The Effect of Market Structure and Public Policy on Segregation and Discrimination.

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Abstract

We build a new theoretical framework of statistical discrimination which reproduces observed discriminatory phenomena (wage discrimination and occupational segregation) in a very simple model. This framework allows us to test the effects of different market structures and public policies to reduce these phenomena. Firms maximize their mean-variance profit function to determine the number of workers to be employed and their wages. The difference between groups of workers is the noise of productivity. We study various labor market structures in this paper. The main results highlight perverse effects that could arise from the classic public policies (equal pay and quota). We propose other policies which are at least as efficient as classic public policies but with less or no perverse effects. Finally, we show that more the labor market is competitive, less discriminatory phenomena operate. Nevertheless competition does not erase these phenomena.

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1 Introduction

Over the last decades, the rising participation of women in the labor market, as well as migration of minorities have changed the composition of workers in industrialized countries. The different socio-cultural categories suffer from disparities of treatment in the labor market. These disparities of treatment are subject to political debate and represent an important socioeconomic challenge in most industrialized countries. Defenders of rights of minorities argue that employers prefer workers coming from the majority group. Angel Gurría (OECD Secretary General) commented:

> "Labor market discrimination is still a big obstacle".

Nevertheless, for more than thirty years, most industrialized countries have passed legislations to regulate discriminatory phenomena, and regularly update to make them more effective. Governments have a long term experience in the fight of these phenomena. These policies have given results to reduce them but problems still occur. These phenomena appear not to be completely removed by these policies. The problem seems to have other sources in addition to traditionally advanced ones.

Discriminatory phenomena seem to be a paradox in the labor market. In fact, majority workers are, at the same time, more employed and have larger wages. This appears paradoxical since a quantity/price relation is normally decreasing. The following model give a way to rationalize this paradox.

It is thus important to understand the fundamental causes of these discriminatory phenomena, to bring adequate and targeted solutions to this major problem. These solutions must act directly on causes rather than just visible consequences of discriminatory phenomena, to avoid creating new problems while trying to solve others.

To that end, we develop a theoretical framework of statistical discrimination to study wage discrimination and occupational segregation in a mean-variance environment. The particularity is that the model enables to study effects of various policies and market structures on both wage discrimination and occupational segregation at the same time. We take simple reduced form functions to model labor supply and firms' behavior. This allows for various policy analyses because the model can be solved under various regimes. We use it to analyze the impact of public policies on discriminatory phenomena and on labor market's efficiency.

There are two categories of workers belonging to populations with the same mean of productivity but with a larger variance (noise) for the minority group. Firms maximize their mean-variance profit function to determine the number of hiring and the wages. Various labor market structures are explored in this study, the market for goods and services remaining competitive.

The main results indicate that perverse effects could arise from classic public policies. We show that classical policies can cause different consequences on the efficiency of the labor market. Quota keeps the efficiency whereas equal pay policy creates shortage and unemployment depending on the groups. We also explore other policies to reduce discriminatory phenomena with less perverse effects. We show competition has favorable effects to reduce discriminatory phenomena. Nevertheless, it is not enough to erase them. We also put forward how it is important to consider the labor supply in the set up to analyze public policies; some effects come directly from the labor supply and could be forgotten.

This paper is organized as follows. First, we review public policies used by governments and the literature on discriminatory phenomena. Then, we develop the baseline model and test the impact of classical public policies and labor market structures. Finally, we present other policies to act versus discriminatory phenomena.

2   Laws on discriminatory phenomena

In this section we review how applied anti-discriminatory laws in most of industrialized countries were.

Anti-discriminatory laws through the world arise from different reasons and mostly in countries which consider themselves as immigration lands. Education, language discrimination, colonial migrant welfare, medical issues and social status are the main reasons which lead governments to vote laws to reduce discriminations.

Regarding the historic of anti-discriminatory legislations, we observe the same kind of evolution in the industrialized countries. We denote three phases:

- Laws to define

- Laws to regulate

- Laws to educate

Most of industrialized countries are actually in phase two or three.

The first step was to define what prohibited discrimination is. We can find as many definitions as there are countries. Some countries, such as Netherland or Canada, are targeting some populations which can benefit from these laws, while other countries have a more universal application of anti-discriminatory laws (France). With these laws, governments act to put limits on what kind of discrimination are allowed regarding gender, origin, etc. These laws had a very limited impact because they do not foresee means of control of the application of legislations. Employers had no credible incentives to change their behavior.

From this report, governments started a second phase of legislation. They imposed some regulation on the labor market and principally on the public labor market. Differences between public and private sectors are still existing in some countries (United States, Canada, ...). We can separate three kind of actions:

- On wage

- On occupation

- To survey

The three kinds of actions are not used by all countries, but in general they are mixing them to reduce discriminatory phenomena.

Governments took actions on wage with equal pay policies which impose firms to make no difference in the wage of workers because of their gender, origin, etc. The application of this kind of regulation had a relative success since wage discrimination decreased but still exists.

Governments took actions on occupation with positive discrimination and quotas. The positive discrimination consists in choosing systematically a minority candidate when there are equal skills' candidates. Quotas consist on imposing firms to hire a minimum proportion of minority workers independently of skills of the candidates. Proportions of minorities arise with these legislation but these actions have not erase discriminatory phenomena. Equal pay policy, quotas and positive discrimination seem to be only partial solutions.

The main criticism on laws to define discrimination was the incapacity to control the behavior of firms. Many governments (United States, Great

Britain,...) impose a statistical survey of the labor market which verifies the situation on minority populations inside the labor market. This statistical survey appears to be the mean of control of governments to give a chance to minorities to benefit from anti-discriminatory laws.

Recently some governments have entered in a third phase and are trying another strategy to reduce discriminatory phenomena. They are voting laws that should educate firms not to use discrimination. For example, the authorities in charge of labor discrimination in France and Great Britain have the goal to promote equality on the labor market. Another example of the third phase is the one in Netherlands. Netherlands stops anti-discriminatory policies claiming that Netherlands' firms have learned to not discriminate with almost twenty five years of anti-discriminatory legislations. At this moment, we cannot conclude on the results of these education policies because they are too young. However, these new strategies show that governments change their minds and it may be the sign that governments act versus statistical discrimination in addition to taste-based discrimination on the labor market.

3 Literature

The economic analysis of discriminatory phenomena started with Becker (1957) and Arrow (1972). They laid the first models of discriminatory phenomena by pointing differences in preferences as being the cause of the discriminatory behavior of the firms. This is the taste-based model of discrimination. One of the major critics of this approach initiated by Becker and Arrow is that preference for the majority group is not justified by clear fundamentals.

Phelps (1972) and Arrow (1972, 1973) initiated another way of thinking: the idea of "statistical discrimination". Statistical discrimination argues that employers have an information problem about the candidates. The costs to assess the candidates perfectly are prohibitive. Employers base their decision on all available information about candidates including visible socio-cultural characteristics. Discrimination may arise from the fact that employers have unequal statistical knowledge about various socio-cultural groups.

In these two approaches, there are models of "second generation" which combine discriminations with another mechanism. The goal is to combine discriminatory phenomena with the imperfections of another mechanism in order to refine the explanation of these phenomena. The level of competition on the

labor market can probably also plays a part in discriminatory phenomena. Indeed, competition has an impact on wages and on the number of hiring. One of the goals of this paper is to look at the impact of the level of competition in the labor market on discriminatory phenomena.

In addition, there is a literature on the employment of risky workers, without reference to socio-cultural criteria, which can supplement statistical discrimination literature. A contribution of interest is that of Hendricks, DeBrock and Koenker (2003). They study the decision of hiring workers under uncertainty. However, they focus on the relationship between prior beliefs and realized outcomes, and generate empirical predictions. They do not analyze occupational or wages differentiation. Wages are regressed only to understand the impact of the rank in which the worker was chosen and his experience. However, some ideas and assumptions are very close with our paper (risk-aversion of firms, etc...).

Discriminatory phenomena we analyze can be described as being wage discrimination and a segregation, i.e. the difference in wages for various socio-cultural groups having the same productivity and the under-representativeness of socio-cultural groups within firms.

The studies on statistical discrimination address, in general, these two issues separately, i.e. wage discrimination or segregation. However, since they have common causes, it is likely that these two phenomena are interdependent. Economic surveys in various fields[1] confirm interdependence between prices and quantities in a market. We will study jointly the two phenomena. In addition, conventional wisdom argues that an equal pay policy would bring up the wages of the minority group to the level of that of the majority, whereas nothing proves that the convergence of the wages would be done in this direction. Another contribution of this paper is to understand better the impact of the public policies on the discriminatory phenomena.

