa. The former is due to the fact that it is very unlikely the merging parties withdraw once the merger proposal has been approved.

---

arguing that the long-run performance following mergers is negative (Agrawal & Jaffe 1999*b*, 02). Yet, an overall assessment of both theoretical and empirical literature on the effects of mergers on stock returns suggests that mergers lead to an aggregate increase in stock returns (Asquith & Kim 1982, Harrison & Liu 2004, Hemmingsson 2002, Feinberg 1980, Jensen 1987, Lindqvist 2003*b,a*, Rosen 2006).

Summing up, there is a very rich literature on European Commission's merger decisions. The market consequences of such decisions, however, remain underresearched. Before providing my model for explaining variation in market response, I firstly lay out the theoretical foundation of this thesis's argument, namely financial theory, which is outlined in the following chapter.

# Financial Theory

---

---

*[A]n economist [is] strolling down the street with a companion when they come upon a \$100 bill lying on the ground. As the companion reaches down to pick it up, the economist says »don't bother – if it were a real \$100 bill, someone would have already picked it up.«*

(Lo & MacKinlay 2002, 06)

## Chapter Outline:

In this chapter, I embed the considerations following from chapter 3 into a broader theoretical framework, namely the foundations of financial theory (sections 4.1 and 4.2). Subsequently, I discuss how news and information possibly impact volatility and stock price returns in section 4.3.

This diploma thesis is mainly based on the theoretical background of financial theory. There are two important theoretical strands, namely the theory of efficient markets and behavioural finance. Each is briefly presented in sections 4.1 and 4.2, respectively. Chapter 3's overview on the state of the art in studies on market reaction to the Merger Regulation is thus extended to the above mentioned general theories of finance (sections 4.1 and 4.2). Finally, section 4.3 aims at combining both strands and highlighting those aspects important for the topic under investigation. Hence, this chapter provides the theoretical foundation motivating the model presented in chapter 5.

## 4.1 The Efficient Market Hypothesis

The Efficient Market Hypothesis (EMH), attributed to Fama (1965) and Fama et al. (1969), has been (and to some extent still is) the workhorse theory in

finance for many years. Its basic idea is that “[t]he price of a stock reflects the time- and risk-discounted present value of all future cash flows that are expected to accrue to the holder of that stock” (Bhagat & Romano 2005, 04). By the same token, Fama characterizes an efficient market by the existence of

a large number of rational profit maximizers actively competing with each other to predict future market values of individual securities and where important current information is almost freely available to all participants (Fama 1965, 36–37).

Rationality in this context follows a dual definition. Firstly, actors are expected to update their beliefs in a bayesian manner whenever they receive new information. This means that investors are not supposed to exactly know the parameters determining market behaviour, but they recognise the uncertainty in their current knowledge as more data arrives (Cuthbertson & Nitzsche 2004, 47). More precisely, investors have a certain prior belief which they consistently update to form a posterior belief upon information arrival. Given that the true parameters are constant, the posterior beliefs should in the long run converge towards the true parameters (Cuthbertson & Nitzsche 2004, 50). Secondly, given their beliefs, investor’s choices are consistent with subjective expected utility (Barberis & Thaler 2003, 1055). This concept of rationality entails that traders rapidly assimilate any information and instantaneously adjust prices accordingly. It further presumes that to the extent that some investors are not rational, their trades are random and therefore cancel each other out without affecting prices. Even if investors are irrational in similar ways, they are met in the market by rational arbitrageurs who eliminate their influence on prices.

To paraphrase Ballie und Bollerslev, in an efficient market, the actual price is a sufficient statistic for the distribution of future price movements (Ballie & Bollerslev 1989, 298), i.e. prices fully reflect all available information at any time. This constitutes the EMH’s major assumption, namely that markets deal efficiently with new information<sup>1</sup> and consequently only react to news. Given that news is per definitionem unpredictable, returns should be unforecastable as well (Bailey 2005, 77; Cuthbertson & Nitzsche 2004, 54). In other words,

the best predictor of the price of an asset at time  $t + 1$  is its price

<sup>1</sup> Prast & De Vor (2005) and Bailey (2005, 64ff) give a good overview on different types of information.

at time  $t$ . The consequence of the efficient market hypothesis is that, in equilibrium, only unexpected information (news) will influence the expected (average) price of an asset (Leblang 2002, 05).

These characteristics imply that (on average) investors cannot yield abnormal profits by trading risky financial assets (Cuthbertson & Nitzsche 2004, 53) as individuals have no comparative advantage in the acquisition of information.

In general, three forms of the EMH can be distinguished. The weak form of the EMH assumes that investors cannot earn superior risk-adjusted profits based on information contained in current and past prices. A simple random walk model provides an example of weak form efficiency (Bailey 2005, 70). The semi-strong form of the EMH, usually considered in empirical work (Cuthbertson & Nitzsche 2004, 64), and as such also relevant for this thesis, postulates that investors cannot yield abnormal returns based on any publicly available information. “The rationale here is that there are sufficient investors who act upon publicly available information for their actions to result in observed prices that reflect the information” (Bailey 2005, 70). Finally, the strong form of the EMH even posits that all information is reflected in asset prices, such that investors cannot even make profits based on private or inside information (Malkiel 2003, 196). However, the strong form EMH has not yet been proven empirically. Still, this might be due to the difficulty of assessing private information rather than theoretical fallacy.

There are several empirical studies investigating whether information is dealt with efficiently. As these studies often contrast the EMH or Random Walk Hypothesis<sup>2</sup> with behavioural approaches, I present them after a brief discussion of behavioural finance (section 4.2) in section 4.3. Still, it can already be deduced from above theoretical outline that, assuming efficient markets, reaction to decisions on mergers are only expected if the respective Commission decision was unforeseen. This deduction also finds empirical support, for instance by Neven & Röller (2002) and Schwert (1996).

Another concept crucial in the study of efficient markets is the existence of anticipation effects. For instance, Haw et al. (1990) examine the effect of non-public information prior to mergers and find out that there is substantial market reaction prior to the release of public information. This is in line with

---

<sup>2</sup> The reader is referred to Lo & MacKinlay (2002) for a compendium on the current state of the Random Walk Hypothesis.

the semi-strong form EMH, stating that no profits can be gained on public information. If the market reacts even before information is made public, this information cannot be used any longer to yield higher returns. In the same vein, Zaima & Harjoto (2005) even show that non-public information or *whispering* can be more informative than public information. Comparing whispering to analysts' forecasts of the value of certain stocks, Zaima & Harjoto (2005) find out that the predictions by whisperers are usually more reliable.<sup>3</sup>

Such findings are robust to different types of events. This can be illustrated by the studies of Mandelker (1974) and Asquith & Kim (1982), both examining whether mergers lead to abnormal asset returns. Whereas Mandelker (1974), focusing on the date of a merger, finds no significant evidence, Asquith & Kim (1982), who rely on the date on which the intent to merge was announced, show significant abnormal returns. The same applies for Brockett et al. (1999, 03) who show that markets anticipate an election result about eight days prior to the election day rather than reacting to the actual election result.

One reason many empirical studies rely on the theory of efficient markets is its simplicity. In the words of Statman (1999): "Standard finance is compelling because it uses a minimum of tools to build a unified theory intended to answer all the questions of finance" (Statman 1999, 19). Yet, simplicity does not always guarantee accuracy. Thus, during the last twenty years, many scholars have focused on the way 'real' actors behave in order to explain divergent (abnormal) market behaviour (Barberis & Thaler 2003). This research can be subsumed under the theory of behavioural finance which is outlined in the following section.

Still, Statman (1999) qualifies the rather strong assumptions underlying the EMH by providing a less demanding definition of efficient markets: "One meaning is that investors cannot systematically beat the market. The other is that security prices are rational" (Statman 1999, 18). He expresses doubts on whether the second meaning holds in reality and therefore suggests sticking to the first one rather than rewriting financial theory such as behaviourists have done.

---

<sup>3</sup> For an earlier account of insider trading the reader is referred to Jaffe (1974).

## 4.2 Behavioural Finance

In contrast to the assumptions of the EMH, behavioural finance acknowledges that investors do not always act in a fully rational way. As Statman (1999, 20) puts it: “Standard finance people are modelled as ‘rational’, whereas behavioural finance people are modelled as ‘normal’”. Such statements are often based on psychological findings and experimental results challenging rationality assumptions. A very well known example is provided by Kahnemann & Tversky (1979), who note that people tend to systematically deviate from the assumptions of expected utility theory. Kahnemann and Tversky’s research efforts have become known under the term *prospect theory*.

Further, based on insights from cognitive psychology, models of investor behaviour attempt to explain deviations from the assumption of efficient markets<sup>4</sup>. For instance, according to behavioural finance, traders are often over- or underreacting to information (e.g. Daniel et al. 1998, de Bondt & Thaler 1985, Odean 1998, Shleifer 2000, Thaler 1993). Such irrational reactions are related to either investor overconfidence in the precision of private information (Odean 1998) or variations in confidence arising from biased self-attribution (Daniel et al. 1998, 1839), which can both be explained by means of psychological experiments and surveys. Thus, Daniel et al. (1998) note that due to imperfect rationality “overconfidence implies negative long-lag autocorrelations [and] excess volatility” (i.e. in excess of what rational actors would cause). They further argue that biased self-attribution leads to “positive short-lag autocorrelations [...] and] short-run earnings ‘drift’, but negative correlations between future returns and long-term past stock market and accounting performance” (Daniel et al. 1998, 1839). The authors conclude that investors tend to overreact to private- and underreact to public information (Daniel et al. 1998, 1865). Odean (1998), in turn, finds that trader’s expected utility decreases and trading volume increases when investors are overconfident. In line with Daniel et al. (1998) and Zaima & Harjoto (2005), he further emphasizes that traders tend to systematically overweigh anecdotal in contrast to abstract information. Remarkably, these findings are subsumed under the seemingly contradictory title “When All Traders are Above Average”.

The claims of behavioural finance only hold if people do not deviate from rationality randomly, but rather most deviate in the same way (de Bondt &

---

<sup>4</sup> For an overview see Barberis & Thaler (2003).

Thaler 1996, 251). Still, Prast & De Vor (2005) note that

even if individuals are biased in their judgement of information, this does not automatically imply that markets are inefficient. As long as not all market participants are influenced, there might be room for markets to function efficiently, as market clearing prices are set by marginal, not average behaviour (Prast & De Vor 2005, 118).

Accordingly, Jacobsen et al. (2000) find that political stock markets work efficiently, although some of the traders participating in their experiment exhibited judgement biases.

A further point in behavioural finance is the notion of ‘noise’ (Black 1996, 03-19), understood as misleading information. Only rational actors base their investment decisions on real information, whereas noise traders react to misperceptions (noise). Thus, behaviouristic assumptions suggest that uncertainty in the market place is not only due to rationally incorporated new information. It is also caused by noise and by rational arbitrageurs’<sup>5</sup> reaction to and anticipation of irrational investors’ (noise traders) trading behaviour (DeLong et al. 1996, 24). McGillivray accordingly concludes:

political uncertainty can have a psychological effect that increases market volatility [...] Political uncertainty, in and of itself, increases general unease in the market and makes irrational behavior more likely (McGillivray 2003*b*).

Building on this argument, I contend that market volatility increases with uncertainty about the outcome of ongoing merger review processes. This argument is further developed in section 5.2.

Such irrational- or only boundedly rational behaviour is closely linked to the notion of cognitive dissonance (Festinger 1968) and has led to a restatement of usual models of rational decision making. For instance Akerlof & Dickens (1982) analyse the welfare consequences of cognitive dissonance by explaining behaviour in labour markets. In their view the concept can be represented by the following propositions:

---

<sup>5</sup> ‘arbitrage’ is defined as “simultaneous purchase and sale of the same, or essentially similar, security in two different markets for advantageously different prices” (Shleifer 2000, 28). For a in-depth discussion of risky abitrage also see Shleifer & Vishny (1997).

First, persons not only have preferences over states of the world, but also over their beliefs about the state of the world. Second, persons have some control over their beliefs; not only are people able to exercise some choice about belief given available information, they can also manipulate their own beliefs by selecting sources of information likely to confirm ‘desired’ beliefs [...] (Akerlof & Dickens 1982, 307).

Goetzmann & Peles (1997) apply the concept to the behaviour of mutual fund investors, who tend to overestimate past fund performance. They provide empirical evidence that investor inertia in effect is due to adjusted beliefs aimed at supporting past decisions, rather than reflecting costs implied by strategy changes (Goetzmann & Peles 1997, 146).

With respect to merger announcements, Rosen (2006) points out that “bidder stock prices are more likely to increase when a merger is announced if recent mergers by other firms have been received well [...] or if the overall stock market is doing better” (Rosen 2006, 987). These results hint that investor sentiment plays an important role in determining market reaction to merger announcements. In fact, “[w]hen investor expectations are based more on optimistic expectations than reality, the short-run boosts in price caused by a merger announcement are reversed in the long run as the track record of the merger becomes known” (Rosen 2006, 1016).

Promising as the approach might be, behavioural theories run the risk of stating ex-post ad hoc explanations for any empirical finding not consistent with classical financial theory. For this reason, the hypotheses presented in chapter 5 are based on the rationality assumptions stipulated by the theory of efficient markets rather than on behaviouristic explanations. As Fama (1998) resumes: “it is safe to predict that we will soon see a menu of behavioral models that can be mixed and matched to explain specific anomalies” (Fama 1998, 291). Moreover, Schwert (2003, 943) notes that both market inefficiencies and anomalies tend to fade out once they have been discussed in the academic literature. This observation allows for two conclusions. Either, the findings are subject to sample selection bias and hence are simply not generalizable, or markets actually do follow the assumptions of the EMH, such that investors learn efficiently and accordingly trade on the information gained by the publication of market anomalies (Schwert 2003, 970). If practitioners indeed implement the strategies suggested by the finance literature, the information on market anomalies

(e.g. weekend-, turn-of-the-year-, or size-effect<sup>6</sup>) will instantaneously be priced in and its market effect ceases to exist.

As mentioned earlier, scholars of both efficient markets and behavioural finance are interested in the way investors deal with information and incorporate it into their trading strategy. The findings of some respective empirical studies are outlined in the following section, providing a first notion on how markets should react to European Commission's merger decisions.

### 4.3 Impact of Information and News on Volatility and Stock Price Returns

Many current publications derive hypothesis based on both the assumption of efficient markets and the insights gained by behavioural theorists. Their main focus is on market reaction to news and 'noise'.

With respect to European merger activity, Aktas et al. (2002)<sup>7</sup> investigate whether the information flow on mergers and acquisitions by DG competition leads to heterogeneous investor valuation of the assets concerned. As they cannot observe any statistically significant increase in heterogeneity, they conclude that the Commission's communication is efficient:

there is a link between heterogeneity, asset prices and volatility. Variations of heterogeneity induce variations of volatility, which leads themselves to variations of prices. Aktas et al. (2002, 02).

Apart from the contributions by Aktas et al. (2004, 2002) and Brady & Feinberg (2000), some literature deals with the effect of other events in the context of European integration on stock markets. With respect to decisions taken by European Institutions, Fatum & Hutchison (2002) investigate the impact of European Central Bank (ECB) intervention and intervention-related news on the Euro-US Dollar exchange rate. They distinguish between rumours and official statements by ECB officials. They find that only negative official

---

<sup>6</sup> The reader is referred to Keim & Ziemba (2000) for a review of these and other market anomalies.

<sup>7</sup> For similar results also see Aktas et al. (2001).

statements have a persistent effect on the Euro exchange rate. This is but one example, that different types of news and information can be distinguished supposedly having divergent effects on stock markets. Ayres et al. (2001) investigate stock reactions to positive and negative news in new-economy and old-economy stocks in Germany. They find differing reactions to good and bad news of old- and new-economy with the effect of both switching from being very strong to not significant and vice versa depending on whether the stock market in general was booming or declining (Ayres et al. 2001, 08). They conclude that “the prices of new economy stocks reflect investor sentiment more readily than those of old economy shares” due to higher uncertainty in the former (Ayres et al. 2001, 09).

Another important factor distinguishing efficient and behaviouristic ways of handling with information is ‘news-filtering’. For instance, Prast & De Vor (2005), following De Grauwe (2000), study the reactions of the Euro-US Dollar exchange rate to economic and political news. They find that there are asymmetries in the reaction pattern to news partly due to “biased information filtering by market participants” (Prast & De Vor 2005, 115). Further, investors are found to pay little attention to economic news, but react to political news and central bank statements as long as the Euro area is concerned. Accordingly, investors might also react to political decisions<sup>8</sup> by the European Commission, such as merger decisions. Interestingly, the authors further find that the intensity of investor’s reactions differs with good and bad news (Prast & De Vor 2005, 126). This finding constitutes a cornerstone of my model of market reactions to European Commission’s merger decisions presented in section 5. In this context, good news would be the announcement of market conformity, whereas bad news relates to the prohibition of a proposed merger.

Both the arrival of news and the way it is filtered by investors can have a direct impact on stock price returns or affect a stock’s volatility (Schneider & Tröger 2004, 07). Whereas the arrival of news is linked to the level of stock prices, uncertainty has been shown to lead to higher volatility (e.g. Chang 2006, Franzese 2002, Leblang 2002, Leblang & Mukherjee 2004, 2005, Schneider & Tröger 2004). The reasoning behind this nexus is that news induces traders to update their priors on future firm performance and is consequently

---

<sup>8</sup> There is some controversy whether the Commission’s decisions on proposed mergers are of pure economic or also of political nature (see section 3).

---

reflected in a stock's value. Volatility, in turn, increases if traders are uncertain about the nature of an upcoming event, e.g. a positive or negative political or economic decision, and as a response constantly adapt their trading strategies to adequately respond to the most current available information. These ever changing trading strategies are reflected by high fluctuations of prices and, on the aggregate level, an increase in market volatility can be observed. This is well in line with the EMH, implying that only uncertainty can explain an increase in volatility due to political events. "Obviously, volatility is a response to news, which must be a surprise" (Engle 2001, 166).

Following these considerations, I expect respective stock return and volatility reactions to the decisions taken within the scope of the Merger Regulation. These are explicitly modelled in the following chapter.

# Model and Hypotheses

---

---

*Models are to be used, not believed.*  
(Henri Theil ‘Principles of Econometrics’)

## Chapter Outline:

Following the theoretical foundations laid out in chapter 3 and 4, this chapter aims at resuming the discussion and building an empirically testable model. The first part (section 5.1) is dedicated to stock returns and the second (section 5.2) deals with volatility. Finally, section 5.3 lays out some alternative explanations.

Recalling the research question outlined in chapter 1, the aim of this thesis is to show whether different types of decisions on proposed mergers (permission, prolonged review process, prohibition) have any and if so what kind of impact on both the value of stock returns and market volatility. Accordingly, chapters 3 and 4 suggest certain expectations on how markets should react to different decisions by the European Commission. This chapter resumes the discussion and presents empirically testable hypotheses.

## 5.1 Stock Returns

It has been shown that markets tend to positively receive merger decisions (e.g. Bittlingmayer 1992, 1993, Block et al. 1981, Bris & Cabolis 2002, Ellert 1976, Eckbo & Wier 1985, Feinberg 1980, 1986, Prager 1992, Stilman 1983). These empirical findings are based on the conjecture that a firm’s value rises with the expectation of a better market position which could be achieved by a respective merger. The EMH implies that rather than reacting to a merger as such, markets should already reflect news on a probable merger. In other

words, stock returns mirror investors' expectations of the probability of a proposed merger to actually take place. Investor expectations are further assumed to change in response to both the actual decision of the European Commission and the expectation of how DG Competition will decide.

In line with several empirical studies (Aktas et al. 2001, 2004, Bergman et al. 2005, Duso et al. 2002, Pautler 2003), already introduced in chapter 3, I expect the market to distinguish between positive and negative Commission's decisions. In particular, based on the assumption that the expected value of a firm is priced in immediately upon the arrival of news, decisions linked to probable future performance increase (decrease) should have a positive (negative) impact on a stock's value once information about the respective decision has reached the market. Accordingly, both declarations of serious doubts about a merger's compatibility with the Common Market (Art 6.1c of the Merger Regulation) and prohibitions of a proposed merger (Art 8.3 of the Merger Regulation) are expected to have a negative impact on the respective companies' stock returns. The causal link being that such a decision implies a possible failure to merge, which, in turn, leads utility-maximizing investors to update their portfolio accordingly. In view of the expectation of worse conditions of competition for the firms in question, rational investors will update their priors about future stock values downwards and thus no longer wish to hold the respective stocks. This causes bidding prices and –assuming that nor will investors wish to buy these stocks any longer– also asking prices to fall.

**H1:** Initiations of phase II (Art. 6(1)(c)) and prohibitions of a proposed merger (Art. 8(3)) tend to negatively influence the respective companies' stock returns.

H1 is partly derived from the findings by Brady & Feinberg (2000) who conclude that “‘serious doubts’ [...] decisions adversely impact stock values [...] This result suggests that investors expect many mergers to have positive effects on company earnings” (Brady & Feinberg 2000, 889).

Correspondingly, one should expect a reversed relationship between permitting decisions and the respective companies' stock returns. Though, this effect, if at all existent, should be rather marginal. This is due to the fact that DG Competition far more frequently concludes that a proposed merger is in

conformance with the Common Market than refusing it (see table 6.1<sup>1</sup>), such that permitting decisions constitute the norm and are thus of little informative value to the market.

**H2:** Decisions according to Art. 8(2) and 6(1)(b) have a slight positive effect on the respective companies' stock returns.

In addition, scholars of behavioural finance have shown that investors tend to react more strongly to bad news than to good news. Accordingly, Kaminsky & Schukler (1999), investigating stock prices during the Asian crisis in the late 1990s, find that some movements can neither be explained by economic, nor by political news. The authors conclude that bad news in periods of crisis may increase uncertainty and promote herd behaviour.

Further, even if a proposed merger is declared to be compatible with the Common Market, the clearance is often accompanied by certain conditions the merging firms need to meet. Bergman et al. (2005, 718) argue that “the conditions for allowing a merger have, in some cases, been so strict as to effectively amount to a prohibition”. This implies that even the permission of a proposed merger might have a negative impact, if the permission is linked to certain obligations that are so strong that they come close to a prohibition.

**H2a:** Decisions according to Art. 8(2) and 6(1)(b) subject to certain conditions and obligations have a less positive effect on the respective companies' stock returns than do these decisions without conditions.

Finally, the rulings by DG Competition should only have an effect on stock returns if they provide news. As such, procedural decisions, i.e. the mere declaration that a certain merger is within or without the Merger Regulation should not significantly effect stock returns:

**H3:** Procedural decisions (Art. 6(1)(a)) do not significantly effect stock returns.

---

<sup>1</sup> Note that this number might be misleading as in many cases the merging parties -fearing a prohibition- withdrew their notification. Arguably, these withdrawals could be understood as de facto prohibitions (Bergman et al. 2005, 718).

H3 again is closely related to the study of Brady & Feinberg (2000) who could not detect any effect of decisions according to Art. 6(1)(a) on the stocks in their sample.

These hypotheses only hold if the Commission's decisions are indeed merely aimed at protecting competition in the Common Market. As mentioned earlier (chapter 3), there is some controversy on whether this assertion in fact applies to DG Competition's actions (Bittlingmayer 1992, Brady & Feinberg 2000, Bris & Cabolis 2002, Ellert 1976, Eckbo 1983, Eckbo & Wier 1985, Eckbo 1992, Hemmingsson 2002, Morgan 2001, Muris 2001, Neven et al. 1993, Neven & Röller 2002, Röller et al. 2001, Stilman 1983, Slovin et al. 1991, Song & Walkling 2000). This has the further consequence that sometimes investors wrongly anticipate certain decisions (Neven & Röller 2002). Incorrect anticipations promote investor uncertainty, the latter being linked to higher volatility. I will provide more details on this nexus in the following section.

## 5.2 Market Volatility

In line with the EMH, the extent to which the implementation of the Merger Regulation leads to an increase in market volatility depends on whether investors confidently anticipate the respective decision (Brady & Feinberg 2000, 894). To be more precise, if traders are not sure about the outcome of an upcoming Commission's decision, they will constantly adapt their trading strategies to adequately respond to the most current available information on the probable outcome so that market volatility increases.

**H4:** The less a certain decision by the European Commission on a proposed merger is anticipated, the higher is the volatility of the respective company's stock return.

The logic of this argument is based on the assumption that traders are risk-averse utility-maximisers. To simplify the model, imagine a risk-averse trader intending to maximize his utility by an optimized trading strategy. Given that he is fully informed on the effects of certain mergers on stock prices and has certain fixed assumptions on the probable impact a merger has on

the respective firm's value, he will update his trading strategy to optimally anticipate and respond to the companies' actions whose shares he is trading. Based on these assumptions the causal mechanism is easily derived: During the examination period (i.e. the revision process by DG Competition) the investor estimates which decision is most likely to occur and buys or sells the companies' stocks accordingly. Whenever he can get hold of new information on either the likelihood of a certain outcome of the revision process or the impact a merger is supposed to have on the involved parties' market power, he instantaneously takes in this information, updating his prior belief in a bayesian manner, and adapts his portfolio to optimally fit this new level of information. In expectancy of an uncertain decision, the trader's anticipation changes continuously and thus leads to ever changing trading strategies. Assuming that the market exists of many such traders, volatility increases as the probability to correctly predict DG Competition's action decreases.

### 5.3 Alternative Explanations

The causal mechanism expected to underlay possible market reactions to European Commission's merger decisions as outlined in sections 5.1 and 5.2 is consistent with current empirical findings, but still there is no guarantee this is the only possible explanation. Below, I therefore briefly sketch out some alternative explanations.

I have claimed that the implication of the European Merger Regulation, namely permissions, prohibitions of mergers and related decisions under certain circumstances have an impact on both stock values and market volatility. However, if abnormal returns or volatility increases can be observed around the day of a respective decision this does not necessarily mean that the hypotheses hold. Nor does the absence of abnormal returns or excess volatility justify a definite rejection. There still could be other factors responsible for either result.

Firstly, the level of a certain stock could also change due to a general market trend or other events (external shocks) relevant for the company, such as the announcement of quarterly figures. Secondly, volatility is not only affected by investor uncertainty but has also been shown to highly correlate with trading

volume (Gallant et al. 1992, Leblang & Mukherjee 2005, 2004).

In order to distinguish the effect of Commission's decisions from other factors effecting both stock value and market volatility, I chose a dual strategy. On the one hand, I opt for an event study (section 6.2) which is explicitly designed to detect the effect of single events on stock values. On the other hand I introduce respective control variables to account for third factors influencing returns and volatility. This strategy is explained in more detail in the following part of this thesis which aims at challenging above hypothesis with empirical data.

## **Part II**

# **Empirical Application**

# Research Design

---

---

*In theory, there should be no difference between theory and practice, but in practice, there is.*  
(William T. Harbaugh)

## Chapter Outline:

Starting with an extensive discussion of case selection (section 6.1), this chapter is further dedicated to presenting this study's research design (section 6.2 and 6.3). The final sections deal with the definition of basic concepts and the operationalisation of respective variables (section 6.4).

The Research Design underlying this diploma thesis is twofold. First, effects of Commission's decisions on the level of asset returns are determined by means of an event study. Secondly, volatility effects are assessed using different kinds of ARCH-models.

In the remainder of this chapter I shall first outline the design decisions relevant for both steps, such as the case selection and period of investigation. This section is followed by an introduction to event studies, which heavily relies on the review article by MacKinlay (1997). The subsequent section discusses the design for analysing volatility effects, followed by the operationalisation of all variables relevant for both parts of the analysis.

## 6.1 Case Selection and Period of Investigation

It follows from chapter I that the population of interest for this study comprises all European Commission's decisions on a proposed merger after the entry into force of the merger regulation in September 1990 until today.

Table 6.1: *Decisions within the scope of the Merger Regulation, September 21<sup>st</sup> 1990 to September 30<sup>th</sup> 2005*

---

Notifications	
Number of notified cases	2901
Cases withdrawn - phase I	67
Cases withdrawn - phase II	26
First Phase Decisions	
Art 6(1)(a) (out of scope of Merger Regulation)	54
Art 6(1)(b) (compatible)	2440
Art 6(1)(b) (compatible under certain conditions and obligations)	132
Art 6(1)(c) (serious doubts, initiation of phase II)	149
Second Phase Decisions	
Art 8(2) (8(1) under Reg. 139/2004, compatible)	28
Art 8(2) (compatible with commitments)	74
Art 8(3) (prohibition)	19
Art 8(4) (restore effective competition)	4
Other Decisions	
Art 6(3)(a) (decision revoked)	1
Art 8(5)(a) (decision revoked)	0
Art 14 (decision imposing fines)	8
Art 7(4) (7(3) under Reg. 139/2004, derogation from suspension)	90

(Source: <http://europa.eu.int/comm/competition/mergers/cases/stats.html>)

Both for reasons of feasibility and data availability it is not possible to investigate the impact of all Commission's decisions during this time period. First and foremost, this is due to the fact that not all companies are listed on a national stock exchange. As Aktas et al. (2004) put it: "Our criterion for including a notification in our final sample is straightforward: at least one of the subject firms must be quoted on a national stock exchange" (Aktas et al. 2004, 739). Thus, I firstly gathered all necessary and available financial data (see chapter 7) on all companies involved in any merger decision over the entire period of interest. In a second step I drew a sample out of this preselection. Still, there are some further limitations which made me refrain from conducting a simple random selection. First of all, table 6.1 shows that the occurrence of certain decisions varies enormously. While there have been 2440 decisions of compatibility with the common market, only nineteen prohibitions were expressed. In order to include all types of decisions despite of rare events, a stratified random sample (cf. Schnell et al. 2005, 279), with each decision

type defining one strata, would be the most appropriate. However, there is little gain from drawing a random sample out of a preselection that has not been drawn randomly but by convenience (availability of financial data is not random).

Yet another concern is the fact that investigating both level and volatility effects requires large stock markets with high market capitalization to yield stable results (McGillivray 2003*a*, 374). Thus, it appears appropriate to concentrate on those decisions effecting companies traded at one of the major European stock markets, namely London, Paris or Frankfurt. As most decisions within the scope of the Merger Regulation were taken on German companies (Aktas et al. 2004, 738), I finally decided to concentrate on those companies traded in Frankfurt.

