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Does Equal Pay Legislation Reduce Labour Market Inequality?

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Abstract

This paper considers a labour market model of monopsonistic competition with taste-based discrimination against minority workers to study the effect of equal pay legislation on labour market inequality. When the taste for discrimination is small or competition is weak, the policy removes job segregation and the wage gap completely. However, with a bigger taste for discrimination or stronger competition, equal pay legislation leads to more job segregation, and sometimes minority workers end up earning less than before. Profits of discriminating firms might increase, and discrimination can persist in the long run, although it would have disappeared without the policy.

Keywords: Discrimination; monopsonistic competition; equal pay legislation
JEL classification: *D*43; *J*71; *J*78

I. Introduction

Wage differentials between different demographic groups are a prevalent phenomenon in most developed countries. In spite of powerful equal pay legislation and other anti-discrimination measures, these gaps remain considerable, even after controlling for workers' qualification and experience. While wage differentials at the job cell level (occupation–establishment) are small, occupational segregation and establishment segregation are important causes of the wage gaps, and there is only a weak tendency of segregation to decline.[1] The aim of this paper is to demonstrate that equal pay legislation can, by itself and under certain circumstances, increase job segregation, reduce wages of minority workers, and contribute to the persistence of discriminatory behaviour by employers.

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[1] For gender, see e.g. Carrington and Troske (1995) and Petersen and Morgan (1995) for the US, and Meyersson Milgrom, Petersen and Snartland (2001) for Sweden; for race (US) see Bayard, Hellerstein, Neumark and Troske (1999). Although race and ethnic segregation in the US declined between 1960 and 1980, this trend seems to have stopped since then; see Tomaskovic-Devey, Zimmer, Stainback, Robinson, Taylor and McTague (2006).

Economic theories of labour market discrimination can be divided into two strands. One is statistical discrimination in the presence of imperfect information; see Phelps (1972) and Arrow (1973). The other is taste-based discrimination, where some agents have a distaste for interacting with minority workers; see Becker (1957). Such discrimination can come from employers, co-workers or customers. As Becker pointed out, taste-based employer discrimination generally has no permanent effect on the wage gap in a competitive labour market. In the long run (i.e. under free entry or perfect capital mobility), there will be enough non-discriminatory employers who hire all minority workers at the same wage as majority workers. In a sense, segregation helps reduce and eventually eliminate discrimination in the competitive model; see Cain (1986, pp. 711–712). In an imperfectly competitive labour market, however, such a result need not hold. First, monopsonists (and similarly, monopsonistic competitors) might easily discriminate if labour supply elasticities differ between demographic groups; see Robinson (1933). Second, taste-based employer discrimination can persist in models of monopsonistic wage competition, since discriminators earn positive profits and will not necessarily be forced out of the market by non-discriminatory employers; see Bhaskar, Manning and To (2002). Search models, as another departure from the competitive paradigm, also permit the persistence of taste-based discrimination; see e.g. Black (1995), Bowlus and Eckstein (2002), Lang, Manove and Dickens (2005).[2]

This paper considers a simple model of monopsonistic wage competition in the spirit of Salop (1979), in which some employers have a distaste for hiring minority workers. Bhaskar *et al.* (2002) discuss discrimination in a related model; they argue that even profit-maximizing firms discriminate in pay because of a spillover effect from discriminating employers. This spillover is due to a strategic complementarity in wage policies; if a discriminating firm pays a lower wage to minority workers, other firms follow suit and cut their wages. Moreover, the complementarity also explains why discrimination can persist: if a firm replaces its discriminatory management with a non-discriminatory one, it realizes that minority wages at competing firms will increase, so that its own wage bill will be driven further up. The objective of this paper is to analyse whether such results call for policy intervention. Namely, can an equal pay policy successfully reduce inequality and eliminate discriminatory behaviour?

An important feature of the model is that employers can, in principle, discriminate both in pay and in hiring. Without any equal pay legislation, employers only discriminate in pay but not in hiring. The wage gap is positive and is a consequence of both employment segregation and within-

[2] Rosén (1997) considers a search model where statistical discrimination arises endogenously from the interaction of hiring and application behaviour under asymmetric information.

firm wage discrimination. The introduction of an equal pay policy can have very different effects on labour market inequality, depending on the structural model parameters. When the taste for discrimination is small or when competition among employers is weak, the policy is successful in completely eliminating segregation and the wage gap. Although discriminators pay lower wages than non-discriminators, all employers hire majority and minority workers in the same proportions. However, in the opposite case of stronger competition or stronger discriminatory tastes, the policy is not successful in removing inequality. When discriminatory employers are not allowed to discriminate in pay, they decide to discriminate in hiring by rejecting minority job applicants.[3] Whenever this happens, non-discriminatory employers face a relatively inelastic labour supply of minority workers and are thus inclined to lower their wage. Hence, the possibility of hiring discrimination induces an additional spillover effect from discriminators to non-discriminators that is not present under *laissez-faire*. In the end, the labour market becomes more segregated, and sometimes both minority and majority workers earn less than under the *laissez-faire* benchmark. In these cases, the policy also entails an efficiency loss. Finally, employer discrimination is more likely to persist with the equal pay legislation; even when discriminatory behaviour is eliminated under *laissez-faire* in the long run, this might not be true under the equal pay legislation.

The model also shows that a larger share of minority workers leads to more segregation and a bigger wage gap. This is consistent with the evidence that there is more black–white segregation and wage inequality in local labour markets with a larger black population in the US; see Huffman and Cohen (2004) and references therein. Intuitively, a larger share of white workers spurs competition between discriminating and non-discriminating employers, raises wages and reduces inter-firm wage differentials.