Part of the studies on statistical discrimination concentrates primarily on wage discrimination. One of the most relevant contributions is the one of Aigner and Cain (1977) who was the first to introduce the notion of risk aversion into the hiring process. They rationalized the fact that the average wage of the minority group is lower in spite of an equal productivity.

Among the economic surveys on segregation within statistical discrimination, the studies of Schwab (1986), Cornell and Welch (1996) and Morgan and

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[1] Theoretical economics, Industrial Organization,...

Vàrdy (2009) appear relevant. Schwab (1986) which studies efficiency of statistical discrimination do an analysis through differences in labor supply elasticity and concludes that statistical discrimination is unambiguously inefficient in that case. Cornell and Welch (1996) show that the hiring decision goes in a very strong proportion to the majority because of the difficulty to evaluate candidates, the hiring decision goes in a very strong proportion to the majority. In their analysis of public policies, they guess that an equal wage policy could go against the representativeness of the minorities. Morgan and Vàrdy (2009) develop a job search model of statistical discrimination. They show that the minority group is under-represented and that they are fired more often. In addition, they highlight levers of interest to influence diversity in the firms: firing cost, interviewing cost and the opportunity cost of hiring.

The literature states doubts about a possible risk-aversion of the firms.[2] Standard industrial organization and labor economics' frameworks consider the firm risk-neutral. This standard vision presumes that managers can fully hedge risks on the financial market and keep a risk-neutral behavior on the other markets where they interact. However, it is possible to challenge this view of risk-neutrality in markets other than financial[3]. Ayers and Siegelman (1995) and Goldberg (1996) show evidences of statistical discrimination based on higher moments of a distribution than mean. Dickinson and Oaxaca (2009) examine different measures of risk to show the existence of a second-moment statistical discrimination in the labor market. This paper concludes that statistical discrimination is under-estimated if risk-aversion is not included in the modeling. Besides, when we observe the hiring behavior of firms, the doubts on risk-aversion are reduced. Indeed, many firms do not hesitate to invest massively in recruitment processes, which multiply costly examinations and interviews in order to acquire more accurate information[4]. These processes are very expensive and their goal is to reduce uncertainty on the candidates. This shows that firms are afraid to make a bad choice in their hiring decisions. Otherwise, fully hedging the recruitment in financial market is complex and appears non realistic. Statistical discrimination theory considers the importance of statistical knowledge in the hiring decision. This statistical adding in the decision mechanism gives to the manager an opportunity of hedging and an additional utility to research costs using them also as coverage information. Indeed, we can consider research costs as sunk costs after been paid to discern best candidates. This information can be used to hedge the "hiring risk" without other cost, while financial hedging generates additional costs. Firms can use human resources as a risk adjustment variable. To supplement this explanation, hiring decisions are

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[2] As early as 1977, Aigner and Cain expressed doubts about risk aversion of firms.

[3] Mirman and Santugini (2008) expose reasons to challenge this classical assumption : Cost of diversification, high variability of market indicators, systematic risks and the recent crisis.

[4] See McKinsey & Company or Nestlé Waters North America career websites, for examples of this hiring process :

http://www.mckinsey.com/careers/Home.aspx

http://careers.nestle-watersna.com/WhatItsLike/HiringProcess.aspx

not taken by the whole firm. These decisions are made by a manager of the firm. We can consider the manager as risk-averse in sense of his personal behavior. He has to give accounts of the overall performance of workers and this orientates its decisions. We consider risk-aversion of managers weigh on hiring decisions of firms. Finally other papers as, Hendricks, DeBrock and Koenker (2003) has used risk-aversion in their modeling in statistical discrimination studies.

4 Model

4.1 Workers

There are 2 groups j of workers in the economy, $j \in (1; 2)$. Group 1 represent the majority in the population (white, male, experienced worker, ...) and group 2 the minority (black, female, without experienced worker, ...). We assume that workers of the group 2 have a larger standard deviation than ones of group 1. The size of each group has no impact on the model; they have not to be comparable.

Suppose that the inverse labor supply curves of each group of workers are the same:[5],[6]

$$w_j = en_j + f \tag{1}$$

where w_j is the wage of a worker of group j, n_j the number of hiring in group j [7] and e and f the parameters of the affine labor supply curve. f could be consider as the lowest reservation wage.

Each worker from group j produces $y_j \sim (\overline{y}; \sigma_j)$. All workers in the economy have the same average productivity $\overline{y}$.[8] So, the results are not driven by a workers' group difference on productivity. This assumption could be relaxed

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[5] This hypothesis is posed to control that the effects do not result from a difference in labor supply. The goal of this assumption is not to simplify the model. The goal is to keep no differentiation between the minority and majority workers and thus to isolate the effect of public policies and market structures. This assumption can be relaxed without any problem.

[6] We suppose an affine supply curve to simplify the resolution. This function could be changed without any problem for intuitions as long as we keep a monotone increasing function.

[7] n_j could also be interpreted as the number of hours to be work by workers from group j

[8] This assumption can be found in a few papers in the literature as in Hendricks, DeBrock, Koenker (2003).

without any consequences for the analysis. The key difference between groups is standard deviations. We interpret it as the difficulty to assess the productivity of a worker from the minority group[9] or a specific risk on productivity.[10] We assume that $\sigma_2 > \sigma_1 > 1$.

4.2   Firms

The standard deviation σ_j is known to the firm. We could interpret it as a noise in the observation of productivity or an evaluation of the specific risk of workers in group j. This observed value of σ_j is not necessarily the true value[11]. Cultural and statistical knowledge of the manager which evaluates candidates could play a role on the observed value of σ_j. We assume that firms have the same evaluation of σ_j. Given that, being from the minority group is perfectly observable, it is evident that the firm will integrate all the available information in the hiring decision.

The manager is risk-averse[12] and tries to maximize a mean-variance profit function taking into account labor supplies for each group of workers. The market for goods and services is assumed perfectly competitive. The price of goods is determined by the market and is normalized to 1, without loss of generality.

The inverse labor supply curves are known by the firm and it chooses numbers of workers (n_1, n_2) to maximize :

$$\pi_{MV} = E[\pi] - \alpha VAR[\pi] \tag{2}$$

$$\iff \pi_{MV} = E\left[\sum_{j=1}^{2}(n_j(y_j - w_j))\right] - \alpha VAR\left[\sum_{j=1}^{2}(n_j(y_j - w_j))\right] \tag{3}$$

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[9] Various papers as Phelps (1972) or Morgan and Vàrdy (2009) used this interpretation.

[10] The idea behind the specific risk is that the firm, itself, can identify specific risks for each group (due to a different legislation, a different education system, a different culture,...).

[11] The true values of σ_j are not necessarily different between groups. Only observed values have to be different.

[12] Risk-aversion was used in many papers on discriminatory phenomena as Aigner and Cain (1977) Hendricks, DeBrock and Koenker (2003) and Dickinson and Oaxaca (2009). See more details in the literature section.

The profit function can be rewritten as follows[13]:

$$\pi_{MV} = n_1 \left(\overline{y} - w_1 \right) + n_2 \left(\overline{y} - w_2 \right) - \alpha \left(n_1^2 \sigma_1^2 + n_2^2 \sigma_2^2 \right) \tag{4}$$

The associated wages are determined by this maximization because labor supply curves are included in the knowledge of firms when they choose the number of workers. Wages come from the correspondence between number of workers and wages rising from labor supplies.

5 Segregation and discrimination in a monopsony labor market

5.1 Optimal hiring behavior

The optimal hiring behavior of the firm is determined by the following maximization program.

$$\max_{n_1, n_2} n_1 \left(\overline{y} - f - e n_1 \right) + n_2 \left(\overline{y} - f - e n_2 \right) - \alpha \left(n_1^2 \sigma_1^2 + n_2^2 \sigma_2^2 \right) \tag{5}$$

Optimal hiring decisions are derived in the appendix. We get:

$$n_1^* = \frac{\overline{y} - f}{2 \left(e + \alpha \sigma_1^2 \right)} \tag{6}$$

$$n_2^* = \frac{\overline{y} - f}{2 \left(e + \alpha \sigma_2^2 \right)} \tag{7}$$

Associated wages with these decisions are:

$$w_1^* = e \frac{\overline{y} - f}{2 \left(e + \alpha \sigma_1^2 \right)} + f \tag{8}$$

$$w_2^* = e \frac{\overline{y} - f}{2 \left(e + \alpha \sigma_2^2 \right)} + f \tag{9}$$

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[13] We suppose that covariances are equal to zero because the differentiation made by the firm between majority and minority workers are specific characteristics. This does not seem to be a strong assumption.