Given these selection criteria, the final sample is rather small. Hence, I refrained from making any restriction to the time period investigated in order to allow for a large enough number of cases for drawing inference. Further, investigating the whole time period since the entry into force of the Merger Regulation enables to track changes in investor behaviour. Traders could for instance need some time to get used to and adequately assess the Commission's behaviour and the kind of decisions usually taken with respect to a proposed merger. Thus, anticipation might become more accurate over time, whereas in the first years, over- or underreactions such as described in section 4.2 are expected to occur more frequently. By the same token, this rather long period of investigation eliminates possible cluster-effects. According to McWilliams et al. (1999, 356) such effects occur if either a large number of firms in the sample belong to the same or a related industry or if events cluster in time. Cluster effects are further reduced by the fact that, as far as possible, I only included one of the merging firms per case in the final sample, reckoning that observations of several firms involved in the same merger are not independent.<sup>1</sup>

Last but not least, the number of cases to investigate for each decision type after having applied above selection criteria varied enormously. I therefore randomly selected ten cases out of each decision type containing more than ten cases. It should be noted, however, that the random selection was conducted with Stata and thus does not rely on real, but pseudo random numbers.

---

<sup>1</sup> There are some exceptions in the case of decisions according to article 8(3) due to poor data availability.

Summing up, the case selection is based on convenience sampling led by both theoretical, methodological, and feasibility criteria. As will be further discussed in section 8.1.1 this inhibits certain estimation procedures as common statistical significance tests are based on the assumption of simple random selection (cf. Chaudhuri et al. 2000). A list of the final sample can be found in appendix A.

## 6.2 Event Study

Although rarely used in political science, the event study methodology has a long history in financial econometrics, one of its first proponents being Dolley (1933). The model used by most scholars today goes back to Ball & Brown (1968) and Fama et al. (1969). The event study methodology rests on the assumption that “given rationality in the marketplace, the effects of an event will be reflected immediately in security prices” (MacKinlay 1997, 13) and is thus directly linked to the assumptions stated in section 4.1. The basic aim of this methodology is to isolate the effect of certain events on asset returns from other factors influencing the movement of the latter. With regard to the research question at hand, this methodology is applied in order to investigate the impact Commission’s decisions on a proposed merger have on the asset returns of the parties involved.

This effect is assessed by means of the so called *abnormal return*. The abnormal return is the difference between the *normal return* and the return observed at the event period (cf. Guidolin & La Ferrara 2006, McGillivray 2003a, MacKinlay 1997). By definition, the normal return is “the expected return without conditioning on the event taking place” (MacKinlay 1997, 15). In other words, it refers to “individual firm returns that would have occurred in the absence of the event” (Aktas et al. 2004, 739). Abnormal returns thus constitute changes in asset prices that are related to certain events (Guidolin & La Ferrara 2006, 04); e.g. a Commission’s decision. In its most general form, the abnormal return  $AR_{i,t}$  of firm  $i$  at event date  $t$  can be stated as

$$AR_{i,t} = R_{i,t} - E(R_{i,t}|X_t), \quad (6.1)$$

where  $AR_{i,t}$  is the abnormal-,  $R_{i,t}$  is the actual,  $E(R_{i,t}|X_t)$  is the normal return for time period  $t$ , and  $X_t$  is the "conditioning information for the normal return model" (MacKinlay 1997, 15). The abnormal return thus equals "the actual ex post return of the security over the event window minus the normal return of the firm over the event window" (MacKinlay 1997, 15; cf. section 6.4.1.1). Hence, any event study is twofold: firstly, normal performance is measured to calculate the *normal return*, and secondly, this normal return is compared to the return at the time of the event of interest. Deviations from the normal return are attributed to the event and constitute abnormal returns.

The general flow of analysis of an event study starts with determining the event of interest and defining the period during which abnormal returns of the firms involved are analysed. This period of interest is commonly called the *event window*. The event window at minimum consists of the unit of time (in this study the day) the event of interest happened. However, it is customary to extend the window over a few days surrounding the event. Starting the event window prior to the day of the event captures possible anticipation effects, whereas extending the event window to include one or more days after the respective event is appropriate if news is only slowly absorbed, e.g. if stock markets close before news announcement. Formally, the event window covers the period  $t = t_0 - k_1, \dots, t_0 + k_2$ , where  $t_0$  is the time the event of interest happens and  $k_i$  are the leads and lags determined by the researcher.

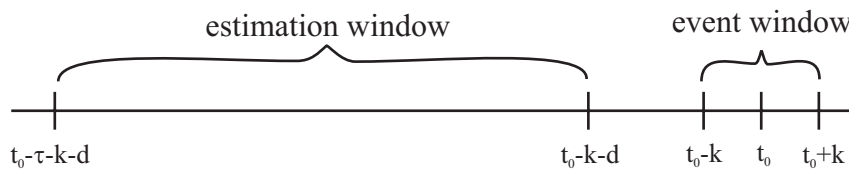


Figure 6.1: *Timeline of an Event Study*

Once having defined the event window, an equilibrium model of expected normal returns (Ruback 1982, 90; see also section 6.4.1.1) has to be chosen, as well as the time period (see page 39) for which this model is applied. In order to prevent the parameters of this normal performance model from being influenced by the event of interest, these are usually estimated for a time period different to the event window (MacKinlay 1997). It is thus common practice to establish an *estimation window* prior to the event window, which does not overlap with the latter. The estimation window is defined as covering the period  $t = t_0 - \tau - k - d, \dots, t_0 - k - d$ , where  $d$  is the distance between estimation and event window. It follows that  $L_1 = t_0 + 2 \cdot |k|$  is the length of the event-

and  $L_2 = t_0 + 2 \cdot |k| + d + \tau$  is the length of the estimation window.<sup>2</sup> This timeline is visualized in figure 6.1.

The normal performance model itself can either be led by statistical assumptions or economic considerations (MacKinlay 1997, 17), each possessing various merits and possible problems. The assumptions of the former rather than relying on economic arguments, concern the behaviour of asset returns, whereas the latter refer to expectations of investor behaviour. Different models applied in this study are presented in section 8.1.1.

Having calculated abnormal returns as specified in section 8.1.1, it is common practice to aggregate these in a meaningful manner. This is because the overall effect of a specific type of event rather than individual returns are of interest (Guidolin & La Ferrara 2006, 16). In particular, this necessitates aggregation both across securities and through time. For this purpose the abnormal returns of security  $i$  are first aggregated through time, namely over the event window. The cumulant of the abnormal return of security  $i$  over the event window  $t_0 - k, \dots, t_0 + k$  is

$$CAR_i = \sum_{t=t_0-k}^{t_0+k} AR_{it}. \quad (6.2)$$

Given that the sample does not include two companies involved in the same merger (see section 6.1), it can be reasonably assumed that cumulative and abnormal returns are independent across securities. Using  $AR$  from 6.1, the individual abnormal returns can be averaged for each event window  $t_0 - k, \dots, t_0 + k$ , so that the sample aggregated abnormal return becomes

$$\overline{AR}_t = \frac{1}{N} \sum_{i=1}^N AR_{i,t}, \quad (6.3)$$

<sup>2</sup> In both cases, I assume that  $k_1 = k_2$ . Otherwise, the length of the event window is defined as  $L_1 = t_0 + k_1 + k_2$  and the length of the estimation window amounts to  $L_2 = t_0 + k_1 + k_2 + d + \tau$ .

where  $N$  is the number of events (MacKinlay 1997, 24).

Using these sample aggregated abnormal returns, these can again be aggregated to construct the cumulant of the sample abnormal return and thus having a synthetic measure across securities and through time. This measure amounts to the cumulative average abnormal return (CAAR):

$$CAAR = \overline{CAR}_t = \sum_{t=t_0-k}^{t_0+k} \overline{AR}_t. \quad (6.4)$$

The cumulative average abnormal returns constituting the event study's dependent variable, operational questions of the event study are discussed in more detail in section 6.4 presenting variables and their operationalisations.

Different statistical models for calculating parameter estimates, as well as the testing framework for the abnormal returns are presented in section 8. The next section is dedicated to the volatility analysis.

## 6.3 Volatility Analysis

The volatility analysis testing hypothesis four (impact of uncertain decisions on volatility) is only employed to a small subset of the whole sample. The reasoning of this constriction is that for most enterprises there is too little variance on the anticipation variables for a meaningful analysis. Hypothesis four is thus exemplarily tested on enterprises subject to Art. 8(3) decisions (prohibition).<sup>3</sup> Apparently, negative decisions are by far better covered by the financial press than positive ones. Still, this does not necessitate that the market is hardly interested in positive decisions: mergers are prohibited only to prevent the merging companies from taking a market dominating position. Yet, only the fusion of companies already holding a large market share will lead to such a dominating position. Such large companies are traded most actively and thus reported on more frequently by the financial press.

<sup>3</sup> Note that all prohibitions according to article 8(3) of the Merger Regulation are preceded by the decision to initiate phase II (Art. 6(1)(c)). The latter type of decision is consequently implicitly tested along with the prohibitions.

## 6.4 Variables and their Operationalisations

This section shall give an overview of the variables included in the empirical analysis, their operationalisation and measurement. Respective data is presented in chapter 7.

### 6.4.1 Dependent Variable

Whereas the dependent variable of hypotheses 1 to 3 are mean asset return reactions, the dependent variable of hypothesis 4 are volatility effects. The former are tested within the framework of the event study, the latter by means of a volatility analysis. Both dependent variables are operationalised below.

#### 6.4.1.1 Event Study

The dependent variable of the event study is given by the cumulated average abnormal return *CAAR* as presented in section 6.2 on page 36. Its value thus depends on the length of estimation and event window, the normal performance model and the way in which abnormal returns are aggregated. I decided to firstly use an event window with  $k = 1$ , i.e. including one lead and lag day each. Whereas some event studies use event windows with five or more leads and lags (Aktas et al. 2004, Guidolin & La Ferrara 2006, Meznar et al. 1994), other authors opt for smaller windows in order to reduce the risk of other events being captured by the event window (Bhagat & Romano 2005, 17). Likewise, McWilliams et al. (1999) argue, “[a]s the event windows are expanded, the number of confounding concurrent events also increases, which reduces the power of the test statistic used to identify abnormal returns, by raising the amount of ‘noise’ relative to information” (McWilliams et al. 1999, 352). In other words, larger windows increase the ‘noise-to-signal ratio’. To cite McWilliams et al. (1999) once more: “[w]indows in well-designed event studies rarely exceed 3 trading days. This follows from a crucial assumption of the event study methodology – that the stock market is efficient” (McWilliams et al. 1999, 354). In line with these considerations, Fatum & Hutchison (2002) derive very mixed results when choosing a larger event window.

With respect to the estimation window, the longer the time period  $\tau$  covered

by the estimation window, the lower is the risk of individual outliers biasing the estimates of the normal performance model. Following Aktas et al. (2004), I therefore use a  $\tau$  of 200 days. Choosing a rather large  $\tau$  is also appropriate with respect to statistical assumptions. The larger  $\tau$ , the lower the risk of serial correlation of the abnormal returns (MacKinlay 1997, 21). MacKinlay (1997, 21) claims that  $\tau$  being reasonably large, the variance of the abnormal return reduces to  $\sigma_{\epsilon_i}^2$  and is not influenced by sampling error in the normal performance model's parameters ( $\alpha_i$  and  $\beta_i$ ). He thus concludes that using a large estimation window, the variance of the abnormal returns is independent through time. Section 8.1.1 shows that this is not necessarily the case. I therefore apply different econometric methods to estimate the market model than suggested by MacKinlay (1997) and Guidolin & La Ferrara (2006); details are presented in chapter 8. In consideration of the fact that rumouring on a proposed merger can start well before the European Commission announces its assessment, I decided to end the estimation window one month ( $d=30$ ) prior to the first Commission's decision (cf. Aktas et al. 2004, 740). This way the estimation window ends before a proposed merger is notified to the Commission.<sup>4</sup>

Regarding the calculation of abnormal returns, recent findings motivate a statistical rather than an economic normal performance model. In this vein, Bhagat & Romano (2005) argue "Since several studies have found evidence inconsistent with the economic models, in particular CAPM [Capital Asset Pricing Model], [their] use [...] is not appropriate" (Bhagat & Romano 2005, 09).

The most popular normal performance models are the *constant mean return model* (hereafter CM) and the *market model* (hereafter MM). The CM rests on the assumption that security returns have a constant mean over time, so that  $X_t$  (in 6.1) is a constant. It thus is the simplest way for estimating normal returns. However, Brown & Warner (1980, 1985) show that more sophisticated models do not necessarily yield better results. If  $\mu$  is the mean return for an asset  $i$ , then the constant mean return model is

$$R_{it} = \mu_i + \epsilon_{it}, \quad (6.5)$$

<sup>4</sup> The Commission is obliged to make an initial assessment within one month after the notification of a proposed merger.

where  $R_{it}$  is the return on security  $i$  at time  $t$  (MacKinlay 1997, 17) and  $\epsilon_{it}$  is a stochastic error term. This model is applied to nominal returns, which according to MacKinlay (1997, 17) is common practice when using daily data. The return itself is calculated as the ratio of the amount that can be gained, or lost by selling the stock at its current market price, relative to the basis. At time  $t$  it thus amounts to the difference of price from time  $t - 1$  to  $t$  divided by the price at time  $t$  ( $R_{it} = \frac{p_{it-1} - p_{it}}{p_{it}}$ ), and can be interpreted as percentage change.

The simplicity of the constant mean return model does not come without problems. Firstly, distributional assumptions might be violated (see section 8.1.1), and secondly, it does not control for general market movements that might be accountable for large abnormal returns. The market model, in contrast, predicts a stable relation between the market return and any security return (MacKinlay 1997, 15). In this simple one factor model,  $X_t$  is the market return. The model assumes joint normality of asset returns (MacKinlay 1997, 18) and thus follows a linear specification:

$$R_{it} = \alpha + \beta_i R_{mt} + \epsilon_{it}, \quad (6.6)$$

where  $R_{it}$  is the return of security  $i$ ,  $R_{mt}$  is the return of market portfolio  $m$ , and  $\epsilon_{it}$  an independently and identically distributed (iid) stochastic error term at time  $t$  (MacKinlay 1997, 18). The market portfolio is usually proxied by the respective local market index; in this case the Deutsche Aktien Index (DAX). Provided that the security and the market portfolio are highly correlated, the market model is superior to the constant mean return model, as it reduces the effects of general market disturbances.

In addition to the market model, there are several multi-factor models. For instance Abadie & Gardeazabal (2003) employ a three factor model; for an overview the reader is referred to Jensen (1972).<sup>5</sup> Apart from some non-parametric models, these are all based on certain assumptions on residual distribution, so that their application mainly depends on the data at hand.

<sup>5</sup> Examples for ‘two-factor market models’ are given by Ball (1972), Jaffe (1974), Mandelker (1974).

This point is further stressed in section 8.1.1. Section 8.1.1 also discusses the application of both the constant mean return and the market model, as well as their advantages and disadvantages.

#### **6.4.1.2 Volatility Analysis**

In the second part of this empirical study, I investigate in how far prohibitions of proposed mergers effect market volatility. Rather than analysing relative price differences at a certain point in time, the volatility analysis is dedicated to evaluating the extend of price fluctuations on the days surrounding a respective decision by DG competition. Volatility is a parameter of a stochastic process referring to the degree of dispersion of asset price changes and hence reflects the risk of an asset. Consequently, opposed to the dependent variable of part one (asset returns) volatility does not imply any direction of price changes. An asset either experiences a tranquil period of low- or a volatile period of high volatility, implying slow or quick price changes in both positive and negative direction.

In finance, volatility is usually understood as one of four concepts, namely implied-, statistical-, process-, or realized volatility (Alexander 2001, 10–11). Within the scope of this study, the notion of statistical volatility applies. Volatility can only be assessed in the context of a model (Alexander 2001, 11). Forasmuch as statistical volatility is concerned it thus “depends on the choice of statistical model that is applied to historical asset returns” (Alexander 2001, 10). Assuming conditional (time-varying) volatility, I further presume –in line with respective test statistics presented in section 8.3– that volatility increases are preceded by large price movements, i.e. volatility clusters over time and is serially correlated. Therefore, I model volatility as an autoregressive conditional heteroskedasticity process. The calculation of the latter is specified in section 8.2.

#### **6.4.2 Independent Variables**

The main explanatory variable of both event study and volatility analysis is the respective Commission’s decision. As outlined in chapter 2 there are five articles of the Merger Regulation specifying certain types of decisions of interest to this study. Namely, these comprise Art. 6(1)(a) (out of scope of Merger

Regulation), Art. 6(1)(b) (compatible or compatible under certain conditions and obligations), and Art. 6(1)(c) (serious doubts, initiation of phase II) in phase I and Art. 8(2) (8(1) under Reg. 139/2004, compatible or compatible with commitments) and Art. 8(3) (prohibition) in phase II.

It lends itself to use a rather operational definition in this case. Article 6(1)(a) constitutes a procedural decision, while positive decisions are marked by article 6(1)(b), and 8(2) and negative decisions are defined as those following Art. 6(1)(c) and 8(3) of the Merger Regulation.

Further it has been discussed in section 5 that given efficient markets, not only the Commission's decision itself but also its anticipation leads to stock market reactions. There are basically two ways of handling this consideration. Some authors simply recommend extending the event window (MacKinlay 1997), such that it covers a few days prior to the event of interest and allows for information leakage entering the estimation. However, extending the event window increases the risk of other events –not related to the merger decision– being erroneously captured by the event window and thus influencing returns. The second option is to introduce a variable accounting for anticipation effects. This way, rather than regarding information leakage prior to the actual event as a nuisance to be eliminated<sup>6</sup>, this concept is explicitly modelled and thus enters the estimation of abnormal returns. Consequently *anticipation* is the second independent variable.

For feasibility reasons, I also chose an operational definition of anticipation effects, namely anticipation is defined as reporting by the financial press prior to the event of interest. Although this definition facilitates data acquisition, it does not come without problems, as it might be that some information

is not publicly announced. However, in this situation, the information is not likely to be accessible to the market either. This is because information of this type that is 'leaked' to traders but not publicly announced violates insider trading laws (McWilliams et al. 1999, 354).

With respect to operationalisation, I opt for a newspaper content analysis, assuming that the daily issues of the German financial paper *Handelsblatt*

<sup>6</sup> e.g. (Meznar et al. 1994, 1998) eliminate all firms from their analysis that were reported on in the Wall Street Journal.

reflect the current level of news on a certain merger. Details of the data generating process are described in chapter 7. Section 7.1.2.1 discusses further methodological issues regarding both the choice of Handelsblatt as a source of company news and assesses the merits and pitfalls of the respective content analysis.

### 6.4.3 Control Variables

With respect to control variables it is crucial to distinguish between volatility analysis and event study. Whereas in the event study factors other than the Commission's decision (or its anticipation) that might influence stock returns need to be controlled for, the volatility analysis requires controlling for exogenous variables causing volatility shocks. One such variable is volume of trade, which has been shown to highly correlate with volatility (Gallant et al. 1992, Leblang 2002, Leblang & Mukherjee 2005, 2004).

Stock price returns, in contrast, might be influenced by events other than a Commission's decision such as changing interest rates or the announcement of quarterly figures. First, one needs to distinguish between those effects influencing the whole market (such as changing interest rates) and those only relevant to the respective company, such as quarterly earning announcements, shareholder meetings, public forums, and press releases. The latter can easily be controlled for by firstly opting for a very short event window and secondly introducing a respective control variable to check whether indeed no such events occur during the event window (McWilliams et al. 1999, 353). I thus define a dummy variable assuming the value 1 for days on which another firm-related event happens and 0 otherwise. This variable also enters the volatility estimation to check whether news as such or just news on possible merger decisions influence volatility. External, firm-related events are again collected by means of a content analysis of the Handelsblatt as specified in section 7.1.2.1.

External factors influencing the whole market are accounted for by changes in the overall market performance, proxied by changes in the closing price of the German market index DAX.

*In the beginning was the Word . . .*

The Gospel according to John (1,1)

**Chapter Outline:**

The following sections outline the data generating process and give details on both data collection and data sources. The chapter concludes by providing some descriptive statistics and a discussion on data transformation.

This chapter builds on the variable descriptions and operationalizations provided in chapter 6 by focusing on the respective data generating process. The first section presents data sources (section 7.1), including a discussion on content analysis (section 7.1.2.1). The chapter is concluded by some comments on data transformation 7.2.

## 7.1 Data Sources

This thesis is based on different data sources. Contrary to former chapters, I refrain from distinguishing between dependent, independent and control variables to present both data sources and the respective data generating process. The reason for this is twofold: firstly, as one of the independent variables, namely anticipation effects and the variable controlling for other events during the merger process were procured by the same data generating process, these are dealt with in the same section. Secondly, the dependent variable (abnormal stock returns) is a construct of other financial series so that sources overlap. I thus distinguish between those variables constituting financial series (section 7.1.1) and those obtained by content analysis (section 7.1.2). An exhaustive list of all variables and data sources can be found in appendix B.

### 7.1.1 Financial Series

All financial series, namely firms' equities, volume of trade, and DAX closing prices were gathered from Datastream, a commercial database run by Thomson Financial. All entries are adjusted for stock splits etc., which facilitates comparable calculation. Further, the currency each series is displayed in can be chosen by the user. In order to avoid miscalculations due to the currency union, I decided to transform all series to US Dollar.

Still, there are missing values on some series, most of all on volume of trade. For some companies there is no data on volume of trade at all, for others there are considerable missings. Yet, these are not systematic so that I assume them to be random missings and use linear extrapolation to fill possible gaps. I chose extra- rather than interpolation as, in contrast to interpolation, extrapolation also yields values for missings at the beginning or end of a series. Whereas both procedures lead to the same value inbetween two data points, extrapolation uses fore- or back-casting to obtain beginn- and end-values. For financial data is only available on weekdays, it is common practice to again use inter- or extrapolation to get some value for weekends and other non-trading days (Hodson 1999, 61). However, I chose to entirely omit non-trading days, as there is no data on other variables either. Neither does the Commission take decisions on weekends, nor is the Handelsblatt published on weekends.

### 7.1.2 Other Variables

Data on Commission's decisions is supplied at the webpage of the Directorate General Competition at

<http://www.europa.eu.int/comm/competition/mergers/cases>.

For each case, the following information is provided on the DG's homepage: case number, name of participating firms, date of notification, regulation under which the procedure was decided upon, type of decision (respective article), deadlines/ dates of decision, and relation with other cases. I collected all of these data on all cases in order to get an overview of the population of interest and used this list for later sampling. Some of these variables are directly used in the analysis, such as the type of decision. Others also play an important role, e.g. the case number serves as an identifier, 'relation with other cases' is important to provide for independent observations.

Both anticipation of Commission's decisions and other firm-related events are collected relying on a newspaper content analysis. Several recent event studies rely on newspapers or press agencies to code events. For instance Jansen & Haan (2003) study the reaction of the Euro-Dollar exchange rate to statements of ECB officials published by Bloomberg News Service, and in the same vein Fatum & Hutchison (2002) analyse the Wallstreet Journal to find out whether rumours and official statements by the ECB have an effect on the Euro-Dollar exchange rate.

### 7.1.2.1 Content Analysis

Hodson (1999, 67) distinguishes three steps of conducting a documentary analysis: "defining the population of cases and selecting the cases systematically, developing a comprehensive and reliable coding instrument, and building in checks for reliability and bias" Hodson (1999, 67). Krippendorff (2004a) and Mayring & Gläser-Zikuda (2003), in turn, differentiate between sampling, unitizing, and recording or coding. They thus cover the whole research design of a study entirely based on content analysis. Given that in this context, the newspaper analysis is only used for gathering data on one variable, several questions about sampling and unitizing have already been answered in previous chapters.

A first step of any content analysis is answering the question which kind of texts to analyse. Coding the financial press was a rather self-evident decision, considering that the variables of interest are financial news which are usually covered by the financial press. In that I opted for only investigating mergers of German companies (see section 6.1), I obviously had to go for German press as well. For the purpose of this diploma thesis, there are several reasons for relying on the Handelsblatt rather than other financial newspapers such as the Financial Times Deutschland. First of all it is the financial newspaper with the biggest print run in Germany, such that it can be assumed to be fairly representative. During the period of investigation yearly numbers of sold issues averaged around 150,000 (IVW <sup>1</sup> 2005; Meyn 2001: 126; Pressebox 2005). The Medien Tenor estimates that roughly 289,000 decision makers regularly read the Handelsblatt: "Bei einer verkauften Auflage von 143.929 Exemplaren (Jahresdurchschnitt IVW/2004) erreicht das Handelsblatt täglich

---

<sup>1</sup> Informationsgemeinschaft zur Feststellung der Verbreitung von Werbeträgern e.V.

rund eine halbe Millionen Leser [...] das Handelsblatt [ist] das meistzitierte Wirtschaftsmedium in Deutschland” (Medien Tenor, 3. Quartal 2005). The average number of sold issues of the Financial Times Deutschland, in contrast, ranges from about 61,000 in 2000 to about 100,000 in 2005 (IVW 2005). Further, the Handelsblatt covers the entire period of investigation, whereas the Financial Times Deutschland was first published in February 2000. Yet, there are some caveats with respect to the usage of newspaper articles:

[u]nfortunately, one thing is clear: Newspapers are very selective in the information they provide. Media news do not simply reflect a reality that is ‘out there,’ but filter it in some [at least partially] predictable ways (Franzosi 2004, 167).

However, the same author later concedes:

perhaps all data are biased in some ways. What is important is to know the type and form of bias in order to be able to gauge its effect on evidence and conclusions (Franzosi 2004, 172).

In order to increase validity, Franzosi (2004, 177–180) suggests to collect control data for a subsample from a different source. In this vein, I recoded the General Electrics/ Honeywell merger relying on the Financial Times Deutschland. Interestingly, with respect to (correct) anticipation both papers agreed perfectly the weeks before the final decision was taken both in terms of the events reported and the prospects of prohibition/permission indicated. Only during the period around the notification, i.e. long before the European Commission took its decision, did the Financial Times Deutschland report more frequently on one of the respective enterprises, but still, reporters from both papers agreed on the facts –and their implications regarding the final decision– concerning the merger review process. I thus conclude that if validity is low, this is independent of the newspaper chosen, but instead questions the usage of newspapers as such.

Coming back to Krippendorff’s classification, *unitizing* is the next step in conducting a content analysis. According to Krippendorff “[s]ampling units are units that are distinguished for selective inclusion in an analysis” (Krippendorff 2004a, 98). In this vein, I considered each issue of Handelsblatt, starting one week prior to the notification of a proposed merger to the Commission and ending with the day of the final decision by the Commission. Excluding

any issues might have led to omitting relevant articles. Subsequently, those units that “are distinguished for separate description, transcription, recording, or coding” (Krippendorff 2004a, 99–100), so-called *recording-units*, have to be singled out. Here, these are defined as single newspaper articles, gathered by automatically searching the Handelsblatt’s archive for certain keywords. Finally, *context units* “are units of textual matter that set limits on the information to be considered in the description of recording units” (Krippendorff 2004a, 101). In principle context units coincide with recording units. Yet, I excluded interviews and opinions as these do not necessarily represent the general expectation of market agents. *Handelsblatt.biz*<sup>2</sup> allows for automatic keyword-scanning of all articles published either in the printed or in the online version of the daily newspaper Handelsblatt. I conducted full text searches, as simply searching titles can be very misleading. Albeit being very well covered by the media, many articles on the famous prohibition of the General Electrics/ Honeywell merger in 2001 would have been omitted by a simple title search. This is due to the fact that newspaper headings often do not fully reveal what the respective article is about. Continuing above example, one header on the General Electrics/ Honeywell case read “Der Kampf des Jack Welch gegen Mario Monti” (Jack Welch’s fight against Mario Monti; Handelsblatt N° 121, 11), another one “Experte räumt Versäumnisse der EU ein” (expert admits EU’s lapse; Handelsblatt N° 121, 6). Next, I had to determine which keywords to use for the full-text search. One strategy for tracking all those articles that report on expected Commission’s decisions on announced mergers is to use keywords referring to the concept of business combination. However, there are many possible ways of reporting such an event, i.e. in English there are about sixteen words for expressing ‘business combination’ (some with different spellings), such as, *absorption, acquisition, amalgamation, assumption, buy-in, buy-out (or buy out), combination, merger, pool, pooling, share deal, take-over (or take over), transfer, underwriting, union*. Furthermore, an expected decision could even be reported on without using any of the words as the following example illustrates: “In Paris erwartet man für diese Transaktion grünes Licht aus Brüssel” (in Paris one expects that Brussels gives this transaction the green light, Handelsblatt N° 217, 41). However, it seems hardly possible to report on a Commission’s merger decision without naming the enterprise in question. Therefore, I chose to search for the name of each enterprise in the sample. This

---

<sup>2</sup> [http://handelsblatt.de/pshb/fn/rehbi/sfn/buildhbi/bmc/biz\\_cn\\_start/SH/0/depot/0/index.html](http://handelsblatt.de/pshb/fn/rehbi/sfn/buildhbi/bmc/biz_cn_start/SH/0/depot/0/index.html).

search strategy led to a sample of up to 695 articles per enterprise.

