

Racial Discrimination and Redlining in Cities^α

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Abstract

The aim of this paper is to bring together spatial and racial discrimination in an urban framework. While racial discrimination is against black workers, spatial discrimination (or redlining) is against residents living in the city-center. When the relative access cost for black workers to employment centers is sufficiently large, a city is segregated by race. When the relative access cost is sufficiently small, a city is segregated by employment status. By examining the interaction between land and labor markets, this paper finds that both race and space are responsible for the high unemployment rate among blacks.

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1 Introduction

The 'race versus space' debate is crucial in understanding why minorities (especially blacks) suffer from economic disadvantages. This debate attempts to measure whether these economic disadvantages endured by blacks are the results of labor market discrimination or their residential location. The aim of this paper is to show that both race and space matter for explaining the high unemployment rate among blacks.

The theoretical literature has given several answers to these two types of problems, i.e., labor discrimination and urban segregation. In labor economics, Becker [3] assumes a 'taste for discrimination' on the part of employers so that discriminated workers will not invest much in human capital due to low returns. In urban economics, Rose-Ackerman [41], Yinger [47], Courant and Yinger [11] (among others) stipulate that whites do not want to live close to blacks because it affects their utility level negatively (negative externalities). They show that, in equilibrium, the two communities are spatially separated, blacks living at the vicinity of the city-center and whites at the outskirts of the city. More recently, Benabou [4],[5] shows that, even though education is a local public good and generates externalities, the only stable urban equilibrium is the one in which the two communities are totally separated.

In all these studies, the direct link between labor discrimination and urban segregation is not explicit. The more natural link has been introduced empirically by Kain [25], who has put forward the spatial mismatch hypothesis to explain the high rates of poverty and unemployment among black inner-city residents. Residing in segregated areas distant from and poorly connected to major centers of employment growth (which are located, in general, in the suburbs of American cities), blacks are said to face strong geographic barriers to finding and keeping well-paid jobs. For example, Zax and Kain [49] show that the suburbanization of employment tends to reduce black opportunities and increase black unemployment since, when firms decide to relocate themselves to the periphery of the city (which is an important phenomenon in the US; see e.g., Garreau [14]), segregation forces some blacks to quit their jobs rather than to follow their employer.

Two reasons (that are linked) can explain why inner-city blacks do not follow suburban jobs: Housing discrimination (see e.g. Gordon [17] and Yinger [48]), in which suburban landlords are reluctant to rent housing to blacks and geographic redlining (see e.g. Ladd [28] and Lang and Nakamura

[29]), involving differentials in mortgage loan supply across neighborhoods or space. In the present paper, we adopt a different definition of (geographic) redlining since it refers to the fact that, irrespective of race, employers draw a red line between the central part of the city and its suburbs, and discriminate against central residents (both in terms of hiring and ...ring). Different reasons can justify this type of prejudice. First, it is well documented that ghettos, generally located at the vicinity of the city-center, are characterized by high crime rates, so that employers are more reluctant to employ 'potential' criminals (Rasmusen [40], Verdier and Zenou [44]). Second, the suburban schools are in general of better quality, so suburban workers might have a superior education, irrespective of race.

The ...rst two aspects (housing discrimination and geographical differentials in mortgage loan supply) limit the residential location of black workers and implicitly restrict black employment to workplaces that are within acceptable commuting distances of black residential areas whereas the third aspect (redlining in the labor market) provides a link between residential location and labor market outcomes.

In this context, accessibility to jobs is the key question since, in general, blacks have fewer cars than whites. For example, Raphael [39] shows that differential accessibility explains 30 to 50% of the neighborhood employment rate differential between white and black male Bay-Area youths (San Francisco-Oakland-San Jose consolidated Metropolitan Statistical Area for the year 1990). Ihlanfeldt [20],[21], and Ihlanfeldt and Sjoquist [22],[23] ...nd similar results for other MSAs. Although there is a huge empirical literature testing the spatial mismatch hypothesis (see the survey articles written by Holzer [19], Kain [26] and Ihlanfeldt and Sjoquist [24]), its theoretical modelling is still in its infancy (exceptions include Anas [1], Arnott [2], Brueckner and Martin, [7], Brueckner and Zenou [9], Coulson, Laing and Wang [10], Wasmer and Zenou [45]).

The aim of this paper is to integrate spatial mismatch (as in Brueckner and Martin, [7], and Brueckner and Zenou [9]) and differential access costs (as in Coulson, Laing and Wang [10], and Wasmer and Zenou [45]) by examining both racial and spatial discrimination and their implications for city segregation (by race and/or employment status). While racial discrimination is against black workers, spatial discrimination (or redlining) is against residents living in the city-center. When the relative access cost for black workers to employment centers is sufficiently large, a city is segregated by race. When the relative access cost is sufficiently small, a city is segregated

by employment status. By examining the interaction between land and labor markets, the paper finds that both race and space are responsible for the high unemployment rate among blacks.

Section 2 of the paper presents the basic urban model. In section 3, we study the equilibrium in both land and labor markets when firms discriminate against blacks (racial discrimination). Section 4 is devoted to the case in which both racial and spatial discrimination are present. Finally, section 5 concludes by addressing some policy implications of the model.

2 Urban land use equilibrium

There is a continuum of black workers (B) whose mass is given exogenously by \bar{N}_B and a continuum of white workers (W) whose mass is given exogenously by \bar{N}_W . For simplicity, we normalize the total active population \bar{N} ($= \bar{N}_B + \bar{N}_W$) to 1. Each worker can either be unemployed (where U_k is the mass of the unemployed of type $k = B; W$) or employed (where L_k is the mass of the employed of type $k = B; W$). Therefore, we have:

$$\bar{N}_k = U_k + L_k \quad k = B; W \quad (1)$$

The city is monocentric, i.e. all jobs and services are located at the city-center called the CBD (Central Business District), closed (i.e., the workers' utility level is endogenous whereas the number of workers is exogenous), and circular. All land is owned by absentee landlords. Land is a normal good (i.e. the income effect on the Marshallian demand for land is positive) so that richer workers consume more land than poorer ones.

Each worker enjoys housing consumption q and a (non-spatial) composite good z (taken as the numeraire), so that the utility function is written $V(q; z)$. We assume that this function is well behaved (continuous, increasing and strictly quasi-concave at all $q > 0$ and $z > 0$). Moreover, the budget constraint for an employed worker of type k is given by:

$$w_k - c(k)z = z + q R(x) \quad k = B; W \quad (2)$$

while the one for an unemployed worker of type k is given by:

$$b_k - c(k)z = z + q R(x) \quad k = B; W \quad (3)$$

where w is the downward rigid (exogenous) wage, which is assumed to be greater than the market clearing wage, so that unemployment prevails in equilibrium;¹ b , the (exogenous) unemployment benefit, with $b < w$; $R(x)$, the equilibrium land rent at a distance x from the CBD; \tilde{c} , the commuting cost per unit of distance. Concerning commuting costs, we have an important but realistic assumption captured by $c(k)$. We indeed assume that $c(k) = 1$ for $k = W$ (whites) and $c(k) = c > 1$ for $k = B$ (blacks), which means that black workers have higher commuting cost per unit of distance than whites ($c\tilde{c}$ versus \tilde{c}). This highlights a well established fact that access to employment centers is more difficult for blacks than for whites. For example, in the U.S., large cities have poor public transportation networks, so that workers frequently have to take their cars to go to work. It is well known that blacks possess fewer cars than whites, so that access to jobs is more difficult for them (see, for example, Glaeser, Kahn and Rappaport [15], Raphael [39] and Zax and Kain [49]). Observe also that we could have differentiated the unemployed and the employed in terms of CBD-trips by assuming that the former go less often to the CBD than the latter. However, we do not adopt this assumption here, since, even if there is no explicit job search behavior, the unemployed are assumed to go to the CBD as often as the employed for shopping, acquiring job information and interviews. Relaxing this assumption will not change the main results but will complicate the analysis (see our discussion below).