Of course there are other contributions pointing at adverse effects of equal-treatment legislation, although most focus on affirmative-action (or quota) policies. Welch (1976) argues that quota policies entail allocative efficiency losses. Coate and Loury (1993) argue that affirmative action can induce a patronization problem: protected workers anticipate that their employment chances are good even if they do not invest in productive skills. More recently, Moro and Norman (2003) consider a related model in which wages respond endogenously to the relative skill supply, showing that the patronization problem can go away but minority workers are still hurt by the policy. The mechanism considered here is much more basic,

[3] Of course, this possibility can only occur if there is no affirmative-action policy in place that enforces equality of employment opportunities. If an equal pay policy were accompanied by a perfect affirmative action programme, all inequality would be removed in our model, although between-firm wage dispersion would remain.

because it considers purely the labour market response to an equal-treatment policy, abstracting from any long-run effects on human capital investment. Moreover, all effects in this paper are exclusively generated by imperfect competition, whereas the above literature focuses on competitive labour markets.

The remainder of this paper is organized as follows. The next section introduces the model framework, and Section III discusses the *laissez-faire* equilibrium. Section IV shows how the firms' wage policies respond to the introduction of equal pay legislation. Section V analyses the different equilibria that can emerge under equal pay legislation. Section VI discusses the persistence of discrimination, and Section VII concludes.

II. The Model

Consider a local labour market that is modelled as a circular city of unit length in the spirit of Salop (1979) and Bhaskar *et al.* (2002). The city is populated by two uniformly distributed groups of workers, each supplying one unit of indivisible labour. There is a mass μ of majority workers who are termed "white" and a mass 1 of minority workers who are termed "black". μ may be any strictly positive number; if it is less than one, the number of minority workers exceeds the number of majority workers in the local labour market. Principally, the model can also be interpreted as one of gender discrimination. In this case, μ should reflect the participation rate of men relative to women in the local labour market. There are three firms, located symmetrically on the circle. Firm 0 has a taste for discrimination, and firms 1 and 2 are colour-blind.

All workers are equally productive at all firms, and their reservation wages are independent of membership in the two demographic groups. In particular, the marginal product of labour at any of the firms is constant at A, and each worker must pay commuting costs tx^2 in order to travel distance x to work.[4] In another interpretation, these costs can also reflect the workers' preferences over horizontally differentiated non-wage job characteristics. The commuting cost parameter t naturally corresponds to the degree of competition in this model; lower values of t make jobs at the three firms closer substitutes, which leads to fiercer wage competition.

While firms 1 and 2 are conventional profit maximizers, firm 0 has a taste for discrimination; it derives disutility $d > 0$ for each black worker in its workforce. The objective function of firm 0 is assumed to be profits minus disutility from black employment. It is assumed throughout this paper that A is large relative to both d and t. This ensures that all workers want to

[4] Quadratic, rather than linear, commuting costs are assumed in order to avoid the well-known payoff discontinuities coming from "hinterland effects".

work for any of the three firms at equilibrium wages and that firm 0 wants to hire black workers at a sufficiently low wage. In particular, I deliberately abstract from any (adverse) employment effects of equal-treatment policy.[5]

All workers have a zero reservation wage and are interested in maximizing wage income net of commuting costs. The strategic interaction between firms and workers is modelled by the following two-stage wage-posting game.

(i) *Stage I:* Firms simultaneously announce wages w_i^s, $i \in \{0,1,2\}$, $s = W, B$. A worker of type s who lives distance x from firm i applies at this firm if $w_i^s - tx^2 \geq 0$.
(ii) *Stage II:* Firms make offers to applicants. Workers with more than one offer pick the one that is best for them. Firms' eventual employment of white and black workers is denoted L_i^s, $i \in \{0,1,2\}$, $s = W, B$.

Subsequent sections consider equilibria of this game under *laissez-faire* and under equal pay legislation. Under *laissez-faire*, firms are free to pay different wages to the two groups. Equal pay legislation restricts such discriminatory behaviour by forcing firms to announce the same wage $w_i = w_i^B = w_i^W, i \in \{0, 1, 2\}$, to the two groups. The policy cannot, however, prevent firms from discriminating in hiring at the second stage of the game.

Stage II can be solved easily. Firms 1 and 2 make offers to all applicants of type s, provided that $A - w_i^s \geq 0, i = 1, 2$. Firm 0 makes offers to all white applicants if $A - w_0^W \geq 0$, and it makes offers to all black applicants if $A - d - w_0^B \geq 0$, rejecting all black applicants if $A - d - w_0^B < 0$. A worker of type s who has more than one offer will accept the one where wage minus commuting cost is highest. The assumption that A is large relative to t guarantees that there is no unemployment at equilibrium wages so that $L_0^W + L_1^W + L_2^W = \mu$ and $L_0^B + L_1^B + L_2^B = 1$.

Subsequent sections study the effects of equal pay legislation on the following two measures of labour market inequality. The *wage gap*, G, is the difference between the average white wage and the average black wage. Given full employment of all workers, this is

$$G \equiv \frac{1}{\mu} \sum_{i=0}^{2} w_i^W L_i^W - \sum_{i=0}^{2} w_i^B L_i^B.$$

[5] This model with three firms, two of them being colour-blind, is the simplest environment in which there is proper wage competition, even when discriminators reject black applicants. The assumptions also guarantee that the limit $t \to 0$ corresponds to the perfectly competitive benchmark, which would not be true if there were only one colour-blind firm. A tedious extension to n firms, one of them being a discriminator, should be possible using the techniques of Bhaskar and To (2003).

Further, *employment segregation*, S, is measured by the Duncan segregation index (Duncan and Duncan, 1955), which is defined as the fraction of black (or white) workers that would need to change employment so that all firms have equal black–white ratios. Given full employment and using the observation that employment levels at the symmetric firms 1 and 2 are identical in any equilibrium, the segregation index is

$$S \equiv |L_0^B - L_0^W/\mu| = 2|L_1^B - L_1^W/\mu| = 2|L_2^B - L_2^W/\mu|.$$

The extreme cases are $S=0$ (no segregation) and $S=1$ (perfect segregation).