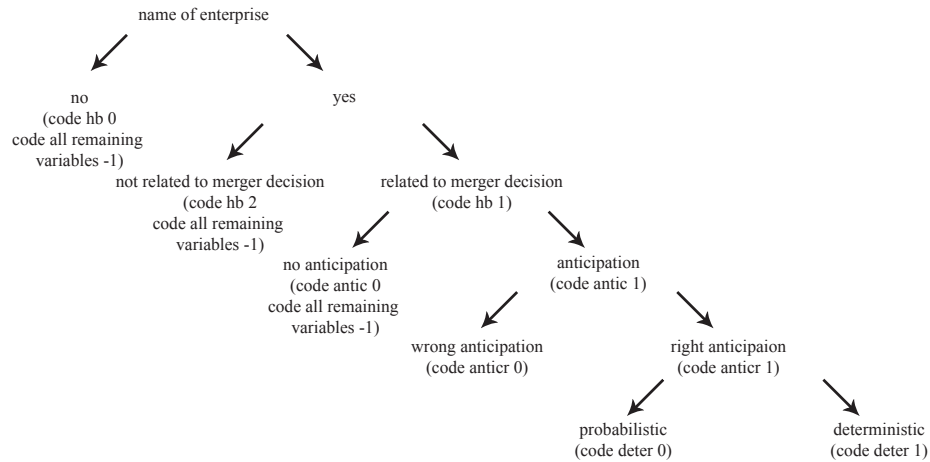


Figure 7.1: *Decision Scheme*

Once having singled out the units of analysis, the next step in any content analysis is recording and coding the information of interest. In Krippendorff's words,

*[r]ecording* takes place when observers, readers, or analysts interpret what they see, read, or find and then state their experiences in the formal terms of an analysis; *coding* is the term content analysts use when this process is carried out according to observer-independent rules (Krippendorff 2004a, 126).

Correspondingly, the articles obtained by searching the Handelsblatt archive were then scanned<sup>3</sup> in order to find out whether they contained information on the anticipation of Commission decisions or on other firm related news. In a second step, I assessed whether the respective article made a correct or wrong conjecture; i.e. whether the outcome anticipated by the newspaper's reporters coincided with the decision actually taken by the Commission. To facilitate coding decisions I rely on a decision scheme, in which "each recorded datum is regarded as the outcome of a predefined sequence of decision" (Krippendorff 2004a, 135). The scheme is visually depicted in figure 7.1. The variables *antic*, *anticr* and *deter* are dummy-variables, assuming the value one and zero for

<sup>3</sup> Although, automated coding is becoming more and more popular in the social sciences (e.g. Bond et al. 1997, 567-569), I coded the variables of interest by hand, because newspapers often use their special language.

yes and no, respectively and are coded -1<sup>4</sup> if they are irrelevant, i.e. if *hb* is zero. For those cases where more than one article containing the name of the respective enterprise existed, these were treated as a single article.

### 7.1.2.2 Reliability

In measurement theory, data are reliable, if they “remain constant throughout variations in the measuring process” (Kaplan & Goldsen 1965, 211). In the context of content analysis this refers to both intra- and intercoder reliability. The former referring to “the extent to which a measuring or coding procedure yields the same results on repeated trials” (Krippendorff 2004a, 214) and the latter “is the degree to which a process can be replicated by different analysts working under varying conditions, at different locations, or using different but functionally equivalent measuring instruments” (Krippendorff 2004a, 214).

There are different ways of checking for reliability. According to Franzosi (2004, 23–24) reliability is obtained “by other coders using the same techniques on the same material with the same set of rules”. With respect to intercoder reliability, Hodson (1999, 29) states the rule of thumb to have 10% of the cases recoded by a second person. I therefore had another student recoding a subsample, using the instructions given in figure 7.1. Hodson (1999) claims that “[r]eliability can be evaluated by using either of two calculations: intercoder correlations and intercoder agreement” (Hodson 1999, 51). The correlation simply estimates the scores of coders who have coded the same data. However, Lombard et al. (2004, 434) note that correlation based measures, such as Cronbach’s alpha and Pearson’s Chi<sup>2</sup> are not suitable as they only measure covariation rather than intercoder agreement. In other words, the scores of one coder can be used for a linear prediction of the scores of another coder. This, by no means signifies that the two agree, since the slope of the linear prediction need not necessarily be 1. Another measure is achieved by cross-tabulating different codings and counting agreements versus disagreements. Based on such cross-tabulation, (Hodson 1999) also suggests using the *kappa* statistic which is the standardized percentage of agreements on the number of categories and on the marginal distribution of responses and thus adjusts for chance agreements (Hodson 1999, 51). Other alternatives are Cohen’s *K* und Scott’s  $\pi$  which both are problematic with respect to the way of dealing with disagreement

---

<sup>4</sup> In the analysis I recoded the variable to only assume the values 1 and 0, such as to avoid uninterpretable results.

(Krippendorff 2004*a*, 246ff). I therefore chose to rely on Krippendorff's  $\alpha$  which –according to its eponym– is considered to be one of the most general agreement measures (Krippendorff 1970*a,b*, 2004*a,b*). As the *kappa* statistic, Krippendorff's  $\alpha$  has the advantage of controlling for intercoder-agreement achieved merely by chance. Krippendorff's  $\alpha$  is calculated as follows:

$$\alpha = 1 - \frac{D_o}{D_e} \quad (7.1)$$

where  $D_o$  is the observed number of disagreements and  $D_e$  is the expected number of disagreement if coders assigned values by chance. For the binary case,

$$\alpha_{binary} = 1 - (n - 1) \frac{o_{ij}}{n_i \cdot n_j},$$

where  $i$  and  $j$  denote the values the respective variable can assume (in this case 0 and 1),  $n_j$  is the total occurrence of  $j$ , and  $n_i$  the total occurrence of  $i$  (adopted from Krippendorff 2004*a*, 225).<sup>5</sup>  $\alpha$  can thus be interpreted as the proportion of intercoder-agreement that does not result by chance (cf. Krippendorff 2004*a*, 225). For nominal data, Krippendorff concludes that “ $\alpha$  is the proportion of the perfectly matching coincidences that, when added to the complementary proportion of chance coincidences, accounts for the coincidences that were observed” (Krippendorff 2004*a*, 225). For the subsample recoded by a third coder, Krippendorff's  $\alpha$  is .91 across variables, indicating rather high intercoder reliability. However, interpretation of  $\alpha$  has in this case to be taken with a pinch of salt, since the data shows rather little variation (Krippendorff 2004*a*, 236).

## 7.2 Data Transformation

As will be discussed in more detail in chapter 8, financial time series often come with their own problems. Whereas some of these are most adequately

<sup>5</sup> Note that some authors suggest even weaker forms of assessing reliability. For instance Mayring & Gläser-Zikuda (2003, 13) argue that only disagreements that could not be sorted out between the two coders should be counted as such.

dealt with by means of an appropriate estimation method, others can be eliminated by simple data transformation. One characteristic inherent to many time series is non-stationarity. Non-stationarity means that the probability distribution of the underlying stochastic process changes over time, i.e. is not identically distributed (Wooldridge 2003, 361). A highly persistent time series thus needs to be transformed to a weakly dependent time-series in order to avoid spurious regression (Wooldridge 2003, 377). Indeed, the Dickey-Fuller unit root test (Dickey & Fuller 1979) showed unit roots for most series. As unit root processes are integrated of order one, the first difference yields a process which is integrated of order zero (Wooldridge 2003, 377). Consequently, I differenced all financial time series. Applying the Dickey-Fuller test to the differenced series rejected the null of unit root in all cases<sup>6</sup>.

Differencing is not only a means for avoiding problems with non-stationary data but also makes sense from a theoretical point of view. As defined in section 6.4.1.1, returns are conceptualized as percentage price differences (Guidolin & La Ferrara 2006, 14) rather than price levels and thus prices have to be differenced by definition. A further merit of differenced data is that it avoids misinterpretation, because it eliminates any linear time trend (Wooldridge 2003, 377).

I also conducted several normality tests, such as Shapiro Francia and Jarque Bera as well as visual representations (histograms, symmetry plots, etc.) to check whether further data transformation was necessary. Respective test results and graphs can be reconstructed by running the do-files on the attached Data CD. Further instructions are given in appendix C.

---

<sup>6</sup> In view of the large quantity of data, I do not report all tests. These can, however, easily be checked using attached data CD. For test results of raw data run do-files an1\* and for those of transformed data files an2\* (substitute the asterisks by the respective company's name).

# Statistical Method

---

---

*An economist is an expert who will know tomorrow why the things he predicted yesterday didn't happen.*  
(Earl Wilson)

## Chapter Outline:

This chapter presents methods for estimating abnormal returns (section 8.1.1), discusses fallacies of widely used estimation methods and describes nonparametric approaches used in this study. The second part deals with hypothesis testing under different model specifications (section 8.1.2). A further section describes the methods used for volatility estimation (section 8.2) and the last part presents some of the diagnostics used for deciding upon the most adequate method (section 8.3).

## 8.1 Event Study Methodology

As specified in section 6.2 the empirical analysis of asset returns is based on the event study methodology. Questions concerning research design, such as the case selection and period of investigation have been discussed in chapter 6. This chapter refers to the statistical methods used to estimate the parameters of the equilibrium model of expected returns and the examination of abnormal returns observed after a Commission's decision. It further introduces some diagnostics and foreshadows further analyses to be found in appendix F.

### 8.1.1 Calculation of Abnormal Returns

The core of each event study is the calculation of abnormal returns as described in section 6.2. This firstly necessitates a normal performance model,

which can either be based on expectations of investor behaviour or rest on statistical assumptions. As the latter kind of models have proven to outperform models relying on economic arguments such as the capital asset pricing model (CAPM) (e.g., Campbell et al. 1997, 157), I chose to calculate both a constant mean and a market model.

The constant mean return model is rather trivial to compute as it simply requires generating the mean of the respective asset over the estimation window and then subtracting this value from the residuals observed during the event window. Emphasis is therefore put on the market model, which firstly requires estimating the parameters to predict normal returns.

Recall that the market model posits a linear relationship between the market portfolio and any asset return. The abnormal return is therefore the difference between predicted normal returns for period  $t = t_0 - k_1, \dots, t_0 + k_2$  and the observed returns during the same period:

$$AR_{it} = R_{it} - \hat{\alpha}_i - \hat{\beta}_i R_{mt}. \quad (8.1)$$

In other words, the abnormal return is the residual of the out-of-sample prediction of the market model. This firstly requires estimating the parameters of the market model for period  $t = t_0 - \tau - k - d, \dots, t_0 - k - d$ . According to its linear specification, these parameters can be estimated by ordinary least squares (OLS) (MacKinlay 1997, 20), the respective factor model being

$$R_t = \alpha + \beta_i R_{mt} + \epsilon_{it}. \quad (8.2)$$

However, OLS regression only yields efficient coefficients if  $var(\epsilon_i) = \sigma^2$ , i.e. if the variance of the error term is constant over time. Due to their high frequency, daily returns seldomly follow the assumptions of the OLS-estimator, i.e. the Gauss-Markov-theorem (Brockett et al. 1994, 05; Schneider & Ruoff 2006, 05). Still, the market model assumes that "asset returns are jointly multivariate normal and independently and identically distributed through time"

(MacKinlay 1997, 17). MacKinlay (1997, 17) further argues that “inferences using the normal return models tend to be robust to” violations of this rather strong assumption. De Jong et al. (1992, 29), however, note that “results obtained under the usual assumptions on the error process (homoskedastic, normal distribution) shows that ignoring [...] fat tails and [...] heteroskedasticity may lead to spurious results” (de Jong et al. 1992, 29). This finding is backed by Gonçalves & Kilian (2002), who provide evidence that standard regression models are not appropriate, given that the residuals of many dynamic regression models in finance and macroeconomics follow martingale difference sequences (mds) rather than being independently and identically distributed (iid).

This concern is shared by many other researchers. Kramer (2001, 19) claims that usually returns data are not normally distributed, in particular she points out the occurrence of leptocurtic (fat-tailed) and highly skewed distributions. Early evidence of these characteristics in stock return data can be found in Nelson (1991), Mandelbrot (1963), Fama (1965), and Officer (1972). Kon (1984) can show clear signs of skewness and excess kurtosis in his analysis of 30 individual stocks and three market indices. Finally, Bollerslev et al. (1992) state, it is “widely recognized that the unconditional price or return distributions tend to have fatter tails than the normal distribution” (Bollerslev et al. 1992, 11). Despite of many simulations demonstrating violations of the Gauss-Markov theorem (e.g. Brockett et al. 1999, Kramer 2001, Gonçalves & Kilian 2002), most empirical studies still rely on the OLS estimator for deriving the parameters of the market model. Classical event studies, postulating a simple linear relationship and assuming away other disturbances are often upward biased, i.e. they detect an effect of the event under investigation although none actually exists (cf. Boehmer et al. 1991, Brown & Warner 1985, see also figure 8.1).

Respective tests (Lagrange-multiplier, Jarque Bera, Ljung-Box, etc. explained below in section 8.3) and graphs<sup>1</sup> show that most of the residuals obtained by OLS estimation do not satisfy the Gauss-Markov theorem. Still, for reasons of comparability with earlier studies on business combinations, I firstly estimate the market model using OLS and in a second step move to more advanced models, which are described below.

---

<sup>1</sup> As noted earlier these can be retrieved from attached data CD.

Another concern with high frequency data are serial correlation and volatility clusters (see for instance Engle 2001). A possible remedy are Generalized Autoregressive Conditional Heteroscedasticity (GARCH) models. GARCH models account for the characteristics of high-frequency financial time-series data and are thus widely used to estimate volatility (e.g. Hays et al. 2002, Jensen & Schmith 2005, Leblang 2002, Leblang & Mukherjee 2005, 2004, Schneider & Tröger 2004). GARCH models were first proposed by Engle (1982), and extended by Bollerslev (1986). In these models volatility clusters and time dependency are not taken as a nuisance to be eliminated, but modeled explicitly. The GARCH(p,q) specification (where p and q specify the respective number of lags) consists of both a mean and a conditional variance equation, the former being

$$R_t = \lambda + \psi R_{mt} + \epsilon_t, \quad (8.3)$$

where  $\lambda$  is a constant and  $\epsilon_t$  is an error term that is normally distributed with mean zero and variance  $\sigma_t^2$  (specified in 8.4). GARCH models provide an ex-post estimate of volatility based on the long-term mean of the variance, the forecasted variance from the prior period (the lagged conditional variance), and random errors from the prior period (Leblang & Mukherjee 2004, 306). Formally stated:

$$\sigma_t^2 = \omega + \alpha_1 \epsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2 + \delta_i R_{mt}, \quad (8.4)$$

where  $\omega$  is the long term mean of variance;  $\sigma_{t-1}^2$  (the GARCH term) is the forecast variance from the prior period; and  $\epsilon_{t-1}^2$  are the random errors from the prior period (ARCH term).

A first approach to explicitly model above mentioned characteristics of financial returns within the scope of a conventional event study has been made by Brockett et al. (1999). Accordingly, Brockett et al. (1999, 202) suggest a time varying coefficient regression, including a time-varying systematic risk parameter and use a GARCH(1,1) process to model time-varying conditional

variance. “This model takes into account certain known characteristics of financial time series, including [...] autocorrelated squared returns, and the fat-tailed property of daily return data” (Brockett et al. 1999, 197). Schwert & Seguin (1990) show a similar model for estimating the market model using a univariate GARCH-model.

In line with these considerations<sup>2</sup>, in a second step I estimate the parameters of the market model using a GARCH(1,1) model as specified in 8.3 and 8.4. The abnormal return  $AR_{it}$  from 8.1 thus becomes

$$AR_{it} = R_{it} - \hat{\lambda} - \hat{\psi}_i R_{mt} \quad (8.5)$$

Following (Leblang & Mukherjee 2004, 313), I use heteroskedasticity-robust standard errors (Huber-White sandwich estimator), because the LM test sometimes rejects homoskedasticity and the Jarque-Bera test often rejects the null hypothesis of normality (Wooldridge 2003, 260).

Last but not least, some authors mention the problem of intertemporal and contemporaneous correlation of estimated residuals (c.f. Salinger 1992). This means that with clustered events, the residuals might be highly correlated across firms (Kramer 2001, 125), violating the independency assumption. Several authors thus rely on calculating a system of equations (e.g. Bonin & Imai 2005, Salinger 1992) rather than running an individual regression for each firm. These seemingly unrelated regressions (SUR) comprise a set of equations that has contemporaneous cross-equation error correlation (Zellner 1962). However, this concern is of less importance in this study, since merger decisions are not clustered in calendar time. Further, I evade possible contemporaneous correlation by only including one of the firms of each proposed merger in the final sample (see section 6.1).

Still other authors ignore all of the problems discussed so far, which leads to a considerable risk of  $\alpha$ -errors in many existing event studies. To give an ex-

---

<sup>2</sup> I further conducted several tests for ARCH effects, such as the Lagrange-multiplier (LM) test, and other distributional characteristics violating the OLS assumptions. These are described in section 8.3.

ample, da Graça & Masson (2003) and da Graça & Masson (2005) introduce a methodology for event studies which is based on a single regression, pooling all pre-event and event data. “The [...] hypotheses [...] can be estimated in a single one stage regression pooling all of the pre-event and event data into one regression. This leads to a GLS model which is BLUE” (da Graça & Masson 2003, 24). They do, however, refrain from providing any evidence of a best linear unbiased estimator (BLUE).

Finally, independent of the model used for parameter estimation, problems “can arise because the true data generating process underlying stock returns is unknown to the researcher” (Kramer 2001, 02). This is one of the reasons why I chose to additionally fit a nonparametric regression model. One of the major advantages of nonparametric methods is that they do not require distributional assumptions. Further, statistical inference based on parametric models and respective significance tests assume random selection. Yet, the sample of this study is based on convenience sampling (see section 6.1).

To my knowledge, there are only but a few attempts to use nonparametric methods for estimating market models. Namely, Dombrow et al. (2000) develop a completely nonparametric event study<sup>3</sup>. In simulations they find that the Theil nonparametric estimation (Theil 1950) of the market model’s slope  $\beta$  yields more robust results than the standard OLS approach.

Theil’s (1950) procedure relies on the median of sample slopes, which is derived by a ranked based approach. Firstly, all data pairs are sorted in ascending order of the independent variable (in the case at hand market returns  $R_{m,j}$ ). Subsequently, data pairs (independent and dependent variable) are separated into two groups, namely those observations lying below and those lying above the median (Dombrow et al. 2000, 364). These pairs are then used to calculate individual slope parameters  $\beta_{(j,j+\frac{N}{2})}$  as follows

$$\beta_{(j,j+\frac{N}{2})} = \frac{R_{(j+\frac{N}{2})} - R_{m,j}}{R_{m(j+\frac{N}{2})} - R_j}, \quad 1 \leq j \leq \frac{N}{2}. \quad (8.6)$$

The sample slope parameter  $\hat{\beta}$  is simply the median of all individual slopes

<sup>3</sup> In fact, the methodology was first applied in Dombrow (1997).

$$\hat{\beta} = \text{median}\{\beta_{(j, j + \frac{N}{2})}\}, \quad 1 \leq j \leq \frac{N}{2}. \quad (8.7)$$

As (Hollander & Wolfe 1999, 426) suggest, Theil's estimation of  $\beta$  is associated with Hettmansperger et al.'s nonparametric intercept estimator. The advantage of Hettmansperger et al.'s estimation is that it does not assume symmetry of the error term distribution. Hettmansperger et al. (1997) have developed a complete linear model, based on ranks. In this model, the corresponding value of the intercept  $\hat{\alpha}$  simply is the median of  $\alpha_i$ , with

$$\hat{\alpha}_i = R_j - \beta R_{m,j}, \quad j = 1, \dots, n. \quad (8.8)$$

Figure 8.1 gives a visual depiction of the claim that models falsely assuming normally distributed data overestimate event effects.

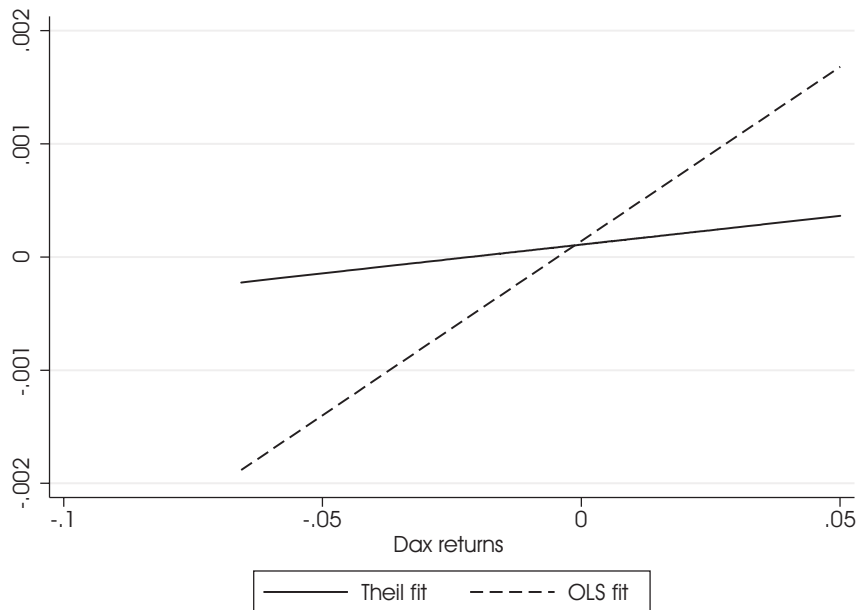


Figure 8.1: *OLS vs. Theil-fit (Bertelsmann, prohibition)*

The parameters derived by these three methods (OLS, GARCH, and Theil) are then used in an out-of-sample prediction to calculate abnormal returns as specified in equation 8.1. Apart from comparability with existing studies, a further merit of using a variety of different estimation methods is to check for robustness of the results obtained by each individual method. This mitigates

Nykvist's claim to some extent:

As with all economic models, they are subject to some degree of uncertainty given their dependence on statistical estimates of relevant economic parameters, and the specification of the underlying economic model (Nykvist 2002, 10).

Still, I run an extensive regression diagnostic for each model. Respective results and graphs can be reconstructed by means of the do-files provided on the attached data CD. Further instructions are given in appendix C. Results of the final specification are discussed in the next chapter.

### 8.1.2 Hypothesis Testing

The last step of the event study consists of testing against the null hypothesis that CAARs are not statistically different from zero ( $H_0 : \text{CAAR}=0$ ). In line with most event studies on merger decisions (Asquith & Kim 1982, Dasgupta et al. 2001, Ellert 1976, Haw et al. 1990, Hong et al. 1978, Ruback 1982, Travlos & Waegelein 1992, e.g.) this could be accomplished using a two-sided t-test. Again, for reasons of comparability with existing studies, I first conduct a t-test for testing against the null hypothesis of no abnormal return, despite of possible methodological objections.

Some argue, the studentized t-test was appropriate using a large number of CAARs, independent of the shape of the CAARs' distribution (Corrado 1989, 385). However, for small samples, the t-test requires normally distributed data (cf. Lehman 1994). In other words,

the statistical tests on which the event study methodology relies are based on normality assumptions that are plausible only with a large sample size. When the sample size is small (especially if it is less than 30), assuming normality is indeed quite heroic (McWilliams et al. 1999, 355).

It has recently been shown that even this weak assumption does not hold (e.g. Cowan & Sergeant 1996, Dombrow et al. 2000, Kramer 2001). The properties of returns data compromise finite sample inference, which means that even

with a very large  $N$ , test statistics do not follow the assumed normal distribution. Further, parametric tests, such as the studentized  $t$ -test yield a high risk of committing a type I error, if variance increases at the event date (event-induced variance). Brown & Warner (1980, 218) as well as Brown & Warner (1985, 11) provide evidence that  $t$ -statistics are often leptokurtic and slightly skewed to the right. Building on these early findings, Kramer (2001) shows the effect of wrongly assuming normally distributed error terms on  $z$ -values, using simulated returns data.

Given these potential difficulties, I consider it more appropriate to use non-parametric tests, such as the sign- or the rank test, as these do not assume a particular distribution of returns. As its name suggests, the sign-test is based on the signs of abnormal returns,  $H_0$  being that it is equally probable that CAR is positive or negative (MacKinlay 1997, 32).

The respective test statistic  $\theta_{sign}$  is given by

$$\theta_{sign} = \left[ \frac{N^+}{N} - 0.5 \right] \frac{\sqrt{N}}{0.5} \sim N(0, 1), \quad (8.9)$$

where  $N$  is the total number of cases and  $N^+$  is the number of cases with positive abnormal return (MacKinlay 1997, 32).  $H_0$  is rejected if  $\theta_{sign} > \phi^{-1}(\alpha)$ , for a test of size  $(1 - \alpha)$ .

Still, the sign test may be misspecified for daily data if the distribution of abnormal returns is skewed (Corrado 1989, 386)<sup>4</sup>. As both graphical and statistical diagnostics show, this is a concern for at least some of the firms under investigation. In the case of skewed abnormal returns, I therefore further apply the more appropriate nonparametric rank test by Corrado (1989), Corrado & Zivney (1992). This test is derived from the well-known Wilcoxon rank-sum test (Wilcoxon 1945) and has been shown to yield more robust results (Dombrow et al. 2000). As Corrado (1989) concludes, due to “the highly nonnormal distributions that characterize daily security returns [...], the rank test is more powerful than its parametric counterparts” (Corrado 1989, 395).

<sup>4</sup> See also Brown & Warner (1980, 1985). For an empirical application compare Guidolin & Ferrara (2004).

The rank test procedure by Corrado treats the 230-day estimation period and the event day as a single time series  $T = L_1 + L_2 + d$ , and assigns a rank to each daily return for each firm. Let  $K_{it}$  be the rank of the abnormal return of security  $i$  for the entire sample period ( $t = -230, \dots, 1$ ), then

$$K_{it} = \text{rank}(AR_{it}) \quad t = -230, \dots, 1.$$

Under the null hypothesis of no abnormal return, the expected rank of the event day equals the average rank, which, by construction, is  $\frac{T}{2}$  (Corrado 1989, 388). The respective test statistic  $\theta_{rank}$  is

$$\theta_{rank} = \frac{1}{N} \sum_{i=1}^N \frac{(K_{i0} - \frac{T}{2})}{s(K)}, \quad (8.10)$$

where  $N$  is the number of equities and the standard deviation  $s(K)$  is calculated over the entire sample period:

$$s(K) = \sqrt{\frac{1}{T} \sum_{t=1}^T \left( \frac{1}{N} \sum_{i=1}^N \left( K_{it} - \frac{T}{2} \right) \right)^2}.$$

In its original specification  $\theta_{rank}$  assumes a single day event window with  $K_{i0}$  being the return on the event day  $t_0$ . Using an event window of three days, I substitute  $K_{i0}$  with the average rank during the event window. Unfortunately, Corrado (1989) does not specify how to calculate the p-value of  $\theta_{rank}$ . However, this can be easily inferred. By definition,  $K$  follows a uniform distribution (each rank is equally likely to occur). Thus, the probability of observing  $K_{i0} \neq 0$  if indeed  $K_{i0} = 0$  is

$$p = \left| \frac{1}{T} \left( \left| \frac{T}{2} \right| - |\theta_{rank}| \right) \right|. \quad (8.11)$$

Testing against the null hypothesis of no abnormal returns is apt for H1, H2, and H3. Hypothesis 2a is tested by means of a rank and median compari-

son of both abnormal returns in consequence of the Commission's expression of compatibility in Phase I (Art. 6(1)(b)) with the same decision subject to certain conditions and obligations, and expressions of no concern in Phase II (Art. 8(2)) with the same type of decision subject to certain conditions and obligations. Again, I apply a nonparametric testing procedure, in this case the *Mann-Whitney two sample statistic* which is the nonparametric counterpart to the two sample t-test (paired Student's t-test) of independent samples.

Recent papers (Godfrey & Tremayne 2005, Gonçalves & Kilian 2002, Kramer 2001, Zhen 2004) have shown that with non-clustered events, normalization of test-statistics augmented by bootstrap resampling yields results robust to "heteroskedasticity, autocorrelation, non-normality, and event-period model changes, even in small samples" (Kramer 2001, 109). Yet, the application of pairwise- or wild bootstrap, which is directed to time series data (Davidson & Flachaire 1999, Godfrey & Tremayne 2005) is hitherto restricted to some simulations but hardly applied in any empirical study using real data. This might be the reason why this method is not (yet) implemented in common statistical packages such as Stata (Baum 2004, 11). Sound programming knowledge is required for writing a programme performing pairwise bootstrapped significance tests, the acquaintance of which would have been out of the scope of this diploma thesis and is thus left for future consideration.

## 8.2 Estimating Volatility Effects

So far I have outlined the features of the event study methodology applied for testing whether European Commission's decisions have an impact on the level of stock price returns. Hypothesis four states that, apart from stock price return-, there are also volatility reactions to be expected by Commission's decisions. As foreshadowed in section 8.1, GARCH(p,q) models are very apt for estimating volatility in high frequency data. This is due to the fact that serial correlation, volatility clusters and heteroskedasticity are explicitly modelled by taking into account both the variance at the prior period and prediction errors of the prior period. In line with equation 8.4 on page 56, the GARCH(1,1) process models effects of European Commission's merger decisions on stock price volatility as

$$\sigma_t^2 = \omega + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2 + \delta_i I_{i,t}, \quad (8.12)$$

where  $I_{i,t}$  is a set of exogenous variables indicating information arrival. Hence  $I_{i,t}$  captures the anticipation variables obtained via the content analysis discussed in section 7.1.2.1.

According to H4, I expect different reactions to negative, compared to positive events on financial markets. Thus, an asymmetric specification, such as EGARCH (exponential GARCH), A-GARCH (asymmetric GARCH), or TARCH (Threshold ARCH), appears appropriate. EGARCH was developed by Nelson (1991) and A-GARCH has been invented by Engle & Ng (1993). Both models assume that negative shocks have a more prominent effect on conditional variance than positive shocks. Threshold models, first applied by Zakoian (1994), also account for diverging impacts of negative and positive shocks. However, they only assume a difference in reaction, which does not necessarily mean that volatility is higher due to negative than to positive shocks. As results are hardly effected by switching from one to the other specification, I decided to fit an EGARCH(1,1) model. Whereas the mean equation is similar to the one of a Vanilla GARCH (GARCH(1,1), equation 8.3), its variance is given by

$$\ln(\sigma_t^2) = \omega + g(z_{t-1}) + \beta_i \ln(\sigma_{t-1}^2), \quad (8.13)$$

where  $g(z_{t-1})$  is an asymmetric response function defined by

$$g(z_{t-1}) = \theta z_t + \gamma(|z_t| - E|z_t|),$$

and  $z_t = \frac{\varepsilon_t}{\sigma_t}$ . The two parameters of the function  $g(\cdot)$  define the size- and sign effects of shocks on volatility.  $\theta z_t$  determines the sign effect and thus constitutes the asymmetric element, and  $(|z_t| - E|z_t|)$  is the size effect, which is similar to a typical ARCH effect (Alexander 2001, 80).