It is important to observe that we do not need the labor market analysis (next section) to determine the urban land use equilibrium. In fact, we can solve the locational equilibrium prior to the labor market equilibrium because there is no job search and locational choices for both employed and unemployed workers involve only mixed transportation costs and consumption of housing and composite goods, which affects only short run utilities. This is similar to the study of Zenou and Smith [42]. However, if locational choices had involved explicit trade-offs between accessibility to the job market through search (affecting long run utilities) and consumption of housing and composite goods (affecting short run utilities), then expected lifetime utilities would have played a fundamental role and the two market equilibria (land and labor) would need to be solved for simultaneously (as in Wasmer

¹This wage could have been endogenized by using, for example, the efficiency wage theory (as in Zenou and Smith [51]), but this would have complicated the analysis without changing the main results since our focus is not on the formation of wages in cities but on labor discrimination and urban segregation.

and Zenou [45] and Smith and Zenou [42]).

Let us denote by $I_k^l(x)$ the net income of a worker of type $k = B; W$ with employment status $l = U; L$ residing at a distance x from the CBD (this is a worker of type ' $k; l; x$ '). In this context, $I_B^U(x) = b_i - c_i x$ refers to the net income of an unemployed black worker, $I_B^L(x) = w_i - c_i x$, of an employed black worker, etc. Each worker of type $k; l; x$ chooses the q that maximizes $V(q; I_k^l; qR(x))$. The first order condition yields:²

$$V_q(\cdot) - R(x) V_z(\cdot) = 0 \quad (4)$$

which defines implicitly the Marshallian demand for land $q(I_k^l; R; x)$ for a worker of type $k; l; x$. In the (steady state) urban equilibrium, all workers of the same type k and the same employment status l reach the same utility level v_k^l , whatever their residential location x . Using (4), we can write the indirect utility function as follows:

$$V(q(I_k^l; R; x); I_k^l; q(I_k^l; R; x)R) = v_k^l \quad k = B; W \quad l = U; L \quad (5)$$

By taking the inverse of the indirect utility function, we can determine workers' bid rents $a_k^l(x; v_k^l)$ as a function of distance, net income and equilibrium utility. Their properties are:

$$\frac{\partial a_B^l(x; v_B^l)}{\partial x} = \frac{-i - c_i}{q(I_B^l; R; x)} < 0 \quad l = U; L \quad (6)$$

$$\frac{\partial a_W^l(x; v_W^l)}{\partial x} = \frac{-i - c_i}{q(I_W^l; R; x)} < 0 \quad l = U; L \quad (7)$$

We have the following results.

Proposition 1 Within a given race, the employed workers have higher bid rents than the unemployed, so that they reside farther away from the CBD.

Proof. Let us denote by \bar{x} the bid rents' intersection point. Then $a_k^L(\bar{x}; v_k^L) = a_k^U(\bar{x}; v_k^U) = \bar{R}$ for $k = B; W$. We must show that:

$$i \frac{\partial a_k^U(\bar{x}; v_k^U)}{\partial x} > i \frac{\partial a_k^L(\bar{x}; v_k^L)}{\partial x} \quad k = B; W$$

Since land is a normal good, $q(I_k^L; \bar{R}; x) > q(I_k^U; \bar{R}; x)$; $k = B; W$. Then by using (6) and (7), it is easily checked that the inequality above is always true. ■

²The second order condition is always satisfied because of the quasi-concavity of $V(\cdot)$:

Proposition 2 For a given employment status, whites have flatter bid rents than blacks, so that they reside farther away from the CBD.

Proof. We must show that at \bar{x} we have:

$$i \frac{\partial^a I_B^l(\bar{x}; v_B^l)}{\partial x} > i \frac{\partial^a I_W^l(\bar{x}; v_W^l)}{\partial x} \quad I = U; L$$

Since $c > 1$, $I_W^l > I_B^l$ so that (because land is a normal good) $q(I_W^l; \bar{R}; x) > q(I_B^l; \bar{R}; x)$; $I = U; L$. Then by using (6) and (7), it is easily checked that the inequality above is always true. ■

Propositions 1 and 2 are easy to understand. Because the employed are richer than the unemployed, they want to consume more land, so that they prefer peripheral locations where land is cheaper. This result relies on the hypothesis that the employed and the unemployed have the same number of CBD-trips. If this were not the case, there would be a trade-off between commuting costs and land consumption. However, it would always be possible to find conditions to ensure that the unemployed have steeper bid rents than the employed (see e.g. Brueckner and Zenou [8]). The second result (Proposition 2) is also quite intuitive. Since blacks have difficulty to access to the employment center, they bid away whites to the outskirts of the city. In Detroit, Zax and Kain [49] show that blacks are indeed very sensitive to commuting costs. By studying the case of a large firm that relocates to the periphery of Detroit, they show that a large fraction of black workers prefer to stay unemployed rather than to have long reverse commuting trips. Of course, it is important to observe that, in our model, there is free mobility and thus no discrimination in the land market, so that blacks are able to locate closer to jobs and to bid away whites. However, this is not always true in reality, since some land owners are reluctant to rent apartments to black workers in certain areas of the city.

Because of propositions 1 and 2, it is easily verified that only two urban equilibria can exist. We have indeed:

Proposition 3

- ² (i) If the access cost c is sufficiently large, then the unique urban equilibrium configuration is Equilibrium 1 where blacks and whites are spatially separated (BU; BL; WU; WL).

- ² (ii) If the access cost c is sufficiently small, then the unique urban equilibrium configuration is Equilibrium 2 where workers are separated by their employment status (BU; WU; BL; WL).

Proof. For (i), i.e. Equilibrium 1 (see Figure 1), let us denote by x_4 the border between the black unemployed and the black employed, by x_3 , the border between the black employed and the white unemployed and by x_2 , the border between the white unemployed and the white employed. We want to show that:

$$\begin{aligned} i \frac{\partial^a U_B(x_4; v_B^U)}{\partial x} &> i \frac{\partial^a L_B(x_4; v_B^L)}{\partial x} \\ i \frac{\partial^a L_B(x_3; v_B^L)}{\partial x} &> i \frac{\partial^a U_W(x_3; v_W^U)}{\partial x} \\ i \frac{\partial^a U_W(x_2; v_W^U)}{\partial x} &> i \frac{\partial^a L_W(x_2; v_W^L)}{\partial x} \end{aligned}$$

For (ii), i.e. Equilibrium 2 (see Figure 2), let us denote by x_4^0 the border between the black unemployed and the white unemployed, by x_3^0 , the border between the white unemployed and the black employed and by x_2^0 , the border between the black employed and the white employed. We want to show that:

$$\begin{aligned} i \frac{\partial^a U_B(x_4^0; v_B^U)}{\partial x} &> i \frac{\partial^a U_W(x_4^0; v_W^U)}{\partial x} \\ i \frac{\partial^a U_W(x_3^0; v_W^U)}{\partial x} &> i \frac{\partial^a L_B(x_3^0; v_B^L)}{\partial x} \\ i \frac{\partial^a L_B(x_2^0; v_B^L)}{\partial x} &> i \frac{\partial^a L_W(x_2^0; v_W^L)}{\partial x} \end{aligned}$$