III. The *Laissez-faire* Equilibrium

Suppose that firms can discriminate in the wages they offer to the two demographic groups. Pay-offs are

$$\pi_0 = (A - w_0^W)L_0^W + (A - d - w_0^B)L_0^B,$$
$$\pi_i = (A - w_i^W)L_i^W + (A - w_i^B)L_i^B, \quad i=1,2.$$

Clearly, no firm will offer a wage above the marginal product, and firm 0 will not offer a wage to blacks above $A-d$. Provided that wages are high enough and close to each other, the group-specific labour supply to any firm is

$$L_i^s = \frac{1}{3} + \frac{3}{t}\left(w_i^s - \frac{w_{i+1}^s + w_{i-1}^s}{2}\right), \quad i \in \{0,1,2\}, \; s = B, W,$$

with the usual modulo 3 notation. Because of pay-off separability, Stage I wage competition can be solved separately for both white and black workers. Wage competition for white workers leads to the symmetric solution:[6]

$$w_i^W = A - \frac{t}{9}, \quad L_i^W = \frac{\mu}{3}, \quad i \in \{0,1,2\}. \tag{1}$$

Competition for black workers leads to an asymmetric allocation of workers because of 0's preference for discrimination. Provided that $d/t < 5/18$, all firms hire black workers:

$$\begin{aligned} w_0^B &= A - \frac{t}{9} - \frac{3d}{5} < w_1^B = w_2^B = A - \frac{t}{9} - \frac{d}{5}, \\ 0 < L_0^B &= \frac{1}{3} - \frac{6d}{5t} < L_1^B = L_2^B = \frac{1}{3} + \frac{3d}{5t} < \frac{1}{2}. \end{aligned} \tag{2}$$

[6] All derivations of best-response functions etc. are contained in the proof of Proposition 1 in the Appendix.

When $d/t \geq 5/18$, however, firm 0 is squeezed out of the market for black workers. In that case, we show in the Appendix that equilibrium in the market for black workers is

$$w_0^B = A - d < w_1^B = w_2^B = \min\left(A - d + \frac{t}{9}, A - \frac{2t}{9}\right), \qquad (3)$$
$$L_0^B = 0, \quad L_1^B = L_2^B = 1/2.$$

These findings can be summarized, and the wage gap and segregation index can be calculated.

Proposition 1. *The laissez-faire equilibrium is as follows:*

(a) If $d/t < 5/18$, wages and employment levels are as in (1) and (2). The wage gap is $G = (d/3) - (12d^2/25t) < t/18$ and the segregation index is $S = (6d/5t) < 1/3$.
(b) If $d/t \geq 5/18$, wages and employment levels are as in (1) and (3). The wage gap is $G = \min(d - 2t/9, t/9)$, and the segregation index is $S = 1/3$.

Proof: See the Appendix. ■

The following features are worth mentioning. First, black workers earn less than white workers at any of the three firms; that is, all firms discriminate in pay, although only firm 0 has a taste for discrimination; see also Bhaskar *et al.* (2002). Second, there is employment segregation, but the segregation index is never bigger than 1/3 because firms share the white workforce equally. At most, one-third of workers of either colour would have to change employment to have a black–white employment ratio of $1/\mu$ at all firms.

The wage gap disappears for the competitive limit $t \to 0$, where all workers earn their marginal product A, while segregation stays at 1/3. As mentioned in the Introduction, segregation eliminates discrimination in the competitive model. Similarly, it follows from part (a) that in less competitive markets (large enough t), the wage gap is increasing in t, whereas the segregation index falls in t. Here again, more competition (smaller t) spurs competition, which lowers the wage gap but leads to more segregation as more black workers in the neighbourhood of firm 0 are employed by the non-discriminating firms 1 and 2.

IV. Wage Policy under Equal Pay Legislation

Suppose now that firms are not allowed to discriminate with wages, so that each firm must offer the same wage to all workers. To understand the equilibrium set, one has to study the best-response behaviour at the wage-setting stage. How does each firm's wage policy depend on the wages of competitors?

Consider firm 0 first. The hiring decision at Stage II depends critically on the level of w_0: if $w_0 < A - d$, firm 0 hires black and white workers in the same proportion as firms 1 and 2. Firm 0's pay-off (profit minus disutility), assuming that $w_2 = w_1$, is

$$\pi_0 = \left(A - \frac{d}{1+\mu} - w_0\right)(1+\mu)\left(\frac{1}{3} + \frac{3}{t}(w_0 - w_1)\right). \tag{4}$$

Note that the average disutility associated with some worker is $d/(1+\mu)$, since the masses of white and black workers are μ and 1, respectively. Conversely, if $w_0 > A - d$, firm 0 rejects all black workers at Stage II, hiring only white workers. Its pay-off is then

$$\pi_0 = (A - w_0)\mu\left(\frac{1}{3} + \frac{3}{t}(w_0 - w_1)\right). \tag{5}$$

Comparing (4) and (5) shows that pay-off is continuous in w_0 and kinks upwards at $w_0 = A - d$ (where firm 0 is indifferent about hiring black workers). Therefore, $w_0 = A - d$ cannot be a best-response behaviour to any $w_1 = w_2$. Instead, there is a critical level of $w_1 = w_2 = \tilde{w}$ such that firm 0's best response $w_0 = R_0(w_1)$ is non-discriminatory ($w_0 < A - d$) when $w_1 = w_2 < \tilde{w}$, and discriminatory ($w_0 > A - d$) when $w_1 = w_2 > \tilde{w}$. In other words, the best-response curve of firm 0 jumps upwards at $w_1 = w_2 = \tilde{w}$.

