

**DEPARTMENT OF ECONOMICS
UNIVERSITY OF CRETE**

BE.NE.TeC. Working Paper Series

Working Paper: 2006-14

A Union-Oligopoly Model of Endogenous Discrimination:
Should It Be Wage Discrimination Taxed Or Discriminated
Employment Subsidized?

Nick Drydakis, Minas Vlassis



Business Economics & NEw TeChnologies Laboratory

A Union-Oligopoly Model of Endogenous Discrimination: Should it be wage discrimination taxed or discriminated employment subsidized?

Nick Drydakis, Minas Vlassis*

Department of Economics, University of Crete, 74100 Rethymnon, Crete, Greece

Abstract

In the context of a homogenous good industry with Cournot rivalry and technological asymmetries among firms, equally skilled workers can be grouped according to their different reservation wages. Under decentralized firm-union bargaining, we show that unions may offer to firms the option to discriminate wages across such groups of employees and, by that, to achieve cost sub-additivity in the equilibrium. We subsequently propose that to combat the emerging wage discrimination a benevolent policy maker may activate either taxation, or subsidization, policy. Interestingly, while the former policy always entails a welfare loss, a welfare gain may emerge under the latter policy, relative to the no policy-wage discrimination status quo. Thus our findings suggest that the E.U- antidiscrimination directives may prove to be effective on both egalitarian and efficiency grounds.

Keywords: Unions, Oligopoly, Discriminatory Wage Contracts, Antidiscrimination Policy.

JEL Classification: J50, J51, J31.

*Corresponding Author.

Tel: + 2831077396. Fax: + 2831077406. E-mail: mvlassis@econ.soc.uoc.gr.

We have benefited from comments and suggestions made during the presentations of an earlier version of this paper at the Departmental Seminar Series of the University of Crete, and the Conference on Research on Economic Theory and Econometrics (CRETE), July 2006. The usual disclaimer applies.

1. Introduction

A considerable body of European legislation has been put in place over the last thirty years in order to combat discrimination (see e.g., Green Paper 2004). More recently, the inclusion of Article #13, in the European Community Treaty, following the entry into the force of the 1997 Amsterdam Treaty, represented a quantum leap forward in the fight against discrimination at the European Union level, in that it empowered the Union to deal with discrimination on a range of grounds, including racial or ethnic origin, religion or belief, age, disability and sexual orientation. That development in turn led, in 2000, to the unanimous adoption by the Council of two Directives, #43, the «Racial Directive», and #78, the «Employment Equality Directive», both aiming to ensure that everybody living in the European Union can benefit from effective legal protection against discrimination.¹

As in particular regards the European labor markets, the stylized facts show that discrimination is indeed witnessed in all the above grounds, thus raising the need for active antidiscrimination policies. According to the *Eurobarometer Survey* (57.0, 2003), in the 15 Member States, the most often cited ground of discrimination is racial or ethnic (22%), followed by learning difficulties or mental illness (12%), physical disability (11%), religion or beliefs (9%), age and sexual orientation (6%). Whilst at the same time people with mental illness and

¹ The purpose of Directive #43 (OJ L 180 19/7/2000), is to lay down a framework for combating discrimination on the grounds of racial or ethnic origin, with a view to putting into a effect in the Member States the principle of equal treatment. With the same view, the purpose of Directive #78 (OJ L 303 27/11/2000), is to lay down a framework for combating discrimination, on the grounds of religion or beliefs, disability and age or sexual orientation, as regards employment and occupation. In particular, Directive #78 applies to all persons (regarding both the public and private sectors), in relation to: (a) Conditions for access to employment, to self-employment and to occupation, selection criteria and recruitment conditions, whatever is the branch of activity and the level of the professional hierarchy (including promotion). (b) Access to all types and to all levels of vocational guidance, vocational training, advanced vocational training and retraining, including practical work experience. (c) Employment and working conditions, including dismissals and pay, (d) Membership of and involvement in an organization of workers or employers, or any organization whose members carry on a particular profession, including the benefits provided for by such organizations. Directive # 43 also applies to all the above cases and further includes: (e) Social protection, including

learning difficulties are thought to be the most disadvantaged group in the labor market (87 %), followed by physical disability (77 %), age (71%) and ethnic minorities (62 %). More importantly, according to the *Cabinet Office Strategy Unit* (2003, 35), in Britain the wage difference of members of ethnic minority groups relative to their native counterparts is found to range from 9 to 150 £, per week, depending on the ethnic group. Key facts such as age, education, economic environment and family structure could only explain 5 to 116 £ of this wage gap. So it seems that an “ethnic penalty”, in the range of 4 to 34 £ per week, applies. On the other hand, according to a questionnaire conducted by the *European Trade Union Confederation* (2003), almost twenty-one, out of twenty-four, national trade unions surveyed agreed that migrants and ethnic minorities face higher levels of unemployment, lower pay and slower promotion.²

The above evidence provides a strong indication that labor market discrimination, as in particular regards ethnic minority groups/economic migrants in Europe is significant, and it might be related with other than productivity factors. Whilst, various empirical studies have in the past assessed discrimination along the same lines, drawing largely on the experience regarding “black” versus “white” workers (see e.g., Bergmann and Krause [1972], Swinton [1977], Aigner and Cain [1977]).³

The theoretical foundations of this ongoing literature (see also, Allanson *et al* [2000], Hinks and Watson [2001]) go back to the seminal papers of G. Becker (1957), and K. Arrow

social security and health care. (f) Social advantages. (g) Education. (h) Access to the supply of goods and services which are available to the public (including housing).

² For instance, in Austria, Belgium, Finland, France, Italy, Netherlands, Norway, Portugal, Spain, Sweden and UK ethnic minorities are worse paid and less likely to be promoted.

³ “Blacks,” including various minority groups, like Latin Americans and American Indians, have found to earn less than the majority group (“whites”). Whilst, the most common forms of discrimination on the part of employers were, to refuse to employ “blacks” in jobs for which they are qualified, to employ them only at lower wages, or to insist on higher qualifications when “blacks” are employed at the same wages as “whites.”

