Social Interactions, Ethnic Minorities and Urban Unemployment*

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Abstract

This paper focuses on the role of social interactions in the location decision of workers and on the consequences of this decision on labor-market outcomes. More precisely, there are three categories of workers: whites, the ethnic minority workers who abide by the white group's norms (referred to as 'status-seekers'), and the ethnic minority workers who are willing to build or restore a group culture (referred to as 'conformists'). Moreover, there are two main determinants of job acquisition: the inherited 'history' of workers (such as social networks or labor discrimination) and the physical distance between their residential neighborhood and the location of jobs. In this context, when locating in the city, workers face a trade-off between commuting costs (which depend on their average employment spells) and their ethnic preferences. We show that there are multiple equilibria in which either whites reside close to the business district while conformists locate further away from jobs (Equilibrium 1) or conformists reside close to jobs while whites locate at the other end of the city (Equilibrium 2). In both cases, status-seekers live in between the two other communities. In this framework, we show that distance to jobs is crucial to the labor-market outcomes of ethnic minorities whereas it matters less for whites because of their strong inherited advantage in terms of history. Finally, even though we are not able to analytically rank the two equilibria, numerical simulations show that Equilibrium 2 leads to a higher surplus than Equilibrium 1 in the more realistic cases.

JEL Classification: J15, R14.

Key words: Racial preferences, urban unemployment, social distance, ghettos.

1 Introduction

It is commonly observed in most US and European cities that ethnic minorities and whites are physically segregated and that, on average, whites experience better labor-market outcomes than ethnic minorities (see e.g. Fieldhouse, 1999, Glaeser, Kahn and Rappaport, 2000). It is thus quite crucial to understand the extent to which labor-market outcomes may be linked to residential segregation. Even though the economic literature in that field has not come up with a clear-cut theory, it has stressed a variety of possible mechanisms linking labor-market outcomes and residential segregation. These typically revolve around local externalities in education (Benabou, 1993), labor discrimination and redlining (Zenou and Boccard, 2000), crime (Glaeser, Sacerdote and Scheinkman, 1996, Verdier and Zenou, 2000), social distance (Glaeser, Sacerdote and Scheinkman, 1996, Akerlof, 1997), or housing discrimination, proximity to jobs and commuting costs (the so-called spatial mismatch hypothesis initially developed by Kain, 1968, and surveyed by Holzer, 1991, Kain, 1992, Ihlanfeldt, and Sjoquist, 1998).

The present paper contributes to the debate by focusing on ethnic preferences as the main force behind the spatial sorting of communities and its adverse consequences for minorities. In accordance with findings from urban sociology, the aim of this paper is to present an urban model which takes into account the role of ethnic preferences to explain both urban segregation and the ensuing negative labor-market outcomes of minorities.

The idea that ethnic preferences play an important role in the location decision of individuals has been around for some time and a recent trend of literature tends to show that preferences for the ethnic composition of neighborhoods is a large, if not the main factor explaining housing segregation (Patterson, 1997, Ihlanfeldt and Scafidi, 1999). This view contrasts with much of the standard literature —and in particular with the spatial mismatch literature— which has long argued that segregation resulted from housing discrimination against minorities.

The idea that segregation has adverse labor-market effects may involve several types of explanations. An attractive mechanism may be that minority neighborhoods tend to form far away from jobs, which entails poor physical connections to jobs and reduced job-search efficiency for those who live in such neighborhoods. In this respect, it has been shown that the information available on job opportunities deteriorates with distance to jobs (Rogers, 1997). It has also been shown that blacks in American cities are

less informed on the spatial distribution of job openings than whites and that the black disadvantage is entirely attributable to residential segregation (Ihlanfeldt, 1997). Another interesting mechanism linking segregation to bad labor-market outcomes argues that social connections to jobs are partly determined at the neighborhood level. In this respect, an abundant literature contends that social networks are a key factor that explains how workers find a job and the type of jobs they find (see Holzer, 1987, 1988, Montgomery, 1991, Waldinger, 1996). It has been shown, indeed, that black youth living in urban areas in which they have less residential contact with whites or the non-poor are less likely to be employed (O'Reagan and Quigley, 1998).