What is the best-response behaviour of firms 1 and 2? When $w_0 < A - d$, firm 0 does not reject black applicants at Stage II, so that firms 1 and 2 compete with firm 0 for white *and* black workers. Firm 1 obtains profit

$$\pi_1 = (A - w_1)(1+\mu)\left(\frac{1}{3} + \frac{3}{t}\left(w_1 - \frac{w_0 + w_2}{2}\right)\right), \tag{6}$$

provided that $w_1 + w_2 \leq 2w_0 + 2t/9$ (so that firm 0 is not squeezed out of the market). When $w_0 > A - d$, firm 0 rejects all black applicants at Stage II. Thus, the black labour supply to firm 1 becomes *more inelastic* in w_1, and firm 1's profit is

$$\pi_1 = (A - w_1)\left(\frac{1}{2} + \frac{9}{4t}(w_1 - w_2) + \frac{\mu}{3} + \frac{3\mu}{t}\left(w_1 - \frac{w_0 + w_2}{2}\right)\right). \tag{7}$$

The last term in this expression simply adds up firm 1's employment of black workers (where it competes only with firm 2) and its employment of white workers (where it competes with firms 0 and 2). This shows that firm 1's profit is discontinuous in w_0, jumping up when w_0 increases beyond $A - d$. Combining the best responses of firms 1 and 2 to the wage at firm 0 shows that the reaction function $w_1 = w_2 = R_1(w_0)$ jumps down at $w_0 = A - d$; as w_0 increases beyond $A - d$, firms 1 and 2 suddenly face a more inelastic supply of labour, so they cut their wage.

In summary, firm 0's best-response function jumps up (at $w_1 = w_2 = \tilde{w}$), and the symmetric best response of firms 1 and 2 jumps down (at $w_0 = A - d$). Because of these jumps in best-response functions, there is an open (albeit small) set of parameter configurations for which no equilibrium exists in pure strategies. The following section concentrates on those situations that permit the existence of (at least one) pure-strategy equilibrium.

V. Equilibrium under Equal Pay Legislation

There are two types of pure-strategy equilibria:

(N) *No-discrimination equilibrium.* Here $w_1 = w_2 > w_0$ and $w_0 < A - d$, there is no segregation, and the wage gap is zero ($G = S = 0$).

(H) *Equilibrium with hiring discrimination* where $w_1 = w_2 < w_0$ and $w_0 > A - d, L_1^B = L_2^B = 1/2, L_0^B = 0, L_0^W > L_1^W = L_2^W$. Segregation is larger than under *laissez-faire* ($S > 1/3$), and the wage gap is positive.

The following discussion establishes necessary and sufficient conditions for these equilibria to exist.

No Discrimination

In an equilibrium without hiring discrimination ($w_0 < A - d$), firm 0 maximizes (4), firm 1 maximizes (6), and firm 2 solves a problem analogous to firm 1. Solving these problems yields wages (see the proof of Proposition 2 in the Appendix):

$$w_0^* = A - \frac{t}{9} - \frac{3d}{5(1+\mu)} < w_1^* = w_2^* = A - \frac{t}{9} - \frac{d}{5(1+\mu)}. \qquad (8)$$

As has been shown above, firm 0's pay-off is non-concave at $w_0 = A - d$. For w_0^* to indeed be a best response, one needs to ensure that $w_0^* < A - d$ and that firm 0 does not want to deviate to some $w_0 > A - d$. As is shown in the proof of Proposition 2, a necessary and sufficient condition for these two requirements is

$$\frac{d}{t} \leq \delta_N(\mu) \equiv \frac{10(1+\mu)}{9} \cdot \frac{\sqrt{1+\mu} - \sqrt{\mu}}{4\sqrt{1+\mu} + \sqrt{\mu}}. \qquad \text{(N)}$$

This condition has a simple intuitive interpretation. If the labour market is not too competitive and if the share of white workers is low enough (t is not too small and μ is not too large), firm 0 has little incentive to raise the wage above $A-d$ so as to attract more white workers and to reject blacks. It rather prefers the lower wage at w_0^*, where it hires both types of workers.[7]

Firm 1's pay-off function (6) applies only when firms 1 and 2 do not capture firm 0's market, i.e. when $w_1+w_2<2w_0+2t/9$ holds. But this condition is easily verified at equilibrium wages (8) under condition (N). Moreover, π_1 is concave in w_1 outside this range (it kinks down at $w_1=2w_0^*-w_2^*+2t/9$), hence w_1^* is indeed a best response to w_0^* and $w_2^*=w_1^*$. Both firms employ positive shares of black and white workers, each in the same proportion:

$$L_0^{B*}=\frac{L_0^{W*}}{\mu}=\frac{1}{3}-\frac{6d}{5(1+\mu)t}<L_i^{B*}=\frac{L_i^{W*}}{\mu}=\frac{1-L_0^{B*}}{2},\quad i=1,2. \quad (9)$$

Proposition 2. *There exists a no-discrimination equilibrium with wages (8) and employment levels (9) if and only if condition (N) is satisfied.*

Proof: See the Appendix. ■

Consequently, when the taste for discrimination is small enough or when competition between firms is weak enough, equal pay legislation succeeds in removing discrimination completely. As should be expected, the average white wage falls and the average black wage increases relative to *laissez-faire*.

Hiring Discrimination

Now consider an equilibrium with $w_0>A-d$, where 0 rejects all black applicants. In this situation, firm 0 maximizes pay-off (5), firm 1 maximizes profit (7), and firm 2 solves a similar problem. Solving these problems yields equilibrium wages

$$w_0^*=A-\frac{t}{9}\frac{9+10\mu}{6+10\mu}>w_1^*=w_2^*=A-\frac{t}{9}\frac{6+5\mu}{3+5\mu}, \quad (10)$$

and employment of white workers

$$L_0^{W*}=\frac{\mu}{3}+\frac{\mu}{6+10\mu}>L_1^{W*}=L_2^{W*}=\frac{\mu}{3}-\frac{\mu}{12+20\mu}>0. \quad (11)$$

[7] For the limit $\mu\rightarrow 0$, there are no white workers and the condition is simply $d/t\leq 5/18$. It is the same as the requirement under *laissez-faire* that firm 0 hires a positive share of black workers (i.e. there is no hiring discrimination).