(1972). In Becker's (1957) model, the motivation for discrimination is based on a "taste for discrimination," implying that white employers may be willing to forego some profits to avoid the "psychic costs" of interracial contact. As a result, the demand for black workers is *ceteris paribus* lowered, depressing their relative wages. Yet, the trouble with this postulate is that it explicitly contradicts the regular view of employers as being profit-maximizers. The idea that product market competition will eventually eliminate such a kind of inefficient discrimination led to the treatment of imperfect information as a factor that may sustain "statistical" rather than "taste" discrimination. In Arrow's (1972) model of statistical discrimination, employers make a hiring test that unveils the worker's true productivity, while the screening process used to determine a worker's qualifications is costly. Therefore, and since prior expectation of productivity differs across groups, wage differentials may arise among workers of identical productivity.

In this paper, we clearly abstain from both those approaches. We instead propose that, in the presence of costless screening regarding workers' qualifications, as well as in the absence of any "taste for discrimination," there is still room for wage discrimination among equally-skilled employees. As long as, first, the latter can be ex-ante grouped according to their opportunity cost of employment, and, second, the labor market agents unanimously (yet independently) find wage discrimination to their best interest. In the context of unionized labor markets, we particularly consider that the (equally-skilled) union members can be grouped according to their different reservation wages. Then, under decentralized firm-union bargaining, we show that both the firm and its union, in each firm/union pair, find wage discrimination to be an equilibrium arrangement, if unions are of the utilitarian type. This key result in turn opens an interesting path for active antidiscrimination policies. As our relevant findings subsequently suggest, the E.U-

antidiscrimination directives may in fact drive benevolent policy makers to combat wage discrimination without them (necessarily) confronting a net loss in social welfare.

The rest of the paper is organized as follows. In section 2 we develop a structural model envisaging a unionized industrial sector where technologically asymmetric firms producing homogenous goods compete *a la* Cournot. Under decentralized union-oligopoly bargaining, and in the presence of ex-ante grouping of the sector's workers according to different reservation wages, the postulated sequence of events is subsequently explained. Solving this game in section 3 we show that (and reason why), in the absence of an active antidiscrimination policy, firm-specific wage discrimination endogenously emerges. Based upon these findings in section 4 we propose alternative taxation/subsidization policies to cure wage discrimination with an explicit view of their welfare effects. Our findings are conclusively evaluated in Section 5.

2. The Model

The product market of our reference industrial sector X consists of two unionized firms which compete *a la Cournot* in homogenous goods. We assume that each firm produces with *C.R.S*, in only the labor input, given that the deployed capital input is always sufficient to produce the good. Specifically, the production function of each firm is: $x_i = k_i N_i$; $i=1,2$, where x_i denotes output, N_i is the number of employees, and $k_i > 0$ represents the labor productivity, of firm i . We thus allow for productivity asymmetries among firms and, by normalizing $k_2 \equiv 1$, $k_1 \equiv k > 1$, we assume that this is due to the possession of a labor-saving technology on the part of firm 1.

Consumer preferences are represented by a variant of the Dixit's (1979) quasi-linear specification: $u(X, Z) = aX - X^2 / 2 + Z$; $X = x_1 + x_2$. Thus, assuming that the

representative consumer's budget M is large enough, the demand for the goods of sectors X and Z

(the *rest of the economy*) respectively are $X = a - \frac{p}{p_Z}$; $Z = \frac{M - pX}{p_Z}$. Where, p is the price of x_i

and p_Z is the price of the *composite good* Z . Normalizing $p_Z \equiv 1$, we subsequently derive the X

sector's inverse demand schedule: $p = a - x_1 - x_2$, giving rise to a standard profit formula, for

each i firm of sector X :

$$\Pi_i = (a - x_1 - x_2)x_i - C_i(x_i) ; i=1,2 \quad (1)$$

In the labor market, the workers who find a job within each i firm are *by default* organized into the i firm's labor union. That is we assume that firm-union bargaining is decentralized and a collective agreement struck in firm/union pair i covers any employee in firm i , regardless of his/her union-membership status⁴. Furthermore, we assume that all workers opting for a job in sector X are equally skilled. However, these workers are grouped according to their different reservation wages. In particular we postulate that there exist two groups of workers: N_0 and N_d with reservation wages b and $(b - d)$; $b \geq 0$, $d > 0$, respectively. In the trade unions literature the reservation wage is typically treated to be a weighted average of the competitive wage and the unemployment benefit. We moreover consider that a group of workers (N_d) are differentiated regarding at least one of these two arguments. Prominent examples here seem to be the economic migrants as well as the aged and long-term unemployed workers. They typically face lower opportunity costs of employment relative to "regular" workers, and/or, they may not be eligible to receive the unemployment benefit. In order to find a job, anywhere, a worker belonging to any of those groups would then be willing to accept a wage, even lower than the unemployment benefit, being equal to his/her disutility of work. Let next, for convenience, normalize $b \equiv 0$. It can

⁴ There is evidence that such an *open shop* scheme is sustained in a number of European countries, like in Greece,

subsequently be postulated that the union's i objective function is an idiosyncratic variant of the Oswald's (1982) total rents formula⁵:

$$U_i = w_{0i}N_{0i} + (w_{di} + d)N_{di} ; i=1, 2 \quad (2)$$

Given the European Council *Antidiscrimination Directives* (#43 and, particularly, #78), and assuming that discrimination monitoring is perfect (yet, costly), the sequence of events arising in the above context is as follows.

At stage one a policy maker, operating under a balanced budget constraint, handles a set of ordinary policy tools (e.g. taxes and subsidies) with the aim to combat wage discrimination in the labor market of sector X . Regarding the choice of a particular antidiscrimination policy (AdP_X , where X refers to taxes or subsidies applying at the X sector's level), our envisaged policy maker is driven by the following lexicographic objective.