The following paragraphs give an overview of the diagnostics used to evaluate the model fit of the GARCH models. Results are discussed in the subsequent chapter.

## 8.3 Diagnostics

Before running the models described above, I extensively analysed all time series to get an idea of their distributional characteristics, check for ARCH-effects and unit roots. Some of these tests were again employed after running the respective regression model to analyse the resulting residuals. All diagnostic results can be reviewed by running the respective do-files (on the attached data CD) as further explained in appendix C. This section is dedicated to describe the less widely used of these tests.

As a first step, I conducted several tests for normality, such as the well known Shapiro Francia or Stata's `sktest`. These numerical analyses were augmented by respective graphical analysis such as symmetry-, box-plots, and histograms. In addition to these standard tests, I use the Jarque-Bera test (Jarque & Bera 1987) which is a normality test based on skewness and kurtosis and thus able to detect whether a series follows a leptocurtic distribution as mentioned in section 8.1.1. The `jb`-value is calculated by:

$$jb = \frac{n - k}{6} \left( S^2 + \frac{(K - 3)^2}{4} \right) \quad (8.14)$$

where  $n$  is the number of observations,  $k$  is the number of estimated parameters,  $S$  is the skewness and  $K$  is the kurtosis. The larger the `jb`-value, the lower is the probability of normally distributed data. The test statistic itself is approximately  $\chi^2$ -distributed with 2 degrees of freedom under the null hypothesis that the series is normally distributed (Fiorentini et al. 2003, 03). However, the Jarque-Bera test is not designed for small samples (Fiorentini et al. 2003, 05).

For many of the series in the sample the Lagrange-multiplier (LM) test for autoregressive conditional heteroskedasticity (invented by Engle 1982) clearly

indicates ‘ARCH-effects’ (time dependency of the error term) which means that the null hypothesis of homoskedasticity can be rejected for these series. This motivated the usage of GARCH models to obtain accurate estimates (Engle 1982, Bollerslev 1986). The basic idea of the LM test is as follows: regress  $y$  on  $x$  and obtain residuals; regress the obtained residuals  $\varepsilon_{t-1}^2$  on  $p$  lags of  $\varepsilon_{t-1}^2$ , i.e.  $\beta_0 + \beta_1\varepsilon_{t-1}^2 + \dots + \beta_p\varepsilon_{t-p}^2$ ; assess the joint significance of  $\beta_1 - \beta_p$  (see e.g. Breusch & Pagan 1980). The null hypothesis of homoskedasticity can be rejected if the coefficient is statistically different from zero (Connolly 1989, 162). In order to check whether there were any remaining ARCH-effects after running the GARCH(1,1) specification, I again applied the test to the residuals obtained by the respective GARCH model. In most cases, running a Vanilla GARCH was sufficient to remove ARCH-effects, in all other cases I added an additional ARCH term, i.e.  $q = 2$  to the specification presented in equation 8.4<sup>5</sup>.

Further, each table of results has an entry for the so called ‘Ljung–Box’ test. The Ljung–Box test, also called Box–Pierce or Q-test for white noise, is performed to test whether a time-series has significant autocorrelation or not. The null hypothesis is that no serial correlation exists which is accepted when the p-value is high. The larger  $Q_k$ , the larger the probability of autocorrelation.  $Q_k$  is calculated as follows:

$$Q_k = N(N + 2) \sum_{i=1}^k \frac{r_i^2}{N - i} \quad (8.15)$$

where  $N$  is the number of samples,  $k$  is the number of lags and  $r_i$  the  $i$ th autocorrelation.  $Q_k$  is  $\chi^2$ -distributed with  $k$  degrees of freedom. Again, the Ljung–Box test was employed both to find the adequate regression model and to test whether there was remaining autocorrelation after running a GARCH(1,1) model.

<sup>5</sup> The conditional variance of the standard GARCH(p,q) model is given by

$$\sigma_t^2 = \omega + \sum_{i=1}^q \alpha_i \varepsilon_{t-i}^2 + \sum_{i=1}^p \beta_i \sigma_{t-i}^2 + \delta_i R_{mt},$$

i.e. additional ARCH terms are simply added up.

Generally, above described diagnostics supported the initial conjecture that GARCH(1,1) was the most adequate model specification. The results of both the event study and volatility analysis are presented in the following chapter.

# Discussion of Results

---

---

*The great tragedy of science is the slaying of a beautiful hypothesis by an ugly fact.*  
(Thomas H. Huxley)

## Chapter Outline:

This chapter is dedicated to the discussion of results. For a quick introduction I will first present some case studies (section 9.1) and their particularities and then move on to the aggregate level, namely the impact of Commission's decisions on stock returns (section 9.2). Finally, section 9.3 illustrates the results obtained by the volatility analysis.

## 9.1 Case Studies

This section presents results and some visual depictions of the stock return analysis for several selected cases. These were chosen to show some particularities and underpin the methodological considerations presented in chapter 6. Rather than distinguishing different cases, I present results according to methodological concerns. In particular, these include questions about a reasonable length of event window (section 6.4.1.1), the selection of the most appropriate equilibrium model (section 8.1.1) and, to start with, a general overview of the possible magnitude of abnormal returns ascribed to European Commission's merger decisions.

### 9.1.1 Impact of Commission's Decisions on Stock Returns

The following examples are meant to give a general impression on how –if at all– the application of the European Merger Regulation impacts stock returns.

For instance, the Metso merger nicely illustrates the importance of modelling anticipation effects. Figure 9.1 clearly shows how new information is priced in even before the respective decision is officially published.

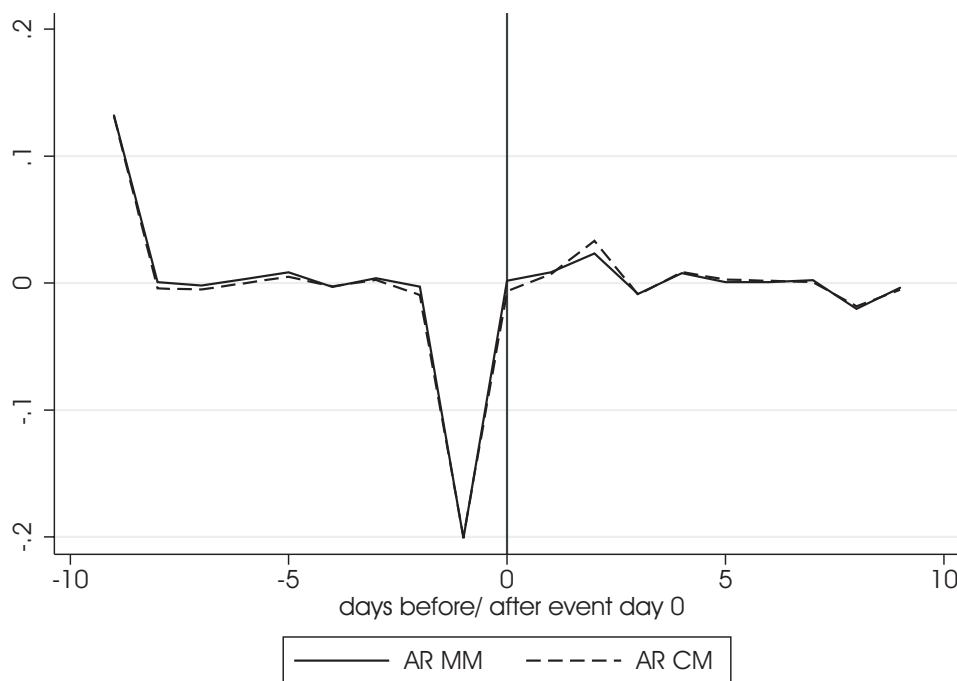


Figure 9.1: *Abnormal Returns Metso; Decision Type 6(1)(c)*

This result is in line with the theoretical framework both in terms of the direction (the decision entails the initiation of phase II which, according to H1, is expected to cause lower stock returns) and the timing of the impact; the latter indicating market efficiency and rational absorption of information.

Figure 9.2 also gives a telling impression of a rather prominent effect on abnormal returns. However, these are opposed to initial expectations. Although we are dealing with an initiation of phase II of the merger review process (Art. 6(1)(c) of the Merger Regulation), figure 9.2 shows positive abnormal returns. There are two possible explanations for this seemingly anomaly. Either, shareholders in the first place expected a prohibition of the proposed merger and were therefore relieved the first decision turned out to merely implicate an extension of the review process, or, which is even more likely, some other event is responsible for the sudden upward movement. As such, this example justifies the inclusion of a variable controlling for other effects possibly affecting firms' values.

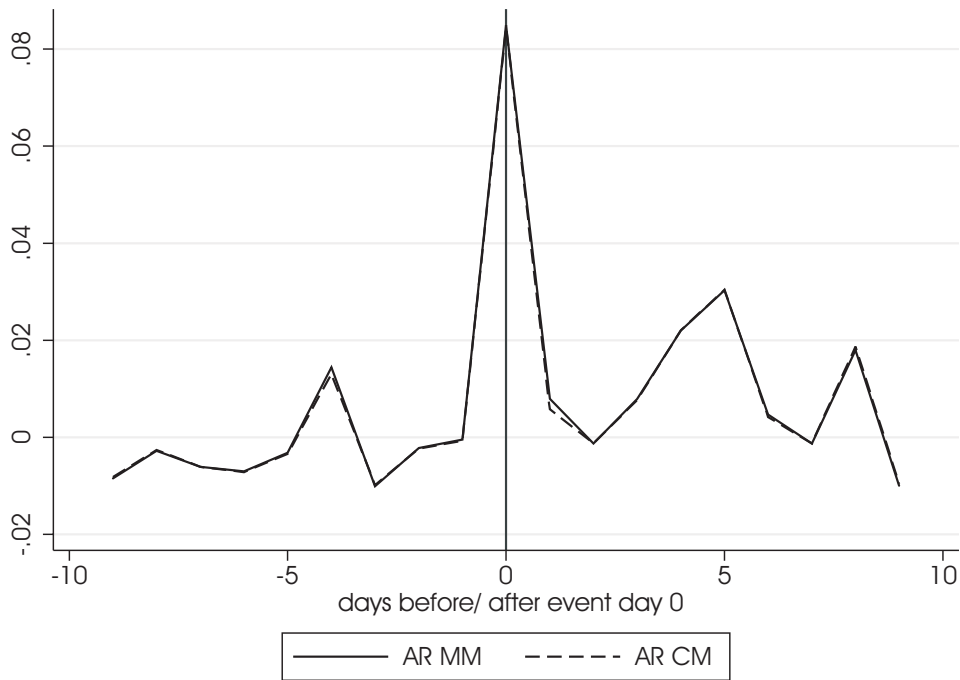


Figure 9.2: *Returns Dow Chemical; Decision Type 6(1)(c)*

### 9.1.2 Length of Event Window

With regards to the length of the event window, most cases suggest using rather short event windows which is in line with the respective literature cited in chapter 6. Still, some cases show prominent anticipation effects which would not have been analysed with too short an event window as the visual depiction of cumulated abnormal returns of the UPM-Kymmene merger illustrates (figure 9.3).

Such examples justify the inclusion of anticipation variables. However well the UPM-Kymmene merger might serve to visualize anticipation effects, the sign of abnormal returns might be misleading. The merger was eventually cleared, but still figure 9.3 depicts that its stock yielded negative abnormal returns. Nevertheless, abnormal returns hardly amounted to -.05 percent as such not necessarily contradicting hypothesis two. Further, one could even argue that anticipation did not take place at day -1, but rather five days before the decision and then slowly ebbed away. It experienced another boost when the decision became public, and then settled around a rather stable mean about two days after the event.

The next example, the Electrabel merger (figure 9.4) confirms the above assertion that normally, short event windows perform better. In this case, only

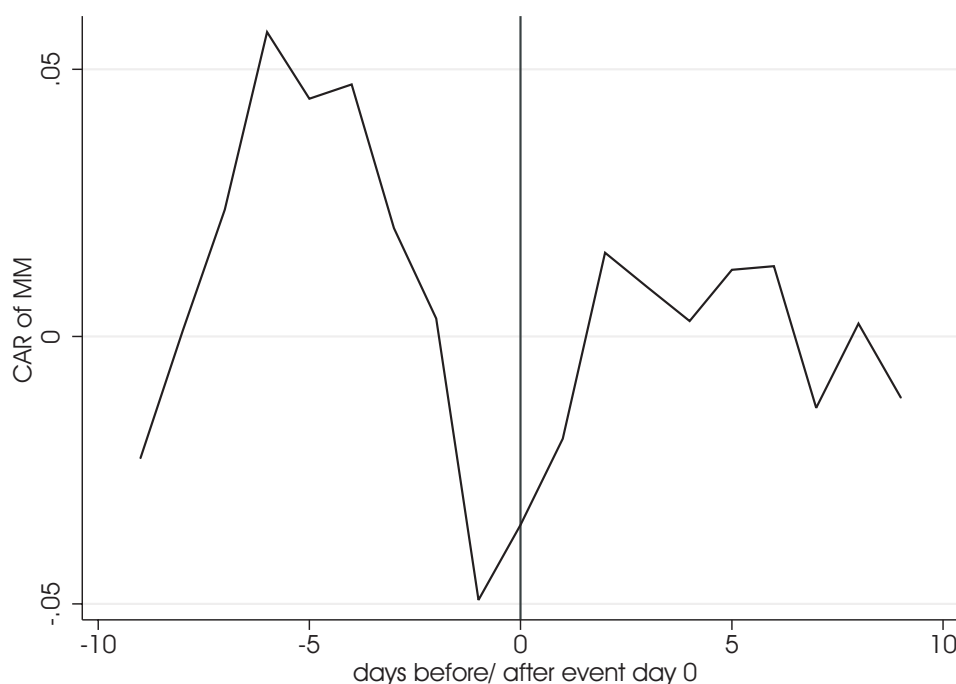


Figure 9.3: *CAR UPM-Kymmene (MM estimated with GARCH); Decision Type 8(2)*

the day of the decision was included.

A similar impression is given by the abnormal returns around the Dow Chemical merger decision depicted in figure 9.2. It highlights the importance of using a rather short event window, since a larger window (i.e. capturing more days than the pre-event and post-event day as suggested in this study) would smooth out the effect making it hardly visible.

### 9.1.3 Equilibrium Model

As extensively described in section 8.1.1 there are quite a few normal performance models for comparing abnormal returns to. For several reasons, I chose to both calculate constant mean and market models. The plot of abnormal returns surrounding the Merck merger (figure 9.5) illustrates that in most cases there is no substantial difference in results by choosing either type of model.

Still, it is worth calculating both specifications, given that on the one hand, only the market model controls for general market movements that might influence stock returns and on the other hand, some stocks are hardly influenced by market movements and thus follow their constant mean rather than being

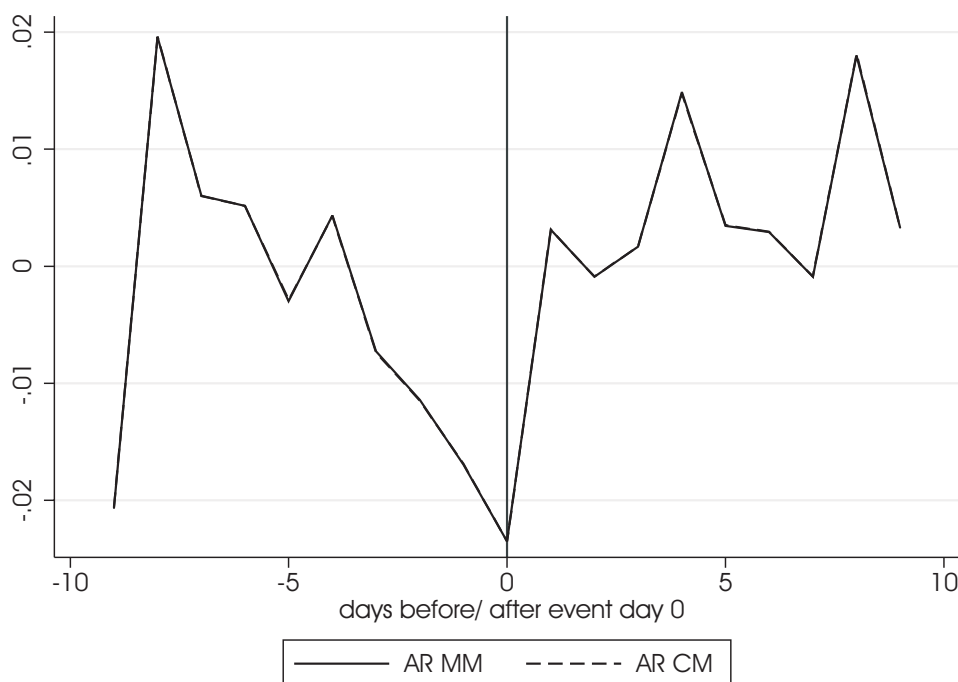


Figure 9.4: *Abnormal Returns Electrabel; Decision Type 6(1)(a)*

at the whim of the DAX movement.

### 9.1.4 Summary

The case studies have shown that there are indeed abnormal returns observable around the date of a Commission's decision on a proposed merger. In particular, most figures reveal that market participants behave efficiently and price in news relatively quickly, justifying the usage of comparatively short event windows.

However, these results are rather indicative and meant to give the reader a first impression of the nexus between the application of the European Merger Regulation and stock returns. In order to draw more general conclusions, the analysis at the aggregate level, discussed in section 9.2, merits a closer look.

## 9.2 Stock Returns

The results presented in the following subsections are based on highly aggregated data. Instead of considering individual firms, abnormal returns were aggregated and averaged both across companies and time (CAAR) to get an

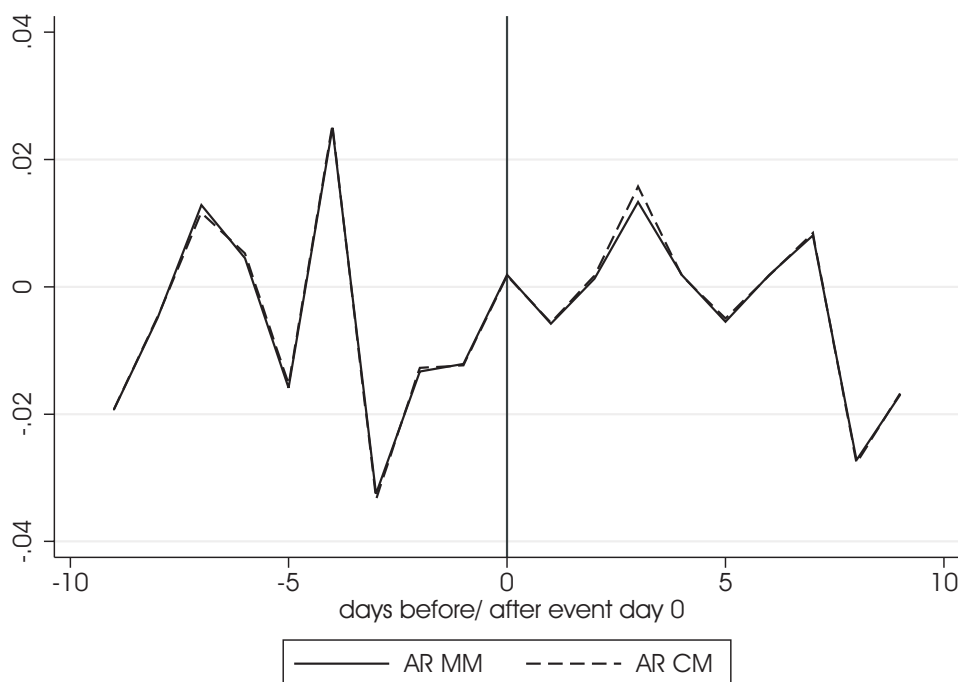


Figure 9.5: *Abnormal Returns Merck; Decision Type 6(1)(a)*

overall impression of the impact of decisions by DG competition on stock values. This has some implications with respect to the size of test statistics. On the one hand, aggregation eliminates random fluctuation, but on the other hand it is also very sensitive to extreme outliers. That is, if abnormal returns of all but one company have the same sign and the abnormal returns of this one company are rather large, averaging might lead to a drastic reduction in the overall effect.<sup>1</sup> Additionally, given rather short event windows, especially the non-parametric tests yield very conservative estimates. These tests compare either the sign, rank or median of CAARs during the event window to those obtained outside the event window. The corresponding p-values reflect the possibility of randomly observing such values if they were indeed indifferent to the rest of the series. If, however, the event window only comprises three days, none of the tests will ever reveal substantial results. This is due to the fact that in a series with about 200 points of measurement it is not that unlikely that three values in a row are higher or lower than the median. Further, the power of most test statistics used is rather low for small samples, which is why the effect does not always appear as substantial as it might actually be.

Thus, it is difficult to assess whether abnormal returns are merely due to

<sup>1</sup> Appendix F shows the impact of these influential cases and lists the respective companies' names.

random fluctuations in stock prices or whether they are indeed attributable to a certain event. Notwithstanding respective difficulties in interpreting non-parametric test statistics, the problem itself is not confined to the tests, but demonstrates one of the pitfalls inherent to any event study.

The results of various tests are presented in tables 9.1 to 9.4; their interpretation follows hypothesiswise in sections 9.2.1 to 9.2.3

### 9.2.1 Hypothesis 1: Initiations of Phase II and Prohibitions

Recall that according to hypothesis 1, initiations of phase II (Art. 6(1)(c)) and prohibitions of a proposed merger (Art. 8(3)) are expected to negatively influence the respective companies' equities. As described in section 8.1.2, I ran several statistical models to empirically test this hypothesis. The two baseline models, the constant mean return- and the market model with OLS parameter estimation are depicted in figure 9.6.

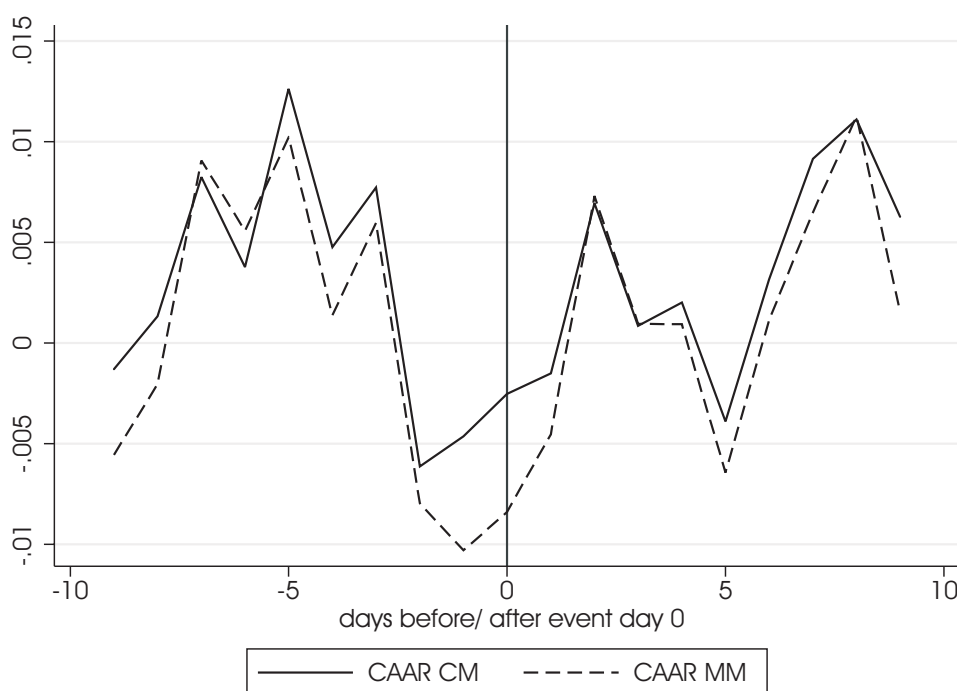


Figure 9.6: *CAAR Decision Type 8(3)*

As figure 9.6 illustrates, abnormal returns on the event day (day 0) are a little blurred by rumours prior to the actual decision, which are immediately priced in. This is in line with the presumption that well anticipated events have less

effects than sudden news. Once a decision is anticipated it becomes ‘noise’ (Black 1996) rather than news. Yet we can observe a distinct negative effect on firms’ stocks slightly before and on the event day. Shortly after the event returns oscillate around a stable mean. However, because rumours lead to increased uncertainty, we should expect higher volatility. Figure 9.6 gives a first impression of this conjecture. This point is further discussed in section 9.3.

The plot of CAARs in figure 9.6 is meant to give the observer a picture of possible impacts on the prohibition to merge on respective firm assets, but is certainly not sufficient to judge whether H1 holds. Table 9.1 contains the results of various significance tests (as discussed in section 8.1.2). The structure of table 9.1 is rather complex, due to the sheer number of tests statistics it contains. Let me thus briefly give some reading instructions. All cell entries display p-values. These are arranged such that rows refer to the respective test-statistic, e.g. t-test or rank-test and columns indicate the method by which the market model’s parameters were estimated, e.g. OLS or Theil. Further, these columns are divided to distinguish between different lengths of event windows in case of the rank- and median test. This was necessary due to aforementioned conservative results of non-parametric tests. Finally, different sets of rows refer to different alternative hypothesis. Cell entries always give the p-value of the respective alternative rather than the null hypothesis.

Starting simple and then getting more complicated, let us begin with the t-tests. The corresponding p-values are quite promising and robust to different parameter estimations. In most cases the probability that cumulated average abnormal returns are different to zero is relatively high, for the constant mean model ranging from .61 to .69. The market model, however, performs a little worse, with values for prohibitions being slightly lower than .5. This could be a first hint that some of the assets included are not merely a function of the DAX development. Further, recalling figure 9.6, the effect could simply be blurred by anticipation effects. Due to lack of variance on the variables measuring anticipation, these variables could not be included in the aggregate level stock return analysis, but effects of anticipation on volatility are presented in section 9.3. Yet, –as far as possible– I run each regression using the day the Handelsblatt expressed a speculation on the possible outcome of a merger review process instead of the event day itself to define the event window. Unfortunately, there were hardly any presumptions advanced in the

Table 9.1: Test Statistics  $H1$ 

	8(3)						6(1)(c)								
<b>Constant Mean</b>															
<i>Prob(CAAR<math>\neq</math>0)</i>															
t-test	.6891	-	-	-	-	.6053	-	-	-	-	-	-	-	-	-
<i>Prob(rank/median event = estim.)</i>															
Rank	.5316	.476	-	-	-	.753	.2405	-	-	-	-	-	-	-	-
Median (median $>$ 0)	0	0	-	-	-	0	.217	-	-	-	-	-	-	-	-
<i>Prob(rank/sign(CAAR)=0)</i>															
Corrado	.5007	-	-	-	-	.4933	-	-	-	-	-	-	-	-	-
<i>Prob(CAAR<math>&lt;</math>0)</i>															
t-test	.6555	-	-	-	-	.6974	-	-	-	-	-	-	-	-	-
<b>Market Model</b>															
<i>Prob(CAAR<math>\neq</math> 0)</i>															
t-test	.4541	-	.4447	-	.4314	-	.8894	-	.9529	-	.9454	-	.9454	-	.9454
<i>Prob(rank/median event = estim.)</i>															
Rank	.2698	.2836	.2629	.2817	.2911	.2932	.6129	.2705	.3743	.305	.8328	.6312	.8328	.6312	.6312
Median (median $>$ 0)	0	.217	.5	.217	1	.217	0	.217	.5	.537	1	1	.537	1	1
<i>Prob(rank/sign(CAAR)=0)</i>															
Corrado	.4988	-	.4989	-	.4987	-	.4958	-	.4989	-	.4954	-	.4954	-	.4954
<i>Prob(CAAR<math>&lt;</math>0)</i>															
t-test	.773	-	.7776	-	.7843	-	.5553	-	.4765	-	.5273	-	.5273	-	.5273

Note: Cell entries are p-values; *day* indicates length of event window.

Handelsblatt, so that reconstructing the event window was often not feasible. For those cases subject to publicly expressed anticipation, redefining the event window hardly changed results at the aggregate level. This constriction does not only hold for prohibitions and initiations of phase II but is also applicable to H2 and H3. This matter of fact should encourage future research to develop a more refined measurement of anticipation.

Notwithstanding above results, there appear to be very prominent reactions to the initiation of phase II of a merger review process, given that the respective p-values oscillate around .9. Independent of the normal performance model (constant mean or market model), the probability that CAARs are lower than zero is quite high. This is well in line with H1 stating that both prohibitions of a proposed merger and initiations of phase II cause negative abnormal returns. p-values indicating the probability that CAARs are smaller than zero are slightly lower for initiations of phase II (Art. 6(1)(c)) than for prohibitions (Art. 8(3)). This is no surprise, considering that decisions according to article 8(3) of the Merger Regulation imply that the proposed merger is definitely not compatible with the Common Market, whereas article 6(1)(c) decisions only express serious doubts. In the latter case the final result remains open, which might be why investors appear to be a little more optimistic to the initiation of phase II.

Moving on to the non-parametric tests, results are less easy to interpret. In the first place, most p-values are substantively smaller than for the t-tests, which confirms the distributional considerations laid out in section 8.1.2 and goes along with the discussion at the beginning of section 9.2. The rank test is roughly in line with the t-test, although some p-values are a little lower. Given that the studentized t-test tends to overestimate, i.e. is very prone to committing a type I error, such divergences are normal. Another concern here is the rather short length of the event window, ranging from three to five days. In the case of article 6(1)(c) decisions, larger windows yield lower p-values, indicating that including too many leads and lags diminishes the event's effect. This becomes even more evident with respect to the median test, supporting above claim that abnormal returns over a very short period of time are not easily distinguished from mere random fluctuation. Finally, Corrado's rank test deprives of any meaningful interpretation. In the words of Stigler: "Theories that are right only 50 percent of the time are less economical than coin-flipping" (cited in Malkiel 2003, 222).

Resuming the discussion of the illustrations of CAARs (figure 9.6) and the results of various significance tests (table 9.1), there is some evidence in favour of hypothesis one. This is to say that markets react negatively to both merger prohibitions and the expressions of serious doubts on the compatibility of proposed mergers with the Common Market. However, test results are not always robust to different specifications.