To support this equilibrium, one needs to ensure that $w_0^* > A-d$ and that 0 does not want to deviate to $w_0 < A-d$. As before, these requirements follow from a single condition that is derived in the proof of Proposition 3:

$$\frac{d}{t} \geq \delta_H(\mu) \equiv \frac{9+10\mu}{9(3+5\mu)}\left(1+\mu-\sqrt{\mu(1+\mu)}\right). \tag{H}$$

Hence (H) guarantees that $w_0^* > A-d$ is a best response to w_1^*. On the other hand, it is also shown in the proof of Proposition 3 that firm 1 (and similarly firm 2) does not deviate to a wage $w_1 < (w_0^* + w_2^*)/2 - t/9$ where it only employs black workers.[8] Again condition (H) has an intuitive interpretation. When the labour market is very competitive, when the discriminatory taste is strong enough, and when the market share of white workers is large enough, firm 0 is inclined to offer a high wage, hire only white workers, and reject black job applicants. A low-wage strategy $w_0 < A-d$ is then not attractive since firm 0 would lose too many workers to its competitors.

Proposition 3. *There exists an equilibrium with hiring discrimination with wages (10), white employment (11), and black employment* $L_1^B = L_2^B = 1/2$ *if and only if condition (H) is satisfied. The wage gap is* $G = (9+10\mu)t/(36(3+5\mu)^2)$, *and the segregation index is* $S = 1/3 + 1/(6+10\mu)$.

Proof: See the Appendix. ■

When the taste for discrimination is large or when competition is strong, equal pay legislation does not remove labour market inequality, and there is more segregation than under *laissez-faire*. Although the wage gap (the difference between mean wages for white and black workers) always falls under the policy, black workers do not necessarily gain under the policy; sometimes the average black wage falls as well.[9] The reason is a spillover effect on non-discriminating firms that is exclusively due to imperfect competition. Even under *laissez-faire*, non-discriminating firms pay lower wages to black workers because of firm 0's reduced willingness to bid up the black

[8] This is not obvious, since firm 1's profit has an upward kink at this point. One can also show that there is no equilibrium with complete segregation where firm 0 hires only white workers, and firms 1 and 2 share the black workforce equally. Indeed, if there were such an equilibrium, firm 1 would set its wage just high enough to attract only white workers, i.e. $w_0 = w_1 + 2t/9$, but at this point firm 1's profit has an upward kink in w_1, so $w_1 = w_0 - 2t/9$ cannot be a best response to w_0 and $w_2 = w_1$.

[9] Because of more segregation, total surplus for black workers (wage income net of total commuting costs) also falls when their average wage falls.

wage. With the equal pay policy, however, there is a different spillover effect: labour supply to firms 1 and 2 becomes more inelastic, because firm 0 rejects black workers and therefore non-discriminators gain market power. Whether firms 1 and 2 resultingly pay lower wages to black workers than under *laissez-faire* depends crucially on the proportion of worker groups. If the share of white workers is low, competition is weak, and black workers are paid lower wages than without the policy. Put differently, local labour markets with larger black populations have more racial inequality, which is consistent with the evidence in the USA.

Corollary. *Suppose condition (H) is satisfied:*

(a) The introduction of equal pay legislation increases segregation and lowers the racial wage gap. The average wage for black workers sometimes falls.
(b) Labour market inequality, as measured by S and G, is falling in terms of the share of white workers in the labour market.

Proof: See the Appendix. ■

Figure 1 illustrates which parameters lead to equilibria with and without discrimination. As stated in Propositions 2 and 3, discrimination disappears

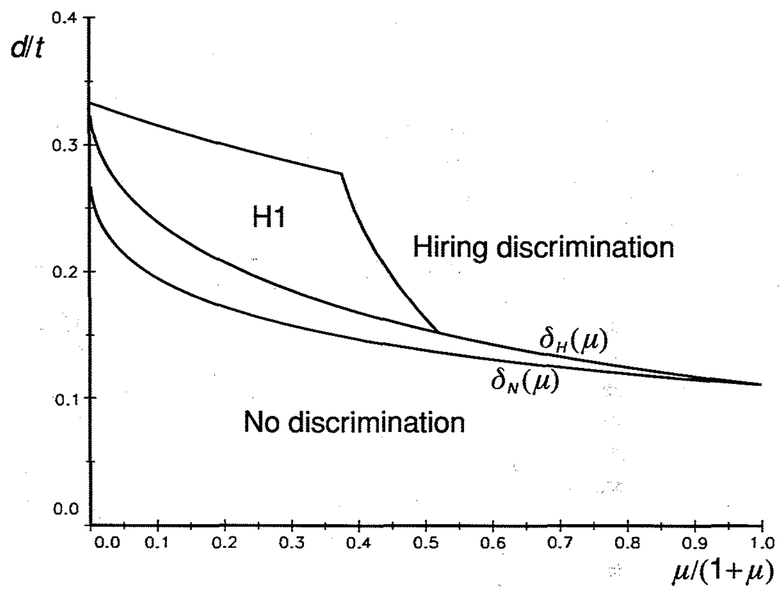

Fig. 1. Equilibrium types depending on d/t and on the relative share of white workers, $\mu/(1+\mu)$. Area H1 shows parameters where the mean black wage falls under the policy

when d/t is sufficiently small, but hiring discrimination prevails otherwise. Figure 1 shows that there are no multiple pure-strategy equilibria (i.e. $\delta_N(\mu) < \delta_H(\mu)$ for all μ), and that there is a (small) range of parameter values for which no equilibrium in pure strategies exists. The figure also shows the range of parameters where the average black wage is lower than under *laissez-faire* (area H1). This outcome requires a predominantly black population ($\mu < 1$) as well as a moderate taste for discrimination relative to the degree of competition.