I. *Activate any AdP_X so long as it leads to non-discriminated wages across employees in each i firm.*

II. *Choose the particular AdP_X :*

$$\max G (AdP_X) \equiv \{DCS (AdP_X) + DU(AdP_X) + DPS (AdP_X) - C(AdP_X)\}$$

Where, given the no policy status quo, the operator D refers to the X -sector-specific derived differentials, regarding *Consumer Surplus (CS)*, *Union Rents (U)*, and *Producer Surplus (PS)*, in case that a particular AdP_X is undertaken, and $C(AdP_X)$ is a measure of the policy's costs.⁶ The reasoning behind this objective is that, while we here consider policy makers to be primarily

France, and Spain (see e.g., Hartog and Theeuwes [1992], Vlassis [2003]).

⁵ Since the union is utilitarian (e.g. it treats all of its members equally) and $b=0$, total union rents appear to be, $[N_{0i}\text{-oriented-rents} = (w_{0i} - 0) N_{0i}] + [N_{di}\text{-oriented-rents} = (w_{di} - (0 - d)) N_{di}]$.

⁶ Of course, in case that any AdP_X entails a negative G (i.e. a net loss in social welfare), the policy maker should choose the one which minimizes $-G (AdP_X)$. Note also that the balanced budget requirement effectively implies that any positive $C(AdP_X)$ identifies a loss in social welfare.

driven by the E.U- antidiscrimination directives, we also credit to them a regular benevolent attitude.

At stage two decentralized bargains are conducted in each firm-union pair i . We assume that each union retains the power to unilaterally set the firm-specific wage rate, whilst firm-specific employment decisions are left to each firm's discretion.⁷ At this stage, given that the prospective employees/union members are *ex ante* differentiated regarding their reservation wage, our interest is focused on whether unions will *ex post* set discriminatory firm-specific wage rates. Each i union may thus alternatively opt for,

- $w_{0i} \neq w_{di}$
- $w_{0i} = w_{di} = w_{ndi}$

Where, w_{0i} (w_{di}) stands for the wage paid to the N_{0i} (N_{di})-employees/union members, and w_{ndi} denotes a non-discriminatory wage rate.

At stage three all firms simultaneously and independently adjust their employment/output levels.

3. Endogenous Wage Discrimination

Solving the game by backwards induction, at stage three each $i=1,2$ firm adjusts its output x_i so that to maximize its own profits (1), given any level $x_{j \neq i=1,2}$ of its rival firm's output, the firm-specific wage scheme resulting from stage two, and $AdP_X \equiv \bar{f}_i \neq 0$, or $AdP_X \equiv \bar{f}_i = 0$, as an outcome of stage one.⁸

⁷ That is, for analytical convenience, we undertake the *monopoly union* variant of the *right-to-manage* hypothesis. This is a regular restriction in the union-oligopoly literature, and it is not expected to qualitatively affect our analysis (see Petrakis and Vlassis [2004], and the references therein).

⁸ Where, \bar{f}_i stands for a vector of firm-specific taxes, or subsidies, and $\bar{f}_i \neq 0$ means that at least one of its elements $f_i; i = 1, 2$ is different than zero.

Assume for the moment that $\bar{f}_i = 0$. Then, since $x_1 = k[N_{01}(\equiv x_{01}) + N_{d1}(\equiv x_{d1})]$, $x_2 = N_{02}(\equiv x_{02}) + N_{d2}(\equiv x_{d2})$, the sub-game equilibrium is defined by the vectors: (x_{01}, x_{d1}) , (x_{02}, x_{d2}) , which maximize: (1.1), (1.2), respectively.

$$\Pi_1 \{= [(\alpha - x_{01} - x_{d1} - x_{02} - x_{d2})(x_{01} + x_{d1})] - [x_{01}(w_{01}/k) - x_{d1}(w_{d1}/k)]\} \quad (1.1)$$

$$\Pi_2 \{= [(\alpha - x_{01} - x_{d1} - x_{02} - x_{d2})(x_{02} + x_{d2})] - [x_{02}w_{02} - x_{d2}w_{d2}]\} \quad (1.2)$$

The *f.o.c.s* yield,⁹

$$a - 2x_{01} - 2x_{d1} - x_{02} - x_{d2} - (w_{01}/k) = 0 \quad (3.1)$$

$$a - 2x_{01} - 2x_{d1} - x_{02} - x_{d2} - (w_{d1}/k) = 0 \quad (4.1)$$

$$a - x_{01} - x_{d1} - 2x_{02} - 2x_{d2} - w_{02} = 0 \quad (3.2)$$

$$a - x_{01} - x_{d1} - 2x_{02} - 2x_{d2} - w_{d2} = 0 \quad (4.2)$$

Subsequently (3.1)-(4.2) can be solved so as to deliver optimal group-specific employment/output rules for each firm, in the absence of an active antidiscrimination policy,

$$x_{01} = [3a - (13w_{01} - 8w_{d1})/k + (w_{02} + w_{d2})]/21 \quad (5.1)$$

$$x_{d1} = [3a - (13w_{d1} - 8w_{01})/k + (w_{02} + w_{d2})]/21 \quad (6.1)$$

$$x_{02} = [3a - (13w_{02} - 8w_{d2}) + (w_{01} + w_{d1})/k]/21 \quad (5.2)$$

$$x_{d2} = [3a - (13w_{d2} - 8w_{02}) + (w_{01} + w_{d1})/k]/21 \quad (6.2)$$

⁹ Note that the *Hessians*: $H_{1(2)} = \begin{vmatrix} -2 & -2 \\ -2 & -2 \end{vmatrix}$ are negative semi-definite. In consequence, (1.1), (1.2), are concave in (x_{01}, x_{d1}) , (x_{02}, x_{d2}) , respectively. Therefore, (3.1)-(4.1) and (3.2)-(4.2), are also sufficient conditions for the independent maximization problems.

