Documents de Travail du
Centre d'Economie de la Sorbonne

CES Working Papers

Competition and Discrimination : a not so Obvious Relationship

Clémence BERSON

2011.05

Maison des Sciences Économiques, 106-112 boulevard de L'Hôpital, 75647 Paris Cedex 13
http://centredeconomiesorbonne.univ-paris1.fr/bandeau-haut/documents-de-travail/
ISSN : 1955-611X

Competition and Discrimination: a not so Obvious Relationship *

Clémence Berson †

November 2010

*I am grateful to Pierre Cahuc, seminars at Paris School of Economics and the congres of AFSE for their useful remarks.

†Paris School of Economics, CES, University of Paris 1, 106-112 bd de l'Hôpital 75647 Paris cedex 13 (FRANCE), Ecole Polytechnique, Route de Saclay 91128 Palaiseau Cedex (FRANCE), e-mail: clemence.berson@univ-paris1.fr

Documents de Travail du Centre d'Economie de la Sorbonne - 2011.05

Abstract

Discrimination models have difficulties to study discrimination without assuming that prejudiced firms are more productive and results lead to workers' segregation. In this article, the model uses oligopsony and heterogeneity of workers' preferences to obtain a persistent discrimination. Firms hire both types of workers and pay a lower wage to the workers discriminated against whatever their taste for discrimination. A single prejudiced firm leads to a substancial wage gap in all firms. Consequently, the existence of discrimination allows a non-zero profit for unprejudiced firms and they have also no incentives to push out prejudiced firms. Moreover, the wage gap is affected by firms' spread out as well as by the number of prejudiced firms in the market. Government policies decrease the impact of taste for discrimination on wages but governments are not interested in.

Résumé

Les modèles de discrimination sur le marché du travail reproduisent difficilement sa persistance sans faire d'hypothèses fortes. Cela conduit de surcroît à une ségrégation des travailleurs selon leurs caractéristiques non-productives. Dans cet article, le modèle se sert de l'oligopsonie et de l'hétérogénéité des préférences des travailleurs pour obtenir une persistance de la discrimination. Un seul employeur discriminant induit un différentiel de salaire substantiel sur le marché. Les entreprises embauchent les deux types de travailleurs et offrent un salaire plus faible aux travailleurs discriminés. Par conséquent, l'existence de discrimination sur le marché permet aux entreprises n'ayant pas de goût pour la discrimination de faire des profits non-nuls. Elles n'ont donc pas d'incitation à faire sortir les entreprises discriminantes du marché.

JEL Codes: J42, J71, L13

Keywords: Discrimination, oligopsony, wage gap

Motes clés : Discrimination, oligopsonie, différentiel de salaire

1 Introduction

Competition and discrimination on the labor market are closely related in theory as in empirical studies. Discrimination is introduced in economics by Becker (1957) as a different treatment of two persons, whose observable productive characteristics are similar, due to a non-productive characteristic. Becker considers that discrimination is due to a taste of employers, customers or workers. Within this framework, members of the group discriminated against receive a lower wage in order to be hired and accepted as employees, co-workers or salespersons. A perfect competition induces a zero profit market, which means that prejudiced firms, less competitive than the others due to higher wages, exit the market. Their presence signifies that they make extra-profit or are more productive than the other firms to stay in the market. Phelps (1972) and Arrow (1973) improve the explanation of discrimination by considering it as a result of beliefs. Indeed, employers only know the productivity level of workers belonging to their group. To set a wage for the other workers, they use the expectancy of the average level of productivity of the group workers belong to. And, generally, their beliefs are that the other groups are less productive in average. Consequently the wage of the workers of other groups is lower than the wage of the majority. Time will remove this statistical discrimination because employers will learn the true productivity of their workers and discrimination will disappear. This paper is focused on the Becker's taste for discrimination but discrimination can be also interpreted as statistical discrimination.

Empirically, Black & Strahan (2001) show that, when the banking sector was deregulated in the middle of the 1970's, the wage gap between women and men decreased, and more women worked in this sector, with higher positions. Decreasing rents, as deregulation done, leads to a reduction in discrimination because firms can no more over-paid workers of the majority and stay competitive. A study of Black & Brainerd (1999) explains that increased competition through trade did contribute to the relative improvement in female wages in concentrated relative to competitive industries, suggesting that, at least in this sense, trade may benefit women by reducing firms' ability to discriminate. The existence of imperfect competition justifies the persistence of discrimination on the labor market. It means that companies have rents or are more productive than the others and can satisfy their taste for discrimination. They are able to stay competitive and do not leave the market. These studies only focus on the impacts of the relation between

competition on the product market and discrimination. But discrimination is not only inconsistent with competition on the product market, but also with the labor market competition theory. According to it, a worker is paid to her marginal productivity and two workers with identical abilities have to be equally paid. The presence of discrimination involves that employers do not pay the workers at their marginal productivity and take into account other workers' characteristics. In a usual framework, employers are wage takers and cannot discriminate. In order to be wage setters, employers are assumed to have a market power to fix the wage. The imperfection of the labor market is an argument of the persistence of discrimination and, as this paper shows, leads every firm to discriminate.

Theoretically, only search and matching models use the imperfection of the labor market to explain discrimination. The introduction of frictions allows a framework of imperfect competition but strong assumptions are necessary to obtain a persistent discrimination. Black (1995) developed first a search model leading to a long-lasting wage gap but he assumes that prejudiced firms are more productive than the average in order to stay competitive in the market and it results that firms segregate workers. Then search and matching models lean on this kind of assumption to fit to the persistence of discrimination. Moreover, matching models focus on ex ante bargaining and this is maladaptive to low wages, which are more often posted.