Because of propositions 1 and 2, we just have to verify that:

$$i \frac{\partial^a L_B(x_3; v_B^L)}{\partial x} > i \frac{\partial^a U_W(x_3; v_W^U)}{\partial x} \quad (8)$$

for Equilibrium 1, and

$$i \frac{\partial^a L_B(x_3^0; v_B^L)}{\partial x} < i \frac{\partial^a U_W(x_3^0; v_W^U)}{\partial x} \quad (9)$$

for Equilibrium 2

By using (6) and (7), equations (8) and (9) can respectively be rewritten as:

$$c > \frac{q(I_B^L; R; x)}{q(I_W^U; R; x)} \quad \text{at} \quad x = x_3 \quad (10)$$

$$c < \frac{q(I_B^L; R; x)}{q(I_W^U; R; x)} \quad \text{at} \quad x = x_3^0 \quad (11)$$

Since $c > 1$ and since land is a normal good, then if

$$w_i c \dot{x}_3 < b_i \dot{x}_3 \quad (12)$$

holds, $q(I_B^L; R; x) < q(I_W^U; R; x)$ at $x = x_3$, implying that (10) and thus (8) are verified. Obviously, when c is large enough, (12) is verified and Equilibrium 1 prevails, thus proving (i).

Using the same procedure, we have when c is small enough:

$$w_i c \dot{x}_3^0 > b_i \dot{x}_3^0$$

so that (11) and thus (9) hold and Equilibrium 2 prevails, thus proving (ii) ■

Equilibrium 1 prevails when, moving outward from the CBD, we have the location of the following groups: BU; BL; WU; WL, where BU denotes the unemployed black workers, BL, the employed black workers, WU, the unemployed white workers and WL, the employed white workers (see Figure 1). There is thus a total separation between blacks and whites. Equilibrium 2 prevails when, starting from the CBD, we have: BU; WU; BL; WL (see Figure 2), where the separation is now in terms of employment status and not in terms of race. So, when the relative access cost for black workers to employment centers is sufficiently large, a city is segregated by race (Equilibrium 1). When the relative access cost is sufficiently small, a city is segregated by employment status (Equilibrium 2). Indeed, because of propositions 1 and 2, the black unemployed workers always reside at the vicinity of the CBD and the white employed workers at the outskirts of the city. So, the aim of proposition 3 is to determine whether the black employed workers, who trade off between land consumption and access costs, outbid the white unemployed workers. When c is sufficiently large, it is very costly for black workers to go to the CBD, so that they prefer more central locations and thus outbid the white unemployed workers. When c is sufficiently small, black workers prefer

more peripheral locations since access cost to the CBD is not very high and land is cheaper in the suburbs.

[Insert Figures 1 and 2 here]

Observe that, even though all jobs are concentrated in the city-center (monocentric city) and there is no decentralization of employment, we can address the issue of spatial mismatch through differential access costs. Indeed, what matters here is not so much the distance to jobs but the relative access cost for black workers so that when the latter is sufficiently large, the city is segregated by race. This implies a spatial mismatch for blacks in the sense that their residential location strongly influences their labor market outcomes (see in particular section 4).

2.1 Equilibrium 1

The urban land use equilibrium conditions for Equilibrium 1 (see Figure 1) are given by:

$$a_B^U(x_4; v_B^U) = a_B^L(x_4; v_B^L) \quad (13)$$

$$a_B^L(x_3; v_B^L) = a_W^U(x_3; v_W^U) \quad (14)$$

$$a_W^U(x_2; v_W^U) = a_W^L(x_2; v_W^L) \quad (15)$$

$$a_W^L(x_1; v_W^L) = R_A \quad (16)$$

where $x_4; x_3; x_2$ are respectively the borders between BU and BL, BL and WU; WU and WL, x_1 is the city-fringe and R_A the land rent outside the city (the agricultural land rent). We need also the population constraints, which are given by:

$$\int_0^{x_4} \frac{2\frac{1}{4}x}{q(l_B^U; v_B^U; x)} dx = U_B \quad (17)$$

$$\int_{x_4}^{x_3} \frac{2\frac{1}{4}x}{q(l_B^L; v_B^L; x)} dx = L_B - \bar{N}_B - U_B \quad (18)$$

$$\int_{x_3}^{x_2} \frac{2\frac{1}{4}x}{q(l_W^U; v_W^U; x)} dx = U_W \quad (19)$$

$$\int_{x_2}^{x_1} \frac{2\frac{1}{4}x}{q(l_W^L; v_W^L; x)} dx = L_W - \bar{N}_W - U_W \quad (20)$$

Since the city is closed, we have 8 unknowns, i.e. the four utility levels ($v_B^U; v_B^L; v_W^U; v_W^L$) and the four borders ($x_1; x_2; x_3; x_4$), and eight equations

(13) (20). By Proposition 1, Equilibrium 1 exists if c is large enough, so that:

$$w_j - c_j x_4 > b_j - c_j x_4$$

$$b_j - c_j x_3 > w_j - c_j x_3$$

$$w_j - c_j x_2 > b_j - c_j x_2$$

implying the following distribution of net incomes:

$$I_B^L(x_4) > I_B^U(x_4) \quad (21)$$

$$I_W^U(x_3) > I_B^L(x_3)$$

$$I_W^L(x_2) > I_W^U(x_2)$$

We are therefore embedded within the standard income classes framework (see e.g., Hartwick, Schweizer and Varaiya [18] or Fujita [13], ch.4), which implies that there exists a unique urban equilibrium (see Fujita [13]). In this context, each of the eight equilibrium values depends on the exogenous parameters $w; b; c; \zeta; U_B; U_W; L_B; L_W$. Observe that U_W, L_W, U_B and L_B will be determined at the labor market equilibrium (see next sections).

Let us now perform a comparative statics analysis by focusing on the impact of the size of the different population of workers on the endogenous variables. The comparative static results are given by theorems 1 and 2 of Hartwick et al. [18], which are valid under a set of assumptions³ and the fact that the size of the different classes are independent. The first four columns of Table 1 are directly derived from Hartwick et al. [18] by considering that the size of one class is independent of the size of the others. Our comments are the following. First, irrespective of race, when the size of the unemployed population increases (this is also true for the employed population), all utilities are reduced. This is because both the size of the ghetto (where only black unemployed workers live) and of the white unemployed area increase, thus enlarging the city. Consequently, all workers bear higher commuting

³There are in fact three assumptions. The first one (p.398) stipulates that marginal commuting costs are always positive, which is always true here since we assume linear commuting costs. The second one (p.399) states that housing is a normal good, so that facing the same land rent, richer individuals demand more housing than poorer ones, a hypothesis that we have also assumed. The third assumption (p.407) is a technical condition that is satisfied in the present model, since we assume linear commuting costs and a circular city (see their footnote 1 p.407).

costs and obtain lower net wages and utilities. Second, the effect of the unemployed workers on the different borders are easy to understand. When the size of U_B increases, all workers are pushed away from the CBD, while when the population of white unemployed workers rises, only people living on the right of U_W are pushed away. The general message is the following: When a class of workers increases in size, then the outer classes are pushed away from the CBD whereas the inner ones are squeezed towards it. Indeed, since land consumption is endogenous, more employed workers implies more space consumption and thus less available space closer to the CBD.