Ethnic preferences could thus be harmful to minorities and lead to high levels of unemployment if, because of the ensuing segregation, they are trapped in low quality social networks at a distance from jobs.

In view of those issues, the present paper provides a simple urban model that shows how ethnic preferences, residential segregation and labor-market outcomes connect together. We assume that blacks[1] and whites are reluctant to live with one another, preferring to socially interact with their own community. However, some blacks are eager to distance themselves from their community and prefer to live close to whites. In our framework, both physical distance and the inherited 'history' of each community are key determinants to find a job, so that segregation can be extremely harmful to communities for which distance to jobs matters a lot. In this context, we show that, because of ethnic preferences, whites may reside close to jobs whereas some blacks, depending on their willingness to interact with other blacks, segregate themselves by living further away from jobs. This urban configuration can have very adverse consequences in the labor market, in particular for those blacks who are segregated.

2 Related literature

In this section, we briefly review some important issues on segregation that explain how our model relates to the economic literature in that field.

Housing discrimination or ethnic preferences? Over the last three decades, the literature on urban segregation has been much dominated by

[1] In the rest of the paper, we use the term 'black' whenever we refer to the ethnic minority.

the spatial mismatch literature —which also aims to explain the bad labor-market outcomes of ethnic minorities— (see the theoretical models of Arnott, 1998, Brueckner and Martin, 1997, Brueckner and Zenou, 2000, Coulson, Laing and Wang, 1997). In the American case, the standard spatial mismatch hypothesis argues that the combination of housing-market discrimination and job decentralization maintaining blacks in inner-city zones at a distance from suburban jobs yields adverse labor-market outcomes for black workers. This view is attractive and many empirical studies have confirmed the existence of mortgage and housing discrimination against blacks (Yinger, 1986, Yinger, 1997). However, it seems that housing-market discrimination does not suffice to explain the spatial structure of American cities. In particular, it does not fit with some key empirical facts and makes it difficult to explain how a significant number of blacks have located in suburban areas.[2] It is thus reasonable to believe that there are also forces at work towards ethnic integration and that housing discrimination is not the sole determinant that drives segregation in American cities (Loury, 1999). In a competitive urban market free of land-use distortions, some black residents might have reasons of their own to locate close to white suburbs while some other blacks might also have reasons of their own not to follow jobs that have moved to the suburbs (and for which they are yet potentially eligible). In this context, residential segregation could be attributed to a whole range of explanations involving the voluntary choice of agents such as racial differences between blacks and whites in occupation and job location, differences in the ability to afford housing, demographic differences affecting the type of housing occupied, or even racial differences in tastes for housing and neighborhood attributes. Ihlanfeldt and Scafidi (1999) investigate those causes and find evidence that preferences for the racial composition of neighborhoods is a large, if not the main factor explaining housing segregation. The authors find that blacks' preferences for black neighborhoods account for 65% of housing segregation and that the racial preferences of whites for their own group also explains 9% of housing segregation. These are important findings that have strong implications for our understanding of how city structures come into shape. It remains to explain, however, why individuals have such preferences.

What determines ethnic preferences? Whereas the mainstream literature on residential ethnic preferences mainly focused on whites wanting

[2]In 1980, one third of blacks residing in urban areas lived in suburbs (Holzer, 1991).

to live at a distance from blacks and blacks preferring to live in racially mixed neighborhoods (Galster, 1990), Ihlanfeldt and Scafidi adopt a different perspective, suggesting that a growing number of blacks prefer to live in all or mostly black neighborhoods. Segregation may indeed be a voluntary phenomenon (Patterson, 1997) and the reasons individuals from a minority group might prefer to live among themselves are well documented by a detailed economic and sociological literature (see e.g. Wilson, 1987). In the case of African Americans, Ihlanfeldt and Scafidi (1999) evoke a wish to share culture, prejudice against whites, or expectations of unfavorable treatment by whites against blacks in white neighborhoods. One could also think of the advantages members of a minority group can derive from locating close to one another, thereby improving their access to 'ethnic goods' such as food, education or religious service, not to mention the ability to socially interact in their own language (Akerlof and Kranton, 2000). Organizing around some feature of ethnic identity involving ethnic solidarity between neighbors is also a good way of mobilizing common resources (Yinger, 1985). Interestingly, a key result of the sociological literature is that members of a same minority group may exhibit different levels of ethnic preferences. This is confirmed by a 1992 study of blacks in the Detroit Metropolitan Area (Bledsoe et al., 1995) which shows that blacks who live in predominantly black neighborhoods display greater solidarity than those who live in mixed neighborhoods. As the authors put it:

> 'Some blacks prefer to live in a predominantly black area and others in a racially mixed neighborhood, reflecting, among other things, their differing senses of black solidarity. To this extent, blacks who live in more integrated neighborhoods feel less racial solidarity than those who live in predominantly black neighborhoods —that is one of the reasons they live in such neighborhoods in the first place.' (Bledsoe et al., 1995).

The reasons for members of a minority group to have different ethnic preferences are diverse. An interesting explanation refers to identity formation: when a community is socially excluded from a dominant group, some individuals will identify with the dominant culture whereas others may reject it, even if it involves low economic returns for the latter subgroup (see Akerlof and Kranton, 2000, and our discussion above). An alternative explanation revolves around qualifications: skilled minorities could benefit more from integration than unskilled minorities (Cutler and Glaeser, 1997).

It should be clear from this short presentation that ethnic preferences play a key role in determining the urban configuration of cities. The idea that ethnic tastes (or distastes) can drive the spatial sorting of communities has been around for some time (Bailey, 1959, Courant and Yinger, 1977, Rose-Ackerman 1975, 1977, Yinger 1976) but there has been little focus on how preferences for the ethnic composition of neighborhoods can lead to adverse labor-market outcomes. This aspect should not be over-shadowed since there are striking figures that suggest a strong link between spatial sorting and labor-market outcomes. In American cities, unemployment rates are nearly twice as high in central cities as they are in suburbs and much higher for blacks than for whites. In 1997, in the 25 largest cities in the US, the unemployment rate of blacks was 12.5 percent in central cities and 7.6 percent in suburbs. This contrasts much with the 5.5 percent unemployment rate among central city whites, while only 3.7 percent of white suburbanites were unemployed (US Department of Labor, 1998). These simple figures suggest that, in the US, it is harmful to live far away from jobs, and that it is more harmful to blacks than to whites. The aim of this paper is to shed some light on what causes these ethnic and spatial imbalances.

3 The model

Let us consider a continuum of workers uniformly distributed along a linear, closed and monocentric city. All land is owned by absentee landlords and all firms are exogenously located in the Business District (BD hereafter). Furthermore, all workers are assumed to be risk neutral. In this framework, workers endogenously decide their optimal place of residence between the BD (located in 0) and the other end of the city, and consume the same amount of land (normalized to 1 for simplicity). The density of residential land parcels is taken to be unity so that there are exactly x units of housing within a distance x of the BD. As we will see below, the continuum of workers is made of three different groups: two types of blacks, namely 'status-seeker blacks' and 'conformist blacks', denoted by BS and BC respectively, and whites, denoted by W. The mass of each population is given by $\overline{N}_{BS}$, $\overline{N}_{BC}$ and $\overline{N}_{W}$. Normalizing total population to 1, we have $\overline{N}_{BS}+\overline{N}_{BC}+\overline{N}_{W}\equiv 1$ so that, given the unitary consumption of land, city size is also equal to 1.

3.1 Ethnic preferences

In our model, individuals have ethnic preferences for their neighbors and the main difference between the three groups of workers resides in their tastes for neighborhood ethnic composition. How to model such ethnic preferences is a key issue in the literature and there are alternative ways of doing so, the main argument being that it is either costly or beneficial to live with individuals from another community.[3] In the present model, we assume that interethnic social contact is costly to some workers but beneficial to others, so that some individuals prefer interacting with workers who share the same ethnic background whereas other individuals are willing to have contacts with workers from a different ethnic group. In our framework, whites and conformist blacks wish to interact exclusively with individuals from their respective communities and value living far away from the other 'race'. This is because the farther an individual locates from a community he does not belong to, the easier it is for him to identify with his own community and interact mostly with members of his own group, thereby minimizing interethnic social contacts. On the contrary, status-seeker blacks are eager to have contacts with whites and value living close to that community.