In this paper, I consider a taste-based model where workers are not paid at their marginal productivity. The workers take into account non-wage characteristics of the job. It could be a physical distance, as I use later, social characteristics of the firm job condition or informational frictions. This hypothesis is usually called heterogeneity of workers' preferences and allows firms to exercise a market power in the labor market. This model of oligopsony with heterogeneous workers' preferences is based on the model of Salop (1979). It allows to obtain a during wage gap between the majority and the minority without segregation. The main contributions of this paper are, first, that a single prejudiced firm is sufficient to induce a significant wage gap in the market. Second, unprejudiced firms discriminate against the minority without any taste for discrimination or beliefs about them. Moreover unprejudiced firms are not incited to compete with prejudiced firms to push them out because they profit of the existence of discrimination. Then, I analyze public policies consisting in wage equalization laws, affirmative action, employment subventions or minimum wage establishment. To my knowledge, this is the first time that this model is applied to issues of discrimination on

the labor market. Thisse & Zenou (1995), Wauthy & Zenou (1999), Hamilton *et al.* (2000) used this model to study employment and training policies. Bhaskar & To (2003) employed it to obtain a wage dispersion and survey the possible uses of the model in Bhaskar *et al.* (2002). The former expound the intuition of this paper among other applications of the model.

This paper is organized as follows. The model is described in Section 2. The effects of competition on labor market discrimination are observed in Section 3. Then, Section 4 studies the policies implications. Finally, Section 5 concludes.

2 The Model

2.1 General framework

The market is made up of n firms uniformly distributed around a circle city. The distance between two firms is also $\frac{1}{n}$. Each firm only uses labor as input in order to product a good sold p on a competitive market. Each worker products one output during the period. To simplify the resolution of the model, there is no free entry or exit in the market.

The labor market is composed by a continuum of workers split out in two types: The Greens and the Reds. The two populations of workers only differ because of an observable characteristic that does not affect their productivity. The Reds represent γ of the working population and both types of workers are identically distributed around the circular market. There are two types of employers. One type is characterized by a discriminatory taste and the other type is indifferent about the observable characteristic that distinguishes workers. A proportion η of employers are taste-based prejudiced against the minority workers. Let d be the monetary term, which denominates the manager's psychic cost of hiring a Red worker.

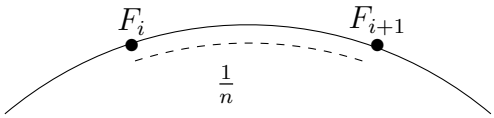

Figure 1: Dispersion of firms

In order to work, the Reds and the Greens have to go to a firm i. All

travels occur along the circle and each worker, which covers a distance x to work in a firm, spends tx to go all the way, where t is the commutation cost. The introduction of distance to job is equivalent to introduce heterogeneity of workers' preferences. This distance is a physical distance but it can also be interpreted as non-wage characteristics of jobs offered by the firms (type of contract, full or part-time, etc), characteristics of the firms themselves (size, environmental or social policies, etc) or informational frictions. It means that different jobs are not perfect substitutes for each other. Consequently, the labor supply does not react to a slight wage modification: The elasticity of the supply to the wage is weak. The heterogeneity leads to a market power in favor of firms, which can set their wage and firms are in a situation of oligopsony in the labor market.

Let w_{ji} denotes the wage offered by the firm i to the workers of the groups j. A worker accepts a job offer only if her net wage is higher than the reservation wage. To keep a simple framework without a loss of generality, the reservation wage is normalized to zero. The worker's net wage is the wage offered by a firm minus the cost of transportation to go to work. As a worker of the group j located at x pays a cost tx to work for the firm i, her net wage is $w_{ji} - tx$. In other words, she decides to work for the firm i if the transportation costs are lower than the wage offered. But the firm i is not alone on the market and the workers compare the net wages offered by the firms. Then she works for the firm i only if the net wage offered by the firm i is higher than the net wage offered by the other firms. In mathematic language, she will work for the firm i only if $w_{ji} - tx > w_{jk} - t(\frac{1}{n} - x)$ for each k.

The employers' utility function contains both profits and a parameter summarizing the disutility associated to the promotion of Red workers. This means that only Red workers face the risk to be discriminated against, because of the observable characteristics that, without affecting their productivity, differentiates them from other workers. The owner of a representative firm i is assumed to maximize utility over the objectives of profit, employment of Green workers and employment of Red workers, noted $U_i(\Pi_i, L_{Gi}, L_{Ri})$. Employers hire workers as long as it generates benefits. When the output sale is no more sufficient to compensate input pay, employers stop take on. Indeed, in order to attract more workers, a firm has to offer higher wages to compensate higher commutation costs. Then, both types of firms face a straightforward utility function:

$$U_i = p(L_{Gi} + L_{Ri}) - w_{Gi}L_{Gi} - (w_{Ri} + d_i)L_{Ri} \quad (1)$$

where $d_i = d$ if the firms i is a prejudiced firm and $d_i = 0$ otherwise, and L_{ji} is the number of employed workers belonging to the group j as input. Note that d could be due to statistical discrimination. In this case, prejudiced employers assume that the Red workers are in average less productive than the Green workers due to beliefs about the Red population, unknown of these employers. They also suppose that the productivity of the Reds is in average $1 - \frac{p}{w}$ and set a corresponding wage of $w - d$ for them. The following results are identical because the model is static and employers cannot learn the true productivity of Reds.