Table 1: Comparative Statics Analysis for Equilibrium 1

	U_B	U_W	L_B	L_W	U_B^{Net}	U_W^{Net}
V_B^U	i	i	i	i	?	?
V_B^L	i	i	i	i	?	?
V_W^U	i	i	i	i	?	?
V_W^L	i	i	i	i	?	?
X_1	+	+	+	+	i^c	i^c
X_2	+	+	+	i	i^c	+
X_3	+	i	+	i	i^c	$+^c$
X_4	+	i	i	i	+	$+^c$

All signs with a c superscript are derived using our conjecture

However, the assumption, stipulating that the size of one class is independent of the size of the others (used by Hartwick et al. [18] and by us in the first four columns of Table 1), does not hold in the present framework because the size of L_k is exactly the residual size of U_k ($L_k = \bar{N}_k - U_k$). So, when U_k increases, contrary to Hartwick et al. [18], we have to take into account the fact that L_k decreases. It is thus necessary to formulate a conjecture based on their theorems: When the number of the unemployed (black or white) rises, the resulting size increase for the unemployed area is smaller than the resulting decrease in size of the employed area, since the latter are richer and thus consume more land than the former (land is assumed to be a normal good). In the two last columns of Table 1, we have deduced the net effect of a marginal increase in U_B or U_W (denoted by U_B^{Net} and U_W^{Net} respectively) based on our conjecture. Of course, in some cases, this conjecture is not needed, since increasing the number of unemployed and

the number of employed have exactly the same effects on borders. Observe that, for utilities, this conjecture cannot be made since other elements than land consumption are present, so that all signs are ambiguous. The following comments are in order. First, all signs are ambiguous for the utilities since, as stated above, there are two opposite forces at work. For example, when U_B increases, it reduces all utilities in the city but, at the same time, it implies a decrease in L_B (since $\bar{N}_B = L_B + U_B$), which in turns affects utilities positively. The net effect is thus ambiguous. Second, based on the fact that the unemployed workers consume less land than the employed workers of the same type $k = B; W$, we can sign (using our conjecture) the different effects on the borders. So, for example, when U_B increases, the resulting increase of the size of the unemployed black area x_4 is less important than the resulting decrease of the size of the employed black area ($x_3 \downarrow x_4$), since the latter workers are richer and thus consume more land than the former. Thus x_3 falls, along with x_2 and x_1 . In this context, when the number of unemployed rises (black or white), the city size is reduced.

2.2 Equilibrium 2

The urban land use equilibrium conditions for Equilibrium 2 (see Figure 2) are equivalent to the one for Equilibrium 1 and thus the modifications of the previous equations are straightforward. The comparative static results of the net effects are also based on our above conjecture. There are given by:⁴

Table 2: Comparative Statics Analysis
for Equilibrium 2

	U_B^0	U_W^0	L_B^0	L_W^0	U_B^{0Net}	U_W^{0Net}
V_B^{U0}	i	i	i	i	?	?
V_B^{L0}	i	i	i	i	?	?
V_W^{U0}	i	i	i	i	?	?
V_W^{L0}	i	i	i	i	?	?
x_1^0	+	+	+	+	i^c	i^c
x_2^0	+	+	+	i	i^c	+
x_3^0	+	$+^a$	i^a	i	$+^a$	+
x_4^0	+	i	i	i	+	$+^c$

All signs with a c superscript are derived using our conjecture

All signs with a a superscript indicate differences between equilibria 1 and 2

⁴All variables with a prime correspond to Equilibrium 2.

The general comments on this table are similar to the ones on Table 1. The main difference lies on the fact that workers are now separated by employment status, while in Equilibrium 1, they were separated by race. So, when the size of the unemployed or the employed population rises, all utilities are reduced because commuting costs increase. Concerning the effect on borders, we have exactly the same types of effects as in Table 1, so that, when a class of workers increases in size, the outer classes are pushed away from the CBD whereas the inner ones are squeezed towards it. Therefore, when the number of black unemployed U_B^0 (who reside at the vicinity of the CBD) rises, all outer classes are pushed away from the CBD and all borders increase. At the other extreme, when the number of white employed L_W^0 (who reside at the outskirts of the city) rises, all the inner classes are squeezed towards the CBD, so that x_2^0 , x_3^0 and x_4^0 are reduced. Moreover, since the location of the black employed is now more peripheral than in Equilibrium 1, the effect on x_3^0 (the border between the white unemployed and the black employed) is different. For example, when U_B^{0Net} increases, two effects are in order. First, all outer classes are pushed away from the CBD (Hartwick et al. [18]), so that (in particular) x_1^0 rises. Second, since $L_B^0 = \bar{N}_B^0 - U_B^0$, a rise in U_B^0 implies a decrease in L_B^0 , which in turn reduces x_1^0 (Hartwick et al. [18]). However, based on our conjecture, the net effect is negative since the (black) employed consume more land than the (black) unemployed, so that the first effect is dominated by the second one.

In the next two sections, we introduce the labor market analysis. In fact, the main role of this analysis is to derive endogenously the level of unemployment for blacks and whites, and to examine how this affects the land use equilibrium. However, the degree of interaction between land and labor markets is quite different depending on whether firms discriminate workers on the basis of their race only (section 3) or on the basis of both race and space (section 4). Indeed, in the first case, the location of workers (Equilibrium 1 or 2) does not affect labor market outcomes, so that the interaction between the two markets is quite shallow. In the second one, both race and space matter in the labor market analysis. So, depending on which urban land use equilibrium prevails, the resulting unemployment rates can have very different values. More precisely, when the relative access cost for black workers to employment centers is sufficiently large (Equilibrium 1), so that the city is segregated by race, blacks experience very adverse labor market outcomes. On the other hand, when the relative access cost is sufficiently small (Equilibrium 2), so that black employed workers reside in

the suburbs, the black unemployment rate is lower and their unemployment spells are shorter than in Equilibrium 1. There is thus a spatial mismatch for black workers since their residential location partly determines their labor market outcomes, showing that both race and space are responsible for the high unemployment rate among blacks. It is worth emphasizing that land and labor markets are better integrated when race and space matter, since the location of workers (land market) affects unemployment rates (labor market). This is no longer true when only racial discrimination prevails.

3 Labor market equilibrium with racial discrimination

3.1 Racial discrimination

Racial discrimination is introduced in the following way. Employers have racial prejudice, so that they are more reluctant to hire blacks than whites, and once employed, black workers have a greater chance to be fired than whites. Formally, let μ_k be the (exogenous) probability that a worker of type $k = B; W$ loses his job during the current period and \pm_k , the probability that a worker of type $k = B; W$ finds a job during the current period. Racial discrimination implies that $\mu_W < \mu_B$, i.e., a black worker is more likely to lose his job than a white worker and $\pm_W > \pm_B$, i.e., a white unemployed has a greater chance to find a job than a black unemployed. This formulation implicitly assumes that blacks are not discriminated against within the job (blacks and whites earn the same wage w) or outside of the job (blacks and whites earn the same unemployment benefit b) but at the entry of the job (through the probability of finding a job) or at the exit of the job (through the probability of losing a job). For simplicity and without loss of generality, we assume that there is a racial factor $r(k)$, with $r(k) = 1$ for $k = W$ (whites) and $r(k) = r > 1$ for $k = B$ (blacks). We have therefore:

$$\mu_B = r\mu \quad ; \quad \pm_B = \frac{\pm}{r} \tag{22}$$

$$\mu_W = \mu \quad ; \quad \pm_W = \pm \tag{23}$$

3.2 Dynamic job turnover

Each worker of type $k = B; W$ is characterized by his employment status (U or L). We assume that changes in employment status are governed by a time homogeneous Markov process with infinite state space, $S = \{U; L\}$ representing the employment status.⁵ At each period of time, any worker can be either employed or unemployed. We know from the theory of Markov stochastic processes (see e.g. Kulkarni [27]) that, given the employment-status history of individuals k up to time t_0 , their employment status X_t at any subsequent time, $t_0 + t$, depends only on their status at time t_0 , i.e.,

$$P_k(X_{t_0+t} = j | X_{t_0} = i, \dots, t_0) = P_k(X_{t_0+t} = j | X_{t_0} = i)$$