Proposition 1 *Firm always employ workers from both groups.*

Firm hires workers of both groups. There is no case where only one group is hired.[14] Contrary to many results from gender and race discrimination studies, our model predicts that there is always worker diversity but we do not find occupational equality. The fact that the firm engages only workers of a specific group is a traditional limitation of the modeling of discriminatory phenomena. Our model does not suffer from this limitation and is thus consistent with reality on this point.

Proposition 2 *The number of hiring and associated wage in a group do not depend on the number of hiring or associated wage in the other group.*

There is no interdependence between groups. A majority worker cannot take the place of a minority worker. The intuition behind is that the firm hire minority and majority workers as long as there is profit to make on the competitive goods and services market. The interest of this proposition comes owing to the fact that firm makes no ranking concept between groups of workers. If a group is less represented, this is because the firm considers that there will be no longer profit to make by hiring more workers of this group. This proposition depends on the structure of the goods and services market. A non-competitive structure constrains the quantity of goods and services that the firm can bring to the market. Then, this proposition could become false.

Proposition 3 *The number of workers and wage are always higher for the group with lower σ, which corresponds to the majority ($n_1^* \geq n_2^*$ and $w_1^* \geq w_2^*$).*

This result shows that the model is robust with the fact that a group of workers can at the same time be better paid and more employed. It is very important since it allows modeling the observed paradox, i.e. the quantity/price relation comparing minority and majority workers[15] and thus to be consistent with reality.

This statement depends only on the noise in the observation of productivity or a specific risk. No taste for discrimination of the firm is responsible for these differences between both categories. The intuition behind this result is the same than in the allocation of shares in the determination of a financial portfolio. Firm

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[14] n_1^* and n_2^* are always strictly positive if parameters are finite.
[15] See introduction for more details on this paradox.

makes arbitration between the impact of a higher observed standard deviation on productivity and the capacity of reducing the wage of minority workers, and a larger wage and a smaller observed standard deviation for majority workers. A risk neutral firm or one that makes no difference in the standard deviation pays the same wage and hires an equal number of workers in both groups.

The interest of our baseline model resides in the rationalization of the observed paradox in the labor market. This model appears very close to the reality because it does not suffer from results which are not observed in the reality as in a large part of the literature[16]. The most important quality of this model is that it allows testing several public policies and market structure and predicts their consequences on discriminatory phenomena.

5.2 Implications of Equal Pay Policy and Quotas to fight discriminatory effects on labor market

Governments in industrialized countries care more and more about discrimination and segregation in the labor market. Affirmative action policies in the United States or creation of the HALDE in 2004 in France are examples of this awareness. In this section, we study the impact of equal pay and quota policies. These policies are implemented by governments to regulate the labor market by acting directly on the observed consequences of discrimination.

5.2.1 Equal Pay Policy

The main preoccupation of several governments, minority rights associations and trade unions is to act directly for Equal Pay. Many governments have voted laws to equal wage of majority and minority groups[17].

Equilibrium with Equal Pay

To understand the impact of an equal pay policy, we need to add the constraint that $w_1 = w_2$. The inverse labor supplies become a generalized inverse

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[16] only one category employed, only quantity or only wage which differs, etc.
[17] See Section 2

labor supply. This labor supply allows having only one equilibrium wage for both categories. The inverse labor supply could become:

$$w = \frac{e}{2}(n_1 + n_2) + f \tag{10}$$

Others market conditions stay the same. Mean-variance profit function becomes:

$$\pi_{MV} = (n_1 + n_2)(\overline{y} - w) - \alpha\left(n_1^2\sigma_1^2 + n_2^2\sigma_2^2\right) \tag{11}$$

Firm chooses (n_1, n_2) to maximize the profit.

The optimal hiring behavior of the firm is determined by the following maximization program.

$$\max_{n_1, n_2} (n_1 + n_2)\left(\overline{y} - f - \frac{e}{2}(n_1 + n_2)\right) - \alpha\left(n_1^2\sigma_1^2 + n_2^2\sigma_2^2\right) \tag{12}$$

Optimal hiring decisions are derived in the appendix. We get:

$$n_1^{\cdot} = \frac{1}{2}\frac{\left(\sigma_1^2 + \sigma_2^2\right)(\overline{y} - f)}{2\alpha\sigma_1^2\sigma_2^2 + e\left(\sigma_1^2 + \sigma_2^2\right)} \tag{13}$$

$$n_2^{\cdot} = \frac{\sigma_1^2(\overline{y} - f)}{2\alpha\sigma_1^2\sigma_2^2 + e\left(\sigma_1^2 + \sigma_2^2\right)} \tag{14}$$

Common wage[18] is then:

$$w' = \frac{e}{2}\frac{\left(\sigma_1^2 + \sigma_2^2\right)(\overline{y} - f)}{2\alpha\sigma_1^2\sigma_2^2 + e\left(\sigma_1^2 + \sigma_2^2\right)} + f \tag{15}$$

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[18] Because of the labor market unbalance, the value of the equal pay wage could differ depending on the wage setting mecanism. In this paper, workers behavior is not built. We suppose that workers observe the given wage and choose to participate or not to the job market.

Consequences of Equal Pay Policy

Proposition 4 *The equilibrium wage under a system of equal pay is between wages determined by the baseline model.*

$$w_2^* \leq w' \leq w_1^* \tag{16}$$

Under equal pay policy, the minority workers wage does not arise to the previous value of the male workers competitive wage. Both wages converge to an intermediate. This proposition shows that a simple equal pay policy is not sufficient to bring the minority wage to the level of the wage of majority workers before the policy. Moreover there is a perverse effect since the wage of majority workers decreases. Implications on social welfare seem not to be as clear as people usually think.

Proposition 5 *Numbers of workers from minority and majority groups hired decrease under a system of equal pay ($n_1' \leq n_1^*$, $n_2' \leq n_2^*$).*

This proposition can appear peculiar but the cause of this particularity is that the supply and the demand for workers from minority and majority groups do not balance. We show that there is a serious perverse effect on numbers of workers in the firm. With the desire to equalize wages, a government policy of equal pay forgets completely the relation quantity / price imposed by the labor demand in the labor market which does not change with the policy. This creates an "injustice" for another "injustice" on the labor market. An equal pay policy creates a shortage of workers from the majority and unemployment for minority workers.

The interpretation of this situation is that the government imposes on the firm to pay workers from minority and majority groups at the same price, but the value for the firm does not change. At this new labor price:

- the firm wants less workers from the minority group because of the rise of their wage ; this rise causes more minority workers to apply for a job. These two effects explain the unemployment of workers from the minority group.

- the firm wants more workers from majority group because of the decline of the majority workers price ; this decline causes less majority workers to apply for a job. These two effects explain the shortage of workers from the majority group.

The model shows that imposing convergence between the wage of minority workers and the wage of majority workers has an important impact on the number of workers in the workplace. The result of this kind of policy is the reduction of the number of workers in the firm. The firm is less compensated for the lack of knowledge and the specific risks of minority groups and prefers hiring in the majority group. Labor supply deviates completely from the reality of the market. This policy completely unbalances the labor market in creating a shortage of workers from the majority group and unemployment for minority workers. The effect on wages is to reduce them for majority and improve for minority.

There is a last effect induced by the equal pay policy. The firm produces less than before the set up of the policy. The level of production on the goods and services market decreases because fewer workers are hired to produce.

Voting laws that reduce the capacity to lower wages of workers from minority groups, without taking into account the total number of workers, seems to have negative consequences. Governments need to keep in mind this perverse effect when deciding on equal pay laws. Controlling wages and influencing choice of workers groups seem to be an excessive intervention of the government and does not appear as the best way to equalize conditions of groups in the labor market.

5.2.2   Quotas

Another classic policy used to reduce discrimination in the labor market is to institute a quota in the hiring of workers. This policy constrains the firm to hire a minimum of workers from each group.

Modelling quotas

The number of workers has to be the same in each group. The number of workers has to set as follows[19]:

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[19]The concept of quota is very strong in this assumption. We could study easily flexible quotas ($n_2 \geq \theta n_1$), but results and interpretation would not change much.

$$n_1 = n_2 = n \tag{17}$$

Others market conditions stay the same. Mean-variance profit function becomes:

$$\pi_{MV} = n\left(\overline{y} - w_1\right) + n\left(\overline{y} - w_2\right) - \alpha\left(n^2\sigma_1^2 + n^2\sigma_2^2\right) \tag{18}$$

The choice variable of the maximization is n.