In this model, I assume that the labor market is covered. Indeed, in the opposite case, an unemployment pocket is formed between firms. All individuals in this pocket have a net wage negative, whatever the firm, which proposes the wage. Then, firms are locally monopsonistic because labor pools are unconnected. Then there are no more interactions between firms and the study becomes less interesting. In order to take unemployment into account, a heterogeneous reservation wage has to be introduce. The model becomes too complex for this study and could be the topic of another paper.

2.2 The case of four firms

In this section, I dwell on the case when $n = 4$ to explore more easily the properties of the model. All results can be generalized to n firms.

When $|w_{ji} - w_{ji+1}| \leq \frac{t}{4}$ for each i and $d \leq \frac{5}{6}t$, workers located between i and $i + 1$ have no incentive to work for another firm than i or $i + 1$. They make a decision by comparing net wages offered by both firms. Both types of workers are uniformly distributed around the circle, then the decision-making is identical whatever the group the worker belongs to. It means that they compare the wage set by the firm i minus the transportation cost to go to this firm with what offered the firm $i + 1$ minus commutation costs to go to this one. Considering the former notation, an individual decides to work for the firm i if $w_{ji} - xt > w_{ji+1} - (\frac{1}{4} - x)t$. The worker located at $\tilde{x} = \frac{1}{2t}(\frac{t}{4} + w_{ji} - w_{ji+1})$ is indifferent between working for firms i or $i + 1$. All workers located up to her will work for the firm i because their

transportation costs are lower. The others will work for $i+1$. Since there is a similar set of workers on the other side of firm i, their labor supply is symmetric. Consequently; the labor supply of the firm 1 is:

$$L_i = \gamma \frac{1}{t}\left(\frac{t}{4} + w_{Ri} - \bar{w}_{Ri}\right) + (1-\gamma)\frac{1}{t}\left(\frac{t}{4} + w_{Gi} - \bar{w}_{Gi}\right) \tag{2}$$

where $\bar{w}_{ji} = \frac{1}{2}(w_{ji-1} + w_{ji+1})$ is the average of wages offered by direct neighbors of the firm i. As firms face to the both types of workers, the labor supply is composed of the Greens' and Reds' supplies (the left hand side and the left hand side, respectively).

In this model, the firms compete in wages to attract workers. Then, they take into account the behavior of their neighbors and introduce the wage offered by the nearest firms to set their wage up. They maximize their utility to obtain their reaction function(s). Substituting the equation of labor supply (2.2) into the utility function (2.1) and then solving the first order condition yields the firms' optimal wages as:

$$w_{Gi} = \frac{1}{2}\left(p - \frac{t}{4} + \bar{w}_{Gi}\right)$$
$$w_{Ri} = \frac{1}{2}\left(p - \frac{t}{4} + \bar{w}_{Ri} - d_i\right)$$

As all firms take into accounts the decisions of their neighbors, the firm i is affected by the decision taken by all firms. Moreover, it is worth to notice that the term of discrimination does not directly appear in the reaction function of unprejudiced firms. Their reaction function is the same whatever the worker's group and the wage gap is induced by the term which depends on neighborhood's wages, then on the prejudiced firm. The non-discriminatory firms take advantage of the weakness of the Red workers' labor demand to offer them a lower wage. *The presence of one prejudiced firm in the market impacts all wages of Reds, even if their employer is unprejudiced. Consequently, a wage gap is observable between wages of Reds and Greens in every firms of the market.*

The wage of Greens is not affected by the taste for discrimination. It is identical for all firms because reaction functions are the same whatever

the firm and is worth $w_{Gi} = p - \frac{t}{4}$. This wage is not equal to the level of productivity of workers because of commutation costs. A wage dispersion is possible if the productivity of firms is heterogeneous. But I want to keep a simple framework in order to observe better the results. I suppose also a uniform productivity without a loss of generality.

the proportion of prejudiced firms on the market impacts positively this mean wage gap between Reds and Greens. The mean wage gap with one prejudiced firm on the market is $\frac{1}{4}d$. It increases to $\frac{1}{2}d$ when two discriminatory firms are on the market and reaches to $\frac{3}{4}d$ with three prejudiced firms.

To explode the impact of the dispersion of firms on the circle, suppose that $\eta = 0.5$ and that firms 1 and 2 are unprejudiced and firms 3 and 4 have a taste for discrimination against the Reds. The Figure 2 shows the different possible layout. In the first one, different types of firms alternate and in the second one, similar firms are side-by-side.

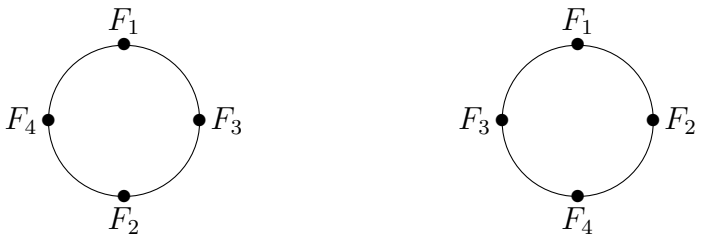

Figure 2: Four firms, prejudiced firms alternate with unprejudiced one on the left (A), identical firms side-by-side on the right (B).