Proposition 3 shows that the equal pay policy does not always remove the wage gap and sometimes even hurts discriminated workers. In these situations, the policy entails an efficiency loss. To see this, consider total surplus as the difference between total output and total commuting costs. This is obviously identical to the sum of workers' net incomes and firms' profits.[10] Because all workers are employed and produce the same output in any equilibrium, total output does not change under the policy. In other words, surplus increases if and only if total commuting costs fall.

Consider the case where $d/t \geq 5/18$, which precludes the possibility that equal pay policy removes inequality. Both under *laissez-faire* and after the equal pay policy, firm 0 does not employ black workers, and firms 1 and 2 share the black workforce equally. Hence, their commuting costs stay the same. Commuting costs of white workers increase under the policy, however. Under *laissez-faire*, commuting costs are minimized since each firm employs one-third of white workers. After the policy, firm 0 pays a higher wage than its competitors and hires more white workers. Total commuting costs are thus higher. In other words, equal pay policy brings about an efficiency loss when the labour market is relatively competitive and/or the disutility taste is high enough.

VI. Persistence of Discrimination

Gary Becker has argued that the wage gap is zero in a competitive labour market in the long run: discriminators do not hire minority workers, and wage competition between non-discriminators ensures that minority and majority workers earn the same wages. Obviously, matters are different under imperfect competition. Nevertheless, firm 0's profit under *laissez-faire* is lower than the profits at firms 1 and 2. The question naturally emerges: is it in the interest of firm 0's owner (who is only interested in the firm's value) to replace a discriminatory management with a

[10] A utilitarian planner should also respect the utility loss of discriminating employers. But if employment decisions are made by finitely many managers in each firm, their utilities are negligible relative to those of workers and shareholders. In this interpretation, a utilitarian welfare function decreases along with our surplus measure.

non-discriminatory one in order to increase profits?[11] Thus, augment the two-stage game with a preceding stage ("the long run") in which firm 0's owner considers replacing the discriminatory management with one that is neutral with respect to race (or gender). *Discrimination persists* whenever the owner does not exercise this option, which is the case whenever firm 0's profit with $d > 0$ is not less than firm 0's profit with $d = 0$. More generally, one might also consider the decisions of owners of firms 1 and 2 regarding whether or not to engage a discriminatory management instead of a neutral one. However, since these firms make a higher profit than firm 0, such a change in management is not as likely to be exercised as it might be at firm 0. To keep the analysis as simple as possible, only firm 0's owner considers a management replacement prior to the wage-setting stage.

In the *laissez-faire* equilibrium of Proposition 1, firm 0's profit (when $d/t \leq 5/18$) is

$$\pi_0^{LF} = (1+\mu)\frac{t}{27} + \frac{d}{15} - \frac{18d^2}{25t}.$$

By engaging a non-discriminatory management, firm 0 would obtain profit

$$\hat{\pi}_0 \equiv (1+\mu)\frac{t}{27}.$$

Thus, firm 0's owner does not exercise this option if and only if $d/t \leq 5/54$. In other words, discrimination persists under *laissez-faire* when $d/t \leq 5/54$, but it disappears in the long run otherwise; see Bhaskar *et al.* (2002). In other words, discrimination disappears without any policy intervention when the labour market is very competitive, in line with Gary Becker's reasoning. The opposite is the case at lower values of d/t, where firm 0's profit is higher with a discriminatory management. This result seems puzzling at first, because discriminators do not maximize profits. From the perspective of the owner, however, the adoption of a discriminatory management is a "commitment device" against fierce (and unprofitable) wage competition. In this model, firms' wage announcements are strategic complements; each owner correctly anticipates that the replacement of its discriminatory management raises wages at competing firms, which further drives up its own wage bill. This finding relates to Fudenberg and Tirole (1984) and Bulow, Geanakoplos and Klemperer (1985), who show that firms tend to underinvest when their actions in the post-investment game are strategic complements.

What happens if equal pay legislation is introduced? Surprisingly, it turns out that firm 0 will not always change its management, even when it would

[11] Alternatively, if firm 0 is owned by a discriminatory owner-manager, the firm will be taken over by a non-discriminatory owner whenever profits (and thereby firm value) can be raised by the change of ownership.

do so under *laissez-faire*. If there is a no-discrimination equilibrium, firm 0's profit is

$$\pi_0^N = (1+\mu)\frac{t}{27} + \frac{d}{15} - \frac{18d^2}{25t(1+\mu)},$$

while a change of management would again yield $\hat{\pi}_0$. π_0^N is larger than $\hat{\pi}_0$ if $d/t \leq 5(1+\mu)/54$. Hence, for any $d/t \leq \delta_N(\mu)$ and $d/t \in [5/54, 5(1+\mu)/54]$, discriminatory behaviour becomes *more persistent* under the equal pay policy than under *laissez-faire*. In both cases, inequality disappears in the long run: if the policy is in place, firm 0 simply stops discriminating in pay and in hiring without a management change; but without the policy the discriminatory management is replaced by the firm owner. Nevertheless, surplus is lower with the policy since the wage and employment differential between the firms does not disappear. Hence, there is a long-run efficiency loss with the policy.