The optimal hiring behavior of the firm is determined by the following maximization program.

$$\max_{n} 2n\left(\overline{y} - f - en\right) - \alpha n^2\left(\sigma_1^2 + \sigma_2^2\right) \tag{19}$$

First order conditions of this maximization problem[20] yields:

$$n" = \frac{\overline{y} - f}{2e + \alpha\left(\sigma_1^2 + \sigma_2^2\right)} \tag{20}$$

Wages associated are:

$$w_1 = w_2 = w" = e\frac{\overline{y} - f}{2e + \alpha\left(\sigma_1^2 + \sigma_2^2\right)} + f \tag{21}$$

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[20]See appendix for details.

Consequences of quotas

Proposition 6 *Wages of workers from minority and majority groups are equal under a quota policy.*

The quota policy has a double impact on the labor market. In addition to ensuring occupational equality, this measure allows the convergence of wages of both groups. This policy allows achieving both pay and occupational equality[21]. This policy has the consequences of forcing the firm to allocate uniformly risks on the wage of workers regardless of their group. The quota policy gets rid of segregation and wage discrimination between minority and majority groups.

This policy thus seems to meet the objectives to cancel the discriminatory phenomena. However, it is important to ensure of consequences on occupation and wage levels of both workers' groups.

Proposition 7 *The number of workers and wage of the majority group hired decreases under a quota policy (n" $\leq n_1^*$)*

Proposition 8 *The number of workers and wage of the minority group hired increases under a quota policy (n" $\geq n_2^*$)*

Workers from the minority group, appear to be winners with the implementation of this policy. This group is then more employed and better paid. The result appears not to be the same for workers in the majority group. These workers receive a smaller wage and are less employed than in the baseline model. This measure implies a perverse effect in relation to the majority group. This policy is more akin to a transfer of wealth from one group to another rather than an upgrade of the status of the minority group in the labor market. Contrary to the equal pay policy, there is no shortage or unemployment, labor markets totally balance, and there is no lack of efficiency on the labor market.

The point to focus here is the mechanism induced by the quota policy. By imposing a quota, the firm has to hire more minority workers than in the baseline case in order be able to hire new majority workers. The minority wage of the baseline model is not enough to catch more minority workers because at this

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[21] The choice to use the same labor supply for the minority and majority workers influences this result. If we relax this assumption, instead of occupational equality there would be a convergence.

wage rate no others want to participate to the job market. The only choice of the firm is then to increase the minority workers wage rate in order to increase the participation of minority workers. The quota has for effect to create a minority wage increasing through the labor supply to satisfy firm majority workers demand. The crucial point here is the importance of the labor supply in the mechanism which explains how the quota has an effect on wage discrimination *and* occupational segregation.

The consequence on the total number of workers depends on values of σ_1^2 and σ_2^2. The effect on the level of production is not always the same.

5.3 Summary of results

5.3.1 No public policies vs. equal pay and quota policies

The first precaution to be taken before interpreting these results is that in the baseline model the market is in equilibrium. There is thus no unemployment in the initial situation[22]. The next table sum the results of policies studied before.

	Equal pay policy	Quota policy
w_1	−	−
w_2	+	+
n_1	−	−
n_2	−	+
Level of production	−	?

Table of effects vs. the baseline model

These two policies are not efficient in the sense of Pareto because whatever the policy is, there is always a wage or a number of workers which decrease. In other words, there is always someone which looses a part of his welfare to increase the welfare of another one. Both policies improve the wage situation of the minority group. However, only the policy of quota has a positive impact on the number of minority workers employed. The equal pay policy reduces this value. The majority group looses a lot from the two policies. Workers from this group are less paid and employed in a smaller proportion with the implementation of one of these policies. In addition, the equal pay policy reduces

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[22]It is important to consider this before making comparisons with the empirical situation.

the production on the market of goods and services since the firm employs fewer workers than previously (at the same time minority and majority workers). It is not possible to conclude unambiguously on this point with the quota policy because it depends on the parameters of the model (there is more worker from minority group and less from majority group).

5.3.2 Equal pay policy vs. quota policy

These two graphs illustrate the impact on the labor market of the application of a public policy of equal pay or quota.

Equal pay policy   Quota policy
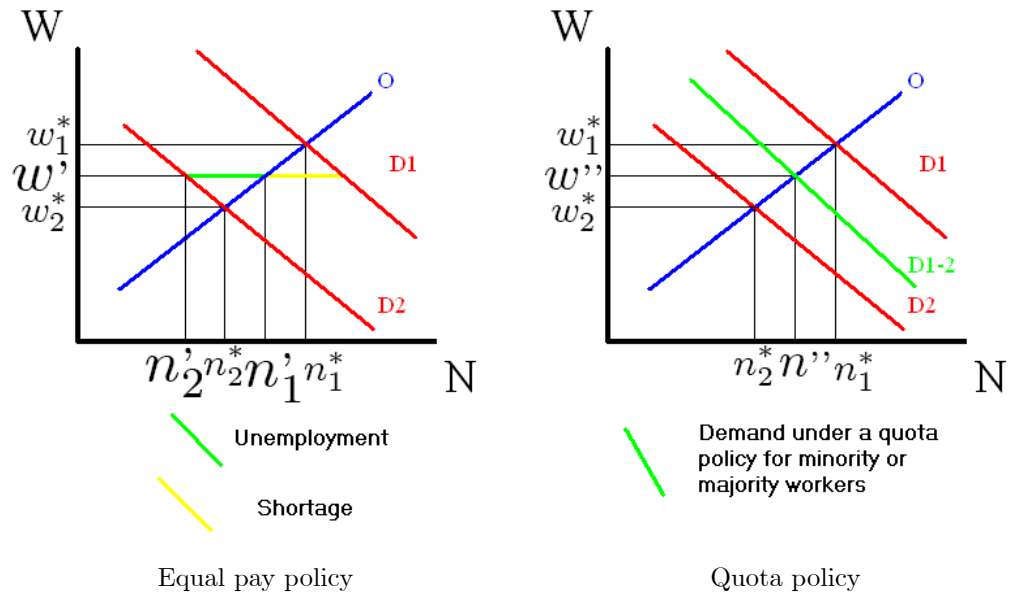
The equal pay policy imposes equal wages between categories, but does not have any consequence on the valorization of workers by firms. This policy unbalances the labor market and creates unemployment for the minority workers as well as a shortage of majority workers.

The quota policy forces the firms to couple the recruiting of a minority and a majority worker. The firm must thus re-examine its valorization of the workers.

Indeed, firms must now recruit by couples of workers and not by individual workers. The labor demand of the firm is thus affected. The quota policy creates an intermediate labor demand for firm which takes account of the new valorization of workers.

The equal pay policy penalizes less the majority group than a quota policy. Indeed, the number of workers and wage for this group are higher with an equal pay policy. The effect is not as clear cut for the minority group. Wages are higher with the equal pay policy but the number of workers hired is larger with the quota policy[23]. If the priority is to be fair with the minority group, the quota policy seems to dominate.

5.4   Cui Bono ?

From these results, it is legitimate to think about why a government could act to reduce discrimination and segregation since it seems efficient in the model. A government which targets social welfare wants to reduce the incremental uncertainty linked to the assessing difficulty of minority workers. A successful policy can increase the social welfare by arising minority workers situation and goods and services production.

It appears, in the comparative results, that the more fair policy for minority workers goes against interests of majority workers. Political choices of the government against discriminatory phenomena could be oriented by different political incentives. The classical policies do not seem to be clearly on all fours with social welfare.

A government, which chooses to vote quotas, seems to care more about be fair with minority group instead of a government, which chooses to apply an equal pay policy, seems more involved in maintaining the welfare of workers of majority group, under cover of a policy which seems to be orientated to the minority group.

The bargaining power of lobbies from minority and majority groups could be incentives for the government when it chooses the policy to apply to fight against discriminatory phenomena.

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[23]Proof in appendix

It thus appears an important issue to work on policies that do not impose to government to choose between the welfare of a group rather than another. Actually, the choice by the government of the policy could not to be orientated to the maximization of the global social welfare.

6 Non-conventional Policies

In front of previous results which show non-wanted effects, we propose other policies which are not already used by governments to fight discriminatory phenomena. The following quote from Dickinson and Oaxaca (2009) motivate this section:

> Policy prescriptions aimed at reducing discrimination in various markets may require re-assessment if the reason behind the discrimination has a different motive than typically thought.

6.1 Implication of a minority work subsidy

The next section introduces the application of a subsidy given by the government to the firm for each minority workers employed. The government wants to erase discrimination and segregation with this direct transfer. This policy could be related with the idea of dual taxation introduced by Alberto Alesina and Andrea Ichino with their article "Why women should pay less tax"[24] in the *Financial Times* of April 18, 2007. They write:

> Normally, free-marketeers and those who are worried about the efficiency costs of taxation are in opposite camps from those social activists who believe you need extensive government intervention to achieve a range of social goals. Here is a policy proposal that should make the two camps agree: reduce income taxes on women and increase, by less, income taxes on men.