The equilibrium wage of Greens is not sensitive to the spread out of firms. But the wage of Reds varies with the dispersion of firms. Indeed, when prejudiced and unprejudiced firms alternate, equilibrium wages of Reds are

$$w_{R1} = w_{R2} = p - \frac{t}{4} - \frac{1}{3}d$$
$$w_{R3} = w_{R4} = p - \frac{t}{4} - \frac{2}{3}d$$

and when identical firms are side-by-side, equilibrium wages are

$$w_{R1} = w_{R2} = p - \frac{t}{4} - \frac{1}{4}d$$
$$w_{R3} = w_{R4} = p - \frac{t}{4} - \frac{3}{4}d$$

The wage gap between Reds and Greens is less than d in the prejudiced firm because of the competition with the unprejudiced firms. It is worth to note that the wage of Reds offered by the non-discriminatory firms is lower than the wage of Greens. It explains that the unprejudiced firms are not prompted to have out the prejudiced firms because they are a source of their profit. In both cases, the mean wage of Reds is $p - \frac{t}{4} - \frac{1}{2}d$. Consequently, the mean wage gap does not fluctuate with the dispersion of the firms. But the wage differential between Reds employed by prejudiced and unprejudiced firms is higher when identical firms are side-by-side than when they alternate. In the case A, a Red worker employed by an unprejudiced firm earns $\frac{1}{3}d$ more than one employed by a prejudiced firms against only $\frac{1}{4}d$ in the case B. *The spread out of firms around the circle impacts the standard deviation of wages of workers discriminated against but does not impact the mean wage of Red workers.*

Concerning the wage bill, variations are observable according the intensity of discriminatory taste, firms spread out and the number of firms on the market. The wage bill of Greens is identical whatever the firms and is worth $\frac{1}{4}$. The whole variations of the wage bill are also due to the Reds. When prejudiced and unprejudiced firms alternate (A), the wage bills of firms are:

$$L_{R1} = L_{R2} = \frac{1}{4} + \frac{1}{3t}\gamma d$$
$$L_{R3} = L_{R4} = \frac{1}{4} - \frac{1}{3t}\gamma d$$

When identical firms are side-by-side (B), the wage bills of firms are:

$$L_{R1} = L_{R2} = \frac{1}{4} + \frac{1}{4t}\gamma d$$
$$L_{R3} = L_{R4} = \frac{1}{4} - \frac{1}{4t}\gamma d$$

The wage bill is lower in prejudiced firms. But it increases with the closeness of other prejudiced firms. Indeed, when two prejudiced firms are side-by-side, their power on Reds located between them is higher and they can offer a lower wage and attract more Reds than when their neighbor is an unprejudiced firm, which offers a higher wage.

Moreover, the wage bill impacts profits: because the productivity is a constant factor, firms increase their profit until the wage set is too high to do benefits. Indeed, in order to attract an additional worker, the employer

has to increase slightly her wage to compensate for the commutation costs of a more distant individual. The higher the wage bill, the higher are wages. When prejudiced and unprejudiced firms alternate (A), the profits of firms are:

$$\Pi_1 = \Pi_2 = \frac{t}{16} + \gamma d\left(\frac{1}{6} + \frac{d}{3t}\right)$$
$$\Pi_3 = \Pi_4 = \frac{t}{16} + \gamma d\left(\frac{1}{12} + \frac{2d}{9t}\right)$$

When identical firms are side-by-side(B), the profits of firms are:

$$\Pi_1 = \Pi_2 = \frac{t}{16} + \gamma d\left(\frac{1}{8} - \frac{d}{16t}\right)$$
$$\Pi_3 = \Pi_4 = \frac{t}{16} + \gamma d\left(\frac{1}{8} - \frac{3d}{16t}\right)$$

Profits are sensible to discrimination and spread out of firms. In both cases, discrimination increases profits of all firms, but more in the unprejudiced firms than in the prejudiced firms. Moreover *the profits are higher for the unprejudiced firms and when they alternate with prejudiced firms. They increase with the level of the taste for discrimination. The prejudiced firms make less profits but it increases with the proximity of similar firms.*

The utility of employers is closely related to their profits: $U_i(\pi_i, L_{Gi}, L_{Ri}) = \pi_i - d_i L_{Ri}$. Without taste-based discrimination, utility and profit are equal. The prejudiced firms have a lower utility because of the taste for discrimination.

To summarize this section, the presence of one prejudiced firm on the market induces a lower wage for all workers discriminated against. The unprejudiced firms make also an extra-profit and are not incited to compete each other in order to push out prejudiced firms.

3 Impact of competition

Becker assumes that the degree of competition impacts the intensity of discrimination on the labor market. Higher the degree of competition, lower the opportunity to satisfy a taste for discrimination. In this part, different

variations of competition are studied to observe their impact on discrimination. As in the former section, suppose that four firms are on the market, 1 and 2 do not have a taste for discrimination and 3 and 4 have one.

A variation of t is equivalent to a variation of the degree of competition in the labor market. When t decreases and $|w_{ji} - w_{ji+1}| \leq \frac{t}{4}$, the wage gap reduces in proportion but stays identical in value because there is no interactions between the transportation cost and the discriminatory term.

When the transportation cost is sufficiently high such that the wage differential between prejudiced and unprejudiced firms is higher than $\frac{t}{4}$, some workers have incentive to work for another firm than one of both nearest firms. It means that other firms of the circle offer a net wage higher than the net wage offered by the both nearest firms. The constraint on the term of discrimination is $d > \frac{5}{6}t$. The labor supply now depends on the type of firm that the worker can reach. For the prejudiced firm, no Red workers chooses to work for this firm because the wage proposed by unprejudiced firms is sufficiently high to compensate the additional transportation costs to go as far as them. Then, the labor supply of Reds is only shared between unprejudiced firms. Then the labor supply of firm i is

$$L_i = \frac{1}{t}(1-\gamma)\left[\frac{t}{4} + (w_{Gi} - \bar{w}_{Gi})\right] + \gamma\frac{1}{t}\left[\frac{t}{2} + w_{Ri} - \bar{w}_{Ri'}\right]$$

if i is unprejudiced

$$L_i = \frac{1}{t}(1-\gamma)\left[\frac{t}{4} + (w_{Gi} - \bar{w}_{Gi})\right]$$

if i is prejudiced

where $w_{Ri'}$ is Reds' wage offered by the other unprejudiced firm.