In order to keep the model tractable, we assume that groups always form spatially homogeneous communities. In other words, we only focus on equilibria in which all the members of a given community live together and do not mix with members of other communities (this is in accordance with real-world cities; see e.g. Table 1 in Borjas, 1998). This is a reasonable assumption since the aim of this paper is not to explain why segregation occurs (or why only homogeneous communities emerge in equilibrium) but rather to analyze the consequences of urban segregation on labor-market outcomes. In this context, what only matters to a white (black) worker in terms of ethnic preferences is the residential location of the closest black (white) individual.

We will now express the utility functions of workers. To do that, let us consider an individual located in x. When this individual is white, we denote by $b_B(x)$ the location of the closest black worker. When this individual is

[3] An interesting formalization is presented in Cutler and Glaeser (1997). In their stylized model of ghettos, blacks incur a cost to move into areas where whites are in majority, and whites bear a similar cost to move into areas where blacks are in majority. The authors argue that these 'discrimination costs' capture both racially based barriers to mobility and tastes for living near similar people. They interpret the discrimination cost incurred by blacks as a measure of segregation since the higher this cost, the less blacks living with whites in equilibrium.

a conformist or a status-seeker black, we denote by $b_W(x)$ the location of the closest white. Since communities are assumed to be homogeneous, observe that: (i) both $b_B(x)$ and $b_W(x)$ are step functions such that generically $b'_B(x) = b'_W(x) = 0$ since two very close neighbors always share the same closest neighborhood border; (ii) the location of the closest black (white) individual is, by definition, the location of the closest border between communities. Therefore, the respective utility functions for a white, a status-seeker black, and a conformist black worker of employment status $j = U, E$, and location x, are given by:

$$V_{Wj}(x) = y_j - \alpha_j\, x - R(x) + e_W\ |x - b_B(x)| \tag{1}$$

$$V_{BSj}(x) = y_j - \alpha_j\, x - R(x) + e_{BS}\ |x - b_W(x)| \tag{2}$$

$$V_{BCj}(x) = y_j - \alpha_j\, x - R(x) + e_{BC}\ |x - b_W(x)| \tag{3}$$

where y_j is the exogenous income of a worker with employment status j (y_E and y_U are respectively the wage of the employed and the unemployment benefit, with $y_E > y_U > 0$), α_j denotes the commuting cost per unit of distance for a worker of employment status j (with $\alpha_E = 1$ and $\alpha_U = 0$), $R(x)$ is the land rent at a distance x from the BD and e_i measures ethnic preferences.

The following comments are in order. First, commuting costs depend on employment status since unemployed workers commute less often to the BD than employed workers. This assumption is standard in the literature (see e.g. Zenou and Smith, 1995). For simplification, we assume that when type-i workers are unemployed ($j = U$) they do not need to go to the BD so their unit transport cost $\alpha_U = 0$. On the contrary, when type-i workers are employed ($j = E$), they must commute to the BD to work so that they incur the maximum transportation cost per unit of distance and $\alpha_E = 1$. As we will see below, an important implication is that, in our model, unemployment influences the location decision through commuting frequency. Second,we assume that blacks and whites use the same transportation mode so that individuals with the same employment status incur the same transportation cost per unit of distance, irrespective of their ethnic belonging. Finally, concerning ethnic preferences, it is easy to see that when the distance to the other ethnic group $|x - b_B(x)|$ or $|x - b_W(x)|$ increases, utility either increases or decreases (depending on the sign of e_i), reflecting the disutility or utility of living close to the boundary between communities. In particular, status-seeker blacks abide by the white group's norms and are willing to minimize

the social and physical distances between themselves and whites ($e_{BS} < 0$) whereas conformist blacks who are willing to build or restore a group culture (e.g. black nationalism) want to maximize the social and physical distances between themselves and whites ($e_{BC} > 0$). This implies that status-seeker blacks are willing to live close to whites ($e_{BS} < 0$) whereas conformist blacks are less sensitive to the issue of integration and value residing far away from whites ($e_{BC} > 0$). Similarly, whites also value residing far away from any black ($e_W > 0$).[4]