Our goal is not to study how to promote participation of minority workers in the labor market. In our study, we consider that participation is the same whether the worker is discriminated or not[25]. By introducing our subsidy, we

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[24]http://www.ft.com/cms/s/0/3fb9f856-ed10-11db-9520-000b5df10621.html?nclick_check=1
[25]labor supplies are the same

keep the idea of a differentiated governmental policy between minority and majority workers, but this subsidy allows acting on firms' behavior and promoting the hiring of minority workers without perverse effects on the majority. For the rest of the paper, this kind of policy will be name "τ policy".

6.1.1   Equilibrium

In order to verify that the τ policy is efficient. A compensation transfer τ has to be added in the profit function in the second term (minority workers). The inverse labor supply curves are known by the firm and it chooses numbers of workers (n_1, n_2) to maximize:

$$\pi_{MV} = n_1 \left(\overline{y} - w_1 \right) + n_2 \left(\overline{y} + \tau - w_2 \right) - \alpha \left(n_1^2 \sigma_1^2 + n_2^2 \sigma_2^2 \right) \tag{22}$$

The optimal hiring behavior of the firm is determined by the following maximization program.

$$\max_{n_1, n_2} n_1 \left(\overline{y} - f - e n_1 \right) + n_2 \left(\overline{y} - f + \tau - e n_2 \right) - \alpha \left(n_1^2 \sigma_1^2 + n_2^2 \sigma_2^2 \right) \tag{23}$$

Optimal hiring decisions are derived in the appendix. We get:

$$n_1^\tau = n_1^* = \frac{\overline{y} - f}{2 \left(e + \alpha \sigma_1^2 \right)} \tag{24}$$

$$n_2^\tau = \frac{\overline{y} - f + \tau}{2 \left(e + \alpha \sigma_2^2 \right)} \tag{25}$$

Associated wages with these decisions are:

$$w_1^\tau = w_1^* = e \frac{\overline{y} - f}{2 \left(e + \alpha \sigma_1^2 \right)} + f \tag{26}$$

$$w_2^\tau = e \frac{\overline{y} - f + \tau}{2 \left(e + \alpha \sigma_2^2 \right)} + f \tag{27}$$

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6.1.2 Is there a τ^* which can erase discrimination and segregation on the labor market ?

Proposition 9 *There is a τ^* which can erase discrimination and segregation on the labor market*[26] *:*

$$\tau^* = \frac{\alpha \left(\sigma_2^2 - \sigma_1^2\right)}{e + \alpha\sigma_1^2} \left(\overline{y} - f\right) \tag{28}$$

This τ policy seems efficient to reduce or erase discriminatory phenomena in the labor market. Wage discrimination and occupational segregation disappear with the implementation of the τ policy. We find the theoretical value which makes this possible. The limitation of this policy could be the social cost because the government has to pay the transfer τ^* and do not receive new amounts of money to finance it[27]. The next section makes the social analysis of this policy.

6.1.3 Social analysis of this policy

To study the social cost of this policy, we have to give more precision on the labor market. We introduce now a external option $\underline{U}$ which correspond to the governmental unemployment transfer. We normalize the transfer $\underline{U}$ to 1 without loss of generality[28].

Governmental Cost

- The cost of this policy is:

$$n_2^\tau \tau^* = \frac{\alpha \left(\overline{y} - f\right)^2 \left(\sigma_2^2 - \sigma_1^2\right)}{2 \left(e + \alpha\sigma_1^2\right)^2} \tag{29}$$

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[26] See appendix for details

[27] We choose not to put a tax to finance this transfer. We do it because the effect of the tax is negative for workers in this environment and do not go in the sense of what we want to study in this paper.

[28] We suppose that the workers has always more utility to work than to stay without job.

The limitation of this policy is if the firm evaluates minority workers as much more risky than majority workers, the cost of this policy become very expensive. Therefore this policy could become an interesting alternative if the differentiation between groups is very limited.

- The gain due to the decrease of the total value of the unemployment compensation in the economy is:

$$n_2^{\tau*} - n_2^* = \frac{\alpha \left(\bar{y} - f \right) \left(\sigma_2^2 - \sigma_1^2 \right)}{2 \left(e + \alpha \sigma_1^2 \right) \left(e + \alpha \sigma_2^2 \right)} \tag{30}$$

The total variation of governmental expense is:

$$\Delta G = \frac{\alpha \left(\bar{y} - f \right) \left(\sigma_2^2 - \sigma_1^2 \right) \left[\left(e + \alpha \sigma_1^2 \right) - \left(\bar{y} - f \right) \left(e + \alpha \sigma_2^2 \right) \right]}{2 \left(e + \alpha \sigma_1^2 \right)^2 \left(e + \alpha \sigma_2^2 \right)} \tag{31}$$

There is no clear conclusion for the variation of governmental cost. For a low productivity industry, this variation is positive and so this implies that this policy reduces the governmental cost. In contrast for a high productivity industry the governmental cost increases.

Firms and Workers

This policy allows erasing discriminatory phenomena. There is no impact for majority workers but welfare of minority workers increases[29]. The welfare of the firm increase because it can produce more and sell more product on the market with the help of the subsidy which take all costs imply by the hiring of more minority workers than no policy case. Both of workers and firm has gain from this policy.

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[29]Both of number of workers and wage increase.

Social Welfare

Proposition 10 *The τ policy could be socially beneficial and especially in a low productivity industry.*

The only question is about the welfare of the government. In the case of a low productivity industry, government makes gain with introducing this transfer because the decrease of the unemployment compensation is higher than the total value of transfers. The social welfare in a low productivity industry increases. In the case of a high productivity, the total value of transfers surpasses unemployment compensation gains. We cannot conclude about the way the social welfare move in this case. In order to be clear, the determination process is :

$$\begin{aligned} \Delta S &= \Delta W + \Delta F + \Delta G \\ &= \ >0 \ + \ >0 \ + \ ? \end{aligned}$$

The determination rule is:

$$\left\{ \begin{array}{c} If \Delta G > 0 \\[2mm] or If \Delta G = 0 \\[2mm] or If \left\{ \begin{array}{c} \Delta G < 0 \\ and \, |\Delta G| \leq \Delta W + \Delta F \end{array} \right\} \end{array} \right\} \implies \text{Socially Beneficial}$$

$$If \left\{ \begin{array}{c} \Delta G < 0 \\ and \, |\Delta G| > \Delta W + \Delta F \end{array} \right\} \implies \text{Non Socially Beneficial}$$

6.1.4 Discussion : implementation of the policy

We show that this policy could be socially beneficial with some conditions. This policy seems not to be difficult to implement because this is only a cash flow between government and firm. Another way to implement this policy is to reduce the level of taxation on the employment of workers of the minority group.

The main difficulty of the implementation is to evaluate the value of the subsidy. The correct value depends on the assessment of workers by the firm. It appears difficult for the government to know this true value.

However, the limitation of this kind of policy could be the reaction of the population or the consistency of this measure with equality laws of the country. Indeed, this kind of policy could break the idea of equality in front of the law between races, gender, etc. Quota policy could seem on the borderline for certain people. We cannot exclude the fact a part of the population protest for their rights or that a constitutional court could judge this law as illegal.

6.2   Implication of a minimal wage

In this section, we challenge the relevance of the Equal Pay policy by studying the minimal wage as a meaning to fight discriminatory phenomena. The main problem with the equal pay legislation is perverse effects for the majority. Our intuition is that we could reproduce with the minimum wage the effect of the Equal Pay policy for minorities but without perverse effects on majorities. The minimum wage is a traditional way used by governments to improve the wage rate of poor workers. This section has for goal to check if a minimum wage which is set between equilibrium wages of minority and majority workers[30] could succeed in reducing wage discrimination and segregation.

6.2.1   Equilibrium

To understand the impact of a minimum wage, we need to define $\underline{w}$ as the minimum wage.