Employers maximize their utility taking into account the labor supply and wages offered by their neighbors. Substituting labor supplies into utilities and then solving the first order condition yields the reaction functions as:

$$w_{Gi} = \frac{1}{2}(p - \frac{t}{4} + \bar{w}_{Gi})$$
$$w_{Ri} = \frac{1}{2}(p - \frac{t}{2} + \bar{w}_{Ri})$$

Then equilibrium wages are:

$$w_{G1} = w_{G2} = w_{G3} = w_{G4} = p - \frac{t}{4}$$
$$w_{R1} = w_{R2} = p - \frac{t}{2}$$

The impact of the term of discrimination is not directly observable because only unprejudiced firms are interested in hiring Red workers. It interfere only in the decision process of workers and no more in the maximization process of firms. The labor demand of Red workers is also lower than the one of Green workers. Due to this weakness of demand, the wage of Reds offered by unprejudiced firms is lower than the wage of Greens. Indeed, the sub-market of Red workers contains only the unprejudiced firms. Then, the market power of the unprejudiced firms is higher than former and they set lower wages to maximize their profit. Both unprejudiced firms are in competition *à la* Cournot. As in matching models, a segregation can be observed because prejudiced firms do not hire Red workers and the wage differential comes essentially of the differential of labor demand of Reds and Greens. The results concerning wages, spread out of firms and composition of the wage bill are still true in the case of overall competition.

The situation is more complex when the number of firms on the market is higher. Indeed, the wage differential can be sufficiently high between some firms to allow Red workers to work for unprejudiced firms but not between others. Consequently, some Red individuals have to work for a prejudiced firm because she cannot reach the nearest unprejudiced firm. Then, the market becomes very heterogeneous and many situations are conceivable. The effect on the wage gap is ambiguous: the demand of labor of Reds is lower and the wage of Reds lowers. But the market power is no more symmetrically shared and the fact that some firms have more market power decreases wages in some parts of the market and increases it in other parts. The impact of discrimination is also indirect. Despite the difficulty to solve the model in more complex case, it is straightforward that *the presence of prejudiced firms is sufficient to lower the wage of Red workers.*

For the special case, when $t = 0$, the market is perfectly competitive and workers can choose any firm without additional costs. Red workers choose one of both non-discriminatory firms and their wage stays lower because the demand of Reds' labor is lower than the demand of Greens' labor. The wage gap is only based on the difference of the number of unprejudiced and prejudiced firms. The more unprejudiced firms on the market, larger is the wage

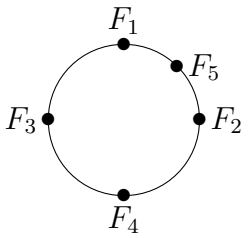

Figure 3: A fifth firm enters the market.

differential between the both types of workers.

An increase of the number of firms n has an impact on the competition on the labor market. Higher is the quantity of firms on the market, closer to the perfect competition. But this model is static and firms are uniformly distributed around the circle. When the number of firms increases and if they stay uniformly distributed, the impact of the transportation costs on wages is lower. Then wages rise with the number of firms and come closer to the productivity of workers. But the impacts of discrimination remain the same as describe in the former section.

Nevertheless the effect is different if the spread out of firms is invariant. Indeed, the former firms are already located on the circle, and the new one has to be inserted between two old firms. Then, firms are no longer uniformly distributed on the circle. The market power of firms in the neighborhood of the new entrant decreases whereas the market power of the firms far away increases. Consequently, the formers fix a lower wage than the others. In both cases: *a new unprejudiced firm decreases the impact of the discriminatory taste whereas a new prejudiced firm increases it.*

Keeping the former example of four firms, assume that a fifth firm wants to enter the market. It takes a location between two firms also installed (see figure 3). Depending on the spread out of the other firms, it can be between two identical firms or two different firms. In both cases, the distance between the last entered and their neighbors is $\frac{1}{8}$ instead of $\frac{1}{4}$ in the rest of the circle. Consequently the sharing of the market power evolves: *the market power of the old firms, near the new one, decreases* because of the closeness of this new firm. On the contrary, *both firms, which are not mixed with the new firm, have a higher market power* and can set a lower wage for their workers.

Indeed, the level of competition is lower in this side of the circle.

Moreover *the new firm will fix up in the neighborhood of prejudiced firms in order to set a lower wage for the Reds.* Indeed, it has incentive to locate near the prejudiced firms whatever its type. When the firm is prejudiced, its effect is to lower wages of the Reds. Its taste for discrimination is more satisfied than when the firm is among unprejudiced firm because the wage set up is higher. When the firm is unprejudiced, its profits are higher if it is located among prejudiced firms. Indeed, the wage of the Reds is lower in this area. Moreover, the firm attracts more Red workers and make more profits. Then the firm benefits of the presence of prejudiced firms in its direct neighborhood.