Can an equilibrium with hiring discrimination persist? Firm 0's profit can be calculated as

$$\pi_0^H = \frac{\mu t}{27}\left(\frac{9+10\mu}{6+10\mu}\right)^2,$$

and one can demonstrate that this expression is always smaller than $\hat{\pi}_0$. Therefore, discriminatory behaviour can never persist in an equilibrium with hiring discrimination. Hence, inequality disappears in the long run. However, since $d/t \geq \delta_H(\mu) > 5/54$, inequality would also have disappeared without any policy intervention, with the same long-run effect on social welfare.

Proposition 4.

(a) *In the long run, the black–white wage gap and the segregation index are zero under equal pay legislation for all combinations of* $(d/t, \mu)$, *while they are positive under laissez-faire if* $d/t \leq 5/54$.

(b) *If* $d/t \in [5/54, 5(1+\mu)/54]$ *and* $d/t \leq \delta_N(\mu)$, *equal pay legislation entails a welfare loss in the long run relative to the laissez faire outcome, because a discriminatory management is retained under the policy but not under laissez-faire.*

VII. Conclusion

This paper considers a model of a monopsonistically competitive labour market with taste-based employer discrimination. It is shown that equal pay legislation can have varying effects, depending on the strength of discriminatory taste and on the degree of competition.

(i) If the taste for discrimination is modest and if competition is weak, equal pay policy succeeds in removing wage inequality and job segregation. Sometimes, however, discriminatory behaviour can become more persistent so that the policy entails an efficiency loss relative to *laissez-faire* in the long run.

(ii) In contrast, if discriminatory tastes are more pronounced and if competition is stronger, equal pay legislation leads to more job segregation and sometimes to lower wages for minority workers. The policy proves to deteriorate welfare in the short run, but in the long run all inequality must disappear, as would also be the case under *laissez-faire.*

I expect that these policy conclusions extend to more general full-employment environments with an arbitrary number of firms. When the full-employment assumption (a large enough labour productivity) is dropped, however, there is room for additional, and potentially quite different, effects. In particular, when discriminators reject black applicants and when commuting costs are large relative to labour productivity, it may happen that non-discriminators do not employ all minority workers so that some of them are unemployed. Thus, it could well happen that equal pay legislation also entails adverse employment effects for minority workers. These extensions are left for future research.

Appendix

Proof of Proposition 1

We first derive equilibrium in the market for black workers when $d/t \leq 5/18$ (the market for white workers is the same with $d=0$), dropping the superscript B from all expressions. Given that $w_1 = w_2$, firm 0's pay-off function $(A-d-w_0)[\frac{1}{3}+(3/t)(w_0-w_1)]$ is maximal at

$$w_0 = R_0(w_1) = \tfrac{1}{2}(A-d+w_1) - \frac{t}{18}.$$

Firm 1 maximizes pay-off $(A-w_1)[\frac{1}{3}+(3/t)(w_1-(w_0+w_2)/2)]$ (similarly for firm 2). From the first-order condition and symmetry $w_1 = w_2$ follows the joint best response of firms 1 and 2 to w_0:

$$w_1 = w_2 = R_1(w_0) = \frac{4}{3}\left[\frac{A}{2} + \frac{w_0}{4} - \frac{t}{18}\right].$$

Solving the intersection of best-response curves yields equilibrium (2), which satisfies $w_0 \leq A-d$ (and thus $L_0 \geq 0$) iff $d/t \leq 5/18$. Otherwise, firm 0 bids its "effective marginal product" $w_0 = A-d$. Firm i's employment of black workers, $i = 1, 2$, is

$$L_i = \frac{1}{2} + \frac{9}{4t}(w_i - w_j), \quad i \neq j \in \{1, 2\},$$

provided that firm 0 gets zero share of black workers, which happens under the condition

$$w_1 + w_2 \geq 2w_0 + \frac{2t}{9}. \tag{A1}$$

The pay-off of firm 1 kinks downward at $w_1 = 2w_0 - w_2 + (2t)/9$: at lower wages, firm 1 competes with firms 0 and 2, and at higher wages it only competes with firm 2, where its labour supply is more elastic (similarly for firm 2). Whenever $d \in [5/18,\ 1/3]$, the joint best response of firms 1 and 2 to $w_0 = A - d$ is at the kink where $w_1 = w_2 = A - d + t/9$, i.e. (A1) binds. Conversely, when $d/t > 1/3$, the joint best response is to the right of the kink where (A1) is slack. Here firm 1 maximizes $(A - w_1)[\frac{1}{2} + (9/4t)(w_1 - w_2)]$, which gives rise to the best response $w_1 = R(w_2) = (A + w_2)/2 - t/9$. By symmetry, $w_2 = R(w_1)$, and equilibrium is $w_1 = w_2 = A - 2t/9$. It is also straightforward to show that $w_0^B = A - d$ is indeed a best response for firm 0 to these wages at firms 1 and 2. Hence, for any $d/t \geq 5/18$, *laissez-faire* equilibrium in the market for black workers is as in (3). ■

Proof of Proposition 2

Firm 0 maximizes (4), and its best response to $w_1 = w_2$ is

$$w_0 = R_0(w_1) = \frac{1}{2}\left[A + w_1 - \frac{d}{1+\mu}\right] - \frac{t}{18}.$$