Moreover, we also know that these conditional probabilities depend only on the elapsed time, t , so that for all $i; j \in S$ and $t \geq 0$,

$$P_k(X_{t_0+t} = j | X_{t_0} = i) = P_k(X_t = j | X_0 = i) \equiv P_{t;k}(i; j)$$

where $P_{t;k}(i; j)$ are the transition probabilities of being in employment state j at time t given state i at time zero for a worker of type $k = B; W$. For example, $P_{t;B}(L; U)$ is the transition probability for black workers of being unemployed at time t given that they have been employed at time zero. In this context, the stochastic or transition matrix P_B for black workers is given by:

$$P_B = \begin{matrix} & \begin{matrix} U & L \end{matrix} \\ \begin{matrix} U \\ L \end{matrix} & \begin{bmatrix} 1 - r & r \\ \mu & 1 - \mu \end{bmatrix} \end{matrix}$$

while the one (P_W) for white workers is given by:

$$P_W = \begin{matrix} & \begin{matrix} U & L \end{matrix} \\ \begin{matrix} U \\ L \end{matrix} & \begin{bmatrix} 1 - \mu & \mu \\ \mu & 1 - \mu \end{bmatrix} \end{matrix}$$

⁵People who are black cannot become white and vice versa. We can therefore study the stochastic process for each population of workers (B and W) separately.

Let us now calculate the different transition probabilities using the standard Chapman-Kolmogorov equations. It can be easily be shown (see e.g. Zenou and Smith [51]) that for a worker of type $k = B; W$, we have (remember that $r(k) = 1$ for $k = W$ and $r(k) = r > 1$ for $k = B$):

$$P_{t;k}(U; L) = \frac{\pm}{[r(k)]^2 \mu + \pm} \text{ i } \frac{\pm}{[r(k)]^2 \mu + \pm} e^{i [r(k)\mu + \frac{\pm}{r(k)}]t} \quad k = B; W \quad (24)$$

$$P_{t;k}(L; L) = \frac{\pm}{[r(k)]^2 \mu + \pm} + \frac{[r(k)]^2 \mu}{[r(k)]^2 \mu + \pm} e^{i [r(k)\mu + \frac{\pm}{r(k)}]t} \quad k = B; W \quad (25)$$

Moreover, since $P_{t;k}(U; U) = 1 - P_{t;k}(U; L)$ and $P_{t;k}(L; U) = 1 - P_{t;k}(L; L)$, we easily obtain:

$$P_{t;k}(U; U) = \frac{[r(k)]^2 \mu}{[r(k)]^2 \mu + \pm} + \frac{\pm}{[r(k)]^2 \mu + \pm} e^{i [r(k)\mu + \frac{\pm}{r(k)}]t} \quad k = B; W \quad (26)$$

$$P_{t;k}(L; U) = \frac{[r(k)]^2 \mu}{[r(k)]^2 \mu + \pm} \text{ i } \frac{[r(k)]^2 \mu}{[r(k)]^2 \mu + \pm} e^{i [r(k)\mu + \frac{\pm}{r(k)}]t} \quad k = B; W \quad (27)$$

3.3 Steady state relations and labor market equilibrium

In this paper, we focus only on the steady state equilibrium. Therefore, in steady state (i.e., when $t \rightarrow +\infty$), because of the ergodic properties of Markov stochastic processes, we have:

$$\lim_{t \rightarrow +\infty} P_{t;k}(U; L) = \lim_{t \rightarrow +\infty} P_{t;k}(L; L) = \frac{\pm}{[r(k)]^2 \mu + \pm} \quad k = B; W$$

$$\lim_{t \rightarrow +\infty} P_{t;k}(U; U) = \lim_{t \rightarrow +\infty} P_{t;k}(L; U) = \frac{[r(k)]^2 \mu}{[r(k)]^2 \mu + \pm} \quad k = B; W$$

which means that the probability of being unemployed or employed does not depend on the initial employment status (at time zero). In this context, we obtain the following steady state relations:

$$\frac{\pm}{[r(k)]^2 \mu + \pm} \bar{N}_k = L_k \quad k = B; W \quad (28)$$

$$\frac{[r(k)]^2 \mu}{[r(k)]^2 \mu + \pm} \bar{N}_k = U_k \quad k = B; W \quad (29)$$

Since $\bar{N}_k = U_k + L_k$, we can determine the steady state unemployment level for black workers. It is equal to:

$$U_B = \frac{(r)^2 \mu}{\pm + (r)^2 \mu} \bar{N}_B \quad (30)$$

with

$$\frac{\partial U_B}{\partial r} > 0 \quad ; \quad \frac{\partial U_B}{\partial \mu} > 0 \quad ; \quad \frac{\partial U_B}{\partial \pm} < 0 \quad (31)$$

while the one for white workers is given by:

$$U_W = \frac{\mu}{\pm + \mu} \bar{N}_W \quad (32)$$

with

$$\frac{\partial U_W}{\partial \mu} > 0 \quad ; \quad \frac{\partial U_W}{\partial \pm} < 0 \quad (33)$$

In this context, the difference in unemployment between blacks and whites is given by:

$$\Phi U = U_B - U_W = \mu \frac{(r)^2 \mu}{\pm + (r)^2 \mu} \bar{N}_B - \frac{1}{\pm + \mu} \bar{N}_W \quad (34)$$

Since $\frac{(r)^2 \mu}{\pm + (r)^2 \mu} > \frac{1}{\pm + \mu}$, black unemployment is higher than white unemployment unless the white population is sufficiently larger than the black population. Furthermore, since the racial factor r affects only black workers, then when r increases, U_B rises whereas U_W is not affected. This obviously increases the unemployment difference ΦU between blacks and whites.

We can also explain the intra-urban unemployment rate differences. Indeed, in Equilibrium 1, in which access costs for blacks are large, the city is segregated by race so that the unemployed are scattered (see Figure 1) whereas in Equilibrium 2, in which access costs for blacks are low, the city is segregated by employment status so that the unemployed live adjacent to one another (see Figure 2). In this context, intra-urban unemployment rate differences only exist in Equilibrium 1 since the unemployment rate U_B in the city-center is different than the one in the suburbs U_W (see equation (34)). In Equilibrium 2, this is no longer true because the unemployed (black or white)

are squeezed towards the city-center, so that there is no unemployment in the suburbs.