Thereby, when the taste for discrimination is too high or the commutation costs are sufficiently low, workers have incentive to go in another firms than the nearest. The direct impact of discrimination decreases but the demand for labor of the minority remains lower than the one of the majority. A wage differential persists in the market. In the extreme case where the transportation costs disappear, the individuals of the minority are only employed by non-discriminatory firms.

When a new firm enters the market, the effect is different because it modifies the sharing of market power. Strategically, the new entrant settles where the highest number of prejudiced firms are located.

4 Policy implications

The former section shows that an improvement of competition decreases the wage gap but it still keeps existing. And since imperfect competition is clearly acknowledged as a reality, governments have to lead suitable policies in order to decrease the wage gap due to discrimination. The next Section describes four possible policies aiming to fight discrimination: minimum wage establishment, employment subsidies, wages equalization and affirmative action. The wages and the reaction functions are calculated from the case of four firms described former.

Minimum wage

The government introduces a minimum wage in order to secure a weaker wage gap. If the minimum wage is a constraint for the prejudiced firms to set up a low wage for the Red people, the wage gap decreases. The minimum wage, noted w_m, can be set up in three main intervals of value: if w_m is lower than the lowest wage, no firms are constrained. If it is higher than the highest wage, all the firms are constrained and the wage gap disappears. Third, the minimum wage is set up between the lower wage and the wage of Greens. The last interval is the more interesting one. The prejudiced firms are constrained by the minimum wage and set $w_{Ri} = w_m$. The wages are in appendix. It is worth to notice that *a minimum wage higher than the lowest wage increases the wage of Red workers whatever the type of firm.* Indeed, the reaction functions depend on the repartition of wages. If the lowest wage increases, all wages increase. When the minimum wage is higher than $p - d$, the prejudiced firms does not employ Red workers.

To extend, the case when every firms are constrained for all wages can reach the first best solution. Indeed, if $w_m = p$, workers earn their productivity level and this is the case of perfect competition. But this is an extreme decision and to set a relatively high minimum wage induces a negative impact on hiring and cannot be used.

Employment subsidies

The government can lead a policy aiming to subsidize the wages of Reds in order to compensate the impact of discrimination. The subsidy is allocated to every firm based on the stock of Red workers on its roll to pull up the wage rates of all discriminated workers. As the government does not know the type of firms, it subsidizes all wages of Reds and not only the wages of Reds hired by prejudiced firms. The utility function of firms becomes $U_i = pL_i - \beta L_i - w_{Gi}L_{Gi} - (w_{Ri} + d_i - s)L_{Ri}$, where s is the amount of subsidies per Red worker and β a tax per worker intended to finance the subsidy. The maximization leads up to following reaction functions:

$$w_{Gi} = \frac{1}{2}\left(p - \beta - \frac{t}{4} + \bar{w}_{Gi}\right)$$
$$w_{Ri} = \frac{1}{2}\left(p - \beta - \frac{t}{4} + \bar{w}_{Ri} - d_i + s\right)$$

If the government is budget constrained, receipts and expenses are equal and $\beta = s\frac{L_R}{L}$. If the government is financed by loan, it does not need taxes and $\beta = 0$. In both cases, *the subsidy on wages of Red workers raises wages of Reds by its amount whatever the firm.* The method of funding only changes the impact of the policy on wages of Greens. In the case of loan funding, the wage of Greens does not vary and their situation is identical. If the government has to balance receipts and expenses, subsidies are bared by all workers, so it is equivalent to a tax on the hiring of Green workers.

Wage equalization

When a government leads a policy of wage equalization, firms have to offer the same wage to workers equally productive. In this model, the productivity of workers is identical whatever the group they belong to. Then, firms have to set the same wage for the Greens and the Reds. Their utility function becomes $U_i = p(L_{Gi} + L_{Ri}) - w_i L_{Gi} - (w_i + d_i)L_{Ri} = pL_i - w_i L_i - d_i L_{Ri}$. The maximization of the utility of firms conducts to the following reaction function:

$$w_i = \frac{1}{2}\left(p - \frac{t}{4} + \bar{w}_i - \gamma d_i\right)$$

The firms set a unique wage and the wage gap totally vanishes within each firm. The wages depend now on the proportion of Reds in the working population. The more they are, lower are the wages. In the configuration A, the wage differential between unprejudiced and prejudiced firms is $\frac{1}{3}\gamma d$. It reaches $\frac{1}{2}\gamma d$ in the configuration B. In both cases, the Reds earn a higher wage than without the wage equalization policy because $\gamma < 0$ but the wages of Greens are lower. Moreover, the unprejudiced firms employ more Green workers than the prejudiced firms due to a higher wage. Nevertheless, the wages of Greens are lower than without the policy.

The disappearance of the direct impact of discrimination on wages within firms affects negatively the well-being of the majority. Consequently, in a democratic system, the government is not incited to reduce discrimination for fear of missing a re-election.

Affirmative action

Affirmative action consists in imposing quota of workers from the minority on firms. It secures a minimum level of employment of workers discriminated

against in each firm. Suppose that the aim is to employ a minimal proportion of τ Red workers in each firm. Assume $\tau \leq \gamma$ to obtain a solution and τ is superior of the proportion of Red workers in the prejudiced firm setting the lowest wage. The firms maximize their utility as in Section 2.2 under constraint that $L_{Ri} \geq \tau$.