### 9.2.2 Hypotheses 2 and 2a: Permissions

In accordance with H2 and H2a we should expect a slight positive effect of merger clearances (decisions according to Art. 8(2) and 6(1)(b)) on the respective companies' assets. This effect is expected to be less prominent or even turn negative for those cases where the respective decision is conditioned by certain obligations.

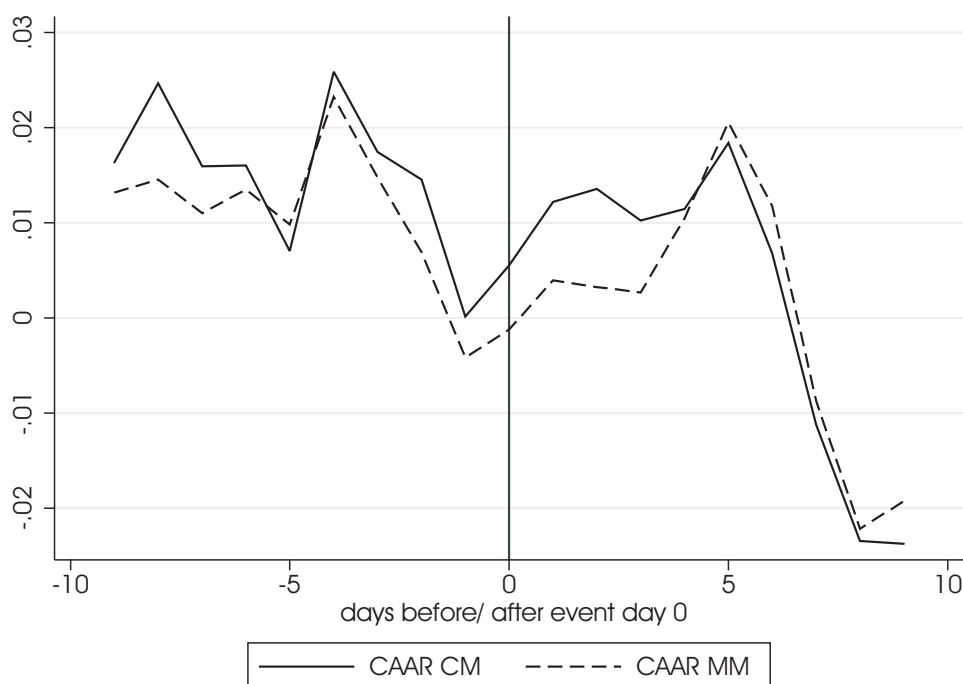


Figure 9.7: *CAAR Decision Type 8(2)*

Again, to get a first impression on whether these conjectures hold in practice, let us visualize the cumulated average abnormal returns of allowed mergers. Figure 9.7 and 9.8 show cumulated averaged abnormal returns for companies whose proposed merger was allowed without any conditions, while figures 9.9 and 9.10 depict those permissions subject to certain conditions and obligations.

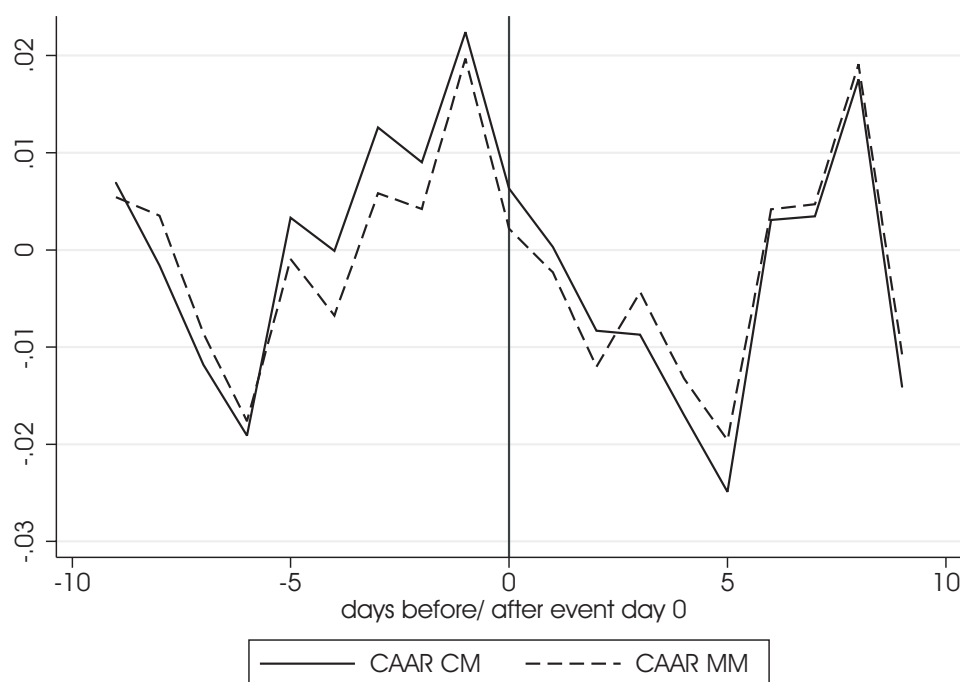


Figure 9.8: *CAAR Decision Type 6(1)(b)*

Both figures 9.7 and 9.8 exhibit slightly positive abnormal returns around the event day, with the effect being a little more prominent in case of decisions according to article 8(2). This is well in line with the theoretical framework underlying this study. Given that phase II (Art. 8(2)) is ruled by higher uncertainty than phase I (Art. 6(1)(b)), decisions during the former are of higher informational value, which –according to the EMH– justifies market reactions. I will discuss this point in more detail on page 81 in the context of respective test-statistics. Further, there are clear anticipation effects observable for both decision types, which gives additional indication for efficient markets.

Moving on to the p-values presented in table 9.2, the constant mean model hints at abnormal returns that are not necessarily different from zero and have a probability of around .5 to be larger than zero. Though not overwhelming, these results might indicate very efficient markets. Brady & Feinberg (2000, 894) claim that there is little effect of merger clearances on companies' stocks, since decisions according to article 6(1)(b) of the Merger Regulation are the norm (see also table 6.1 on page 32), therefore easy to anticipate and thus hardly contain new information. Interestingly, in this case the t-test yields lower p-values than the non-parametric tests, which is in slight contradiction to the claim by Brown & Warner (1980, 1985), Cowan & Sergeant (1996), Dombrow et al. (2000), Kramer (2001), and others that in contrast to their



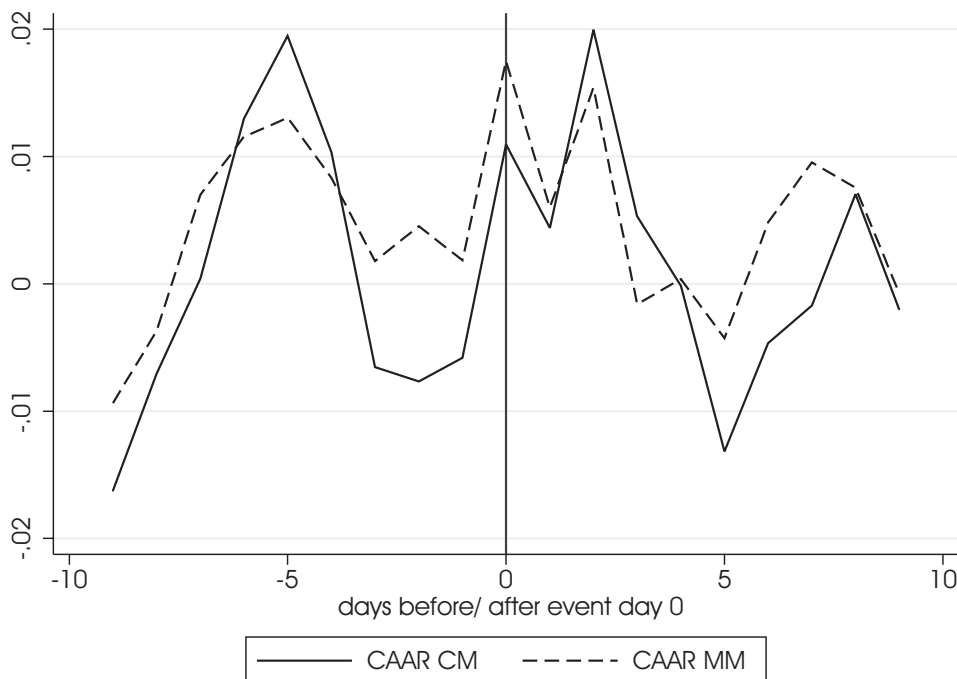


Figure 9.9: *CAAR Decision Type 8(2) with conditions*

non-parametric counterparts, t-tests tend to overestimate the effect of certain events on stock markets.

The market model, in turn, yields less ambiguous p-values. For decisions according to article 8(2) of the Merger Regulation, most values are higher than .5, confirming both abnormal returns different to and higher than zero. However, based on the figures presented in table 9.2 it is difficult to judge whether permissions during phase I (Art. 6(1)(b)) have any non-random influence on the respective companies' stock returns. Recalling the two possible phases of a merger review process according to the European Merger Regulation, a difference in reaction to merger permissions according to article 6(1)(b) and 8(2) can well be justified from a theoretical point of view. The theoretical hook of the current thesis is that investors efficiently incorporate new information and hence only surprising news impacts the price of an asset. A proposed merger only enters phase II if DG Competition has serious doubts on whether it is compatible with the Common Market (see section 2). Consequently, phase II implies far more uncertainty than phase one and hence information on a commission's decision is real 'news' in the sense of Black (1996). Merger review processes are only abandoned during phase I if the judgement whether or not the proposed merger is compatible with the Common Market is very clear-cut. Yet, if this decision is so obvious, investors should be quite prepared to antici-

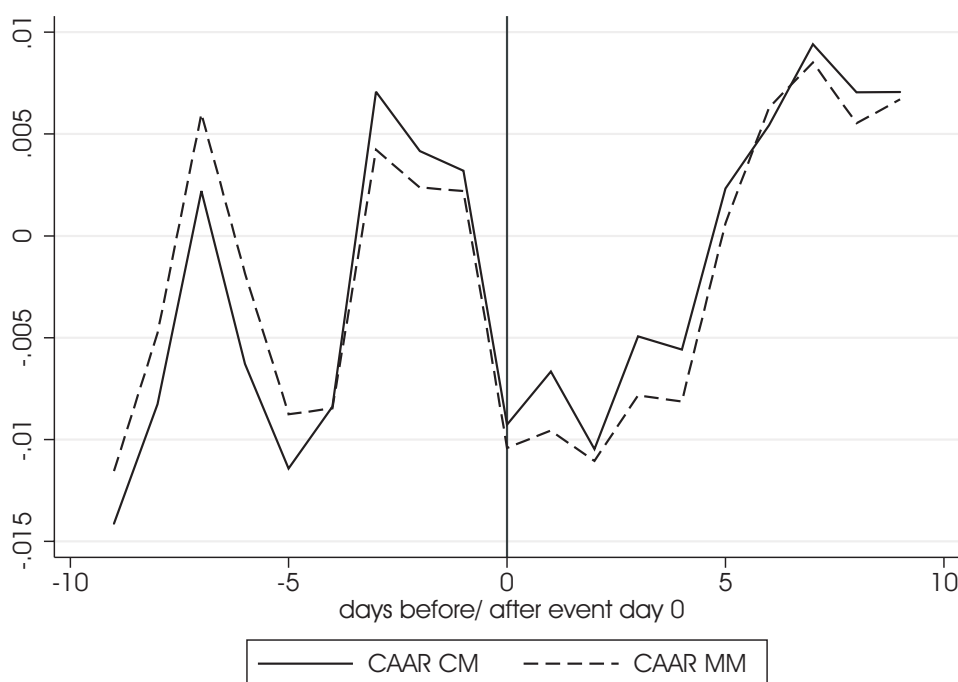


Figure 9.10: *CAAR Decision Type 6(1)(b) with conditions*

pate it and are consequently not expected to change their trading strategy on the actual day of the decision but way before.

Again, p-values are quite robust to the method of market model parameter estimation. Specification of the test-statistic, in turn, does in many cases make a difference, especially with respect to Corrado's rank test, which once more spares any meaningful interpretation.

Comparing the results to test statistics of the behaviour of abnormal returns following merger clearances subject to certain conditions and obligations, the most obvious distinction is demonstrated by the sign test's p-values. Across decision types and independent of market model parameter estimation method, all values are rather close to zero, indicating it is very unlikely that decisions without- and subject to certain conditions are related to abnormal returns of the same size. Accordingly, the sign test supports H2a which states that the conditioning of merger clearance decisions diminishes positive abnormal returns. However, other tests yield less distinct p-values. This especially holds for decisions according to article 8(2) subject to conditions, which are very similar to the same type of decision not subject to conditions. In contrast, for decisions taken during phase I, there is a clear-cut difference in impact in the



direction predicted by H2a. At least the non-parametric tests in general, result in lower p-values for decisions subject to certain conditions than for straight-away permissions.

In total, there is weak support for H2 and H2a. Apparently, my results indicate some market reactions to merger clearances. Yet, differences between straight-away permissions and those subject to certain conditions are not always clear-cut. However, a broader and more representative case selection is needed to draw generalizable conclusions.

### 9.2.3 Hypothesis 3: Procedural Decisions

Hypothesis three states that procedural decisions (Art. 6(1)(a)) do not significantly effect assets. The illustration of CAARs in figure 9.11 at first sight seems to confirm this assertion. Yet, abnormal returns around the event day are slightly higher than .01 in case of the market model and hardly reach .02 when estimated by the constant mean model. Such minor effects are not necessarily attributable to a certain event but may well be due to random fluctuation as the test results in table 9.4 confirm. Further, distributional diagnostics have shown highly non-normal, left-skewed CAARs. In the face of this evidence, the non-parametric Theil estimation method is more appropriate than the OLS model. As table 9.4 shows, the probability of normal returns during the event period is slightly higher in case of the Theil specification.

Apart from Corrado's rank test, which once more suggests no meaningful interpretation whatsoever, almost all p-values are lower than .1, indicating that market reactions to procedural decisions are rather unlikely. P-values are slightly higher for the median test. Consequently, it can be concluded that if abnormal returns are at all statistically different from zero during the event window, they are higher than the daily median percentage price change of the respective stock. Counter to the findings by Brady & Feinberg (2000), this result suggests that there is indeed some relief when DG competition declares a notified merger to be out of the scope of the Merger Regulation.

Given these results, I conclude that the cases selected for this study support H3 insofar as stock market reactions to procedural decisions are very unlikely. However, my findings go further than those of former studies (c.f. Brady &

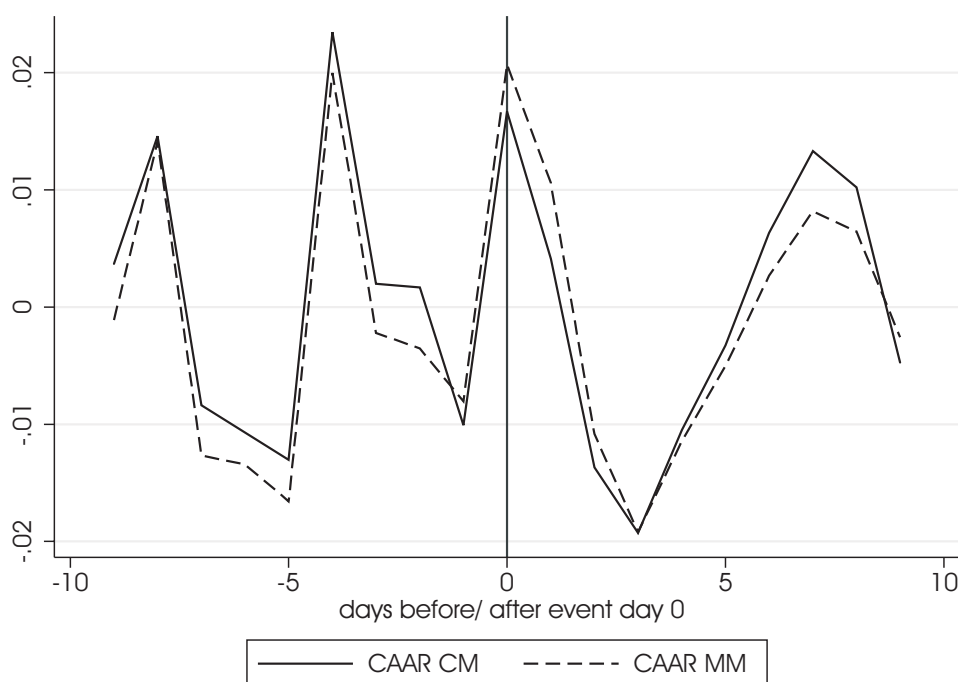


Figure 9.11: *CAAR Decision Type 6(1)(a)*

Feinberg 2000) as some tests indicate positive rather than negative abnormal returns which confirms the expectation of higher returns in case of good news.

#### 9.2.4 Summary

The results presented in sections 9.1 and 9.2 weakly support most of the hypotheses presented in chapter 5. Yet, results are somewhat contradictory with respect to procedural decisions. Across all hypotheses, results have shown to be relatively robust to both parameter estimation of the market model and the significance test employed; an exception being Corrado's test statistic, which does not allow for any meaningful interpretation.

Having shown the impact of certain decisions by the European Commission on stock returns, the analysis of event induced volatility is presented in the following section.

### 9.3 Volatility Analysis

The following paragraphs present the results obtained by testing hypothesis four. This hypothesis states that uncertainty about the outcome of a merger

Table 9.4: *Test Statistics H3*

	<b>6(1)(a)</b>					
<b>Constant Mean</b>						
<i>Prob(CAAR!=0)</i>						
t-test	.0885	-	-	-	-	-
<i>Prob(rank/sign(CAAR)=0)</i>						
Corrado	.5018	-	-	-	-	-
<i>Prob(CAAR&lt;0)</i>						
t-test	.0442	-	-	-	-	-
<i>Prob(rank/median event = estim.)</i>	<i>1 day</i>	<i>5 days</i>				
Rank	.3135	.8309	-	-	-	-
Median (median>0)	.124	1	-	-	-	-
	<b>OLS</b>		<b>GARCH</b>		<b>Theil</b>	
<b>Market Model</b>						
<i>Prob(CAAR!=0)</i>						
t-test	.0447	-	.031	-	.0299	-
<i>Prob(rank/sign(CAAR)=0)</i>						
Corrado	.5036	-	0	-	.5030	-
<i>Prob(CAAR&lt;0)</i>						
t-test	.0223	-	.0155	-	.015	-
<i>Prob(rank/median event = estim.)</i>	<i>1 day</i>	<i>5 days</i>	<i>1 day</i>	<i>5 days</i>	<i>1 day</i>	<i>5 days</i>
Rank	.0468	.4083	.0229	.1337	.1066	.2705
Median (median>0)	.245	.537	.245	.217	.247	.54

**Note:** Cell entries are p-values; *day* indicates length of event window.

review process induces an increase in market volatility. Tables 9.5 to 9.8 show the results of the volatility analysis. Each table is tripartite with the first section containing coefficients, significance levels, and corrected standard errors for the variance estimation, the second displaying ARCH/ GARCH terms, and the last section illustrating model fit and some diagnostics.

Most times several GARCH models had to be fitted to achieve convincing results. There is no single model best explaining volatility for all series under investigation. All models for one company in the sample are displayed in a separate column in the respective table of results (tables 9.5 to 9.8). These different model specifications are mainly due to the fact that data for some variables were not available for all cases or that the variables did not show enough variance to fit any model. Above all, volume of trade, which I included as a control variable due to its commonly high correlation with volatility, is not available for the Bertelsmann stocks. Poorly fitting models for this company might thus partly be due to the omission of this variable.

Table 9.5: *Volatility Analysis (GARCH/ EGARCH) Bertelsmann (Art. 8.3 decision)*

	1	2	3	4	5
Diff DAX	.0001 (.0817)	.0001 (.0016)	-4.3005*** (.0082)	-.002 (.0016)	-.8382 (.0637)
Lag return			-15383.23	-43.7652* (25.1727)	
Antic	-.9014*** (.298)	-1.4869*** (.4572)			
Other	-.4806** (.2258)	-1.0481*** (.2696)			
Any			359.7222	-.9669*** (.245)	83.7765*** (7.2377)
Cons	-9.0456*** (.1202)	-13.8165*** (2.1887)	-964.0402	-13.7366*** (2.4971)	. (.)
ARCH	L1: .2326*** (.0943)		L1: .1080** (.0432)		L1: -.1195** (.0507)
GARCH	L4: .2809 (.2419)		L4: .9430 (.0413)		L1: 1.0461*** (.0409)
EARCH		.088 (.2138)		L1: .4426* (.2737)	
EARCH_a		-.613* (.3253)		-.7210*** (.2848)	
EGARCH		-.4587** (.2257)		-.4433* (.2587)	
N	132	132	132	132	132
Log likelihood	456.03	456.05	468.3	456.359	455.1601
Prob>Chi2	.2	.21	.1	.1	.6
	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>
Archlm	.6175	.65	.1884	.76	.24
Jb	0	0	0	0	0
Ljung Box	.918	.9264	.6229	.1192	.7275

**Note:** corrected standard errors in parenthesis  
significance levels: \*:10% \*\*:5% \*\*\*:1%.

Arguably, volume of trade explains much of the observed volatility for the other companies' stock returns, which is why it is even more problematic that the data was not always at hand. It is left for future research to show, whether including volume of trade leads to better results than those presented in table 9.5. A possible explanation for the significant values for volume of trade in most models is that news on enterprises might give raise for more traders to buy and sell those stocks, which is why both volume of trade and volatility increase. In any case, due to before mentioned lack of data, results should be seen as indicative. Further, recalling section 6.1 only those enterprises with sufficient variance on the anticipatory variables were included in the analysis (i.e. Deutsche Telekom, ENI, Lenzing, and SCA did not show enough variance

to fit a GARCH model<sup>2</sup>). Finally, the results are rather limited as only the period of time for which newspapers were coded (one week prior to notification until day of last decision) was used for estimating the coefficients. A longer time horizon might yield more robust coefficients. Still, there is no obvious theoretical reason why and to what extent the period of investigation should be enlarged. Last but not least, in accordance with the considerations discussed in section 7.1.2.1, one could claim that newspapers are a rather crude proxy for both anticipation effects and other firm relevant information.

Still, apart from these shortcomings of the volatility analysis some insights can be gained by having a closer look at tables 9.5 through 9.8. Lets start with table 9.5. In order to interpret the coefficients, recall that all variables referring to information arrival (*antic*, *any*, *other*) are dummy variables. For instance *antic* is coded one on days where one or more articles in Handelsblatt indicate anticipation and zero otherwise. For the Bertelsmann case, this means that volatility decreases by about one percent on those days on which the Handelsblatt indicated some notion of anticipation of the expected Commission's decision on the proposed merger. In the asymmetric (E-GARCH) specification the decrease in volatility even amounts to one and a half percent. Remarkably, if we look at the control case, the effect of any information on volatility, the coefficients are ambiguous with respect to their signs. Whereas the E-GARCH specification –as expected– yields negative significant coefficients (model 4), symmetric specification displays non-significant positive coefficients (model 3 and 5). Although this change in coefficients hints at a rather poor fitting model, it also indicates that the asymmetric specification is better suited. I took advantage of the fact that in general the asymmetric specification yielded far more consistent results and, to simplify matters, I only report the EGARCH results in the following tables (tables 9.6–9.8). The results of the GARCH(1,1) models can be found in appendix D.

Coming back to table 9.5, we can deduce that anticipation effects (*Antic*) do have a significant influence on volatility and so does other news (*Other*). However, no conclusions on whether the correct anticipation of a decision rather than any anticipation makes a difference can be drawn, as the variable measuring correct anticipation (*Correct*) did not show any variance and was thus excluded from the analysis. Further, it can be observed that there were signifi-

---

<sup>2</sup> Apart from the general problems of drawing inference with too little variance, the problem here is that the Hessian simply is not invertible.

cant ARCH effects in most models, whereas only model five exhibits significant GARCH effects. This indicates that while the conditional variance from time  $t-1$  does not significantly affect the conditional variance at time  $t$ , random errors from the prior period ( $\varepsilon_{t-1}^2$ ) do. Finally, different specifications show that the model is usually overspecified when both the (differenced) local market index, in this case the DAX, and the lag of the dependent variable are included. Notably, the market index yields better results than the lagged return for the Bertelsmann and Honeywell case. With respect to model fit, although individual values are sometimes highly significant, the overall model fit is rather poor, with the Wald  $\chi^2$  statistic yielding probabilities of .1 and higher. One reason for this poor fit, rather than a misspecified theoretical or statistical model, might be the data structure as such. Most variables are only dummies and thus of little explanatory power. Further, the before mentioned lack of sufficient variance is still persistent. However, these problems cannot be solved without either forging the data or simply posing a different research question. Both options seem rather inadequate. To put it in Gill and King's words "computer programs should not be in the business of deciding what questions are worthy of study" (Gill & King 2004, 54).

Finally, with respect to distributional criteria, for all entries, Ljung-Box tests suggest retaining the null hypothesis of no autocorrelation. Lagrange-multiplier tests also produce high p-values for all models, justifying to maintain the null hypothesis of homoskedastic residuals.

Summing up, apart from a somewhat poor model fit, which is mainly due to the inherent data structure, in the case of Bertelsmann, the volatility analysis affirms my theoretical considerations. Volatility decreases with information arrival lessening investors' uncertainty.

The results of the volatility analysis on the effects of the General Electrics (GE) merger presented in table 9.6 look somewhat more inconsistent. Throughout half the models (model 1, 3, and 4) volume of trade is statistically significant with none of the variables of interest exhibiting a substantial effect. Only model four hints at a possibly statistically significant effect of any news (Any) on volatility; as expected the coefficient is negative. Thus, if news hit the market, volatility decreased. This is in line with the presumption that volatility is positively correlated with uncertainty and hence decreases with the arrival of

Table 9.6: *Volatility Analysis (EGARCH) General Electrics (Art. 8.3 decision)*

	1	2	3	4	5	6
Lag return		-27.4767** (12.8564)		-6.710 (5.6193)	-27.246** (12.8482)	
Correct antic		.2694 (.5401)				
Antic	-.3826 (.9455)		.0512 (.2353)		.1466 (.4174)	
Other	-1.1138 (.5026)	-.3489 (.4686)			-.3444 (.4671)	
Any				-.8727* (.444)		-.1593 (.3602)
Volume	.0097** (.0046)	.0160 (.0122)	.0186* (.0095)	.0097* (.0047)	.0152 (.0120)	.0054 (.0079)
Cons	-11.0079*** (2.7252)	-2.5805 (2.6600)	-.1261 (2.3712)	-12.2012*** (2.1766)	-2.5982 (2.7200)	-6.5824 (4.9536)
EARCH	L2: -.1650 (.2601)	L1: .2688 (.2474)	L1: .0544 (.1711)	L2: -.1742 (.2442)	L1: .2624 (.2414)	L1: -.2985 (.2163)
EARCH_a	L2: .9867*** (.3429)	L1: -.6118** (.3026)	L1: .2487 (.2503)	L2: .7826* (.4197)	L1: -.6197** (.3022)	L1: -.1830 (.3623)
EGARCH	-.4648 (.3613)	L2: .6924** (.3263)	.99177*** (.3185)	L1: -.6251* (.2839)	L2: .6896**	L1: .1903 (.6013)
N	104	104	104	104	104	104
Log likelihood	251.6501	285.1637	249.158	251.3598	285.0356	278.99
Prob>Chi2	.7533	0	.7077	.6721	0	0
	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>
Archlm	.9995	.0428	.2412	.1971	.0523	.0489
Jb	0	.0301	0	0	.0316	.0277
Ljung Box	0	.8304	.6004	.7185	.8254	.8361

**Note:** corrected standard errors in parenthesis  
significance levels: \*:10% \*\*:5% \*\*\*:1%.

news which lessen investors' uncertainty. Again, the overall fit is rather poor for some models, increasing notably when the lagged dependent variable is included in the model (models two and five). Interestingly, the Wald  $\chi^2$  statistic is rather promising for model six, although none of the variables included shows statistically significant effects.

Again, the asymmetric ARCH term being significant and substantively larger than the simple ARCH term in most models, hints that the asymmetric specification is better suited than the symmetric one.<sup>3</sup> Altogether the GE case renders less promising results than the Bertelsmann merger. However, this is not too surprising, given the fact that, for internal consistency, I only used data on stocks traded at Frankfurt, whereas GE assets are traded at many

<sup>3</sup> The results for the symmetric specification are found in appendix D in table D.1.

other stock exchanges around the world. Usually volatility effects are better observed in large liquid markets. Although Frankfurt is one of Europe's largest stock exchanges, the volume of GE assets traded at the Deutsche Börse might simply be too small to observe significant volatility shocks.

Accordingly, one should expect similar results for the Honeywell share, given that the merger was intended to take place between the two US based companies<sup>4</sup> GE and Honeywell. Looking at table 9.7 reveals rather inconsistent results, comparable to those presented in table 9.6. The most startling figures are the coefficients for anticipation that have positive signs throughout all models and thus stand in clear contrast to the relationship stipulated in H4. Even more surprising, all other events related to Honeywell (Other) have negative signs, indicating that any news, apart from those related to the merger decreased volatility. However, none of the coefficients is statistically significant, even though the model fit is rather good for all models. The latter might above all be due to significant values of volume of trade, or, respectively, the lagged dependent variable. Still, model three, which appears to be the best fit of all models estimated, reveals a statistically significant, positive effect of anticipation on volatility. There are two possible explanations for this violation of H4. Firstly, it is intuitive to ascribe the divergence between theoretical considerations and empirical results to the specificities of the GE/Honeywell case. Before the case was notified to the European Commission, the US antitrust agency had already cleared the proposed merger between GE and Honeywell. Accordingly, most shareholders expected the European procedure to be of rather formal nature. Thus, one could argue, news actually did not reduce but rather increased investors' uncertainty as it was in clear opposition to the prior expectation of most traders, which, in turn, caused an increase in market volatility. Secondly, the contradiction between theory and practice might allude a poor causal chain. In particular, my theoretical deduction that information reduces uncertainty and thus leads to less volatility might be erroneous. Or, to be less generalistic, this conjecture might simply not hold for all cases. As described in chapter 7, the proxies for anticipation effects are rather crude. More refined measurement and a closer look at the characteristics of each case (including investors' priors about the probable outcome of an

---

<sup>4</sup> The already small number of prohibitions made me refrain from the case selection criteria stipulated in section 6.1 of only selecting one of the firms involved in each merger.