The maximization problem becomes:

$$\max_{n_1,n_2} n_1 \left(\overline{y} - w_1\right) + n_2 \left(\overline{y} - w_2\right) - \alpha \left(n_1^2 \sigma_1^2 + n_2^2 \sigma_2^2\right) \tag{32}$$

$$\text{u.c.:} \begin{cases} w_1 = \max\left(\underline{w}; w_1^*\right) \\ w_2 = \max\left(\underline{w}; w_2^*\right) \\ w_j = en_j + f \end{cases}$$

We get:

$$n_1^{MW} = n_1^* = \frac{\overline{y} - f}{2\left(e + \alpha\sigma_1^2\right)} \tag{33}$$

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[30] Other cases are trivial and cannot have better results.

$$n_2^{MW} = \frac{\overline{y} - \underline{w}}{2\alpha\sigma_2^2} \tag{34}$$

The wages associated with these numbers of workers are :

$$w_1^{MW} = w_1^* = e\frac{\overline{y} - f}{2\left(e + \alpha\sigma_1^2\right)} + f \tag{35}$$

$$w_2^{MW} = \underline{w} \tag{36}$$

Proposition 11 *The minimum wage has no impact on majority workers*

Proposition 12 *The minimum wage reduces the number and increase the wage of minority workers*

Using the minimum wage enable to artificially raise the wage of minority workers but with no impact on majority workers. We are able to reproduce the effect of Equal Pay policy for minority workers while keeping the baseline situation for majority workers. The following graph illustrates the impact on the labor market of the application of a minimum wage.
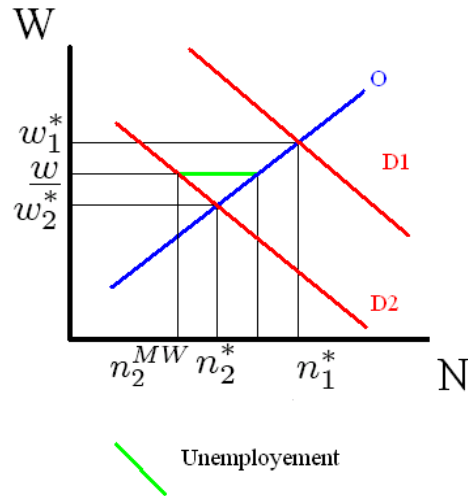
6.2.2   Discussion : Equal Pay vs. Minimum Wage

We show the introduction of a minimum wage could have same results than equal pay policy for minority workers. Minimum wage allows improving the wage for minority workers. As for the equal pay policy there is a perverse effect for minorities because the number of workers decreases.

When we look at the situation of majority workers, the minimum wage dominates the equal pay policy. Majority workers do not support any effect from this policy; it does not change anything for them.

If we aggregate minority and majority workers, the minimum wage appears as a best way to improve the wage of minorities because there is no perverse effect on majority workers. Equal Pay policy appears as a less relevant policy than Minimum wage because of implications for majority workers. However, equal pay does not arise from minimum wage since majority workers keep a larger wage than minority workers. There is no constraint to equalize wages with the minimum wage. Lobbies which only focus on Equal Pay without caring of welfare would not be agree with this policy because of majority keep a better wage. Once again, we see that equality and social welfare are not necessarily synonyms.

6.3   Other policies ?

We have shown two policies which could help to fight discriminatory phenomena but which care about social welfare of all groups of the economy. The minority work subsidy seems to be a way to increase the welfare of firms and workers but the social cost, if it exists, has to be taken by the government. The minimum wage allows implementing the same effect for minority workers than the Equal Pay policy but, at the same time, keep intact the welfare of majority workers.

Policies could have results but do not point the imperfection which cause the discriminatory phenomena. In this model, we focus on risk-aversion of productivity of the firm and difficulty of assessment of candidates by the firm. A good policy has to point directly these two issues. The problem is these issues can not disappear with a policy. The government can, at least, take measures to reduce their impact.

To restrain the effect of the risk-aversion of the firm, a way could be to find policies that reduce the consequence of a bad choice of workers. When it is difficult for the firm to correct its choice by replacing the worker, the risk-aversion should have a big impact. Laws which constrain the firm to keep on the payroll the worker even if he does not fit perfectly reinforce the influence of the risk-aversion.

In some countries there is some difference in the law between majority and minority workers (such as night hours of works for men and women, maternity allowance, work hardness, limited time visas, national preference, etc...). These kinds of restrictions makes minorities different and less attractive, not because they are less skill but because they cannot, because of the law, be as much productive as majority workers. The government has to erase of laws all this kind of points that make minority different and less attractive.

To restrain the effect of the difficulty of assessment, the government could promote equality by making information program for the firms in order to give true information on minorities to make them easier to assess. A good way to transfer this knowledge is to create school or university courses to improve the understanding of minorities (courses on cultural and ethnical aspect, on education systems out of the firm environment, ...). Another way could be that an international NGO can create a database of information on different educational systems in the world. This database needs to enable a clear and realistic comparison. Prejudices are often more on the lack of knowledge of the origin system than on the cultural or ethnical origin of the minority workers. We think if an organization works on this point, there will be a significant reduction of discriminatory phenomena. Governments can act to recognize diplomas awarded in foreign countries to facilitate the comparison. The important thing is that this recognition has to be legitimate to do not cause confidence problems.

7   The effect of labor market structure

As Industrial Organization shows, market power variations have impacts on a quantity-price relation. This relation is a central issue in our study, that's why we verify these impacts in the case of discriminatory phenomena. This allows introducing strategic behavior of firms in the hiring decision. Another motivation is that during a long time there was a consensus on the disappearance of discriminatory phenomena with competition. This section gives another argument to this debate.

7.1 Oligopsony

There are $K > 1$ symmetrical firms competing in the labor market. We solve this oligopsony as a reverse Cournot competition with symmetrical firms. The conditions in the goods and services market stay the same as in the previous section. Inverse labor supplies of each category of workers could be expressed as follows in this oligopsony environment:

$$w_{kj} = e \left(\sum_{k=1}^{K} n_{kj} \right) + f \tag{37}$$

The optimal hiring behavior of the firm is determined by the following maximization program.

$$\max_{n_{i1},n_{i2}} n_{i1} \left[\overline{y} - f - e \left(n_{i1} + \sum_{k \neq i} n_{k1} \right) \right] + n_{i2} \left[\overline{y} - f - e \left(n_{i2} + \sum_{k \neq i} n_{k2} \right) \right] - \alpha \left(n_{i1}^2 \sigma_1^2 + n_{i2}^2 \sigma_2^2 \right) \tag{38}$$

First order conditions yields[31]:

$$n_{i1}^o = \frac{\overline{y} - f}{e(K+1) + 2\alpha\sigma_1^2} \tag{39}$$

$$n_{i2}^o = \frac{\overline{y} - f}{e(K+1) + 2\alpha\sigma_2^2} \tag{40}$$

Equilibrium wages are:

$$w_1^o = eK \frac{\overline{y} - f}{e(K+1) + 2\alpha\sigma_1^2} + f \tag{41}$$

$$w_2^o = eK \frac{\overline{y} - f}{e(K+1) + 2\alpha\sigma_2^2} + f \tag{42}$$

In the case of the oligopsony, we find same intuitions as in monopsony case. The results do not show any major change because of this market structure. We

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[31] See appendix for details.

observe only changes on values of employment and wage levels. Indeed firms employ workers of the two groups and we also continue to observe discriminatory phenomena against the minority group (occupational segregation and wage discrimination).

Proposition 13 *Levels of employment and wages increase with the oligopsony market structure.*

Oligopsony gives market power to workers of both groups. There is now a part a competition in the labor market which allows workers to use competition to get a better contract. Emergence of market power of workers leads to higher wages and number of workers for each group.

To verify implications of this market structure on discriminatory phenomena we have to compare these ratios : $\frac{Kn^o_{i2}-Kn^o_{i1}}{Kn^o_{i2}} = 1 - \frac{e(K+1)+2\alpha\sigma^2_1}{e(K+1)+2\alpha\sigma^2_2}$ and $\frac{n^*_2-n^*_1}{n^*_2} = 1 - \frac{e+\alpha\sigma^2_1}{e+\alpha\sigma^2_2}$ which are proportions of the deficit of minority workers compared with majority workers in the oligopsony and in the monopsony case. Given that equilibrium wages and number of workers are proportional, conclusions for the implications of the oligopsony are the same for occupational segregation and wage discrimination.

This comparison is trivial and we can conclude that:

$$\frac{n^*_2 - n^*_{i1}}{n^*_2} > \frac{Kn^o_{i2} - Kn^o_{i1}}{Kn^o_{i2}} \tag{43}$$

Proportions of deficits of wages and number of workers between minority and majority workers are larger in the monopsony case.

Proposition 14 *Oligopsony market structure reduce discriminatory phenomena.*

We observe that differences in proportion of wages and occupation inside the firm are reduced by the change of market structure. This result suggests that the introduction of a dose of competition helps to reduce discriminatory phenomena. The market structure change addresses both the wage discrimination and the occupational segregation and generates positive results in this fight. We notice that no worker is losing with the change in market structure. Positive impacts affect both groups.