The presence of quota on Red workers affects all wages in all firms. When the government leads an affirmative action policy, the negative impact of transportation costs on wages of Greens is higher than without the policy, but it is lower for Reds in both types of firms. The discriminatory term impacts negatively the wage of Greens but positively the wage of Reds. *The general impact is also positive on the wage of workers discriminated against and negative on the wage of workers belonging to the majority.* In the case A, the effect on wages of workers of prejudiced firms is two times higher than the one on wages of workers of unprejudiced firms. The variations of the transportation costs are explained by the correlation between the numbers of workers of both types. Indeed, a discriminatory firm has to employ relatively more Reds and/or fewer Greens. Then the wage of Reds has to be higher to attract more Red workers and/or the wage of Greens has to be lower because the location of the last Green employed is shorter.

As the Greens are the majority of the working population, governments do not want to risk to miss the re-election and have no incentive to lead this policy.

To conclude this section, a high minimum wage solves the problem but is economically inefficient. A Red workers employment subsidy does not lead to a first best solution and has no impact on the wage of Greens only in the case of a funding by loan. The more efficient policies are the wage equalization and the affirmative action however the governments are not incited to lead them because of the loss of well-being of the majority.

5 Concluding Remarks

This paper shows that a taste-based model of discrimination can match the stylized facts of persistence of discrimination. The model is based on heterogeneity of workers' preferences, which leads to an employers' non negligible market power over their workers. This assumption induces a wage gap, which will not disappear. Indeed, the unprejudiced firms make non-zero

profits due to the existence of discriminatory firms in the market and they are not prompted to drive out prejudiced firms because they are a source of profit. Contrary to most models of the literature, there is no segregation between groups and both types of workers are hired by all the firms. Last but not least, the existence of only one prejudiced firm in the market leads to a wage gap between Reds and Greens without any differences in observable productive abilities. The wage of Reds is not unique and depends on the concentration of unprejudiced firms.

A higher competition on the market reduces the wage gap but is not sufficient to make it disappear. A complementary policy is necessary but the governments are not incited to lead it due to electoral implications.

In this model, firms are assumed homogeneous. A model with heterogeneous firms and productivity level could be implemented. It is also natural to expect the more productive firms to have higher sales, which requires a larger labor force. Being more productive, these firms can afford to pay higher wages to attract the additional workers they need. Then, the wages of Greens follow a distribution and are not identical whatever the firm. However the results would be unchanged.

Unemployment issues are a future extension of this paper. Indeed, in the actual model, unemployment leads to monopsony. Heterogeneous reservation wage is a solution to introduce unemployment and keep the interest of the model.

References

Arrow, K. J. 1973. The Theory of Discrimination. *Pages 3–33 of:* Ashenfelter, O., & Rees, A. (eds), *Discrimination in Labor Markets*. Princeton University Press.

Becker, G. 1957. *The Economics of Discrimination*. University of Chicago Press.

Bhaskar, V., & To, T. 2003. Oligopsony and the distribution of wages. *European Economic Review*, **47**(2), 371–399.

Bhaskar, V., Manning, A., & To, T. 2002. Oligopsony and Monopsonistic Competition in Labor Markets. *Journal of Economic Perspectives*, **16**(2), 155–174.

Black, D. A. 1995. Discrimination in an Equilibrium Search Model. *Journal of Labor Economics*, **13**(2), 309–33.

Black, S.E., & Brainerd, E. 1999. Importing equality? The effects of increased competition on the gender wage gap. *Federal Reserve Bank of New York*, Staff Reports.

Black, S.E., & Strahan, P.E. 2001. The Division of Spoils: Rent-Sharing and Discrimination in a Regulated Industry. *American Economic Review*, **91**(4), 814–831.

Hamilton, J., Thisse, J.-F., & Zenou, Y. 2000. Wage Competition with Heterogeneous Workers and Firms. *Journal of Labor Economics*, **18**(3), 453–472.

Phelps, E. 1972. The Statistical Theory of Racism and Sexism. *American Economic Review*, **62**(4), 639–651.

Salop, S. C. 1979. Monopolistic Competition with Outside Goods. *The Bell Journal of Economics*, **10**(1), 141–156.

Thisse, J.-F., & Zenou, Y. 1995. Appariement et concurrence spatiale sur le marché du travail. *Revue Economique*, **46**(3), 615–625.

Wauthy, X., & Zenou, Y. 1999. Le rôle de l'hétérogénéité des agents sur le marché du travail en concurrence imparfaite. *Revue Economique*, **50**(5), 965–984.

A Impact of competition

In the layout described in Figure 3, a prejudiced firm enters the market and sets up between the both unprejudiced firms. Then the wages offered to the Reds are:

$$\begin{aligned} w_{R1} = w_{R2} &= p - \frac{47}{152}t - \frac{7}{19}d \\ w_{R3} = w_{R4} &= p - \frac{41}{152}t - \frac{15}{19}d \\ w_{R5} &= p - \frac{33}{152}t - \frac{13}{19}d \end{aligned}$$

If this fifth firm chose to set up between the both prejudiced firms, the wages offered to the Reds would be:

$$\begin{aligned} w_{R1} = w_{R2} &= p - \frac{41}{152}t - \frac{5}{19}d \\ w_{R3} = w_{R4} &= p - \frac{47}{152}t - \frac{15}{19}d \\ w_{R5} &= p - \frac{33}{152}t - \frac{17}{19}d \end{aligned}$$