Table 9.7: Volatility Analysis (EGARCH) Honeywell (Art. 8.3 decision)

	1	2	3	4	5	6
Diff DAX						.0015 (.0014)
Lag return			25.7518*** (5.4941)	-2413 (.7675)	7.3928 (5.2359)	
Correct antic		.0985 (.1130)		.0907 (.1322)		
Antic	.1218 (.1431)		1.2763* (.7327)			
Other	-.028 (.0667)	-.0222 (.0495)		-.0223 (.0549)		
Any					.2361 (.2392)	.0100 (.1938)
Volume	.108 (.1275)	.0886 (.0866)	.2416* (.1453)	.0820 (.0945)	.2389*** (.0854)	.1800* (.0883)
Cons	6.0483*** (.0083)	6.7874*** (.0206)	-1.8783*** (1.9265)	6.8800*** (.0071)	-14.0544*** (.6987)	-15.3140*** (.6345)
EGARCH	L1: -4226*** (.0898)	L1: -.3523*** (.0799)	L1 -1.0039*** (.1821)	L1: -.3326*** (.0951)	L1: .1087 (.2093)	L1: .4352*** (.0734)
EGARCH_a	L1: -.0731 (.1262)	L1: -.0555 (.0872)	L1: -.0948 (.2434)	L1: -.0402 (.1045)	L1: .2317 (.2591)	.1767 (.2102)
EGARCH	L1: 1.9290*** (.0059)	L1: 2.0374*** (.0052)	L2: -.5640** (.2646)	L1: 2.0500*** (.00738)	L1: -.9618*** (.0996)	L1: -1.2000*** (.1133)
N	104	104	104	104	104	104
Log likelihood	231.4426	23.3934	222.1359	23.5881	224.7183	224.5827
Prob>Chi2	0	0	0	0	0	0
Archlm	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>
Jb	.0801	.0525	.032	.0297	.05	.0499
Ljung Box	.0615	.032	.0698	.0313	.0283	.0282
	.8196	.8272	.8589	.8323	.8375	.8373

**Note:** corrected standard errors in parenthesis  
significance levels: \*.10% \*\*.5% \*\*\*.1%.

antitrust review process) might yield less contradictory results.

Table 9.8: *Volatility Analysis (EGARCH) Scania (Art. 8.3 decision)*

	1	2	3	4	5
Lag return			73.4613*	35.8091	68.4953*
			(38.9275)	(34.5283)	(39.6859)
Correct antic		3.3482*		3.0656	
		(2.0365)		(5.0122)	
Antic	3.1473		3.8429***		
	(2.2977)		(.8925)		
Other	.7735*	.7501*	1.0168*	.9295**	
	(.4179)	(.4528)	(.6194)	(.4379)	
Any					2.5184***
					(.4775)
Volume	-3.3498*	-3.7279**	-3.3460	-3.6947**	-2.9118
	(1.9293)	(1.8313)	(4.1688)	(1.7171)	(1.9935)
Cons	-9.2215***	-9.9167***	-12.3660***	-12.5332***	-1.7816***
	(2.6822)	(2.3241)	(1.2722)	(2.1454)	(1.2917)
EARCH	L1: .1657	L1: .3229*	-.3406433	L1: -.0543	-.4876*
	(.2047)	(.2025)	(.2535)	(.3405)	(.3103)
EARCH_a	L1: -.2547	L1: -.4731	L1: .2521	L1: .0665	L1: .4541*
	(.3389)	(.3337)	(.3137)	(.3392)	(.2722)
EGARCH	L1: .0767	L1: .0114	L1: .2668**	L1: -.2734	L1: -.1071
	(.2789)	(.2408)	(.1225)	(.2212)	(.1315)
N	126	126	126	126	126
Log likelihood	431.0236	437.5887	432.2842	438.6579	427.3792
Prob>Chi2	0	.0001	.0423	.0004	.0009
	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>
Archlm	0	0	.6678	0	.3313
Jb	0	0	0	0	0
Ljung Box	0	0	.5705	0	.5004

**Note:** corrected standard errors in parenthesis  
significance levels: \*:10% \*\*:5% \*\*\*:1%.

Finally, the analysis of Scania merits a closer look. At first sight the results presented in table 9.8 have the semblance of a parody on the theoretical model. Many models show a good fit, have significant coefficients, but all signs contradict the expectations expressed in part I of this thesis. Not only do anticipation effects increase volatility, also volume of trade persistently shows negative results, which are robust to different model specifications<sup>5</sup>. Interestingly, the coefficients for any anticipation effects (Antic), no matter whether these were consistent with the actual Commission's decision and correct anticipation (Correct), do not substantively differ. As such it seems as if the market does not distinguish between different types of news. In any case, prior to

<sup>5</sup> For the symmetric models, which essentially yield the same results, see table D.3 in appendix D.

the final decision, it is irrelevant whether anticipation was right or wrong. In fact, market participants simply cannot know, whether news correctly predict future action or not. With respect to residual diagnostic, only models three (the full model) and five (the control case without anticipatory effects) satisfy all distributional assumptions.

Recalling the notion of an efficient market, one could argue that the day an event is reported on in the newspapers is not necessarily identical to the time traders get hold of this information (Campbell et al. 1997, 176). As newspapers are published the day after a certain event happens, information might leak through the day before it appears in the papers. I therefore rerun the analysis with one-day lead anticipation variables. In no case did the inclusion of these recoded variables cause the coefficients to change sign or the diagnostics to substantively change magnitude (see tables D.4 and D.5 in appendix D for respective results). The results thus seem robust to different model specifications. However, the substantive effect of anticipation is slightly larger and more significant; yet another indicator for efficient markets.

These results definitely challenge the theoretical framework underlying this thesis. Still, at this point one cannot preclude that the Scania merger simply represents an abnormal case. This would be somehow justified with respect to the fact that not only the variables of prior interest, namely, anticipation effects, but also volume of trade with a well established usually positive correlation with volatility (Gallant et al. 1992, Leblang 2002, Leblang & Mukherjee 2005, 2004) exhibits counter-intuitive results.

### 9.3.1 Summary

Resuming the volatility analysis of the Bertelsmann, GE/ Honeywell and Scania mergers, results lead to somewhat contradictory conclusions. Recall that hypothesis four states that uncertainty about the outcome of a merger review process induces higher market volatility. On the one hand, solely examining the Bertelsmann case, model and empirical results seem to fit quite nicely. On the other hand, all other cases show either fairly bad model fits or counter-intuitive coefficients. Whatever the reason for these inconsistencies, the selection of cases is simply too small to draw valid inference. Although results remain indicative, one can conclude that the market distinguishes different

types of mergers. In most cases, information showed some impact on volatility, however not always significantly so and with differing directions. Recalling the literature overview in chapter 3 this confirms the assertion of some authors that the market reacts differently to each type of mergers (acquisition, combination, share deal, take-over, ...) and distinguishes between bidding and acquiring firm (Agrawal & Jaffe 1999*b*, Asquith & Kim 1982, Harrison & Liu 2004, Hemmingsson 2002, Feinberg 1980, Jensen 1987, Lindqvist 2003*a,b*, Rosen 2006). A route for further research would be to accumulate the respective information about each proposed merger and then conduct a more refined volatility analysis.

I will present some general conclusions on these results both in light of the underlying theoretical framework and of some methodological considerations in chapter 10. This chapter also outlines some prospects for future research. For more in-depth results, distributional diagnostics, such as normality or homoscedasticity tests, and several analytical plots of both raw and transformed data, regression- and residual diagnostics as well as figures of abnormal returns for all firms, the reader is referred to the CD accompanying this diploma thesis. The CD contains all data and do-files to replicate this analysis and review all diagnostics and plots with the statistics package Stata (Version 9). Yet, I deem a brief warning appropriate: on an average machine, running all do-files (i.e. the master do-file) might take several hours due to considerably high computational effort of some of the employed methods and the extensive usage of graphs. Instructions on how to use the CD and its contents can be found in appendix C.

## Conclusion

---

---

*What we call the beginning is often the end  
And to make an end is to make a beginning,  
The end is where we start from*

...

*We shall not cease from exploration  
And the end of all our exploring  
Will be to arrive where we started  
And know the place for the first time.*

(T.S. Elliot)

The aim of this thesis is to show whether there are sizeable market reactions to decisions by the European Commission on proposed mergers. More specifically, I both investigate to what extent such decisions lead to abnormal returns and whether uncertainty of the outcome of a review process is related to market volatility.

Following a brief introduction to the European Merger Regulation, I present a theoretical framework based on the Efficient Market Hypothesis. Assuming rational, utility-maximizing individuals, I presume that investors incorporate any available information on future firm performance in their current trading strategy. Linking these basic assumptions of financial theory to empirical findings on the impact of merger decisions on firm values, I present a model on market reactions to decisions within the scope of the Merger Regulation. The hypotheses deduced in chapter 5 all presume that investors rely on the information gained by decisions of DG Competition to assess the future value of certain assets and adjust their portfolio accordingly. On the aggregate level, such individual utility-maximizing behaviour is expected to be reflected by the market in terms of higher or lower stock returns respectively.

This conjecture is challenged with empirical data on individual firms' stock returns preceding and following different decisions by DG competition. I rely on an event study approach to single out market reactions to the implications

of the Merger Regulation and distinguish *normal*- from *abnormal* returns supposed to be caused by merger decisions.

As such, this thesis marks an extension of the current literature on the European Merger regulation in two respects. On the one hand, I focus on market reactions to specific decisions within the scope of the regulation on the individual level. That is, rather than investigating general reactions to the implications of antitrust law, such as Bishop & Lofaro (2004), Block et al. (1981), Bulmer (1994), Büthe (2005), DeYoung (1994), Feinberg (1980, 1986), and Feinberg & Harper (1999), I intend to show whether there is a sizeable effect of certain decisions on individual stocks and whether abnormal returns are observable at the aggregate level. On the other hand, augmenting the landmark studies by Brady & Feinberg (2000) and Aktas et al. (2004), this thesis relies on a broader case selection than the former and is embedded in a more refined theoretical framework than the latter. More specifically, I explicitly model anticipation effects which show to have a non-negligible impact on volatility.

Two main findings of the empirical analysis should be mentioned here. Independent of the decision type, the analysis reveals that clearly markets incorporate news efficiently. This result is robust to different model specifications and test procedures. Yet, the direction or extent of abnormal returns following certain decisions is not always consistent with what was stipulated by the theoretical framework. In particular, results on hypothesis three stating that procedural decisions have no sizeable impact on stock returns are a little ambiguous. Whereas statistical tests indicate a low probability of abnormal returns on the aggregate level, in several individual cases slight positive abnormal returns were observed. These inconsistencies might be ascribed to the rather crude presumption that investors *always* favour business combinations and therefore boost prices when a positive decision by DG competition is expected and vice versa. Depending on the circumstantialities of the respective merger there might be quite different reactions. Empirical studies reveal that it is above all the acquired firm's stockholders who earn large positive abnormal returns (Asquith & Kim, 1982, 1989; Mandelker 1974). Although Asquith & Kim (1982, 1989) claim net merger effects to be positive, this conjecture only holds provided that the bidding firms' stockholders are hardly affected, which need not always be the case. A potential challenge for further research thus

lies in the extension of data collection<sup>1</sup> on traders' expectations of the merits of specific mergers, so as to expand the model by a variable indicating market expectations.

In a further effort, I hypothesise that prohibitions of proposed mergers induce negative abnormal returns (H1). The results of the respective hypothesis tests are by far the most compelling of this study. In most of the cases investigated, the final decision was afflicted with some kind of uncertainty and the merger review process was accompanied by many newspaper reports. Hence, I suspect that on the one hand, these stocks were traded more actively and on the other hand, the respective decisions were of fairly high informative value and thus exerted a significant and substantial effect on asset returns.

Hereafter, attention is paid to a detailed delineation of possible volatility in- or decreases related to the predictability of certain Commission's decisions (H4). In particular, I assert that the more difficulties traders experience in anticipating the probable outcome of a merger review process, the more market volatility increases. The main results of the respective empirical examination can be subsumed as follows. Surprisingly, the only variable to exert a significant individual effect in all models is volume of trade. Apart from the Bertelsmann merger, results were sometimes counter-intuitive and often contradictory. Notwithstanding these shortcomings, some general conclusion can be drawn. As such, many models display significant ARCH effects. That is, random errors from the prior period ( $\varepsilon_{t-1}^2$ ) affect the current conditional variance. Explicit modelling of volatility clusters is thus justified. Further, throughout all cases investigated, asymmetric model specification outperformed Vanilla GARCH models. This finding supports the contention that traders react differently to negative and positive news. In particular, negative shocks exert a more prominent effect on conditional variance than positive shocks. Finally, markets were shown to behave very efficiently, given that rerunning the analysis with one-day lead anticipation variables did not cause the coefficients to change sign, but noticeably increased their statistical significance. Although results remain indicative, one can conclude that the market distinguishes different types of mergers. In most cases, information showed some impact on volatility, however, not always significantly so.

---

<sup>1</sup> Such data could be gathered either by a broader analysis of press-agency releases or by expert interviews.

Future research should accordingly strive to develop better ways of measuring the degree to which investors anticipate the outcome of certain merger review processes. Given such an enlarged data basis, a restatement of hypothesis one to three could reward additional insights. In particular, rather than investigating the nexus between specific types of decisions (permission, serious doubts, prohibition) and respective market reactions, research could then focus on the effect of investors' anticipations deviating from the actual decision. That is, returns might reflect discrepancies between investor expectations and Commission's decisions on the day a certain decision is announced.

With respect to data quality, improvement is thus clearly desirable regarding the measurement of anticipation effects. The visual depiction of both abnormal- and cumulated averaged abnormal returns in sections 9.1 and 9.2 indicates anticipation effects in many of the cases investigated. However, during the weeks preceding the decision, the Handelsblatt hardly reported on either the proposed merger or DG competition's position towards it. Apart from prohibitions, which were commented on relatively frequently, most other decisions were not reported on at all. Hence, validity of this proxy for anticipation effects is probably rather low, despite the fact that recoding a subsample based on the Financial Times Deutschland hardly revealed any divergences. A route for further research would thus be to replicate the analysis using a more refined proxy of anticipation effects. Conducting a content analysis relying for instance on the Wallstreet journal might be a fruitful alternative. Still, for reasons of both availability and feasibility, retrieving data on anticipation effects from Handelsblatt was the only doable option within the scope of this diploma thesis.

Of course, the predetermination of the Handelsblatt proxy comes along with further prongs. First and foremost, it has a non-negligible effect on the case selection. Given its German readership, the Handelsblatt mainly reports on those companies traded in Frankfurt, and narrows down the universe of cases to companies whose stocks are traded there. This non-random case selection is prone to severe sampling bias, which might influence results in a non-predictable way and thus compels to refrain from any generalizations to the global impact of decisions according to the Merger Regulation on financial markets.

---

A study investigating the impact of the Merger Regulation on companies other than those traded in Frankfurt is postponed for future consideration.

Yet, I consider a further remark concerning data quality appropriate. Regarding the frequency of financial data, using daily figures is very apt for investigating abnormal returns (cf. MacKinlay 1997). However, with respect to the volatility analysis, Alexander (2001, 17) notes that data should at least be daily to draw any meaningful inference on volatility reactions to external shocks. Still, only very high-frequency data (i.e. intra-day prices) yield reliable estimates of volatility clusters. Unfortunately, intra-day prices are hardly available for large samples.

Resuming the empirical analysis' main findings, this study clearly reveals market reactions to decisions within the scope of the European Merger Regulation. However, given some methodological shortcomings and poor data quality, there is still ample space for future research.

# Bibliography

- Abadie, A. & Gardeazabal, J. (2003), 'The Economic Costs of Conflict: A Case Study of the Basque Country', *American Economic Review* **93**(1), 113–132.
- Agrawal, A. & Jaffe, J. F. (1999a), 'Do Takeover Targets Underperform? Evidence from Operating Stock Returns', *Journal of Financial and Quantitative Analysis* **38**(4), 721–746.
- Agrawal, A. & Jaffe, J. F. (1999b), 'The Post-merger Performance Puzzle', *Working Paper*. <http://ssrn.com/abstract=199671>, (consulted Jan 9<sup>th</sup> 2006).
- Akerlof, G. A. & Dickens, W. T. (1982), 'The Economic Consequences of Cognitive Dissonance', *American Economic Review* **72**, 307–314.
- Aktas, N., de Bodt, E. & Levasseur, M. (2001), 'The Information Impact of the European Commission Interventions in the Field of Merger and Acquisition Monitoring. The Economics Behind Information Flow Coming to the Market', *Working Paper*. <http://www.eco.fundp.ac.be/affi2001/C12.pdf>, (consulted Nov 6<sup>th</sup> 2005).
- Aktas, N., de Bodt, E. & Roll, R. W. (2002), 'Market Response to European Regulation of Business Combinations', *UCLA Working Paper 12-01*. EFMA 2002 London Meetings; EFA 2002 Berlin Meetings Presented Paper, <http://ssrn.com/abstract=290232>, (consulted Nov 6<sup>th</sup> 2005).
- Aktas, N., de Bodt, E. & Roll, R. W. (2004), 'Market Response to European Regulation of Business Combinations', *Journal of Financial and Quantitative Analysis* **39** (4), 731–757.
- Alexander, C. (2001), *Market Models. A Guide to Financial Data Analysis*, John Wiley and Sons, Chichester.
- Andrade, G., Mitchell, M. & Stafford, E. (2001), 'New Evidence and Perspectives on Mergers', *Journal of Economic Perspectives* **15**, 103–120.
- Asquith, P. & Kim, E. H. (1982), 'The Impact of Merger Bids on the Participating Firms' Security Holders', *The Journal of Finance* **37**(5), 1209–1228.
- Ayrer, B., Upper, C. & Werner, T. (2001), 'Stock Market Valuation of Old and New Economy Firms', *Paper prepared for the Working Group on the Financing of the New Economy of the Committee on the Global Financial System (Deutsche Bundesbank)*. [www.bis.org/publ/cgfs19bbk2.pdf](http://www.bis.org/publ/cgfs19bbk2.pdf), (consulted Feb 23<sup>rd</sup> 2006).
- Bailey, R. E. (2005), *The Economics of Financial Markets*, Cambridge University Press, Cambridge.
- Ball, R. (1972), 'Risk, Return and Disequilibrium: An Application to Change in Accounting Techniques', *The Journal of Finance* **27** (2), 343–353.
- Ball, R. & Brown, P. (1968), 'An Empirical Evaluation of Accounting Income Numbers', *Journal of Acc Res* **6**(2), 159–178.

- Ballie, R. & Bollerslev, T. (1989), 'The Message in Daily Exchange Rates: A Conditional-Variance Tale', *Journal of Business and Economic Statistics* **7**, 297–305.
- Barberis, N. & Thaler, R. (2003), A Survey of Behavioral Finance, in G. Constantinides, M. Harris & R. M. Stulz, eds, 'Handbook of the Economics of Finance', Vol. 1B, Elsevier, Amsterdam, pp. 1053–1123.
- Baum, C. F. (2004), 'A Review of Stata 8.1 and its Time Series Capabilities', *International Journal of Forecasting* **20**, 151–161. [http://escholarship.bc.edu/cgi/viewcontent.cgi?article=1025&context=econ\\_papers](http://escholarship.bc.edu/cgi/viewcontent.cgi?article=1025&context=econ_papers), (consulted Jan 5<sup>th</sup> 2006).
- Baum, C. F. (2005), 'The Language of Choice for Time-Series Analysis', *Working Papers in Economics* **5(1)**, 46–63.
- Bergman, M. A., Jakobsson, M. & Razo, C. (2005), 'An Econometric Analysis of the European Commission's Merger Decisions', *International Journal of Industrial Organization* **23 (9–10)**, 717–737.
- Bhagat, S. & Romano, R. (2005), Empirical Studies of Corporate Law, in A. M. Polinsky & S. Shavell, eds, 'Handbook of Law and Economics', Elsevier, Amsterdam. <http://ssrn.com/abstract=728103>, (consulted Jan 12<sup>th</sup> 2006).
- Bishop, S. & Lofaro, A. (2004), 'A Legal and Economic Consensus? The Theory and Practice of Coordinated Effects in EC Merger Control', *The Antitrust Bulletin* **1-2**, 195–242.
- Bittlingmayer, G. (1992), 'Stock Returns, Real Activity, and the Trust Question', *Journal of Finance* **47 (5)**, 1701–1730.
- Bittlingmayer, G. (1993), 'The Stock Market and Early Antitrust Enforcement', *Journal of Law and Economics* **36**, 1–32.
- Black, F. (1996), Noise, in Thaler, ed., 'Advances in Behavioral Finance', Russel Sage Foundation, New York.
- Block, M., Nold, F. & Sidak, J. G. (1981), 'The Deterrent Effect of Antitrust Enforcement', *Journal of Political Economy* **89**, 429–445.
- Boehmer, E., Musumeci, J. & Poulsen, A. B. (1991), 'Event-Study Methodology under Conditions of Event-Induced Variance', *Journal of Financial Economics* **30**, 253–272.
- Bollerslev, T. (1986), 'Generalised Autoregressive Conditional Heteroskedasticity', *Journal of Econometrics* **31**, 307–27.
- Bollerslev, T., Chou, R. & Kroner, K. (1992), 'ARCH Modeling in Finance', *Journal of Econometrics* **52**, 05–59.
- Bond, D., Jenkins, J., Talyor, C. & Schock, K. (1997), 'Mapping Mass Political Conflict and Civil Society: Issues and Prospects for the Automated Development of Event Data', *Journal of Conflict Resolution* **41**, 533–579.

- Bonin, J. P. & Imai, M. (2005), 'Soft Related Lending: A Tale of Two Korean Banks', *Working Paper*.
- Brady, U. & Feinberg, R. M. (2000), 'An Examination of Stock-price Effects of EU Merger Control Policy', *International Journal of Industrial Organizations* **18**, 885–900.
- Breusch, T. & Pagan, A. (1980), 'The Lagrange Multiplier Test and Its Applications to Model Specification in Econometrics', *The Review of Economic Studies* **47**(1), 293–253.
- Bris, A. & Cabolis, C. (2002), 'Merger Laws, Globalization, and Corporate Value', *Working Paper*. <http://ssrn.com/abstract=302912>, (consulted Nov 6<sup>th</sup> 2005).
- Brockett, P. L., Chen, H.-M. & Garven, J. R. (1999), 'A New Stochastically Flexible Event Methodology with Application to Proposition 103', *Insurance: Mathematics and Economics* **25** (2), 197–217.
- Brown, S. J. & Warner, J. B. (1980), 'Measuring Security Price Performance', *Journal of Financial Economics* **8**, 205–258.
- Brown, S. J. & Warner, J. B. (1985), 'Using Daily Stock Returns: The Case of Event Studies', *Journal of Financial Economics* **14**, 03–31.
- Büthe, T. (2005), 'The Politics of Competition in European Union: The First 50 Years', *Paper presented at the Conference on the State of the European Union (vol.8), Princeton University, Sept 2005*. [www.princeton.edu/~smeunier/Buthe%20Memo.pdf](http://www.princeton.edu/~smeunier/Buthe%20Memo.pdf), (consulted Feb 28<sup>th</sup> 2006).
- Büthe, T. & Swank, G. T. (2005), 'The Politics of Antitrust and Merger Review in the European Union: Institutional Change and Decisions from Messina to 2004', *Paper presented at the Annual Meeting of the American Political Science Association (Washington, D.C.), Sept 2005*. <http://www.gwu.edu/~igis/seminar.html>, (consulted Feb 28<sup>th</sup> 2006).
- Bulmer, S. (1994), 'Comparative and International Administration. Institutions and Policy Changes in the European Communities: the Case of Merger Control', *Public Administration* **72**, 423–444.
- Campbell, J. Y., Lo, A. W. & McKinlay, A. C. (1997), *The Econometrics of Financial Markets*, Princeton University Press, Princeton, NJ.
- Chang, R. (2006), 'Electoral uncertainty and the volatility of international capital flows', *Working Paper*. <http://www.vanderbilt.edu/econ/sem papers/Chang2.pdf>, (consulted Mar 3<sup>rd</sup> 2005).
- Chaudhuri, A., Adhikari, A. K. & Dihidar, S. (2000), 'Mean Square Error Estimation in Multi-Stage Sampling', *Metrika* **52**, 115–131.
- Connolly, R. (1989), 'An Examination of the Robustness of the Weekend Effect', *Journal of Financial and Quantitative Analysis* **24**, 133–169.
- Corrado, C. (1989), 'A Nonparametric Test for Abnormal Security-Price Performance in Event Studies', *Journal of Financial Economics* **23**(2), 385–395.

- Corrado, C. & Zivney, T. (1992), 'The Specification and Power of the Sign Test in Event Study Hypothesis Tests Using Daily Stock Returns', *Journal of Financial and Quantitative Analysis* **27**(3), 465–478.
- Cowan, R. A. & Sergeant, A. (1996), 'Trading Frequency and Event Study Test Specification', *Journal of Banking and Finance* **20**, 1731–1757.
- Cuthbertson, K. & Nitzsche, D. (2004), *Quantitative Financial Economics: Stocks, Bonds & Foreign Exchange*, John Wiley & Sons Ltd, Chichester, (2<sup>nd</sup> edition).
- da Graça, T. & Masson, R. (2003), 'More Power To You: A Stronger Event Study Methodology Illustrated using Brazilian Privatization Auctions', *Paper presented at the Latin American Summer Meeting 2003*. <http://gemini.econ.umd.edu/conference/lasm2003/program/lasm2003.html>, (consulted Jan 13<sup>th</sup>).
- da Graça, T. & Masson, R. (2005), 'More Power To You: Demonstrating a More Powerful Event Study Methodology with Privatization Auction Data', *mimeo*. [www.arts.cornell.edu/econ/jobcan/da%20Graca-Abstract.pdf](http://www.arts.cornell.edu/econ/jobcan/da%20Graca-Abstract.pdf), (consulted Jan 13<sup>th</sup> 2006).
- Daniel, K., Hirshleifer, D. & Subrahmanyam, A. (1998), 'Investor Psychology and Security Market Under- and Overreactions', *Journal of Finance* **53** (6), 1839–1885.
- Dasgupta, S., Laplante, B. & Mamingi, N. (2001), 'Pollution and Capital Markets in Developing Countries', *Journal of Environmental Economics and Management* **42**, 310–335.
- Davidson, R. & Flachaire, E. (1999), 'The Wild Bootstrap, Tamed at Last', *Working Paper*. <http://fmwww.bc.edu/RePEc/es2000/1413.pdf>, (consulted Feb 07<sup>th</sup>).
- de Bondt, W. F. M. & Thaler, R. H. (1985), 'Does the Stock Market Overreact?', *Journal of Finance* **40**, 793–807.
- de Bondt, W. F. M. & Thaler, R. H. (1996), Does the Stock Market Overreact?, *in* R. H. Thaler, ed., 'Advances in Behavioral Finance', Russel Sage Foundation, New York, pp. 249–264.
- De Grauwe, P. (2000), 'Exchange Rates in Search of Fundamentals: The Case of the Euro-Dollar Rate', *International Finance* **3**(3), 329–356.
- de Jong, F., Kemna, A. & Kloek, T. (1992), 'A Contribution to Event Study Methodology with an Application to the Dutch Stock Market', *Journal of Banking and Finance* **16**, 11–36.
- DeLong, B., Shleifer, A., Summers, L. H. & Waldmann, R. J. (1996), Noise Trader Risk in Financial Markets, *in* R. H. Thaler, ed., 'Advances in Behavioral Finance', Russel Sage Foundation, New York, pp. 249–264.
- DeYoung, R. (1994), 'Do Regulators Read the Literature? Bank Merger Regulation, 1963-1990', *Southern Economic Journal* **61**(1), 69–84.

- Dickey, D. & Fuller, W. (1979), 'Distributions of the Estimators for Autoregressive Time Series with a Unit Root', *Journal of the American Statistical Association* **74**, 427–431.
- Dolley, J. C. (1933), 'Characteristics and Procedure of Common Stock Split-Ups', *Harvard Business Review* **11**, 316–326.
- Dombrow, J. F. (1997), 'Theil's Nonparametric Estimation in Event Study Methodology', *PhD Dissertation*. [http://wwwlib.umi.com/dissertations/preview\\_all/9807528](http://wwwlib.umi.com/dissertations/preview_all/9807528), (consulted Jan 14<sup>th</sup>).
- Dombrow, J. F., Rodriguez, M. & Sirmans, C. F. (2000), 'A Complete Nonparametric Event Study Approach', *Review of Quantitative Finance and Accounting* **14**(4), 361–380.
- Duso, T., Neven, D. J. & Röller, L.-H. (2002), 'The Political Economy of European Merger Control: Evidence using Stock Market Data', *Discussion Paper FS IV 02-34*. Wissenschaftszentrum Berlin, <http://www.cepr.org/pubs/dps/DP3880.asp>, (consulted Nov 6<sup>th</sup> 2005).
- Eckbo, B. E. (1992), 'Mergers and the Value of Antitrust Deterrence', *Journal of Finance* **47** (3), 1005–1029.
- Eckbo, B. E. & Wier, P. (1985), 'Antimerger Policy Under the Hart-Scott-Rodino Act: A Re-examination of the Market Power Hypothesis', *Journal of Law and Economics* **28**, 119–149.
- Eckbo, E. B. (1983), 'Horizontal Mergers, Collusion, and Stockholder Wealth', *Journal of Financial Economics* **11**, 241–273.
- Ellert, J. C. (1976), 'Mergers, Antitrust Law Enforcement and Stockholder Returns', *Journal of Finance* **31** (2), 715–732.
- Engle, R. F. (1982), 'Autogressive Conditional Heteroskedsticity with Estimates of the Variance of U.K. Inflation', *Econometrica* **50**, 987–1008.
- Engle, R. F. (2001), 'GARCH 101: The Use of ARCH/GARCH Models in Applied Econometrics', *Journal of Applied Economic Perspectives* **15**(4), 157–168.
- Engle, R. F. & Ng, V. K. (1993), 'Measuring and Testing the Impact of News and Volatility', *Journal of Finance* **48**, 1749–1778.
- European Commission (2004), 'Merger Control: Merger Review Package in a Nutshell'. [http://europa.eu.int/comm/competition/publications/special/3\\_merger.pdf](http://europa.eu.int/comm/competition/publications/special/3_merger.pdf), (consulted Feb 15<sup>th</sup> 2006).
- European Communities (1989), 'Council Regulation (EEC) No 4064/89 of 21 December 1989 on the control of concentrations between undertakings'. Official Journal L 395 of December 30<sup>th</sup> 1989 - corrected version Official Journal L 257 of September 21<sup>st</sup> 1990, 13.
- European Communities (2004), 'Council Regulation (EC) No 139/2004 of 20 January 2004 on the control of concentrations between undertakings ("EC Merger Regulation")'. Official Journal L24/1 of January 29<sup>th</sup> 2004.