Rules (5.1)-(6.2) can be also arranged as a regular system of reaction functions $x_{i(j)} = R_{i(j)}(x_{i(j)})$, given the unit cost of production of each firm (e.g., $(w_{01} + w_{d1})/2k$; $(w_{02} + w_{d2})/2$),

$$x_1 = 2[a - x_2 - (w_{01} + w_{d1})/2k]/5 \quad (7)$$

$$x_2 = 2[a - x_1 - (w_{02} + w_{d2})/2]/5 \quad (8)$$

The reduced form of (7)-(8) are then seen to be¹⁰,

$$x_1 = [6a - 5((w_{01} + w_{d1})/k) + 2(w_{02} + w_{d2})]/21 \quad (9)$$

$$x_2 = [6a - 5(w_{02} + w_{d2}) + 2((w_{01} + w_{d1})/k)]/21 \quad (10)$$

Let next consider stage two. Given that firm $I(2)$ will unilaterally choose its employment level $N_1 = ((x_{01} + x_{d1})/k) = x_1/k$ ($N_2 = (x_{02} + x_{d2}) = x_2$) so that to satisfy (9) ((10)), union $I(2)$, unilaterally and independently from union $2(I)$, determines the firm-specific wage contract so that to maximize its total rents (given in (2)). As postulated, here each union faces a binary choice, whose ingredients are summarized below.

(a) Discriminatory wage rates

Substituting $(x_{01}/k, x_{d1}/k)$ and (x_{02}, x_{d2}) , from (5.1)-(6.2) into (2), from the *f.o.c.s* of the derived total rents formulas, *w.r.t* (w_{01}, w_{d1}) and (w_{02}, w_{d2}) , we get the following (discriminatory) wage rates.

¹⁰ Note that, $6a > [5(w_{02} + w_{d2}) - 2((w_{01} + w_{d1})/k)]$ guaranties non-trivial interior solutions. For that, however, k must be sufficiently small.

$$w_{01} = [36ak - d(1 + 5k)] / 96 \quad (2.1.1)$$

$$w_{d1} = [36ak - d(49 + 5k)] / 96 \quad (2.1.2)$$

$$w_{02} = [36ak - d(5 + k)] / (96k) \quad (2.2.1)$$

$$w_{d2} = [36ak - d(5 + 49k)] / (96k) \quad (2.2.2)$$

(b) Non-discriminatory wage rates

Subsequently setting $w_{0i} = w_{di} = w_{ndi}$, we analogously get the following (non-discriminatory) wage rates.

$$w_{nd1} = [36ak - 5d(k + 5)] / 96 \quad (2.3)$$

$$w_{nd2} = [36ak - 5d(5k + 1)] / 96k \quad (2.4)$$

Note that, as it can be easily checked, $w_{0i} - w_{di} = d/2$ (e.g. $w_{0i} > w_{di}$); $w_{ndi} = \frac{w_{0i} + w_{di}}{2}$. It then

proves that the following critical differentials are derived.

$$U_{d1}(w_{01}, w_{d1}; w_{nd2}) - U_{nd12}(w_{nd1}; w_{nd2}) = d^2 / 8k^2 \quad (11.1a)$$

$$U_{nd1}(w_{nd1}; w_{02}, w_{d2};) - U_{d12}(w_{01}, w_{d1}; w_{02}, w_{d2}) = -d^2 / 8k^2 \quad (11.1b)$$

$$U_{d2}(w_{02}, w_{d2}; w_{nd1}) - U_{nd21}(w_{nd2}; w_{nd1}) = d^2 / 8 \quad (11.2a)$$

$$U_{nd2}(w_{nd2}; w_{01}, w_{d1};) - U_{d21}(w_{02}, w_{d2}; w_{01}, w_{d1}) = -d^2 / 8 \quad (11.2b)$$

$$\Pi_{d1}(w_{01}, w_{d1}; w_{nd2}) - \Pi_{nd1}(w_{nd1}; w_{nd2}) = d^2 / 8k^2 \quad (12.1a)$$

$$\Pi_{nd1}(w_{nd1}; w_{02}, w_{d2};) - \Pi_{d12}(w_{01}, w_{d1}; w_{02}, w_{d2}) = -d^2 / 8k^2 \quad (12.1b)$$

$$\Pi_{d2}(w_{02}, w_{d2}; w_{nd1}) - \Pi_{nd2}(w_{nd2}; w_{nd1}) = d^2 / 8 \quad (12.2a)$$

$$\Pi_{nd2}(w_{nd2}; w_{01}, w_{d1};) - \Pi_{d21}(w_{02}, w_{d2}; w_{01}, w_{d1}) = -d^2 / 8 \quad (12.2b)$$

Differentials (11.1a)-(11.2b) predict that, in the absence of an active antidiscrimination policy, each union will independently of what the other union does opt for the discriminatory wage contract. Why? The reason is that by doing so each union internalizes the effect of the exogenous factor d (which differentiates the reservation wages) so that the remuneration of each one of its members to equally contribute to the union's total rents in the equilibrium. To grasp it note that, in case $w_{0i} = w_{di}$ (i.e., under a non-discriminatory wage scheme), a worker belonging to the low reservation wage N_d -group would effectively enjoy a “wage premium” d , relative to a worker belonging to the high reservation wage N_0 -group. Therefore, the rent of an N_{di} -employee/union member would be considered to be higher than that of an N_{0i} -employee/union member, by as much as d . Hence, each union driven by its utilitarian objective will set a discriminatory wage contract, $w_{0i} = w_{di} + d/2$, to exactly compensate for that difference in group-specific rents.

Yet, why firms to accommodate such discriminatory wage rates in the equilibrium? As it is in turn predicted by (12.1a)-(12.2b), the reason is that by independently doing so firms enjoy higher profits. Interestingly, this happens with no firm changing its employment-output level relative to the case of a non-discriminatory wage contract. To check for it, note that under a non-

discriminatory wage contract the equilibrium vector (x_1, x_2) would be the solution to the system of reaction functions,

$$x_1 = 2[a - x_2 - (w_{nd1})/k]/5 \quad (13.1)$$

$$x_2 = 2[a - x_1 - (w_{nd2})]/5 \quad (13.2)$$

Then, recalling (7) and (8), and that $w_{ndi} = \frac{w_{0i} + w_{di}}{2}$, it is obvious that $x_i(w_{0i}, w_{di}) = x_i(w_{ndi})$: As

expected in Cournot rivalry, so long as the firm-specific unit cost of production remains the same, the quantities and the price do not change in the equilibrium.¹¹ Unlike in the regular case, however, here the firms' profits increase despite that their market shares remain invariant, because their total costs become sub-additive in N_{di} and N_{0i} via the discriminatory wage scheme.