7.2 Competitive labor market

There are $L > K + 1$ symmetrical firms in a competitive labor market. The conditions in the goods and services market stay the same as in the previous sections. Inverse labor supplies of each category of workers could be expressed as follows in this competitive environment:

$$w_{kj} = e \left(\sum_{k=1}^{L} n_{kj} \right) + f \tag{44}$$

The optimal hiring behavior of the firm is determined by the following maximization program. w_1 and w_2 are fixed by the competitive labor market.

$$\max_{n_{i1}, n_{i2}} n_{i1} \left(\overline{y} - w_1 \right) + n_{i2} \left(\overline{y} - w_2 \right) - \alpha \left(n_{i1}^2 \sigma_1^2 + n_{i2}^2 \sigma_2^2 \right) \tag{45}$$

First order conditions yields[32]:

$$n_{i1}^c = \frac{\overline{y} - f}{eL + 2\alpha\sigma_1^2} \tag{46}$$

$$n_{i2}^c = \frac{\overline{y} - f}{eL + 2\alpha\sigma_2^2} \tag{47}$$

Equilibrium wages are:

$$w_1^c = eL \frac{\overline{y} - f}{eL + 2\alpha\sigma_1^2} + f \tag{48}$$

$$w_2^c = eL \frac{\overline{y} - f}{eL + 2\alpha\sigma_2^2} + f \tag{49}$$

Proposition 15 *Competition can not erase discriminatory phenomena*

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[32] See appendix for details.

In the competition case, we find same intuitions as in the monopsony and oligopsony cases. No major change is observed with competition. We observe only changes on values of employment and wage levels. Occupational segregation and wage discrimination continue to be observed despite the fact that workers hold all the market power. Competition is not strong enough to avoid discriminatory phenomena. This proposition reinforces studies as Rosen (2003) which conclude in this sense.

Proposition 16 *Levels of employment and wages increase with the competitive market structure.*

Competitive market structure gives all the market power to workers. The competition allows workers to have the best contract possible in this market with better wages and occupation level than in previous market structures.

To verify implications of competitive market structure on discriminatory phenomena we have to compare these ratios : $\frac{Kn_{i2}^o - Kn_{i1}^o}{Kn_{i2}^o} = 1 - \frac{e(K+1) + 2\alpha\sigma_1^2}{e(K+1) + 2\alpha\sigma_2^2}$ and $\frac{Ln_{i2}^c - Ln_{i1}^c}{Ln_{i2}^c} = 1 - \frac{eL + 2\alpha\sigma_1^2}{eL + 2\alpha\sigma_2^2}$ which are proportions of the deficit of minority workers compared with majority workers in the oligopsony and in the competitive case. Given that equilibrium wages and number of workers are proportional, conclusions for the implications of the oligopsony are the same for occupational segregation and wage discrimination.

This comparison is trivial and we can conclude that:

$$\frac{Kn_{i2}^o - Kn_{i1}^o}{Kn_{i2}^o} > \frac{Ln_{i2}^c - Ln_{i1}^c}{Ln_{i2}^c} \tag{50}$$

Proportions of deficits of wages and number of workers between minority and majority workers are smaller in the competitive case than others.

Proposition 17 *Competitive market structure reduce discriminatory phenomena more than other labor market structures.*

Even if, the discriminatory phenomena do not disappear, we observe that competition reduces differences in proportion of wages and occupation inside the firm. This result confirms that competition helps to reduce wage discrimination and occupational segregation. No worker suffers from this change. Every group of workers has a better wage and occupational situation with competition.

7.3 Impacts of labor market structure

The more competitive become the labor market, the more wages and the number of workers increase. This phenomenon is true for all the categories of workers. We can also notice that the more competitive the labor market is, the less discriminatory phenomena are observed. Differences between groups are reduced by increasing competition. However competition is not enough to stop these phenomena. Wage discrimination and occupational segregation persist in a competitive labor market.

Rising the level of competition in labor market appear as a meaning to fight discriminatory phenomena while improving workers situation.

8   Conclusion

This paper develops a framework which enables to simply analyze the implication of the public policies and labor market structures on the discriminatory phenomena. The particularity of the model is that it makes possible to analyze, at the same time, these impacts on wage discrimination and occupational segregation. The model establishes the link between quantity and price dimensions, to study discriminatory phenomena, within the same model. It is very important to take into account these two dimensions in the studies linked to discriminatory phenomena and means to fight them. This model takes place in a mean-variance environment and uses reduced form functions to illustrate the profit of the firms and the labor supply. There is no taste discrimination at all in this model; all effects are consequences of statistical discrimination and the risk-aversion of firms.

In our baseline model, we conciliate several empirical observations such as: - firms always hire workers from both groups; - the number of workers and the wage of majority workers are, at the same time, higher. We do not find a link between the numbers of workers of each group who find work.

The model shows that equal pay policy creates negative effects. This policy leads to the rise of the wage of minority workers, while a decrease of the wage of majority workers, of the total number of workers from both groups and of the total production.

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A quota policy has a good consequence on segregation and discrimination. A policy that forces firms to equalize the number of workers from each group eliminates pay discrimination and the segregation. However, the perverse effects of this policy are the reduction, for majority workers, of the wage and of the number of workers.

When the two public policies are compared, there is no stochastic dominance. However, if the priority is to be fair with the minority group, the quota policy seems to be better.

We model two policies to verify if it is possible to have various policy to correct discriminatory phenomena but with less perverse effect. Using a minimum wage between wages of both groups and adding a transfer to favor the hiring of minority workers seem to be alternative solutions of classical policies. We discuss other policies that could have significant results without imposing anything on the hiring decision of the firm. We focus on the idea that government can act more on the legislation differences between groups, to promote the information on minority workers and to reduce the weight of a bad hiring decision of firms.

No market structure can stop the discriminatory phenomena. Competition softens the effects and plays in favor of diversity and higher wages. Competition can help both minority and majority groups while reducing discriminatory phenomena.

To conclude, a government which wants to reduce discriminatory phenomena has to be sure of the required effects. We have seen that Quotas and Equal Pay policies have different impacts. A government can also act to improve competition in the labor market. Improving competition, more than reducing discriminatory phenomena, seems to have no perverse effect on minority and majority groups. Improving competition appears as the only way to not penalize a group to improve the welfare of another.

9   Appendix

9.1   Monopsony model

9.1.1   Resolution of the baseline model

$$\max_{n_1,n_2} n_1 \left(\overline{y} - f - en_1 \right) + n_2 \left(\overline{y} - f - en_2 \right) - \alpha \left(n_1^2 \sigma_1^2 + n_{21}^2 \sigma_2^2 \right)$$

$$\Leftrightarrow \frac{\partial -}{\partial n_1} = 0 \qquad\qquad \Leftrightarrow \frac{\partial -}{\partial n_2} = 0$$

$$\Leftrightarrow \overline{y} - 2en_1 - f - 2\alpha n_1 \sigma_1^2 = 0 \qquad \Leftrightarrow \overline{y} - 2en_2 - f - 2\alpha n_2 \sigma_2^2 = 0$$

$$\Leftrightarrow n_1^* = \frac{\overline{y} - f}{2\left(e + \alpha \sigma_1^2\right)} \qquad\qquad \Leftrightarrow n_2^* = \frac{\overline{y} - f}{2\left(e + \alpha \sigma_2^2\right)}$$

$$\Rightarrow w_1^* = e\frac{\overline{y} - f}{2\left(e + \alpha \sigma_1^2\right)} + f \qquad\qquad \Rightarrow w_2^* = e\frac{\overline{y} - f}{2\left(e + \alpha \sigma_2^2\right)} + f$$

9.1.2 Resolution of the model adapted for equal pay

$$\max_{n_1,n_2} (n_1 + n_2) \left(\overline{y} - f - \tfrac{e}{2}(n_1 + n_2)\right) - \alpha \left(n_1^2 \sigma_1^2 + n_2^2 \sigma_2^2\right)$$

$$\Leftrightarrow \frac{\partial -}{\partial n_1} = 0 \qquad\qquad\qquad \Leftrightarrow \frac{\partial -}{\partial n_2} = 0$$

$$\Leftrightarrow \overline{y} - \tfrac{e}{2}(2n_1 + 2n_2) - f - 2\alpha n_1 \sigma_1^2 = 0 \quad \Leftrightarrow \overline{y} - \tfrac{e}{2}(2n_1 + 2n_2) - f - 2\alpha n_2 \sigma_2^2 = 0$$

$$\Leftrightarrow n_1 \left(2\alpha \sigma_1^2 + e\right) = \overline{y} - f - en_2 \qquad \Leftrightarrow n_2 \left(2\alpha \sigma_2^2 + e\right) = \overline{y} - f - en_1$$

$$\Rightarrow n_1^{\textrm{'}} = \frac{\sigma_2^2 (\overline{y} - f)}{2\alpha \sigma_1^2 \sigma_2^2 + e\left(\sigma_1^2 + \sigma_2^2\right)} \qquad \Rightarrow n_2^{\textrm{'}} = \frac{\sigma_1^2 (\overline{y} - f)}{2\alpha \sigma_1^2 \sigma_2^2 + e\left(\sigma_1^2 + \sigma_2^2\right)}$$

$$w^{\textrm{'}} = \frac{e}{2} \frac{\left(\sigma_1^2 + \sigma_2^2\right)(\overline{y} - f)}{2\alpha \sigma_1^2 \sigma_2^2 + e\left(\sigma_1^2 + \sigma_2^2\right)} + f$$