- Evans, D. S. & Padilla, A. J. (2003), 'Demand-Side Efficiencies in Merger Control', *World Competition Law and Economics Review* **26**(2), 167–193.
- Fama, E. (1965), 'The Behavior of Stock Market Prices', *Journal of Business* **38**, 34–105.
- Fama, E. (1998), 'Market Efficiency, Long Term Returns and Behavioral Finance', *Journal of Financial Economics* **49**(3), 283–306.
- Fama, E., Fisher, L., Jensen, M. C. & Roll, R. (1969), 'The Adjustment of Stock Prices to New Information', *International Economic Review* **10**(1), 01–21.
- Fatum, R. & Hutchison, M. M. (2002), 'ECB Foreign Exchange Intervention and the Euro: Institutional Framework, News, and Intervention', *Open Economies Review* **13**(4), 413–425.
- Feinberg, R. M. (1980), 'Antitrust Enforcement and Subsequent Price Behaviour', *Review of Economics and Statistics* **62**, 609–612.
- Feinberg, R. M. (1986), 'The Effects of European Competition Policy on Pricing and Profit Margins', *Kyklos* **39**, 267–287.
- Feinberg, R. M. & Harper, R. K. (1999), 'Regime Effects of EU Market Integration Policies on the UK Financial Sector', *Review of Industrial Organization* **15**(4), 357–365.
- Festinger, L. (1968), *A Theory of Cognitive Dissonance*, Stanford University Press, Stanford.
- Fiorentini, G., Sentana, E. & Calzolari, G. (2003), 'On the Validity of the Jarque-Bera Normality Test in Conditionally Heteroskedastic Dynamic Regression Models', *CEMFI Working Paper* **0306**. [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=383980](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=383980), (consulted Feb 28<sup>th</sup> 2006).
- Franzese, R. J. (2002), 'Electoral and Partisan Cycles in Economic Policies and Outcomes', *Annual Reviews of Political Science* **5**, 369–421.
- Franzosi, R. (2004), *From Words to Numbers: Narrative, Data, and Social Science*, Cambridge University Press, Cambridge.
- Früh, W. (1991), *Inhaltsanalyse: Theorie und Praxis*, Ölschläger, München.
- Froeb, L., Tschantz, S. & Werden, G. J. (2005), 'Pass-through Rates and the Price Effects of Mergers', *International Journal of Industrial Organization* **23**, 703–715.
- Gallant, A. R., Rossi, P. E. & Tauchen, G. E. (1992), 'Stock Prices and Volume', *Review of Financial Studies* **5**, 199–242.
- Geradin, D. (2004), 'Efficiency Claims in EC Competition Law and Sector-specific Regulation', *Paper presented at the first Workshop on Coparative Competition Law, Florence, Nov 2004*. <http://ssrn.com/abstract=617922>, (consulted Nov 6<sup>th</sup> 2005).

- Gill, J. & King, G. (2004), 'What to Do When Your Hessian Is Not Invertible: Alternatives to Model Respecification in Nonlinear Estimation', *Sociological Methods & Research* **32**(4), 1–34.
- Godfrey, L. & Tremayne, A. (2005), 'The Wild Bootstrap and Heteroskedasticity-robust Tests for Serial Correlation in Dynamic Regression Models', *Computational Statistics and Data Analysis*, **49** (2), 377–395.
- Goetzmann, W. N. & Peles, N. (1997), 'Cognitive Dissonance and Mutual Fund Investors', *Journal of Financial Research* **20** (2), 145–158.
- Gonçalves, S. & Kilian, L. (2002), *Bootstrapping Autoregressions with Conditional Heteroskedasticity of Unknown Form*, Deutsche Bundesbank, Frankfurt am Main.
- Guidolin, M. & Ferrara, E. L. (2004), 'Diamonds Are Forever, Wars Are Not. Is Conflict Bad for Private Firms?', *Working Paper 2005-004B, Federal Reserve Bank of St. Louis*. <http://research.stlouisfed.org/wp/2005/2005-004.pdf>, (consulted Feb 22<sup>nd</sup> 2006).
- Guidolin, M. & La Ferrara, E. (2006), 'The Economic Effects of Violent Conflict: Evidence from Asset Market Reactions', *Journal of Conflict Resolution* **forthcoming**.
- Handelsblatt (N°121). June 27<sup>th</sup> 2001.
- Handelsblatt (N°217), 'Boerse Paris: Accor-Activitaeten waren Tagesgespraech. Zum Wochenschluss gab es zufriedene Gesichter'. November 11<sup>th</sup> 1991.
- Harrison, J. S. & Liu, Z. (2004), 'Leveraging Mergers and Acquisitions', *CHR Working Paper Series No. 12-07-04*.
- Hausman, J. A. & Leonard, G. K. (2005), 'Using Merger Simulation Models: Testing the Underlying Assumptions', *International Journal of Industrial Organization* **23**, 693–698.
- Haw, I.-M., Pastena, V. S. & Lilien, S. B. (1990), 'Market Manifestation of Nonpublic Information Prior to Mergers: The Effect of Ownership Structure', *The Accounting Review* **65**(2), 432–451.
- Hays, J., Stix, H. & Freeman, J. R. (2002), 'The electoral information hypothesis revisited', *Unpublished Manuscript*. [sitemaker.umich.edu/jchays/files/hsf00.circ.doc](http://sitemaker.umich.edu/jchays/files/hsf00.circ.doc), (consulted Feb 28<sup>th</sup> 2006).
- Healy, P. M., Palepu, K. G. & Rubak, R. S. (1992), 'Does Corporate Performance Improve after Mergers?', *Journal of Financial Economics* **31**(2), 135–175.
- Hemmingsson, E. (2002), 'The Volvo/Scania Merger: An Analysis of the EC Merger Process', *Masters Thesis in Law*. Gothenburg School of Economics and Commercial Law. <http://www.handels.gu.se/epc/archive/00003259/>, (consulted Nov 6<sup>th</sup> 2005).
- Henehan, B. M. (2002), 'The Decision to Merge: A Case Study of U.S. Dairy Cooperatives', *Conference Paper* pp. NCR–194 Committee Meeting St. Louis, Missouri, Nov 13<sup>th</sup>, 2002.

- Hettmansperger, T., McKean, J. & Sheather, S. (1997), Rank-based Analyses of Linear Models, *in* G. Maddala & C. Rao, eds, 'Robust Inference', number 15 *in* 'Handbook of Statistics', Elsevier, Amsterdam, pp. 145–173.
- Hodson, R. (1999), *Analyzing Documentary Accounts*, number 128 *in* 'Quantitative Applications in the Social Science', Sage Publications, Thousand Oaks.
- Holland, E. E. (2003), 'Using Merger Review to Cure Prior Conduct: The European Commission's GE/ Honeywell Decision', *Columbia Law Review* **103**, 74–110.
- Hollander, M. & Wolfe, D. A. (1999), *Nonparametric Statistical Methods*, John Wiley & Sons, New York, (2<sup>nd</sup> edition).
- Hong, H., Kaplan, R. S. & Mandelker, G. (1978), 'Pooling vs. Purchase: The Effects of Accounting for Mergers on Stock Prices', *The Accounting Review* **53**(1), 31–47.
- Horn, H. & Stennek, J. (2002), EU Merger Control and Small Member State Interests, *in* K. Lundvall, ed., 'The Pros and Cons of Merger Control', Swedish Competition Authority, Stockholm.
- Ivaldi, M. & Verboven, F. (2005a), 'Quantifying the Effects from Horizontal Mergers: Comments on the Underlying Assumptions', *International Journal of Industrial Organization* **23**, 699–702.
- Ivaldi, M. & Verboven, F. (2005b), 'Quantifying the Effects from Horizontal Mergers in European Competition Policy', *International Journal of Industrial Organization* **23**, 669–691.
- IVW (2005), 'Quartalszahlen'. Informationsgemeinschaft zur Feststellung der Verbreitung von Werbeträgern e.V.
- Jacobsen, B., Potters, J., Schram, A., van Winden, F. & Wit, J. (2000), '(In)accuracy of a European Political Stock Market: the Influence of Common Value Structures', *European Economic Review* **44**, 205–230.
- Jaffe, J. F. (1974), 'Special Information and Insider Trading', *Journal of Business* **47** (3), 410–428.
- Jansen, D. & de Haan, J. (2003), 'Statements of ECB Officials and their Effect on the Level and Volatility of the Euro-Dollar Exchange Rate', *Research Memorandum WO* **726**.
- Jarque, C. & Bera, A. (1987), 'A Test for Normality of Observations and Regression Residuals', *International Statistical Review* **55**, 163–172.
- Jensen, M. C. (1972), 'Capital Markets: Theory and Evidence', *Bell Journal of Economics and Management Science* **3**, 357–398.
- Jensen, M. C. (1987), 'The Free Cash Flow Theory of Takeovers: A Financial Perspective on Mergers and Acquisitions and the Economy: The Merger Boom', *Conference Series Federal Reserve Bank of Boston* pp. 202–143.
- Jensen, M. C. & Ruback, R. S. (1983), 'The Market for Corporate Control', *Journal of Financial Economics* **11**, 05–50.

- Jensen, N. M. & Schmith, S. (2005), 'Market Response to Politics: The Rise of Lula and the Decline of the Brazilian Stock Market', *Comparative Political Studies* **38** (10), 1245–1270.
- Jin, P. (2002), 'Turning Competition on its Head: Economic Analysis of the EC's Decision to Bar the GE-Honeywell Merger', *Northwestern Journal of International Law and Business* **23**, 187–211.
- Kahnemann, D. & Tversky, A. (1979), 'Prospect Theory: An Analysis of Decision under Risk', *Econometrica* **47**(2), 263–291.
- Kaminsky, G. L. & Schukler, S. (1999), 'What Triggers Market Jitters? A Chronicle of the Asian Crisis', *Journal of International Money and Finance* **18**, 537–560.
- Kaplan, A. & Goldsen, J. M. (1965), The Reliability of Content Analysis Categories, in H. D. Lasswell & N. Leites, eds, 'Language of Politics: Studies in Quantitative Semantics', MIT Press, Cambridge, pp. 83–112.
- Keim, D. B. & Ziemba, W. T. (2000), Security Market Imperfections: An Overview, in D. B. Keim & W. T. Ziemba, eds, 'Security Market Imperfections in Worldwide Equity Markets', Cambridge University Press, Cambridge, pp. xv–xxvii.
- Kühn, K.-U. (2002), Closing Pandora's Box? Joint Dominance After the Airtours Judgment, in K. Lundvall, ed., 'The Pros and Cons of Merger Control', Swedish Competition Authority, Stockholm.
- Kohler, U. & Kreuter, F. (2006), *Data Analysis Using Stata*, Stata Press, Texas.
- Kon, S. (1984), 'Models of Stock Returns – a Comparison', *Journal of Finance* **39** (1), 147–166.
- Kramer, L. A. (2001), Alternative Methods for Robust Analysis in Event Study Applications, in C. F. Lee, ed., 'Advances in Investment Analysis and Portfolio Management', Elsevier Science Ltd, Amsterdam, pp. 109–132.
- Krippendorff, K. (1970a), Bivariate Agreement Coefficients for reliability Data, in E. F. Borgatta & G. W. Bohrnstedt, eds, 'Sociological Methodology', Jossey-Bass, San Francisco, pp. 139–150.
- Krippendorff, K. (1970b), 'Estimating the Reliability, Systematic Error and Random Error of Interval Data', *Educational and Psychological Measurement* **30**, 61–70.
- Krippendorff, K. (2004a), *Content Analysis: An Introduction to its Methodology*, Thousand Oaks, Sage Publications.
- Krippendorff, K. (2004b), 'Measuring the Reliability of Qualitative Text Analysis Data', *Quality and Quantity* **38**, 787–800.
- Lagerlöf, J. N. & Heidhues, P. (2005), 'On the Desirability of an Efficiency Defense in Merger Control', *International Journal of Industrial Organization* **23**, 803–827.
- Leblang, D. (2002), 'Politics and Markets: The Stock Market and the 2000 Presidential Election', *Unpublished Manuscript*.

- Leblang, D. & Mukherjee, B. (2004), 'Presidential Elections and the Stock Market: Comparing Markov-Switching and (FIE)GARCH Models of Stock Volatility', *Political Analysis* **12**(3), 296–322.
- Leblang, D. & Mukherjee, B. (2005), 'Government Partisanship, Elections and the Stock Market: Examining American and British Stock Returns, 1930-2000', *American Journal of Political Science* **49**(4), 780–802.
- Lehman, E. L. (1994), *Testing Statistical Hypotheses*, Chapman & Hall, New York, NY, (2<sup>nd</sup> edition, repr. (Originally publ: New York: Wiley 1986)).
- Lindqvist, T. (2003a), 'Acquisition Strategies: Empirical Evidence of Outsider-Toeholds', *Working Paper* . [www.iui.se/staff/tobiasl/Toeholds.pdf](http://www.iui.se/staff/tobiasl/Toeholds.pdf), (consulted Feb 28<sup>th</sup> 2006).
- Lindqvist, T. (2003b), 'Mergers by Partial Acquisition', *Working Paper* . <http://www.iui.se/wp/wp630/IUIwp630.pdf>, (consulted Feb 28<sup>th</sup> 2006).
- Lindsay, A., Lecchi, E. & Williams, G. (2003), 'Econometrics Study into European Merger Decisions Since 2000', *European Competition Law Review* **24**, 673–682.
- Lo, A. W. & MacKinlay, C. (2002), *A Non-Random Walk Down Wall Street*, Princeton University Press, Princeton.
- Lombard, M., Snyder-Duch, J. & Bracken, C. C. (2004), 'A Call for Standardization in Content Analysis Reliability', *Human Communication Research* **3**, 434–437.
- Lundvall, K. (2002), *The Pros and Cons of Merger Control*, Swedish Competition Authority, Stockholm.
- MacKinlay, A. C. (1997), 'Event Studies in Economics and Finance', *Journal of Economic Literature* **35**, 13–39.
- Malkiel, B. G. (2003), *A Random Walk Down Wall Street: The Time-Tested Strategy For Successful Investing*, W.W. Norton & Company, New York.
- Mandelbrot, B. (1963), 'The Variation of Certain Speculative Prices', *Journal of Business* **36**, 394–419.
- Mandelker, G. (1974), 'Risk and Return: The Case of Merging Firms', *Journal of Financial Economics* **1**(4), 303–336.
- Mayring, P. & Gläser-Zikuda, M., eds (2003), *Qualitative Inhaltsanalyse: Grundlagen und Techniken*, Beltz, Weinheim and Basel.
- McGillivray, F. (2003a), 'Redistributive Politics and Stock Price Dispersion', *British Journal of Political Science* **33**, 367–395.
- McGillivray, F. (2003b), 'The Coalition Poker Game and Stock Price Volatility', *Work in Progress* pp. 01–20.
- McWilliams, A., Siegel, D. & Teoh, S. H. (1999), 'Issues in the Use of the Event Study Methodology: A Critical Analysis of Corporate Social Responsibility Studies', *Organizational Research Methods* **2**(4), 340–365.

- Medien Tenor (3. Quartal 2005), cited in: Verlagsgruppe Handelsblatt (2005), 'Handelsblatt: Substanz entscheidet'. <http://www.vhb.de/psvnb/fn/vhb/SH/0/sfn/bp/cn/art/p1/4/p2/11/strucid/36/index.html>, (consulted Dec 19<sup>th</sup> 2005).
- Meyn, H. (2001), *Massenmedien in Deutschland*, UVK Medien, Konstanz.
- Meznar, M., Nigh, D. & Kwok, C. (1994), 'Effect of Announcements of Withdrawal from South Africa on Stockholder Wealth', *Academy of Management Journal* **37**(6), 1636–1648.
- Meznar, M., Nigh, D. & Kwok, C. (1998), 'Announcements of Withdrawal from South Africa Revisited: Making Sense of Contradictory Event Study Findings', *Academy of Management Journal* **41**(6), 715–730.
- Morgan, E. J. (1997), 'European Community Merger Policy in the Service Industries: The Second Phase', *The Service Industries Journal* **17** (4), 626–651.
- Morgan, E. J. (2001), 'A Decade of EC Merger Control', *International Journal of the Economics of Business* **8** (3), 451–473.
- Motta, M. & Vasconcelos, H. (2005), 'Efficiency Gains and Myopic Antitrust Authority in a Dynamic Merger Game', *International Journal of Industrial Organization* **23**, 777–801.
- Mulherin, H. J. & Bwine, A. L. (2000), 'Comparing Acquisitions and Divestures', *Journal of Corporate Finance* **6**, 117–139.
- Muris, T. (2001), 'Merger Enforcement in a World of Multiple Arbitrators', *Working paper*. <http://www.ftc.gov/speeches/muris/brookings.pdf>, (consulted Nov 6<sup>th</sup> 2005).
- Nelson, D. B. (1991), 'Conditional Heteroskedasticity in Asset Returns: A New Approach', *Econometrica* **59** (2), 347–370.
- Neven, D. J. & Röller, L.-H. (2005a), 'Consumer Surplus vs. Welfare Standard in a Political Economy Model of Merger Control', *International Journal of Industrial Organization* **23**, 829–848.
- Neven, D. J. & Röller, L.-H. (2005b), 'Editor's Introduction', *International Journal of Industrial Organization* **23**, 665–668.
- Neven, D., Nuttall, R. & Seabright, P. (1993), *Merger in Daylight*, CEPR, London.
- Neven, D. & Röller, L.-H. (2002), Discrepancies Between Markets and Regulators: An Analysis of the First Ten Years of EU Merger Control, in K. Lundvall, ed., 'The Pros and Cons of Merger Control', Swedish Competition Authority, Stockholm, pp. 13–38.
- Nykvist, A.-C. (2002), Introduction, in K. Lundvall, ed., 'The Pros and Cons of Merger Control', Swedish Competition Authority, Stockholm.
- Odean, T. (1998), 'Volume, Volatility, Price and Profit. When All Traders Are Above Average', *Journal of Finance* **53** (6), 1887–1934.

- Officer, R. (1972), 'The Distribution of Stock Returns', *Journal of the American Statistical Association* **67** (340), 807–812.
- Pautler, P. A. (2003), 'Evidence on Mergers and Acquisitions', *The Antitrust Bulletin* **48**(1), 119–121.
- Prager, R. (1992), 'The Effects of Horizontal Mergers on Competition: The Case of the Northern Securities Company', *Rand Journal of Economics* **23**, 123–133.
- Prast, H. M. & De Vor, M. P. (2005), 'Investor Reactions to News: a Cognitive Dissonance Analysis of the Euro-Dollar Exchange Rate', *European Journal of Political Economy* **21** (1), 115–141.
- Röller, L.-H., Stennek, J. & Verboven, F. (2001), 'Efficiency Gains from Mergers', *European Economy* **5**, 31–128.
- Rosen, R. J. (2006), 'Merger Momentum and Investor Sentiment: The Stock Market Reaction to Merger Announcements', *Journal of Business* **79**(2), 987–1017.
- Ruback, R. S. (1982), 'The Effect of Discretionary Price Control Decisions on Equity Values', *Journal of Financial Economics* **10**, 83–105.
- Salinger, M. (1992), 'Standard Errors in Event Studies', *Journal of Financial and Quantitative Analysis* **27** (1), 39–53.
- Schmittmann, M. & Vonnemann, W. (1992), 'Mergers and Acquisitions in Europe 1993: The New EC Merger Control Regulation and Its Effects on National Merger Control in Germany', *Antitrust Bulletin* **37** (4), 1025–46.
- Schneider, G. & Ruoff, G. (2006, forthcoming), Quantitative Methoden der Internationalen Politik, in A. Wilhelm & C. Masala, eds, 'Handbuch Internationale Politik', VS Verlag, Wiesbaden.
- Schneider, G. & Tröger, V. (2004), 'The Winners and Losers of War: Stock Market Effects of Armed Conflict, 1990-2000', *Working Paper*. <http://www.uni-konstanz.de/FuF/Verwiss/GSchneider/downloads/papers.htm>, (consulted Mar 18<sup>th</sup> 2006).
- Schnell, R., Hill, P. B. & Esser, E. (2005), *Methoden der empirischen Sozialforschung*, Oldenbourg, München, Wien. 7. Auflage.
- Schwert, G. & Seguin, P. J. (1990), 'Heteroskedasticity in Stock Returns', *Journal of Finance* **45**, 1129–1155.
- Schwert, G. W. (2003), Anomalies and Market Efficiency, in G. Constantinides, M. Harris & R. M. Stulz, eds, 'Handbook of the Economics of Finance', Vol. 1B, Elsevier, Amsterdam, pp. 939–974.
- Schwert, W. (1996), 'Markup Pricing in Mergers and Acquisitions', *Journal of Financial Economics* **41**, 153–192.
- Shleifer, A. (2000), *Inefficient Markets - An Introduction to Behavioral Finance*, Oxford University Press, Oxford.

- Shleifer, A. & Vishny, R. (1997), 'The Limits of Arbitrage', *Journal of Finance* **52** (1), 35–55.
- Slovin, M. B., Sushka, M. E. & Hudson, C. D. (1991), 'Deregulation, Contestability, and Airline Acquisitions', *Journal of Financial Economics* **30**, 231–251.
- Song, M. H. & Walkling, R. A. (2000), 'Abnormal Returns to Rivals of Acquisition Targets: A Test of the 'Acquisitions Probability Hypothesis'', *Journal of Financial Economics* **552**, 143–171.
- Statman, M. (1999), 'Behavioural Finance: Past Battles and Future Engagements', *Financial Analyst Journal* **55** (6), 18–27.
- Stilman, R. (1983), 'Examining Antitrust Policy Towards Horizontal Mergers', *Journal of Financial Economics* **11**, 225–240.
- Thaler, R., ed. (1993), *Advances in Behavioral Finance*, Russel Sage Foundation, New York.
- Theil, H. (1950), 'A Rank-Invariant Method of Linear and Polynomial Regression Analysis I–III', *Indagationes Mathematicae* **12**, 367–392, 520–525, 1397–1412.
- Travlos, N. G. & Waegelein, J. F. (1992), 'Executive Compensation, Method of Payment and Abnormal Returns to Bidding Firms at Takeover Announcements', *Managerial and Decision Economics* **13**(6), 493–501.
- Wilcoxon, F. (1945), 'Individual Comparisons by Ranking Methods', *Biometrics Bulletin* **1**(6), 80–83.
- Wooldridge, J. M. (2003), *Introductory Econometrics: A Modern Approach*, Thomson South-Western, Mason, Ohio, (2<sup>nd</sup> edition).
- Zaima, J. K. & Harjoto, M. A. (2005), 'Conflict in Whispers and Analyst Forecasts: Which One Should Be Your Guide?', *Financial Decisions* **6**, 1–16.
- Zakoian, J.-M. (1994), 'Threshold Heteroskedastic Models', *Journal of Economic Dynamics and Control* **18** (5), 931–955.
- Zellner, A. (1962), 'An efficient method of estimating seemingly unrelated regression equations and tests for aggregation bias', *Journal of the American Statistical Association* **57**, 348–368.
- Zhen, W. (2004), 'Bootstrap Methods with Application in Econometrics and Finance', *Undergraduate Thesis* . [www.stanford.edu/~zhenwei/papers/bootstrap.pdf](http://www.stanford.edu/~zhenwei/papers/bootstrap.pdf), (consulted Jan 9<sup>th</sup> 2006).
- Zweifel, T. D. (2003), 'Democratic Deficits in Comparison: Best (and Worst) Practices in European, US and Swiss Merger Regulation', *Journal of Common Market Studies* **41**(3), 541–566.

# List of Final Sample

---

---

Case N°	Companies involved	Type of decision
88	Elf Enterprise	6(1)(a)
159	Mediobanca Generali	6(1)(a)
192	Solvay Laporte	6(1)(a)
285	Pasteur Merieux Merck	6(1)(a)
293	Philips Thomson Sagem	6(1)(a)
353	British Telecom MCI	6(1)(a)
397	Ford Hertz	6(1)(a)
425	BS BT	6(1)(a)
661	Strabag Bank Austria Struag	6(1)(a)
711	Generali Unicredito	6(1)(a)
941	Veba Degussa	8(2) cond.
993	Bertelsmann Kirch Premiere	8(3)
1027	Deutsche Telekom	8(3)

– continued from previous page –

<b>Case N°</b>	<b>Companies involved</b>	<b>Type of decision</b>
	Beta Research	
1094	Caterpillar Perkins Engines	6(1)(a)
1095	Nec Bull PNB	6(1)(a)
1587	Dana GKN	6(1)(a)
1671	Dow Chemical Union Carbide	8(2) cond.
1672	Volvo Scania	8(3)
1845	AOL Time Warner	8(2) cond.
1855	Singapore Airlines Virgin Atlantic	6(1)(b)
1879	Boeing Hughes	8(2)
1940	Framatome Siemens Cogema JV	8(2)
2033	Metso Svedala	8(2) cond.
2097	SCA Metsä Tissue	8(3)
2187	CVC Lenzing	8(3)
2200	Deutsche Bank DGB Varta	6(1)(b)
2220	General Electrics Honeywell	8(3)
2314	BASF Pantochim Eurodiol	8(2)

– continued from previous page –

<b>Case N°</b>	<b>Companies involved</b>	<b>Type of decision</b>
2333	De Beers LVHM	8(2)
2439	Hitachi STMicroelectronics Super H JV	6(1)(b)
2498	UPM-Kymmene Haindl	8(2)
2638	3i group Consors 100 World	6(1)(a)
2698	Promatech Sulzer	8(2) cond.
2706	Carnival Corporation P&O Princess	8(2)
2801	RWE Innogy	6(1)(b)
2822	ENBW Eni GVS	8(2) cond.
2978	Lagadere Natexis VUP	8(2) cond.
2997	Accor Ebertz Dorint	6(1)(a)
3003	Electrabel Energia Italiana Interpower	6(1)(a)
3056	Celanese Degussa European Oxo Chemicals	8(2)
3216	Oracle Peoplesoft	8(2)
3436	Continental Phoenix	8(2) cond.
3440	ENI EDP GDP	8(3)

---

– continued from previous page –

<b>Case N°</b>	<b>Companies involved</b>	<b>Type of decision</b>
3544	Roche Bayer Healthcare	6(1)(b) cond.
3662	XStrata WMC Resources	6(1)(b)
3686	Honeywell Novar	6(1)(b) cond.
3692	Reuters Telerate	6(1)(b) cond.
3732	Procter & Gamble Hexal	6(1)(b) cond.
3751	Novartis Hexal	6(1)(b) cond.
3853	Solvay Fournier	6(1)(b)

---

---

---



---

# Data Sources and Codebook

---



---

Variable	Description	Values
case	case number	numeric
enter	company name	string
date	date in Stata format	%d
day	day	1-31
month	month	1-12
year	year	1990-2005

### Data on Commission's decisions

Source: <http://europa.eu.int/comm/competition/mergers/>

note	notification	0,1
decart1-7	Article 6(1)(a)	611
	Article 6(1)(b)	612
	Article 6(1)(c)	623
	Article 6(2)	62
	Article 8(2)	82
	Article 8(3)	83
	Article 9(4)	94
	Article 18	18
	Article 22(4)	224
		withdrawn
	none taken	-1
cond1-3	decision subject to conditions	yes/no [0,1]
press1-7	press release	yes/no [0,1]

### Content analysis

Source: <http://handelsblatt.de>

hb	name of enterprise mentioned	yes/no [0,1]
	events that might influence returns	2
antic	anticipation of Commission's decision	yes/no [0,1]; irrelevant [-1]
anticr	correct anticipation of Commission's decision	yes/no [0,1]; irrelevant [-1]
deter	deterministic anticipation	yes/no [0,1]; irrelevant [-1]
hbs	issue, date and page of article in Handelsblatt	string
hbt	title of article in Handelsblatt	string

### Financial Data

Source: *Datastream (Thomson Financial)*

findate	date in numeric format	dd/mm/yy
price	asset price in US \$	numeric

---

– continued from previous page –

<b>Variable</b>	<b>Description</b>	<b>Values</b>
dax	DAX 30 in US \$	numeric
mtval	market value	numeric
volcns	consolidated volume	numeric
voltrd	volume most traded	numeric

---

---

All other variables not listed in this table were created during the analysis, descriptions can be found in the respective do-files.

# Data CD

---

---

This diploma thesis is accompanied by a CD-ROM containing all data- and do-files used for the empirical analysis.

Please note that on an average machine, running all do-files (i.e. the master do-file) might take several hours due to considerably high computational effort of some of the employed methods and the extensive usage of graphs. In order to replicate the analysis you first need to copy all files stored in the directory “replication” to a single directory on your hard disk or any other storage device which allows for saving data on the run. This is necessary as both datasets and graphs are saved while running the do-files. Using Stata (Version 9 or higher<sup>1</sup>) change to the respective directory and run the file called ‘master.do’. This file contains the master files for each decision type, which in turn invoke all other do-files. Once the master do-file has been run and the necessary data-files are created, all other do-files will also run separately.