This, let us call it "diseconomies of scope" feature of wage discrimination, is explicitly portrayed in the following cost differentials.

$$C_{d1}(w_{01}, w_{d1}; w_{nd2}) - [C_{nd12}(w_{nd1}; w_{nd2}) \text{ or } C_{nd1}(w_{nd1}; w_{02}, w_{d2})] = -d^2/8k^2 \quad (14.1)$$

$$C_{d2}(w_{02}, w_{d2}; w_{nd1}) - [C_{nd21}(w_{nd2}; w_{nd1}) \text{ or } C_{nd2}(w_{nd2}; w_{01}, w_{d1})] = -d^2/8 \quad (14.2)$$

In the background, (14.1)-(14.2) are obtained since firms, driven by the differentials in group-specific wage rates (e.g., $w_{0i} - w_{di} = d/2$), reallocate their group-specific employment levels so that,

$$N_{d1}(w_{01}, w_{d1}) - N_{d1}(w_{nd1}) = d/4k ; N_{01}(w_{01}, w_{d1}) - N_{01}(w_{nd1}) = -d/4k \quad (15.1)$$

$$N_{d2}(w_{02}, w_{d2}) - N_{d2}(w_{nd2}) = d/4 ; N_{02}(w_{02}, w_{d2}) - N_{02}(w_{nd2}) = -d/4 \quad (15.2)$$

Of course, each firm would earn even higher profits if it could ex-post remunerate each one of its

¹¹ It is this-no variability of unit costs-property of wage discrimination that makes the firm-specific U_i and Π_i differentials, given in (11.1a) – (12.2b), insensitive to what happens in the (rival) union/firm pair $j \neq i = 1, 2$.

employees with $w_{di} < w_{0i}$. However, this is not an option for any firm. In such an event, as it can be readily checked, the union's rents would be worsened relative to the non-discrimination case. Hence, union i , being the unique input supplier for firm i , by virtue of its monopoly power over the wage would credibly switch to $w_{0i} = w_{di} = w_{ndi}$. In effect we suggest that, in the absence of an active antidiscrimination policy, each union will offer to its own firm a binary *take it-or-leave it* wage contract scheme. That is, at stage two union i will offer $w_{0i} \neq w_{di}$, as an option for firm i , and $w_{ndi} (= \frac{w_{0i} + w_{di}}{2})$, as an alternative option.

Proposition 1 summarizes our findings so far.

Proposition 1

a. In the absence of an active antidiscrimination policy, the union of firm $i=1, 2$, offers to its own firm a binary -take it or leave it- wage contract scheme, with the following options.

1. $w_{0i} \neq w_{di}$; $w_{0i} = w_{di} + d/2$, provided that w_{0i} (w_{di}) applies only to the N_{0i} (N_{di}) employees.

2. $w_{ndi} = \frac{w_{0i} + w_{di}}{2}$, applying to any employee.

b. The profits of each i firm increase under a.1., while its employment/output level(s) remain invariant, relative to a.2. This is due to the reallocation of employment/production, so that N_{di} increases by exactly as much as N_{0i} decreases, leading to total cost sub-additivity in each firm. Hence, since both firms independently find a.1. to their best interest, firm-specific wage discrimination emerges in the equilibrium.

4. Antidiscrimination Policy

Under the light of Proposition 1, let now consider antidiscrimination policy. In our context that is to search for the equilibrium $AdP_X \equiv \bar{f}_i \neq 0$, according to the policy maker's lexicographic objective (**I**; **II**). Recalling that \bar{f}_i denotes a vector of taxes or subsidies, the policy options are as follows.

4.1. Taxing Wage Discrimination

As regards the -order **I**- criterion, the intuitive policy option seems to be a vector of taxes, $\bar{f}_i > 0$, per unit of N_{di} , imposed to employers i whenever they apply the discriminatory wage scheme (*a.I*), sufficient to nullify the i union's rent differential derived from independent firm-specific wage discrimination. Union i would then never offer the binary wage contract scheme. Yet, as regards its welfare consequences (e.g., the-order **II**-criterion), it is rather evident that such a policy would definitely ensue a negative $G(\bar{f}_i)$. To see this, simply recall the -non variability of unit costs-property of wage discrimination. Since sectoral production will therefore remain invariant despite \bar{f}_i -led nondiscrimination, $DCS(\bar{f}_i)$ will be zero, whilst $DU(\bar{f}_i)$ and $DPS(\bar{f}_i)$ will be negative. Apart from its "egalitarian" effect (satisfying **I**), such an active antidiscrimination policy would thus distort the decisions of the labor market agents (i.e., firms and unions) with no effect on the consumers' welfare.

To derive the above explicitly, we first repeat the backwards induction algorithm (stages three and two), in case that at stage one,

(i) $\bar{f}_i > 0$, if $w_{0i} \neq w_{di}$

(ii) $\bar{f}_i = 0$, if $w_{0i} = w_{di} = w_{ndi}$

For tractability assuming that $f_1 = f_2 = f$, the profit schedules in the event of discrimination are then,

$$\Pi_1 \{= [(\alpha - x_{01} - x_{d1} - x_{02} - x_{d2})(x_{01} + x_{d1})] - [x_{01}(w_{01}/k) - x_{d1}((w_{d1} + f)/k)]\} \quad (16.1)$$

$$\Pi_2 \{= [(\alpha - x_{01} - x_{d1} - x_{02} - x_{d2})(x_{02} + x_{d2})] - [x_{02}w_{02} - x_{d2}(w_{d2} + f)]\} \quad (16.2)$$

At stage three, therefore, the group-specific output rules become as follows.

$$x_{01f} = [3a - (13w_{01} - 8w_{d1})/k + (w_{02} + w_{d2}) + f(8+k)/k]/21 \quad (17.1.1)$$

$$x_{d1f} = [3a - (13w_{d1} - 8w_{01})/k + (w_{02} + w_{d2}) - f(13-k)/k]/21 \quad (17.1.2)$$

$$x_{02f} = [3a - (13w_{02} - 8w_{d2}) + (w_{01} + w_{d1})/k + f(8k+1)/k]/21 \quad (17.2.1)$$

$$x_{d2f} = [3a - (13w_{d2} - 8w_{02}) + (w_{01} + w_{d1})/k - f(13k-1)/k]/21 \quad (17.2.2)$$