3.2 Job acquisition

At any moment of time, workers can either be employed or unemployed. We assume that changes in the employment status (employed versus unemployed) for a worker of type $i = W, BS, BC$ are governed by a Poisson process. We also assume that the job acquisition rate for a worker of type i is given by:[5]

$$\theta_i = \theta(h_i, \overline{x}_i) \tag{4}$$

with

$$\frac{\partial \theta_i}{\partial h_i} > 0 \qquad , \qquad \frac{\partial \theta_i}{\partial \overline{x}_i} < 0$$

where $h_i > 0$ is a parameter that captures inherited 'history' (social capital, human capital, employers' perceptions, beliefs,...) for workers of type i, with

[4]This way of modeling social interactions is somewhat similar to Akerlof (1997) where utilities of agents are taken with respect to their position x in the social space. In his 'conformist model', Akerlof assumes a utility of the type $U = u(x) - d\,|x - \overline{x}|$ where the parameter d describes the taste for conformity and $|x - \overline{x}|$ is the social distance to the group's average. In our model, we focus on the physical urban space and assume a utility function of the form $U = u(x) + e_i\,|x - b|$ where the ethnic preference parameter e_i can be either positive or negative, and where $|x - b|$ is the distance to the other community (i.e. the distance to the physical frontier b between black and white communities). In fact, Bailey (1959), Rose-Ackerman (1975, 1977), Courant and Yinger (1977) and Yinger (1976) were the first to propose this type of formulation to model the prejudices of whites against blacks (see Fujita, 1989, ch.7, or Kanemoto, 1980, for a survey of this approach referred to as 'border models'). More recently, Corneo and Jeanne (1999) have proposed an alternative formalization in which both local externalities and word-of-mouth communication play a crucial role in explaining the location of people.

[5]Here also the assumption that each community lives in an ethnically homogeneous neighborhood is important to derive θ_i.

$h_W > h_{BS} = h_{BC} \equiv h_B$ since all blacks have the same history, and $\overline{x}_i$ is the average distance to the employment center for workers of type i.

This specification accounts for two main determinants of job acquisition: the history of workers and the physical distance between residential neighborhood and job locations. As already mentioned, history is an exogenous parameter that has a positive influence on the job acquisition rate, capturing a variety of factors such as human capital, beliefs, or the social network effort. We assume that conformist and status-seeker blacks benefit from the same history ($h_{BS} = h_{BC} \equiv h_B$) so that they only differ in their tastes for interethnic social contacts. On the contrary, blacks and whites differ in their history and the difference accounts for exogenous differences in access to jobs between the two groups. It is then quite obvious that, due to differences in history (for instance school segregation in the US), whites have a strong advantage over blacks in American cities ($h_W > h_B$).[6]

The second determinant of the job acquisition rate θ_i is the neighborhood's —or group's— physical distance to jobs $\overline{x}_i$, which lowers the probability to find a job (see Wasmer and Zenou, 1999). Indeed, the empirical studies on job search confirm that, within a city, distance to jobs deteriorates the information one has on job opportunities. In our specification, the job acquisition rate is the same for all members of a given community so that the job acquisition rate of a given worker does not depend on the particular location x of that worker in the city. In this framework, a worker's job acquisition rate depends on his neighborhood's average distance $\overline{x}_i$ to the business district and not on that worker's exact location x within the neighborhood. Our justification for this is that, due to intense social contacts within pools of neighbors, information about job availability in the business district may be neighborhood-specific. In this case, all individuals residing in a given neighborhood may share the same amount of information about potential jobs, whereas individuals residing in different neighborhoods will not benefit from the same level and quality of information.