Firm 1 maximizes (6); from the first-order condition and symmetry $w_1 = w_2$ follows the joint best response of firms 1 and 2 to firm 0's wage announcement:

$$w_1 = w_2 = R_1(w_0) = \tfrac{1}{3}[2A + w_0] - \frac{2t}{27}.$$

Solving these two equations yields wages w_0^* and $w_1^* = w_2^*$ as in (8). It remains to prove that this is indeed an equilibrium. The first requirement $w_0^* < A - d$ is equivalent to

$$\frac{d}{t} < \frac{5(1+\mu)}{9(2+5\mu)}.$$

Straightforward algebra shows that this condition follows from (N). If firm 0 deviates to $w_0 > A - d$, it would obtain pay-off (5), which attains its maximum

$$\tilde{\pi}_0 = \frac{3\mu}{t}\left(\frac{t}{9} + \frac{d}{10(1+\mu)}\right)^2$$

at

$$\tilde{w}_0 = A - \frac{t}{9} - \frac{d}{10(1+\mu)}.$$

Such a deviation is not profitable if either $\tilde{w}_0 \leq A-d$ (in which case π_0 is decreasing in $w_0 \geq A-d$) or if $\tilde{\pi}_0 < \pi_0^*$, where

$$\pi_0^* = \frac{3(1+\mu)}{t}\left(\frac{t}{9} - \frac{2d}{5(1+\mu)}\right)^2$$

is firm 0's profit at w_0^*. The second condition is the same as (N), and the first condition is

$$\frac{d}{t} < \frac{10(1+\mu)}{9(9+10\mu)}.$$

A little algebra reveals that this condition is stronger than (N) so that (N) is necessary and sufficient to preclude deviations to $w_0 > A-d$. ■

Proof of Proposition 3

Now firm 0 maximizes (5), which is maximal at

$$w_0 = R_0(w_1) = \tfrac{1}{2}[A + w_1] - \frac{t}{18}.$$

Firm 1 maximizes (7). From the first-order condition of this problem and symmetry follows the joint best response of firms 1 and 2:

$$w_1 = w_2 = R_1(w_0) = \frac{1}{3+6\mu}\left[(3+4\mu)A + 2\mu w_0\right] - \frac{2t(3+2\mu)}{27(1+2\mu)}.$$

Solving $w_0 = R_0(R_1(w_0))$ yields wages w_0^* and $w_1^* = w_2^*$ as in (10). To prove that this is indeed an equilibrium, one first needs to show that $w_0^* > A-d$, which is the same as

$$\frac{d}{t} > \frac{9+10\mu}{9(6+10\mu)}.$$

Straightforward algebra shows that this is a consequence of (H). If firm 0 deviates to $w_0 < A-d$, it obtains pay-off (4), which attains maximum

$$\tilde{\pi}_0 = \frac{3(1+\mu)}{4t}\left(\frac{t(9+10\mu)}{9(3+5\mu)} - \frac{d}{1+\mu}\right)^2$$

at

$$\tilde{w}_0 = A - \frac{t(9+10\mu)}{18(3+5\mu)} - \frac{d}{2(1+\mu)}.$$

To ensure that such a deviation does not happen, one needs either $\tilde{\pi}_0 \leq \pi_0^*$ where

$$\pi_0^* = \frac{3\mu}{4t}\left(\frac{t(9+10\mu)}{9(3+5\mu)}\right)^2$$

is pay-off at w_0^*, or $\tilde{w}_0 \geq A-d$. The first condition is (H), and the second condition is

$$\frac{d}{t} \geq \frac{(1+\mu)(9+10\mu)}{9(1+2\mu)(3+5\mu)},$$

which is stronger than (H). Thus, (H) is necessary and sufficient to ensure that firm 0 does not deviate from $w_0^* > A - d$.

Finally, it is necessary to show that firm 1 does not deviate to a wage below $\hat{w}_1 \equiv (w_0^* + w_2^*)/2 - t/9$, where firm 1 stops attracting white workers. When firm 1 attracts only black workers, its profit is

$$\tilde{\pi}_1 = (A - w_1)\left(\frac{1}{2} + \frac{9}{4t}(w_1 - w_2^*)\right),$$

which is concave in w_1 and maximal at

$$\tilde{w}_1 = A - \frac{t(12 + 15\mu)}{9(6 + 10\mu)}.$$

One can easily verify, however, that $\tilde{w}_1 > \hat{w}_1$. Hence, $\tilde{\pi}_1$ is strictly increasing in $w_1 \leq \hat{w}_1$ so that $w_1^* > \hat{w}_1$ is indeed a best response to w_0^* and w_2^*. ■

Proof of the Corollary

(a) Because the segregation index in Proposition 3 is larger than 1/3, it is also bigger than under *laissez-faire*. When $d/t \leq 5/18$, the wage gap falls relative to *laissez-faire* iff

$$\frac{\delta}{3} - \frac{12\delta^2}{25} > \frac{9 + 10\mu}{36(3 + 5\mu)^2}, \tag{A2}$$

where $\delta \equiv d/t$. Since the LHS is increasing in $\delta \leq 5/18$, the inequality holds for all $\delta \geq \delta_H(\mu)$ iff it holds at $\delta_H(\mu)$. But this is the same as

$$1 < \frac{4c(\mu)}{3}(3 + 5\mu - 4(9 + 10\mu)c(\mu)/25),$$

with $c(\mu) \equiv 1 + \mu - \sqrt{\mu(1+\mu)} \in [0.5, 1]$, which is true for all $\mu \geq 0$. For $\delta \geq 5/18$, the *laissez-faire* wage gap is at least as large as the LHS of (A2), so that (A2) still holds.

The mean black wage never falls under the policy when $d/t \geq 1/3$. For $\delta \leq 5/18$, the mean black wage under *laissez-faire* is $A - t/9 - d/3 + 12d^2/(25t)$. This wage is larger than the mean black wage with the policy under (H) (w_1^* in Proposition 3) iff

$$\delta - \frac{36}{25}\delta^2 < \frac{1}{3 + 5\mu}.$$

One can verify that this condition is compatible with $\delta \geq \delta_H(\mu)$ (see area H1 in Figure 1). When $\delta \in (5/18, 1/3)$, the mean black wage under *laissez-faire* is $A - d + t/9$, which is larger than w_1^* iff

$$\delta < \frac{9 + 10\mu}{9(3 + 5\mu)},$$

which is again compatible with $\delta \geq \delta_H(\mu)$ (area H1 in Figure 1). Part (b) is obvious. ■

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