Using (17.1.1)-(17.2.2) instead of (5.1)-(6.2), at stage two, we subsequently get the after-tax discriminatory wage rates,

$$w_{01f} = [36ak + f(1+5k) - d(1+5k)]/96 \quad (18.1.1)$$

$$w_{d1f} = [36ak - f(47-5k) - d(49+5k)]/96 \quad (18.1.2)$$

$$w_{02f} = [36ak + f(5+k) - d(5+k)]/(96k) \quad (18.2.1)$$

$$w_{d2f} = [36ak - f(47k-5) - d(5+49k)]/(96k) \quad (18.2.2)$$

Note that, though $f > 0$ ex-ante raises the unit cost of only the N_{di} - production, it would ex-post affect both wages (see, e.g., w_{0if} , w_{dif} , relative to, w_{0i} , w_{di}). The reason is that if, after the tax, firms i would go on with the discriminatory wage contract, they would decrease (increase) N_{di} (N_{0i}) according to their group-specific output rules (17.1.1)-(17.2.2). Unions i should therefore

have to decrease (increase) w_{di} (w_{0i}) so that to adjust their discriminatory wage rates to this, f -brought, distortion in the structure of labor demand. On the other hand, however, it is easy to see that $\frac{\partial N_{0i}}{\partial f} < -\frac{\partial N_{di}}{\partial f}$; $i = 1, 2$, for k being sufficiently low. Hence, though the f -oriented adjustment in the structure of group-specific wages is *ceteris paribus* beneficial for the utilitarian unions, if f is high enough both unions might be willing to abandon it for the sake of higher firm-specific employment. The latter is ensuing when $f = 0$ for which nonetheless the requirement is that unions set the non-discriminatory firm-specific wage rates in the equilibrium. To check for that explicitly, (17.1.1)-(18.2.2) can be used to calculate the following critical union rent differentials.¹²

$$U_{d1f}(w_{01f}, w_{d1f}; w_{nd2}) - U_{nd12}(w_{nd1}; w_{nd2}) \quad (19.1)$$

$$U_{d2f}(w_{02f}, w_{d2f}; w_{nd1}) - U_{nd21}(w_{nd2}; w_{nd1}) \quad (19.2)$$

The f -roots of, (19.1), (19.2), securing interior solutions, are then found to be respectively the following.

$$f_{R1} = \frac{24(\gamma_1 - \sqrt{\varepsilon_1})}{\sigma_1} \quad (20.1)$$

Where,

$$\gamma_1 = k\{a(180 - 72k) - d(71 - 10k)\} + 619d$$

$$\sigma_1 = 14971 - k(2258 - 355k)$$

$$\varepsilon_1 = \gamma_1^2 - 212d^2\sigma_1$$

¹² The outcomes of these differentials turn to be highly complicated expressions in the parameters of our model. Since therefore they do not add much to the reader, they are presently omitted. Yet, they are available from the authors upon request.

$$f_{R2} = \frac{24(\gamma_2 - \sqrt{\varepsilon_2})}{\sigma_2} \quad (20.2)$$

Where,

$$\gamma_2 = k\{a(180k - 72) - d(71 - 10/k)\} + 619dk^2$$

$$\sigma_2 = 14971k^2 - k(2258 - 355/k)$$

$$\varepsilon_2 = \gamma_2^2 - 21(dk)^2 \sigma_2$$

It can be readily checked that $f_{R1} > f_{R2}$, for all positive a, d , values, and k being sufficiently low. Since both (19.1) and (19.2) decrease with f , the imposition of $f = f_{R1}$ will be thus binding for both unions. It indeed proves that,

$$U_{d1f}(w_{01f}, w_{d1f}; w_{nd2}) - U_{nd12}(w_{nd1}; w_{nd2}) \Big|_{f=f_{R1}} = 0 \quad (20.1)$$

$$U_{d2f}(w_{02f}, w_{d2f}; w_{nd1}) - U_{nd21}(w_{nd2}; w_{nd1}) \Big|_{f=f_{R1}} < 0 \quad (20.2)$$

Therefore, as long as $f_1 = f_2 = f_{R1}$ is credibly announced (at stage one), both unions will be deterred to offer the binary wage contract scheme (at stage two), and the non-discriminatory wage rates (2.3) - (2.4) will be set in the sub-game perfect equilibrium.

As regards the policy maker's -order **II**- criterion, the following - welfare comprising - differentials are then seen to arise.

$$DCS(AdP_X = f_{R1}) \equiv \left\{ \sum_{i=1}^2 x_i(w_{nd1}, w_{nd2}) \right\}^2 - \sum_{i=1}^2 x_i(w_{01}, w_{d1}, w_{02}, w_{d2}) \right\} / 2 = 0 \quad (21)$$

$$DU(AdP_X = f_{R1}) \equiv \left\{ \sum_{i=1}^2 U_i(w_{nd1}, w_{nd2}) - \sum_{i=1}^2 U_i(w_{01}, w_{d1}, w_{02}, w_{d2}) \right\} = -\frac{d^2(k^2 + 1)}{8k^2} \quad (22)$$

$$DPS(AdP_X = f_{R1}) \equiv \left\{ \sum_{i=1}^2 \Pi_i(w_{nd1}, w_{nd2}) - \sum_{i=1}^2 \Pi_i(w_{01}, w_{d1}, w_{02}, w_{d2}) \right\} = -\frac{d^2(k^2 + 1)}{8k^2} \quad (23)$$

Thus, even ignoring any monitoring and implementation costs of the suggested taxation policy (e.g., effectively assuming that $C(AdP_X = f_{R1}) = 0$, hence, the balanced budget constraint is satisfied), the policy maker will confront a net welfare loss:¹³

$$-G(AdP_X = f_{R1}) = \frac{d^2(k^2 + 1)}{4k^2} \quad (24)$$

Is there an alternative policy option?