In verifying with the majority workers labor supply, it appears that there is not a sufficient number of workers available to work at this wage. The number of workers from the majority group which accept to work at this wage is :

$$n_1^{\textrm{'}} = \frac{1}{2} \frac{\left(\sigma_1^2 + \sigma_2^2\right)(\overline{y} - f)}{2\alpha \sigma_1^2 \sigma_2^2 + e\left(\sigma_1^2 + \sigma_2^2\right)}$$

9.1.3 Resolution of the model adapted for the quota policy

$$\max_{n} 2n \left(\overline{y} - f - en\right) - \alpha n^2 \left(\sigma_1^2 + \sigma_2^2\right)$$

$$\Leftrightarrow \frac{\partial -}{\partial n} = 0$$

$$\Leftrightarrow 2\left(\overline{y} - f - 2en\right) - 2\alpha n \left(\sigma_1^2 + \sigma_2^2\right) = 0$$

$$\Leftrightarrow n^{\textrm{''}} = \frac{\overline{y} - f}{2e + \alpha \left(\sigma_1^2 + \sigma_2^2\right)}$$

$$\Rightarrow w^{\textrm{''}} = e\frac{\overline{y} - f}{2e + \alpha \left(\sigma_1^2 + \sigma_2^2\right)} + f$$

9.1.4 Equal pay policy vs. quota policy.

$$n" = \frac{\overline{y} - f}{2e + \alpha\left(\sigma_1^2 + \sigma_2^2\right)} = \frac{\left(\sigma_1^2 + \sigma_2^2\right)(\overline{y} - f)}{2e\left(\sigma_1^2 + \sigma_2^2\right) + \alpha\left(\sigma_1^2 + \sigma_2^2\right)^2}$$

$$n_1^{\cdot} = \frac{1}{2}\frac{\left(\sigma_1^2 + \sigma_2^2\right)(\overline{y} - f)}{2\alpha\sigma_1^2\sigma_2^2 + e\left(\sigma_1^2 + \sigma_2^2\right)} = \frac{\left(\sigma_1^2 + \sigma_2^2\right)(\overline{y} - f)}{4\alpha\sigma_1^2\sigma_2^2 + 2e\left(\sigma_1^2 + \sigma_2^2\right)}$$

Since the numerators are the same, the denominators will be compared in order to know if $n"$ or $n_1^{\cdot}$ is largest

$$2e\left(\sigma_1^2 + \sigma_2^2\right) + \alpha\left(\sigma_1^2 + \sigma_2^2\right)^2 - 4\alpha\sigma_1^2\sigma_2^2 - 2e\left(\sigma_1^2 + \sigma_2^2\right)$$
$$= \alpha\left(\sigma_1^2 + \sigma_2^2\right)^2 - 4\alpha\sigma_1^2\sigma_2^2$$
$$= \alpha\left(\sigma_1^2 - \sigma_2^2\right)^2 \geq 0$$

$$\Longrightarrow n_1^{\cdot} \geq n"$$

The proof is close to be the same for $w' \geq w"$

$$n" = \frac{\overline{y} - f}{2e + \alpha\left(\sigma_1^2 + \sigma_2^2\right)} = \frac{\sigma_1^2(\overline{y} - f)}{2e\sigma_1^2 + \alpha\sigma_1^2\left(\sigma_1^2 + \sigma_2^2\right)}$$

$$n_2^{\cdot} = \frac{\sigma_1^2(\overline{y} - f)}{2\alpha\sigma_1^2\sigma_2^2 + e\left(\sigma_1^2 + \sigma_2^2\right)}$$

Since the numerators are the same, the denominators will be compared in order to know if $n"$ or $n_1^{\cdot}$ is largest

$$2e\sigma_1^2 + \alpha\sigma_1^2\left(\sigma_1^2 + \sigma_2^2\right) - 2\alpha\sigma_1^2\sigma_2^2 - e\left(\sigma_1^2 + \sigma_2^2\right)$$

$$= e\left(2\sigma_1^2 - \sigma_1^2 - \sigma_2^2\right) + \alpha\left(\sigma_1^4 + \sigma_2^2 - 2\sigma_1^2\sigma_2^2\right)$$

The first part is negative because $\sigma_1^2 < \sigma_2^2$

The second part is negative too because $\sigma_1^4 < \sigma_1^2\sigma_2^2$ and $\sigma_1^2 < \sigma_1^2\sigma_2^2$

$$\Longrightarrow n" \geq n_2^{\cdot}$$

9.2 Oligopsony model with symmetrical firms

$$\max_{n_{i1}, n_{i2}} n_{i1}\left[\overline{y} - f - e\left(n_{i1} + \sum_{k \neq j} n_{k1}\right)\right] + n_{i2}\left[\overline{y} - f - e\left(n_{i2} + \sum_{k \neq j} n_{k2}\right)\right] - \alpha\left(n_{i1}^2\sigma_1^2 + n_{i2}^2\sigma_2^2\right)$$

$$\Leftrightarrow \frac{\partial-}{\partial n_{i1}} = 0 \qquad\qquad \Leftrightarrow \frac{\partial-}{\partial n_{i2}} = 0$$

$$\Leftrightarrow \overline{y} - 2en_{i1} - f - 2\alpha n_{i1}\sigma_1^2 - e\sum_{k \neq j} n_{k1} = 0 \qquad \Leftrightarrow \overline{y} - 2en_{i2} - f - 2\alpha n_{i2}\sigma_2^2 - e\sum_{k \neq j} n_{k2} = 0$$

$$\Leftrightarrow n_{i1}^o = \frac{\overline{y} - f}{e(K+1) + 2\alpha\sigma_1^2} \qquad\qquad \Leftrightarrow n_{i2}^o = \frac{\overline{y} - f}{e(K+1) + 2\alpha\sigma_2^2}$$

$$\Rightarrow w_1^o = eK\frac{\overline{y} - f}{e(K+1) + 2\alpha\sigma_1^2} + f \qquad\qquad \Rightarrow w_{i2}^o = eK\frac{\overline{y} - f}{e(K+1) + 2\alpha\sigma_2^2} + f$$

9.3 Competitive model

$$\max_{n_{i1},n_{i2}} n_{i1}\left(\overline{y}-w_1\right)+n_{i2}\left(\overline{y}-w_2\right)-\alpha\left(n_{i1}^2\sigma_1^2+n_{i2}^2\sigma_2^2\right)$$

$$\Leftrightarrow \frac{\partial-}{\partial n_{i1}}=0 \qquad \Leftrightarrow \frac{\partial-}{\partial n_{i2}}=0$$
$$\Leftrightarrow \overline{y}-w_1-2\alpha n_1\sigma_1^2=0 \quad \Leftrightarrow \overline{y}-w_2-2\alpha n_2\sigma_2^2=0$$
$$\Leftrightarrow n_{i1}=\frac{\overline{y}-w_1}{2\alpha\sigma_1^2} \qquad \Leftrightarrow n_{i2}=\frac{\overline{y}-w_2}{2\alpha\sigma_2^2}$$

In the labor market with symmetrical firms, we have :

$$\left\{\begin{array}{c} n_{i1}=\frac{\overline{y}-w_1}{2\alpha\sigma_1^2} \\ w_{i1}=eLn_{i1}+f \end{array}\right\} \qquad \left\{\begin{array}{c} n_{i2}=\frac{\overline{y}-w_2}{2\alpha\sigma_2^2} \\ w_{i2}=eLn_{i2}+f \end{array}\right\}$$

$$\Leftrightarrow n_{i1}^c=\frac{\overline{y}-f}{eL+2\alpha\sigma_1^2} \qquad \Leftrightarrow n_{i2}^c=\frac{\overline{y}-f}{eL+2\alpha\sigma_2^2}$$

$$\Rightarrow w_1^c=eL\frac{\overline{y}-f}{eL+2\alpha\sigma_1^2}+f \quad \Rightarrow w_{i2}^c=eL\frac{\overline{y}-f}{eL+2\alpha\sigma_2^2}+f$$

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