We are now able to put together the analysis of land (section 2) and labor (section 3) markets. As noted at the end of section 2, the integration between the two markets is quite shallow here, since the location of workers does not affect their labor market outcomes. However, we can link the two markets by examining how labor market variables (such as unemployment levels, hiring and firing rates, the racial discrimination factor) affect the different borders of the city, including city-size. By using Table 1, (31) and (33), we easily obtain for Equilibrium 1:

Table 3a: Comparative Statics Analysis for Equilibrium 1 with racial discrimination

	U_B^{Net}	U_W^{Net}	r	μ	\pm
X_1	i^c	i^c	i^c	i^c	$+^c$
X_2	i^c	$+$	i^c	$?$	$?$
X_3	i^c	$+^c$	i^c	$?$	$?$
X_4	$+$	$+^c$	$+$	$+^c$	i^c

All signs with a c superscript are derived using our conjecture

while, by using Table 2, (31) and (33), we have for Equilibrium 2:

Table 3b: Comparative Statics Analysis for Equilibrium 2 with racial discrimination

	U_B^{0Net}	U_W^{0Net}	r	μ	\pm
X_1^0	i^c	i^c	i^c	i^c	$+^c$
X_2^0	i^c	$+$	i^c	$?$	$?$
X_3^0	$+$	$+$	$+^a$	$+^a$	i^a
X_4^0	$+$	$+^c$	$+$	$+^c$	i^c

All signs with a c superscript are derived using our conjecture

All signs with a a superscript indicate differences between equilibria 1 and 2

Our comments on these two tables are the following. First, we did not consider the impact of r ; μ or \pm on equilibrium utilities since the effects are all ambiguous. Second, since the racial discrimination factor r affects only U_B , its effects on the endogenous variables are unambiguous. For example, when r increases, more blacks become unemployed, so that, in both urban equilibria, the city shrinks and the size of the ghetto (measured by all the

black unemployed workers living close to the city-center) increases. This result is interesting since it shows that racial discrimination does not only affect unemployment but also the size of ghettos. Observe also that, when r rises, x_3 (the border between BL and WU) decreases in Equilibrium 1 while x_3^0 (the border between WU and BL) increases in Equilibrium 2. This is because, in both cases, r affects the number of the black unemployed, which in turn affects x_3 or x_3^0 but the location of the black unemployed differs in the two equilibria. Finally, when \pm (the job acquisition rate) increases or μ (the job destruction rate) decreases, the size of the city increases while the size of the ghetto, x_4 or x_4^0 , is reduced.

More generally, all the results of this section, in particular the impact of r on U_B , are independent of the urban equilibrium. So, whatever the location of workers in the city, the labor market equilibrium yields the same outcomes. This will be no longer true in the next section when redlining is introduced.

4 Labor market equilibrium with racial discrimination and redlining

So far, only labor discrimination was introduced in our model. We have seen that two types of urban land use equilibria were possible. Now, we want to see how redlining (i.e., the fact that, in the labor market, employers discriminate against central residents), a pure spatial phenomenon, affects the labor market equilibrium. For that, we split the city in two by drawing a 'red' line between the center (from zero to x_3 or x_3^0) and the suburbs (from x_3 to x_1 or from x_3^0 to x_1^0). In this context, redlining signifies that, irrespective of race, employers are more reluctant to hire and more eager to hire workers residing close to the CBD (i.e., in the ghetto) than workers living in the suburbs. In our framework, the red line is endogenous since it divides in two the city between the four types of workers and thus depends on which urban equilibrium prevails. In Equilibrium 1, this means that all blacks will suffer from redlining whereas in Equilibrium 2, all the unemployed will be affected by spatial discrimination.

It is worth noting that racial and spatial discrimination are exogenous in our model. This is quite natural for racial discrimination since it is based on prejudices such as the 'taste for discrimination' on the part of employers

(Becker [3]). Concerning redlining, the exogeneity assumption is adopted for simplicity and tractability. Our justification of employers' prejudices against inner-city residents is based on the fact that crime levels are in general higher in central cities than in suburbs (Glaeser and Sacerdote [16], South and Crowder [43]), implying a greater uncertainty about hiring 'potential criminals', which can be harmful to productivity and thus to the cohesion of workers within a firm (see Rasmusen [40] and Verdier and Zenou [44] for theoretical models on this issue).

As with racial discrimination, there is a 'double' spatial discrimination (at the entry and at the exit of the job), so that the probability of finding a job μ^m ($m = C; S$) is lower for a central worker (C) than for a suburban one (S) and the probability of losing a job \pm^m is higher. Formally, spatial discrimination implies that $\mu^C > \mu^S$ and $\pm^C < \pm^S$. Here also, in order to simplify the analysis, we assume that there is a spatial discrimination factor $s(m)$, such that $s(m) = 1$ for $m = S$ (suburbs) and $s(m) = s > 1$ for $m = C$ (center).

4.1 Equilibrium 1

Let us start with Equilibrium 1 in which black workers are both racially and spatially discriminated against. The probabilities of losing a job for the employed workers are given by:

$$\mu_k^m = r(k) s(m) \mu \quad k = B; W \quad m = C; S \quad (35)$$

whereas the probability of finding a job for the unemployed workers are equal to:

$$\pm_k^m = \frac{\pm}{r(k) s(m)} \quad k = B; W \quad m = C; S \quad (36)$$

In this context, the transition matrix P_B^1 for (central) black workers is now written:

$$\begin{array}{c}
 \bar{A} \quad U \quad L \\
 U \quad 1 - j \pm = (rs) \quad \pm = (rs) \\
 L \quad r s \mu \quad 1 - j r s \mu
 \end{array}
 \quad P_B^1$$

whereas for (suburban) white workers, the transition matrix is the same as before ($P_W^1 = P_W$) and is thus equal to (whites are not affected by this policy):

$$U_B^1 - U_W^1 = \frac{(rs)^2\mu}{\pm + (rs)^2\mu} \bar{N}_B - \frac{\mu}{\pm + \mu} \bar{N}_W \quad (36)$$

As in the previous section, we easily obtain the following steady state relations:

$$U_B^1 = \frac{(rs)^2\mu}{\pm + (rs)^2\mu} \bar{N}_B \quad (37)$$

$$U_W^1 = \frac{\mu}{\pm + \mu} \bar{N}_W \quad (38)$$

with

$$\frac{\partial U_B^1}{\partial r} > 0 \quad ; \quad \frac{\partial U_B^1}{\partial s} > 0 \quad ; \quad \frac{\partial U_B^1}{\partial \mu} > 0 \quad ; \quad \frac{\partial U_B^1}{\partial \pm} < 0 \quad (39)$$

$$\frac{\partial U_W^1}{\partial \mu} > 0 \quad ; \quad \frac{\partial U_W^1}{\partial \pm} < 0 \quad (40)$$

The unemployment difference is equal to:

$$\Delta U^1 = U_B^1 - U_W^1 = \mu \frac{(rs)^2\mu}{\pm + (rs)^2\mu} \bar{N}_B - \frac{1}{\pm + \mu} \bar{N}_W \quad (41)$$

Here also, since $\frac{(rs)^2\mu}{\pm + (rs)^2\mu} > \frac{1}{\pm + \mu}$, black unemployment is higher than white unemployment unless the white population is sufficiently larger than the black population. Observe that, because of spatial discrimination between the center and the suburbs ($s > 1$), the unemployment difference between blacks and whites is even larger than when there is no redlining (see (34)). This is due to the fact that whites are not affected by the redlining policy, so that their unemployed level stays the same whereas blacks, suffering from their central location, see an increase in their unemployment level.