## Contents

1. Diploma Thesis

- DA\_AnnaKalbhenn.pdf

2. Replication

- (a) Data

- Merger
  - Copy of DG Competition’s homepage
- Original data files are all named *company000.dta*, where *000* is a wildcard denoting the decision type according to the respective article of the Merger Regulation, and *company* is to be substituted by the respective company name, e.g.
  - 3igroup611.dta
  - ...

---

<sup>1</sup> In principle, all files should run in version 8 as long as you remove the first command of each do-file “version 9”. Independent of the Stata version you are using, you might need to install the *Jarque-Bera* module and *outtex* tool. The former is available at <http://econpapers.repec.org/software/bochocode/s380301.htm>; *outtex* can be retrieved from <http://www.ats.ucla.edu/stat/stata/latex/estimates.htm>.

- basf82.dta
- ...
- degussa821.dta
- ...
- bertelsmann83.dta
- ...
- dowchemical613.dta
- ...
- deutschebank612.dta
- ...
- novartis6121.dta

(b) Do-files<sup>2</sup>

- master.do
  - master611.do
  - master82.do
  - master821.do
  - master83.do
  - master613.do
  - master612.do
  - master6121.do
  - master83vol.do
  - cr1\*.do<sup>3</sup>
  - an1dia\*.do
  - cr2\*.do
  - an2dia\*.do
  - an3e\*.do
  - cr3m611.do
  - cr3m82.do
  - cr3m821.do
  - cr3m83.do
  - cr3m613.do
  - cr3m612.do
  - cr3m6121.do
  - an5cg\*.do
  - cr4m.do
  - cr5m611mmg

<sup>2</sup> The master do-file contains a brief description of each datafile, which, in order to simplify matters, I do not repeat at this place.

<sup>3</sup> Asterisks are to be replaced by the respective company name (i.e. one of those listed in appendix A. All files starting with “*cr*” serve to creating a dataset, whereas those starting with “*an*” are part of the analysis.

- cr5m82mmg
- cr5m821mmg
- cr5m83mmg
- cr5m613mmg
- cr5m612mmg
- cr5m6121mmg
- an661mmg
- an82mmg
- an821mmg
- an683mmg
- an6613mmg
- an6612mmg
- an6121mmg
- an7htng611
- an7htng82
- an7htng821
- an7htng83
- an7htng613
- an7htng612
- an7htng6121
- an9htn.do
- an91htn.do
- cr5mg.do
- an10htng.do
- an101htng.do
- an20th\*
- cr6nth.do
- an11htnth.do
- an111htnth.do
- cr6m611mmth.do
- cr6m82mmth.do
- cr6m821mmth.do
- cr6m83mmth.do
- cr6m613mmth.do
- cr6m612mmth.do
- cr6m6121mmth.do
- do an21611mmth.do
- do an2182mmth.do
- do an21821mmth.do
- do an2183mmth.do

- do an21613mmth.do
- do an21612mmth.do
- do an26121mmth.do
- an22htnth611.do
- an22htnth82.do
- an22htnth821.do
- an22htnth83.do
- an22htnth613.do
- an22htnth612.do
- an22htnth6121.do
- an40ic611.do
- an40ic82.do
- an40ic821.do
- an40ic83.do
- an40ic613.do
- an40ic612.do
- an40ic6121.do
- an41ic611.do
- an41ic82.do
- an41ic821.do
- an41ic83.do
- an41ic613.do
- an41ic612.do
- an41ic6121.do

## Additional Results

---

---

The following tables present results from Vanilla GARCH models on all mergers subject to the volatility analysis presented in section 9.3. Further, tables D.4 and D.5 present the volatility analysis of the proposed Scania merger assuming that traders anticipate newspaper articles, i.e. a one-day lead is included instead of the anticipatory variables used in all other models. These results are also discussed in section 9.3.

Table D.1: *Volatility Analysis (GARCH) General Electrics (Art. 8.3 decision)*

	1	2	3	4	5	6
Diff Dax						
Lag return		-20.6398 (20.0045)		3.4076 (10.8096)	-60.0341 (54.2693)	
Correct antic		.3931 (1.2086)				
Antic	-.1541 (.8705)		.06292 (.7196)		.3458 (1.8426)	
Other	-91.1023*** (3.0509)	-.0541 (.8983)			.6797 (1.3263)	
Any				-.559 (.4651)		-.1831 (2.2123)
Volume	.0302** (.0128)	.0140 (.0172)	0.0321* (.0187)	.0272* (.0158)	.01971 (.0198)	.0477 (.0732)
Cons	-8.0087*** (.3673)	-8.9007*** (1.0827)	-8.3230*** (.7651)	-7.8571*** (-7.8571)	-10.8076*** (2.8396)	-10.4746*** (4.0343)
ARCH	L2: .2427 (.1816)	L1: -.0533912 (.0755)	L1: .1089 (.1718)	L1: .1343 (.1873)	L1: -.1501*** (.0607)	L1: -.0173 (.0757)
GARCH	L1: .1171 (.1757)	L3: .4323 (.4959)	L1: .2965 (.3792)	L1: .0974 (.3713)	L2: .8858*** (.2494)	L2: .8018* (.3571)
N	104	104	104	104	104	104
Log likelihood	253.169	281.9142	250.5198	251.3969	283.3211	279.0217
Prob>Chi2	.9967	0	.6794	.4021	0	0
	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>	<i>P</i>
Archlm	.8189	.0424	.2314	.1261	.0491	.0491
Jb	0	.0425	0	0	.0273	.0276
Ljung Box	0	.7548	.6228	.6876	.8407	.8355

**Note:** corrected standard errors in parenthesis  
significance levels: \*:10% \*\*:5% \*\*\*:1%

Table D.2: *Volatility Analysis (GARCH) Honeywell (Art. 8.3 decision)*

	1	2	3	4	5	6
Diff Dax						-.0171* (.0089)
Lag return		-23.0852** (9.1779)	-24.3022** (10.1408)	-24.198** (10.0993)	-30.8936*** (7.9080)	
Correct antic	3.3549*** (.9076)		2.203168*** (.5701)	2.1981*** (.56209)		
Antic		2.2708*** (.5475)				
Other	.426 (.8682)	.4146 (.772)	.3946 (.8288)	.403 (.8149)		
Any					1.4407*** (.4247)	3.7947*** (1.2998)
Volume	.1241 (.2456)	.2654* (.1480)	.2924* (.1593)	.2908* (.1599)	.3636** (.1597)	.2656 (.285)
Cons	-8.7263*** (1.3787)	-8.6869*** (.7656)	-8.7713*** (.8173)	-8.7731*** (.8182)	-8.9233*** (.7564)	-10.314*** (1.8286)
ARCH	L1: -.0019 (.1364)	L1: -.0396 (.124)	L1: -.0498 (.118)	L1: -.0514 (.1172)	L1: -.0034 (.1058)	L1: -.0215 (.1005)
GARCH	L1: .5803* (.2788)	L1: .5145 (.2330)	L1: .5380** (.2277)	L1: .5420** (.2277)	L1: .5147*** (.2000)	L2: .4797*** (.1265)
N	104	104	104	104	104	104
Log likelihood	220.3863	225.3755	225.7491	225.7335	223.5681	223.0331
Prob>Chi2	0	0	0	0	0	0
Archlm	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>
Jb	.0588	.0492	.0838	.0819	.0545	.0553
Ljung Box	.0308	.0273	.0274	.0447	.0355	.0365
	.877	.8426	.8901	.9031	.84	.8406

**Note:** corrected standard errors in parenthesis; significance levels: \*.10% \*\*.5% \*\*\*.1%

Table D.3: *Volatility Analysis (GARCH) Scania (Art. 8.3 decision)*

	1	2	3	4
Lag return			20.3148 (18.6616)	21.2485 (21.6016)
Correct antic		3.2457 (3.2102)		3.3086 (2.6356)
Antic	2.9262* (1.814)		3.1671*** (.8107)	
Other	.7657** (.391)	.8314* (.3944)	.6885*** (.3851)	.8973** (.3988)
Any				
Volume	-3.7938** (1.634612)	-3.9922* (1.683283)	-2.5994* (1.37909)	-3.8329** (1.7373)
Cons	-9.7841*** (.2895)	-9.8776*** (.3133)	-9.5495*** (.2437)	-9.8994*** (.2378)
ARCH	L1: -.0524 (.0623)	L1: -.0528 (.0601)	L1: .0060 (.0807)	-.023 (.0585)
GARCH	L1: -.0364 (.2283)	L1: .0162 (.2547)	L1: -.2472 (.1994)	.0095 (.1843)
N	126	126	126	126
Log likelihood	431.6584	437.6709	432.2367	438.0157
Prob>Chi2	.0012	.0016	.001	.001
	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>
Archlm	0	0	0	0
Jb	0	0	0	0
Ljung Box	0	0	.0258	0

**Note:** corrected standard errors in parenthesis  
significance levels: \*:10% \*\*:5% \*\*\*:1%

Table D.4: *Volatility Analysis with lags (EGARCH) Scania (Art. 8.3 decision)*

	1	2	3	4	5
diff dax					.0000*** 0
Lag return		-71.8476*** (17.782)	32.1706* (18.2877)	-64.7427*** (22.2485)	
Lag Correct	3.3092*** (1.0087)		-1.0321*** (.1658)		
Lag Antic		1.5796*** (.3696)			
Lag Other	.7328* (.3904)	.5428* (.3092)	-.3962 (.2929)		
Lag Any				1.4314*** (.3996)	-.0061 (.0096)
Volume	-1.304 (1.2355)	-1.9540* (1.155)	-2.1485 (1.6269)	-1.2875 (1.4491)	
Cons	-3.5740* (1.8751)	-7.9051*** (.141)	-18.8669*** (1.1025)	-5.2569*** (1.5823)	-.0013* (.0007)
Earch	L1: .2921* (.1581)	L1: .9282*** (.3074)	L1: -.2224 (.164)	L1: .4612* (.2612)	L1: -.1616 (.1628)
Earch_a	L1: -.4495** (.2276)	L1: -.8388*** (.2812)	L1: .2907** (.1488)	-.0664 (.2528)	L1: .2624 (.2318)
Egarch	L1: .6632*** (.1927)	L1: .2309*** (.0157)	-1.0315*** (.1184)	.4934*** (.1648)	L1: .2380 (.2654)
N	126	126	126	126	126
Log likelihood	425.2171	426.3918	420.5196	421.405	426.1003
Prob>Chi2	.4527	0	.3057	.1089	.0174
Archlm	<i>p</i> 0	<i>p</i> 0	<i>p</i> 0	<i>p</i> .0001	<i>p</i> 0
Jb	0	0	0	0	0
Ljung Box	0	0	0	.0167	.0033

**Note:** corrected standard errors in parenthesis  
significance levels: \*:10% \*\*:5% \*\*\*:1%

Table D.5: *Volatility Analysis with lags (GARCH) Scania (Art. 8.3 decision)*

	1	2	3	4	5
diff dax					.0028 (.0025)
Lag return			3.8528 (15.0732)	17.7985 (29.6634)	
Lag Correct		4.4110*** (.5302)		4.5130*** (.6035)	
Lag Antic	3.4513*** (.4265)		3.4847*** (.7338)		
Lag Other	1.4030*** (.5044)	1.6525*** (.4856)	1.4487** (.6189)	1.6435*** (.5810)	
Lag Any					2.7768*** (.7056)
Volume	-4.3776* (2.9237)	-4.5875* (2.8617)	-4.4506*** (1.6514)	-4.9828* (2.8607)	-.8085 (2.2137)
Cons	-10.5783*** (.4090)	-10.6577*** (.4189)	-10.6077*** (.2114)	-10.734*** (.492)	-10.6112*** (.663)
ARCH	L1: -.0832* (.0535)	L1: -.0931*** (.0562)	L1: .2114** (.0390)	L1: -.0734* (.0504)	L1: -.0649 (.0819)
Garch	L1: .4418*** (.179)	L1: .4658*** (.174)	L1: .4506*** (.1015)	L1: .4715*** (.1842)	L1: .3362* (.1783)
N	126	126	126	126	126
Log likelihood	429.0402	430.8597	429.0569	432.1832	426.649
Prob>Chi2	.1619	.968	.0989	.1586	.0063
Archlm	0	0	0	.8489	0
Jb	0	0	0	0	0
Ljung Box	0	0	0	.3433	.0128

**Note:** corrected standard errors in parenthesis  
significance levels: \*:10% \*\*:5% \*\*\*:1%

# Correlation Matrices of Variables Used in the Volatility Analysis

---



---

Given that independent of the normal performance model, the event study only comprises one independent variable (either the long-term mean return or the DAX-return), I refrain from presenting any correlation matrices for these cases. However, correlation matrices for the volatility analysis are presented for each company.

## E.1 Bertelsmann

<b>Model 1 and 2</b>	dax diff	antic	other
dax diff	1		
antic	.0232	1	
other	.0904	-.0477	1

<b>Model 3, 4, 5</b>	dax diff	lag return	any
dax diff	1		
lag return	-.1112	1	
any	.0775	.0096	1

## E.2 General Electrics

<b>Model 1, 3, 5</b>	lag return	antic	other	volume
lag return	1			
antic	.0086	1		
other	-.0048	-.0311	1	
volume	-.2006	-.0482	-.0411	1

<b>Model 2</b>	lag return	correct antic	other	volume
lag return	1			
correct antic	.0168	1		
other	-.0048	-.0284	1	
volume	-.2006	-.0482	-.0411	1

<b>Model 4, 6</b>	lag return	any	volume
lag return	1		
any	.0021	1	
volume	-.2006	-.0634	1

## E.3 Honeywell

<b>Model 1, 3</b>	lag return	antic	other	volume
lag return	1			
antic	-.1259	1		
other	-.0261	-.0256	1	
volume	.0403	.1319	-.0375	1

<b>Model 2, 4</b>	lag return	correct antic	other	volume
lag return	1			
correct antic	-.1760	1		
other	-.0261	-.0233	1	
volume	.0403	.1434	-.0375	1

<b>Model 5</b>	lag return	any	volume
lag return	1		
any	-.1136	1	
volume	.0403	.0759	1

<b>Model 6</b>	diff dax	any	volume
lag return	1		
any	.0115	1	
volume	.0396	.0759	1

## E.4 Scania

<b>Model 1, 3</b>	lag return	antic	other	volume
lag return	1			
antic	-.0367	1		
other	-.0316	-.0219	1	
volume	.0671	-.0500	-.0392	1

<b>Model 2, 4</b>	lag return	correct antic	other	volume
lag return	1			
correct antic	-.0367	1		
other	-.0316	-.0219	1	
volume	.0671	-.0500	-.0392	1

<b>Model 5</b>	lag return	any	volume
lag return	1		
any	-.0480	1	
volume	.0671	-.0623	1

## Influential Cases

---

---

In light of the amount of data investigated, I distinguish between influential cases at the individual and at the aggregate level. The former refers to unusual peaks of a single security. This means that the normal performance model could be biased due to single non-random price fluctuations during the estimation period. Respective outliers were assessed via scatterplot matrices, added-variable plots, DFBETAs<sup>1</sup>, and Cook's D (cf. Kohler & Kreuter 2006, 205–212). To simplify matters, I do not report all the respective graphs and tests, but once more refer the reader to the attached CD-ROM. Sensitivity tests were always conducted jointly with the respective estimation method and can thus be found in do-files an3e\*, an5cg\*, and an20th\*<sup>2</sup>. In view of the fact that there hardly were any extreme outliers at the individual level I did not see the need to exclude any cases. Further, the Theil regression model is fairly robust to outliers.

Aggregate level sensitivity refers to the extent to which single CARs cause CAARs to exhibit a different sign than they would without these outliers. Detecting such cases at the aggregate level is a bit more tricky as there exists no standard procedure. Instead, I listed the magnitude and sign of each CAR pertaining to a certain CAAR and took a closer look at those exhibiting different signs or differing substantially in magnitude from other abnormal returns. The results of this analysis are presented in table F.1. Further, CAARs are visually depicted excluding influential cases, in figures F.1 to F.6. We can clearly see that the results outperform those presented in section 9.2 with respect to the direction and magnitude of abnormal returns.

---

<sup>1</sup> The DFBETA diagnostic denotes the standardized difference in parameter estimates which occurs due to the deletion of one observation.

<sup>2</sup> Replace asterisks by the respective company's name.

Table F.1: *Influential Cases*

<b>Decision Type</b>	<b>Influential Cases</b>	<b>CAARs without Outliers</b>
8(3)	Lenzing Volvo	figure F.1
6(1)(c)	Dow Chemical Phoenix BASF	figure F.2
6(1)(b)	Singapore Airlines	figure F.3
8(2)	LVHM UPM-Kymmene	figure F.4
6(1)(b) cond.	Roche Honeywell	figure F.5
8(2) cond.	Time Warner	figure F.6
6(1)(a)	no influential cases	–

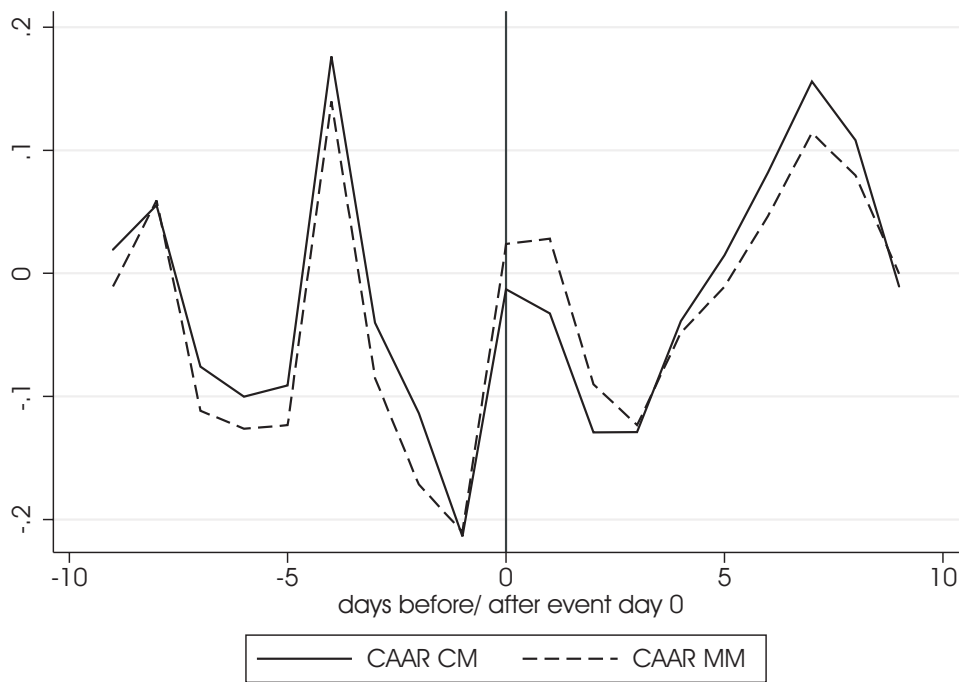


Figure F.1: CAAR without influential cases, Decision Type 8(3)

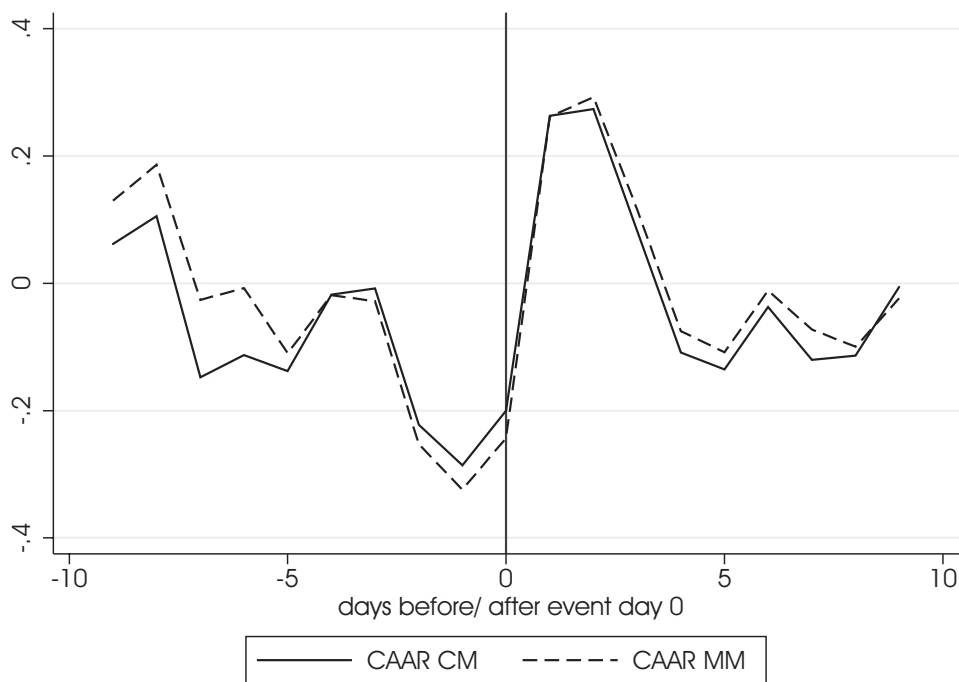


Figure F.2: CAAR without influential cases, Decision Type 6(1)(c)

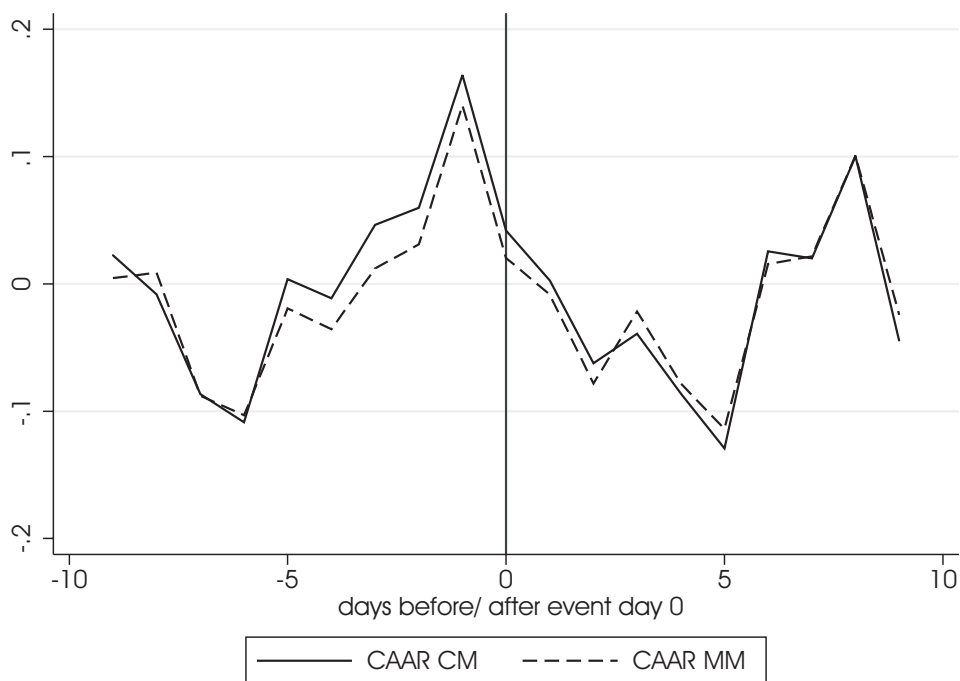


Figure F.3: CAAR without influential cases, Decision Type 6(1)(b)

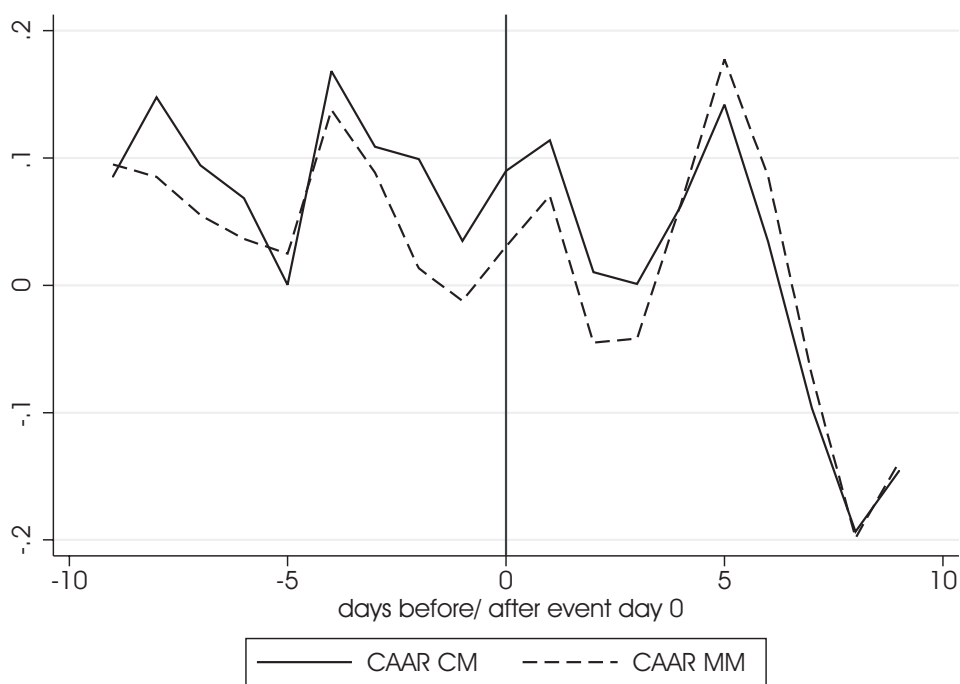


Figure F.4: CAAR without influential cases, Decision Type 8(2)

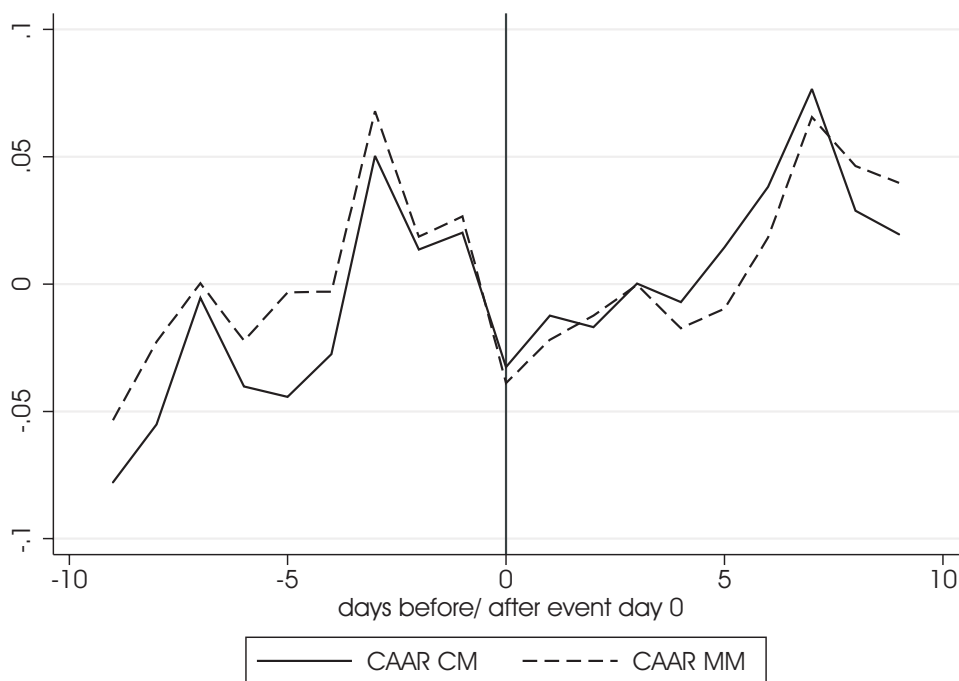


Figure F.5: *CAAR without influential cases, Decision Type 6(1)(b) with conditions*

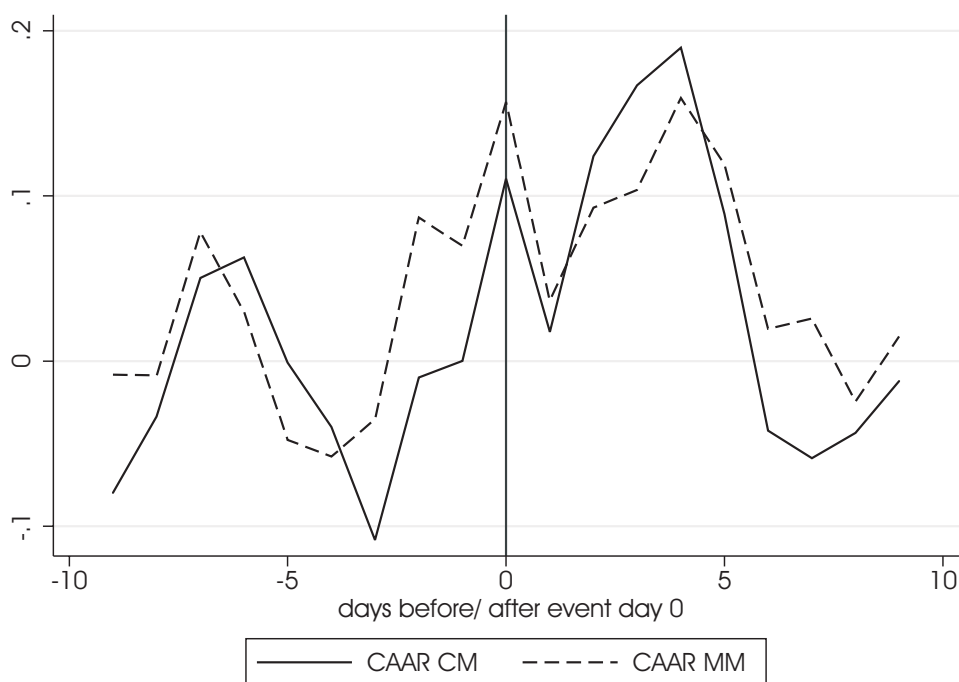


Figure F.6: *CAAR without influential cases, Decision Type 8(2) with conditions*