4.2. Subsidizing Discriminated Employment

The answer to this inquiry can be traced by recalling (17.1.1)-(17.2.2) and setting $f \equiv -s$ therein. That is, by postulating that at stage one a subsidy (instead of a tax) per unit of N_{di} is announced. We further postulate that this subsidy would be given to employers whatever is their firm-specific wage rates' configuration.

Then, in the event of ex-ante discrimination it is rather obvious that, if $-s = -d$, from (18.1.1)-(18.2.2) we ex-post get,

$$w_{01-s} = w_{d1-s} = [36ak - 2d(1 + 5k)]/96 \quad (25.1)$$

$$w_{02-s} = w_{d2-s} = [36ak - 2d(5 + k)]/(96k) \quad (25.2)$$

Whilst, if it is assumed that unions do not ex-ante discriminate (e.g., opt for $w_{ndi-s} = w_{0i-s} = w_{di-s}$; $i = 1,2$), it analogously proves that, as expected, under the $f \equiv -s = -d$ regime we ex-post get the same as above firm-specific wage configuration,

$$w_{nd1-s} = [36ak - 2d(1 + 5k)]/96 \quad (26.1)$$

$$w_{nd2-s} = [36ak - 2d(5 + k)]/(96k) \quad (26.2)$$

¹³ Note that, apart from any expenditures needed to detect discrimination and thus be able to tax the discriminating firms (: monitoring and implementation costs), the policy maker incurs no other costs from the suggested taxation

Our intuition on this result can once more be enlightened by means of (17.1.1)-(18.2.2). Note now that, if $f \equiv -s$ and firms i operate under the discriminatory wage contracts, they would this time increase (decrease) N_{di} (N_{0i}), according to their group-specific output rules. Unions i should thus have to increase (decrease) w_{di} (w_{0i}), and it simply proves that this adjustment runs all the way, up to non-discrimination among w_{di} and w_{0i} , if $-s = -d$. The emerging equilibrium can be also assured by means of the following critical union rent differentials.

$$U_{d1-s}(w_{01-s}, w_{d1-s}; w_{nd2-s}) - U_{nd12-s}(w_{nd1-s}; w_{nd2-s}) = \frac{(d-s)^2}{8k^2} \quad (27)$$

$$U_{d2s}(w_{02s}, w_{d2s}; w_{nd1s}) - U_{nd21s}(w_{nd2s}; w_{nd1s}) = \frac{(d-s)^2}{8} \quad (28)$$

As (26)-(27) clearly dictate, if $-s = -d$, both unions will have no incentive to independently deviate from non-discrimination. Hence, the unions will definitely set the non-discriminatory firm-specific wage rates (24a)-(25a) in the sub-game perfect equilibrium.

The -welfare comprising- differentials, arising from the suggested subsidization policy, are subsequently seen to be as follows.

$$DCS(AdP_x = -s = -d) \equiv \left\{ \sum_{i=1}^2 x_i (w_{nd1-s}, w_{nd2-s}) \right\}^2 - \sum_{i=1}^2 x_i (w_{01}, w_{d1}, w_{02}, w_{d2}) \right\} / 2 ;$$

$$DCS(AdP_x = -s = -d) = \frac{d \{200ak(1+k) + d[3(1+k)^2]\}}{6272k^2} \quad (29)$$

$$DU(AdP_x = -s = -d) \equiv \left\{ \sum_{i=1}^2 U_i(w_{nd1-s}, w_{nd2-s}) - \sum_{i=1}^2 U_i(w_{01}, w_{d1}, w_{02}, w_{d2}) \right\} ;$$

$$DU(AdP_x = -s = -d) = \frac{d \{1080ak(1+k) + d[7433(1+k^2) - 1150k]\}}{16128k^2} \quad (30)$$

policy. Nor she/he collects any tax revenues in the (non-discriminatory) equilibrium.

$$DPS(AdP_x = -s = -d) \equiv \left\{ \sum_{i=1}^2 \Pi_i(w_{nd1-s}, w_{nd2-s}) - \sum_{i=1}^2 \Pi_i(w_{01}, w_{d1}, w_{02}, w_{d2}) \right\};$$

$$DPS(AdP_x = -s = -d) = \frac{d\{5400ak(1+k) + d[49261(1+k^2) - 5750k]\}}{112896k^2} \quad (31)$$

Recall, nonetheless, that the policy maker operates under a balanced budget constraint. He/she will therefore have to bear the costs of financing the subsidy in the equilibrium. It thus proves that, apart from any monitoring and implementation costs, the suggested subsidization policy would entail a cost equal to,

$$C(AdP_x = -d) = d \sum_{i=1}^2 N_{di}(w_{ndi-s}) = \frac{d\{90ak(1+k) + d[619(1+k^2) - 50k]\}}{1008k^2} \quad (32)$$

Yet, by summing up (29)-(32), it interestingly follows that a (gross) welfare gain is ensuing in the equilibrium:

$$G(AdP_x = -d) = \frac{d\{3240ak(1+k) + d[16657(1+k^2) - 2750k]\}}{56448k^2} \quad (33)$$

Hence, it is rather apparent that a net welfare gain may even arise if the subsidization policy's monitoring and implementation costs are sufficiently low. Consider for instance that the latter costs amount to $c \sum_{i=1}^2 N_{di}(w_{ndi-s})$, where c denotes a constant expenditure per unit of N_{di} -

subsidized, in the equilibrium.¹⁴ It then easily proves that:

$$G(AdP_x = -d) - c \sum_{i=1}^2 N_{di}(w_{ndi-s}) > 0, \text{ if } c < \bar{c}. \text{ Where,}$$

$$\bar{c} = \left[\frac{d}{56} \right] \left[\frac{3240ak(1+k) + d(16657(1+k^2) - 2750k)}{90ak(1+k) + d(619(1+k^2) - 50k)} \right] ; \quad \frac{\partial \bar{c}}{\partial d} > 0 \quad (34)$$

¹⁴ That is c is needed to be spent per subsidized employee in order the latter to be detected as truly belonging to the low reservation wage- group and thus her/his employer to receive the subsidy d .

Our findings regarding antidiscrimination policy are establishing Proposition 2.