B Policy implications

B.1 Employment subsidies

When prejudiced and unprejudiced firms alternate (A), equilibrium wages are

$$\begin{aligned} w_{R1} = w_{R2} &= p - \beta - \frac{t}{4} + \frac{1}{3}(s-d) \\ w_{R3} = w_{R4} &= p - \beta - \frac{t}{4} + \frac{2}{3}(s-d) \end{aligned}$$

and when identical firms are side-by-side (B), equilibrium wages are

$$\begin{aligned} w_{R1} = w_{R2} &= p - \beta - \frac{t}{4} + \frac{1}{4}(s-d) \\ w_{R3} = w_{R4} &= p - \beta - \frac{t}{4} + \frac{3}{4}(s-d) \end{aligned}$$

B.2 Minimum wage

When prejudiced and unprejudiced firms alternate (A), equilibrium wages are

$$\begin{aligned} w_{R1} = w_{R2} = &\quad \tfrac{1}{2}\left(p - \tfrac{t}{4} + w_m\right) \\ w_{R3} = w_{R4} = &\quad w_m \end{aligned}$$

and when identical firms are side-by-side (B), equilibrium wages become

$$\begin{aligned} w_{R1} = w_{R2} = &\quad \tfrac{2}{3}\left(p - \tfrac{t}{4} + \tfrac{1}{2}w_m\right) \\ w_{R3} = w_{R4} = &\quad w_m \end{aligned}$$

B.3 Wage equalization

When prejudiced and unprejudiced firms alternate (A), equilibrium wages are

$$\begin{aligned} w_1 = w_2 &= p - \frac{t}{4} - \frac{1}{3}\gamma d \\ w_3 = w_4 &= p - \frac{t}{4} - \frac{2}{3}\gamma d \end{aligned}$$

and when identical firms are side-by-side (B), equilibrium wages become

$$\begin{aligned} w_1 = w_2 &= p - \frac{t}{4} - \frac{1}{4}\gamma d \\ w_3 = w_4 &= p - \frac{t}{4} - \frac{3}{4}\gamma d \end{aligned}$$

B.4 Affirmative action

When prejudiced and unprejudiced firms alternate (A), equilibrium wages are

$$\begin{aligned} w_{G1} = w_{G2} = &\quad p - \tfrac{t}{4}\left(1 + \tfrac{\tau(\tau(1-\gamma)-\gamma(1-\tau))}{\tau^2(1-\gamma)+\gamma(1-\tau)^2}\right) - \tfrac{1}{3}\left(\tfrac{(1-\tau)\tau\gamma}{\tau^2(1-\gamma)+\gamma(1-\tau)^2}\right) d \\ w_{R1} = w_{R2} = &\quad p - \tfrac{t}{4}\left(1 - \tfrac{(1-\tau)(\tau(1-\gamma)-\gamma(1-\tau))}{\tau^2(1-\gamma)+\gamma(1-\tau)^2}\right) - \tfrac{1}{3}\left(1 - \tfrac{(1-\tau)^2\gamma}{\tau^2(1-\gamma)+\gamma(1-\tau)^2}\right) d \\ w_{G3} = w_{G4} = &\quad p - \tfrac{t}{4}\left(1 + \tfrac{2\tau(\tau(1-\gamma)-\gamma(1-\tau))}{\tau^2(1-\gamma)+\gamma(1-\tau)^2}\right) - \tfrac{2}{3}\left(\tfrac{(1-\tau)\tau\gamma}{\tau^2(1-\gamma)+\gamma(1-\tau)^2}\right) d \\ w_{R3} = w_{R4} = &\quad p - \tfrac{t}{4}\left(1 - \tfrac{2(1-\tau)(\tau(1-\gamma)-\gamma(1-\tau))}{\tau^2(1-\gamma)+\gamma(1-\tau)^2}\right) - \tfrac{2}{3}\left(1 - \tfrac{(1-\tau)^2\gamma}{\tau^2(1-\gamma)+\gamma(1-\tau)^2}\right) d \end{aligned}$$

and when identical firms are side-by-side (B), equilibrium wages become

$$
\begin{aligned}
w_{G1} = w_{G2} = &\quad p - \tfrac{t}{4}\left(1 + \tfrac{\tau(\tau(1-\gamma)-\gamma(1-\tau))}{\tau^2(1-\gamma)+\gamma(1-\tau)^2}\right) - \tfrac{1}{4}\left(\tfrac{(1-\tau)\tau\gamma}{\tau^2(1-\gamma)+\gamma(1-\tau)^2}\right) d \\
w_{R1} = w_{R2} = &\quad p - \tfrac{t}{4}\left(1 - \tfrac{(1-\tau)(\tau(1-\gamma)-\gamma(1-\tau))}{\tau^2(1-\gamma)+\gamma(1-\tau)^2}\right) - \tfrac{1}{4}\left(1 - \tfrac{(1-\tau)^2\gamma}{\tau^2(1-\gamma)+\gamma(1-\tau)^2}\right) d \\
w_{G3} = w_{G4} = &\quad p - \tfrac{t}{4}\left(1 + \tfrac{2\tau(\tau(1-\gamma)-\gamma(1-\tau))}{\tau^2(1-\gamma)+\gamma(1-\tau)^2}\right) - \tfrac{3}{4}\left(\tfrac{(1-\tau)\tau\gamma}{\tau^2(1-\gamma)+\gamma(1-\tau)^2}\right) d \\
w_{R3} = w_{R4} = &\quad p - \tfrac{t}{4}\left(1 - \tfrac{2(1-\tau)(\tau(1-\gamma)-\gamma(1-\tau))}{\tau^2(1-\gamma)+\gamma(1-\tau)^2}\right) - \tfrac{3}{4}\left(1 - \tfrac{(1-\tau)^2\gamma}{\tau^2(1-\gamma)+\gamma(1-\tau)^2}\right) d
\end{aligned}
$$