We can now shed some light on the interaction between land and labor markets. Because of both the color of their skin and their central location, black workers are strongly discriminated against in the labor market, showing the importance of both race and space in the labor market analysis. We have therefore introduced a bridge between land (or residential location) and labor markets. We now deepen this analysis, by showing how labor market variables affect land market ones. By using Table 1, (39) and (40), we easily obtain the following comparative statics results for Equilibrium 1:

Table 4a: Comparative Statics Analysis for Equilibrium 1 with racial and spatial discrimination

	U_B^{Net}	U_W^{Net}	r	s	μ	\pm
X_1	i^c	i^c	i^c	i^c	i^c	$+^c$
X_2	i^c	$+$	i^c	i^c	$?$	$?$
X_3	i^c	$+^c$	i^c	i^c	$?$	$?$
X_4	$+$	$+^c$	$+$	$+$	$+^c$	i^c

All signs with a c superscript are derived using our conjecture

In Equilibrium 1, where the black and white population is totally separated, the black unemployment level has increased because of the double discrimination (race and space). In particular, when r (the racial discrimination factor) or s (the spatial discrimination factor) increases, the city shrinks, all borders are reduced except the size of the ghetto, x_4 , which increases. This means that the black unemployed are even more segregated because they are both racially and spatially discriminated against and have therefore lower chances to get a job and to leave the ghetto. We have similar effects when the job acquisition rate \pm decreases or the job destruction rate μ increases.

Observe that contrary to the model with only labor discrimination, the labor market equilibrium strongly depends on the urban equilibrium one. Because of high access costs, blacks tend to locate at the vicinity of the CBD, which in turn causes employers to redline them. The resulting unemployment is thus higher and the intra-urban unemployment differences are even more pronounced.

4.2 Equilibrium 2

In Equilibrium 2, workers are separated by their employment status. The red line is thus between the unemployed and the employed and not between blacks and whites as before. In this context, blacks are racially discriminated against and the unemployed workers are spatially discriminated against. Thus, the transition matrix P_B^2 for black workers can be written as:

$$\begin{array}{c}
 \begin{array}{cc}
 & \begin{array}{c} U \\ L \end{array} \\
 \begin{array}{c} U \\ L \end{array} & \begin{array}{cc}
 \tilde{A} & \\
 1 - i & \pm = (r s) \\
 r \mu & \pm = (r s) \\
 & 1 - i - r \mu
 \end{array}
 \end{array}
 \end{array}
 \quad P_B^2$$

whereas the transition matrix P_W^2 for white workers is given by:

$$P_W^2 = \begin{pmatrix} \bar{A} & U & L \\ U & 1 - \mu & \mu \\ L & \mu & 1 - \mu \end{pmatrix}$$

As above, we obtain the following steady state relations:

$$U_B^2 = \frac{(r)^2 s \mu}{\pm + (r)^2 s \mu} \bar{N}_B \quad (42)$$

$$U_W^2 = \frac{s \mu}{\pm + s \mu} \bar{N}_W \quad (43)$$

with

$$\frac{\partial U_B^2}{\partial r} > 0 ; \quad \frac{\partial U_B^2}{\partial s} > 0 ; \quad \frac{\partial U_B^2}{\partial \mu} > 0 ; \quad \frac{\partial U_B^2}{\partial \pm} < 0 \quad (44)$$

$$\frac{\partial U_W^2}{\partial s} > 0 ; \quad \frac{\partial U_W^2}{\partial \mu} > 0 ; \quad \frac{\partial U_W^2}{\partial \pm} < 0 \quad (45)$$

Furthermore, it is easily verified that:

$$U_B^2 < U_B^1 ; \quad U_W^2 > U_W^1 \quad (46)$$

which implies that

$$\Phi U^2 < U_B^2 ; U_W^2 < \Phi U^1 < U_B^1 ; U_W^1 \quad (47)$$

In other words, when job access costs are large for blacks (Equilibrium 1), the city is segregated by race, which implies that black unemployment is higher and white unemployment is lower than when access costs are lower (Equilibrium 2). The key element here is that redlining establishes a link between location and labor market outcomes. Indeed, in Equilibrium 1, blacks have high access costs and thus reside in the central part of the city, which, because of redlining, has an adverse impact on employment. If we now compare this result with the case without redlining (section 3), then white and black unemployment levels increase because the unemployed are spatially discriminated against.

Finally, the interaction between land and labor markets can be apprehended by a comparative static analysis. Indeed, by using Table 1, (44) and (45), we have:

Table 4b: Comparative Statics Analysis for Equilibrium 2 with racial and spatial discrimination

	U_B^0	U_W^0	r	s	μ	\pm
x_1^0	i^c	i^c	i^c	i^c	i^c	$+^c$
x_2^0	i^c	$+$	i^c	$?^{\pi}$	$?$	$?$
x_3^0	$+$	$+$	$+^{\pi}$	$+^{\pi}$	$+^{\pi}$	i^{π}
x_4^0	$+$	$+^c$	$+$	$+^c$	$+^c$	i^c

All signs with a c superscript are derived using our conjecture

All signs with a π superscript indicate differences between equilibria 1 and 2

Compared to Equilibrium 1, black and white unemployed workers are both discriminated against; blacks because of r and s and whites because of s . In this context, when r or s increases, the city shrinks but both x_3^0 and x_4^0 rise. The interesting point here is that, when redlining is introduced, the urban equilibrium strongly affects the labor market equilibrium, so that Equilibrium 1 becomes very problematic for blacks since both race and space negatively affect their labor market outcomes. This is in accordance with the empirical study of Cutler and Glaeser [12] who found that blacks in more segregated areas have significantly worse outcomes than blacks in less segregated areas.

5 Concluding remarks

In this paper, we have proposed an urban model dealing with both racial and spatial discrimination. When the relative access cost for black workers to employment centers is sufficiently large, a city is segregated by race. When the relative access cost is sufficiently small, a city is segregated by employment status. We have shown that, because of redlining and racial discrimination, blacks have higher unemployment rates than whites. There is thus a complete interaction between land and labor markets since the residential location of blacks strongly influences their labor market outcomes.

In terms of policy implications, different aspects can be considered. First, access costs for blacks matter since high costs imply a segregated city and worse labor market outcomes for blacks. Consequently, transportation policies such as subsidizing commuting costs for blacks or improving the transportation network can be implemented to improve access to jobs (see Martin

[32] and Zenou [50] for a theoretical analysis of transportation policies in a spatial mismatch framework). Different transportation policies have been implemented in the U.S. and it seems that policy makers are beginning to pay more attention to the transportation challenges faced by low-income central city residents (see Pugh [38] for a complete description of these programs).

Second, our model can shed some light on policies aiming at fighting only against racial discrimination, such as, for example, affirmative action, which gives a preferential treatment to blacks, women or other minority groups. In our framework, this policy amounts to a decrease in r , thus reducing the unemployment rate for black workers. However, as we have seen, this is not a complete remedy since firms tend to redline workers and reducing r does not change the location of black unemployed workers. Observe that, after the implementation of the affirmative action policy in the U.S., the wage gaps between blacks and whites and the access to employment have remained very significant (Leonard [30],[31], O'Neill [36]), and major criticisms have gone as far as stipulating that this policy is not very efficient and should be suppressed.

Finally, the present model has also pointed out the importance of residential segregation and its consequences on black labor market outcomes. In our analysis, fighting against spatial discrimination is equivalent to reducing s , which decreases urban unemployment. Such policies have been implemented in the U.S. through the enterprise zone programs (Papke [37], Boarnet and Bogart [6] and Mauer and Ott [35]). The basic idea is to designate a specific urban (or rural) area, which is depressed, and target it for economic development through government-provided subsidies to labor and capital. In Europe, such policies have also been implemented. In France, for example, any firm that desires to set up in a depressed area ('zone franche') is tax free but 20% of its workforce must be composed of local workers. Typically, such policies act on residential segregation and thus on redlining but not on labor discrimination.