Proposition 2

a. To combat wage discrimination, a benevolent policy maker (operating under a balanced budget constrain) may alternatively,

1. Announce a tax $f_i = f_{R1}$, per unit of N_{di} , which will be imposed to firms $i=1, 2$, whenever they apply the discriminatory wage scheme (a.1 in Proposition 1.).

2. Issue to firms $i=1, 2$, a subsidy $f_i = -s = -d$, per unit of N_{di} , independently of whether or not they apply the discriminatory wage scheme.

b. Both policies result to non-discriminatory wage rates in the equilibrium. However, while the taxation policy always entails a net welfare loss, the subsidization policy may lead to a net welfare gain, if it's monitoring and implementation costs are sufficiently low. Thus, the latter policy is always superior to the former on efficiency grounds.¹⁵

5. Conclusions

In this paper we have developed a union-oligopoly sectoral framework reasoning wage discrimination among equally-skilled workers that, apart from elsewhere, is often observed in the (heavily unionized) European labor markets. Under quite regular assumptions regarding union behavior and power we have shown that, in the absence of an active antidiscrimination policy, wage discrimination is emerging as an (implicit) equilibrium arrangement among firms and unions. Three key elements are necessary for that. First, the equally skilled workers must be differentiated (grouped) regarding (according to) their reservation wages. Second, unions must effectively embody all kinds (groups) of equally skilled workers. Third, collective bargaining

¹⁵ Note that, most probably, the last statement in Proposition 2b holds true even if $c > \bar{c}$. Unless, there is enough

must be decentralized at the firm level. There is adequate evidence that all those elements are often met in our reference sector(s). Apart from the *open shop* scheme (recall footnote 4), firm-specific collective agreements are taking place in many European labor markets (see, e.g., Hartog and Theeuwes [1992]). While, given the above facts, and the European migrant experience over the last decades, it is rather unlikely reservation wages to be uniform, even at the firm level.

Our analysis, though stylized, turns to be robust along a number of dimensions. First, qualitatively similar results would be obtained if we ignore for technological asymmetries among firms, allow for a positive upper bound of the reservation wage, consider product differentiation, or extent the analysis to the $n(>2)$ -firm oligopoly (and thus subsequently consider the case of perfect competition). Moreover, since total cost sub-additivity along with unit cost invariance is essentially what drives our results regarding the product market, wage discrimination would also emerge under the Bertrand mode of competition. On the other hand, depending on the relative weights assigned to each group's rents, unions may still opt for wage discrimination even if we allow for a more "egalitarian" union objective function.

As it comes to our considered antidiscrimination policies, we propose that wage discrimination can be fought without the latter necessarily ensuing a welfare loss. More importantly, our findings imply that a tax announced to deter wage discrimination is rather non-credible, since it always incurs a loss to the policy makers.¹⁶ Last, but not least, we have shown that our suggested subsidization policy would ensue a net welfare gain, provided however that its costs are sufficiently low. Hence, our analysis suggests that the E.U.-antidiscrimination directives may in fact prove to be effective, on both egalitarian and efficiency grounds, insofar as they are

reasoning that the subsidization policy's monitoring and implementation costs are sufficiently higher than their counterparts arising from the taxation policy.

¹⁶ Our conjecture is that even if the policy makers' objective is altered, so as to capture political economy considerations, the suggested taxation policy would still prove to incur a loss to them: Simply because the unions

escorted by a financial assistance scheme to policy makers, covering (at least a part of) those costs, including the sunk ones of setting up the monitoring system.

and the firms would definitely oppose that policy, while consumers would be indifferent.

References

Aigner, D., Cain, C., 1977: Statistical Theories of Discrimination. In Ashenfelter, O., Rees, A., (editors): *Discrimination in the Labor Markets*, Princeton University Press.

Allanson, P., Atkins, J.P., and T. Hinks, 2000: A multilateral decomposition of racial wage differentials in the 1994 South African Labour Market, *Journal of Development Studies*, 37(1), 93-120.

Arrow, K.J., 1972: The Theory of Discrimination. In Ashenfelter, O., and Rees, A., (editors): *Discrimination in the Labor Markets*, Princeton University Press.

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

Bergmann, B., Krause W., 1972: Evaluating and Forecasting Progress in Racial Integration of Employment. *Industrial and Labor Relations Review*, 25(3), 399-409.

Cabinet Office Strategy Unit: 35, 2003.

Council Directive 2000/43/EC: Implementing the Principle of Equal Treatment between Persons Irrespective of Racial or Ethnic Origin. *Official Journal of the European Communities*, June, 29, 2000.

Council Directive 2000/78/EC: Establishing a General Framework for Treatment in Employment and Occupation. *Official Journal of the European Communities*, November, 27, 2000.

Discrimination in Europe. *Eurobarometer*, 57.0, 2003.

Dixit, A., 1979: A Model of a Duopoly Suggesting a Theory of Entry Barriers. *Bell Journal of Economics*, 10, 20-32.

Equality and Non-Discrimination in an Enlargement Union: Commission of the European Communities, *Green Paper*, 2004.

Hartog, J., Theeuwes, J., 1992: *Labour Market Contracts and Institutions: a Cross-National Comparison*, Amsterdam: North-Holland.

Hinks, T., Watson, D., 2001: A multinomial logit non-discriminatory approach to estimating racial wage and occupational discrimination. *Applied Economics*, 33, 605-612.

Migrant and ethnic minority workers: Challenging Trade Unions: *European Trade Union Confederation*, 2003.

Oswald, A. J., 1982: The Microeconomic Theory of the Trade Union. *Economic Journal*, 92, 269-283.

Petrakis, E., Vlassis, M., 2004: Endogenous Wage-Bargaining Institutions in Oligopolistic Sectors. *Economic Theory*, 24, 55-73.

Swinton, D.H., 1977: A Labor Force Competition Theory of Discrimination in the Labor Market. *American Economic Review: Paper and Proceedings*, 67, 400-404.

Vlassis, M., 2003: Wage Centralization and the Scope of Firm-Union Bargaining in Oligopoly: “Efficient Bargains” or “Labour Demand”? *Manchester School*, 71(3), 308-329.

www.soc.uoc.gr/benetec