Therefore, the main policy implication of this paper is that, in order to be efficient, policies such as affirmative action must be accompanied by measures that provide better job accessibility for blacks and fight against spatial segregation. In particular, affirmative action must take into account the problem of residential segregation since a large share of blacks in the U.S. remain spatially segregated on the basis of race and because life chances are so decisively influenced by where one lives (Massey and Denton [33],[34]). As a result of residential segregation, blacks endure an extraordinary harsh

and intensely disadvantaged environment where poverty, crime, single parenthood, welfare dependency, and educational failure are not only common, but the norm (Wilson [46]).

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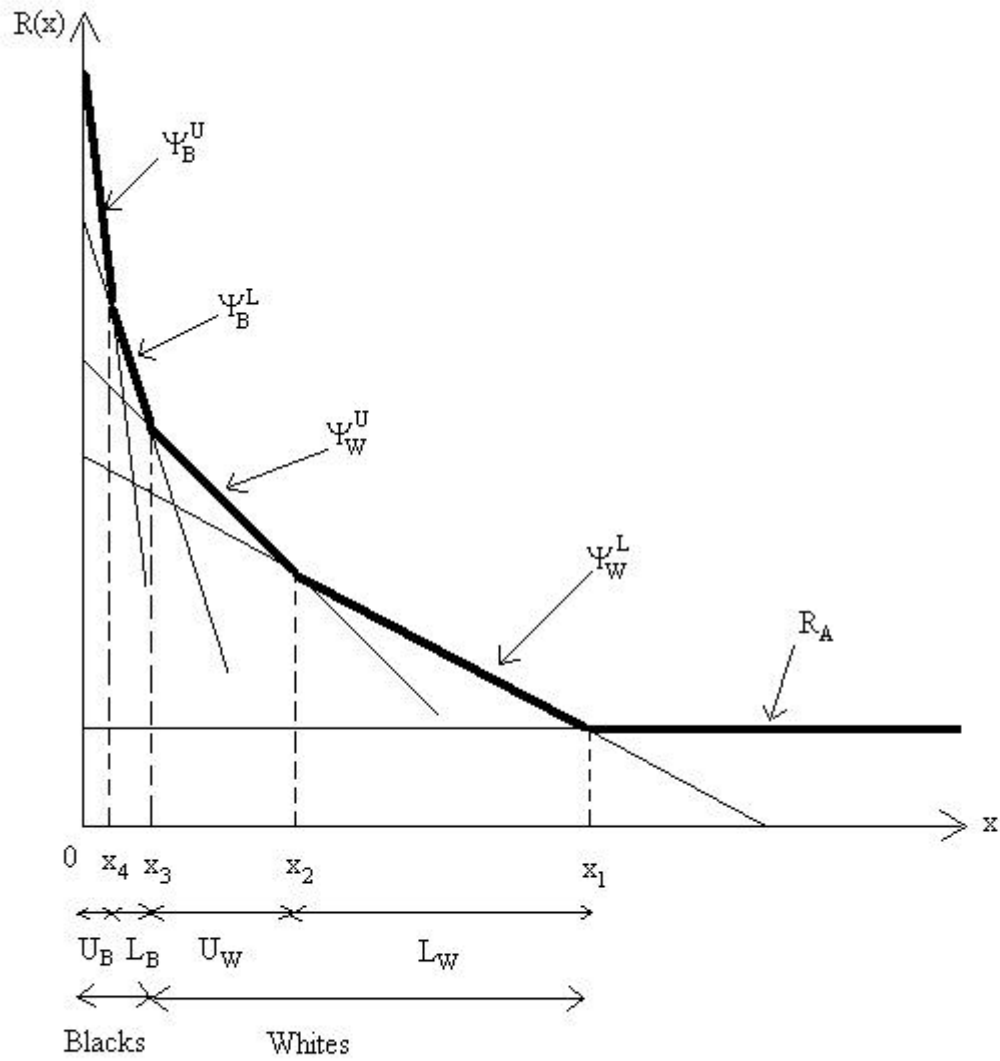


Figure 1: Equilibrium 1

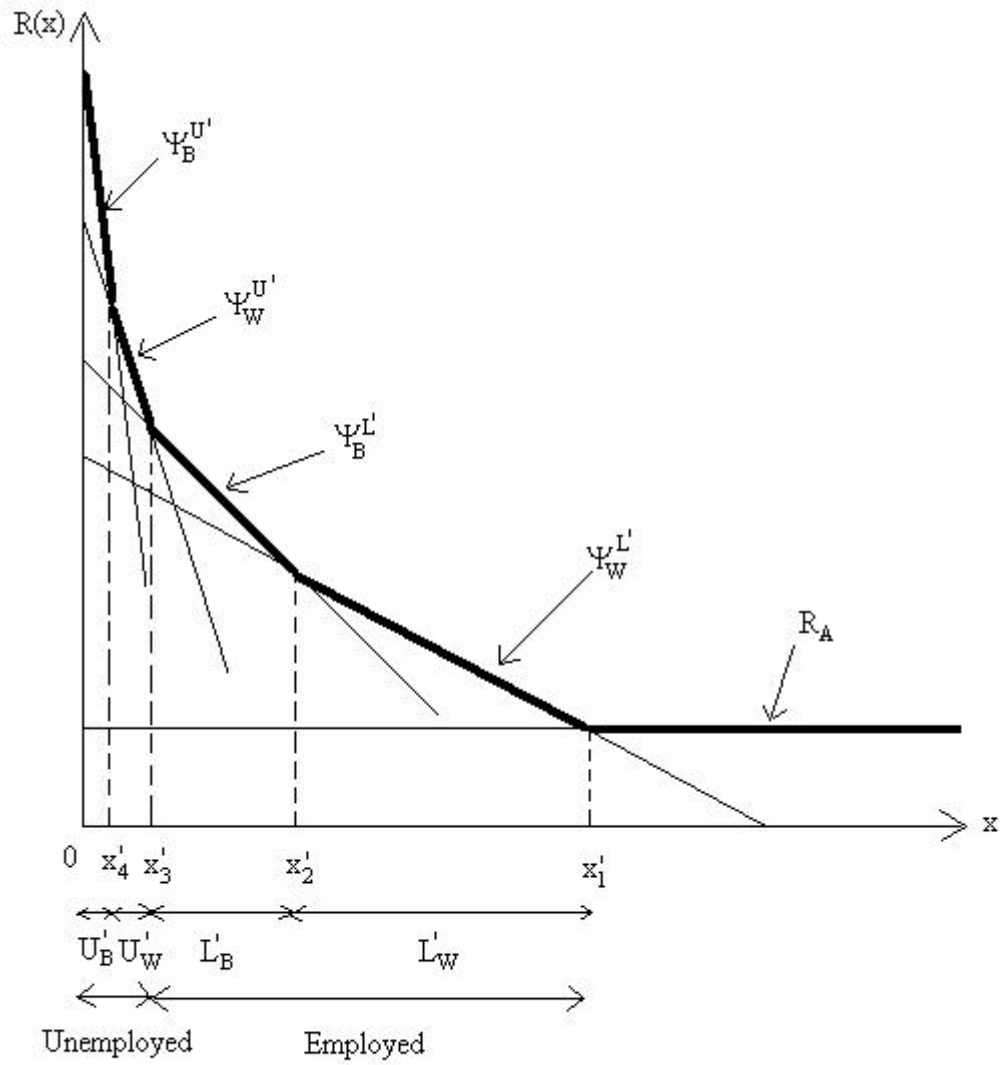


Figure 2: Equilibrium 2