Therefore, *the probability to find a job depends on both social and physical connections to jobs.* In this paper, we assume that these two effects are independent and, for simplicity, we express (4) as follows:

$$\theta_i = h_i - \mu\,\overline{x}_i \tag{5}$$

[6]It should be clear that the term 'history' only refers to a parameter and not in any case to an implicit dynamic aspect of the model.

where μ is a positive parameter and where $\overline{x}_i$ is group i's location —or distance to jobs— that will be determined in the urban land use equilibrium. The parameter μ measures the loss of information per unit of distance so that, other things being equal, workers residing in neighborhoods further away from jobs have a lower chance to find a job than those residing closer to the BD. Since $\overline{x}_i \in]0,1[$, we impose the following condition to guarantee that θ_i is always strictly positive:

$$\mu < h_B \tag{6}$$

3.3 The labor market

Since changes in employment status for a worker of type $i = W, BS, BC$ are governed by a Poisson process, the expected durations of employment and unemployment for a worker of type i are respectively equal to $1/\delta$ and $1/\theta_i$ (where θ_i, defined above, is the job search-efficiency of a type-i worker and δ denotes the exogenous destruction rate). It then follows that a type-i worker spends a fraction $\theta_i/(\theta_i+\delta)$ of his lifetime employed and a fraction $\delta/(\theta_i+\delta)$ of his lifetime unemployed.

In steady state, flows into and out of unemployment are equal. Therefore, we have:

$$\theta_i \, u_i = \delta \, l_i$$

where $u_i = U_i/\overline{N}_i$ (U_i is the unemployment level for workers of type i) and $l = L_i/\overline{N}_i$ (L_i is the employment level for workers of type i) respectively denote the unemployment rate and the employment rate for workers of type $i = W, BS, BC$. It follows that :

$$l_i \equiv 1 - u_i = \frac{\theta_i}{\theta_i + \delta} \tag{7}$$

$$u_i = \frac{\delta}{\theta_i + \delta} \tag{8}$$

Observe that, in our framework, the steady-state unemployment rate among type-i workers also corresponds to the expected fraction of time that a type-i worker will remain unemployed.

We are now able to write the expected utilities of each group. We assume that there exists a perfect capital market with a zero interest rate, so that workers are able to smooth their income over time and do not relocate

following a change in employment status.[7] Therefore, for a worker of type $i = BS, BC, W$, the expected utility obtained at a location x is given by:

$$EV_i = (1 - u_i)V_{iE} + u_i V_{iU} \tag{9}$$

where u_{BS}, u_{BC} and u_W (or equivalently θ_{BS}, θ_{BC} and θ_W) and $R(x)$ are endogenous variables that will be determined at the urban equilibrium and where V_{iE} and V_{iU} are given by (1), (2) and (3).

Observe that the expected utility of a type i worker depends on his expected commuting cost per unit of distance $(1 - u_i)$ which is a decreasing linear function of u_i —the unemployment rate of community i—. This is because unemployed and employed workers have different commuting frequencies and because each worker can expect to remain unemployed a fraction of time that is equal to its community's steady state unemployment rate.

4 The different equilibria

In equilibrium, there are no relocation costs, so that all workers of the same type have the same utility level: v_W, v_{BS} and v_{BC} for whites, status-seeker blacks and conformist blacks respectively. Therefore, the bid rent of a white worker residing at a distance x from the BD is equal to:[8]

$$\begin{aligned} \Psi_W(x, v_W) &= (1 - u_W)(y_E - y_U) + y_U - (1 - u_W)\, x \\ &\quad + e_W\ |x - b_B(x)| - v_W \end{aligned} \tag{10}$$

whereas those of status-seeker and conformist blacks are respectively given by:

$$\begin{aligned} \Psi_{BS}(x, v_{BS}) &= (1 - u_{BS})(y_E - y_U) + y_U - (1 - u_{BS})\, x \\ &\quad + e_{BS}\ |x - b_W(x)| - v_{BS} \end{aligned} \tag{11}$$

[7] When there is a zero interest rate, workers only care about the fraction of time they spend employed and unemployed and not about their present employment status. Therefore, the expected utilities are not state dependent. For example, since a white worker spends a fraction $\theta_W/(\theta_W + \delta)$ of his lifetime employed and a fraction $\delta/(\theta_W + \delta)$ unemployed, his average income is equal to $\frac{\theta_W}{\theta_W+\delta} y_E + \frac{\delta}{\theta_W+\delta} y_U$. The same analysis applies for status-seeker and conformist blacks.

[8] The bid rent is a standard concept in urban economics. It indicates the maximum land rent that a worker i located at a distance x from the BD is ready to pay in order to achieve utility level v_i.

$$\begin{aligned}\Psi_{BC}(x, v_{BC}) &= (1-u_{BC})(y_E - y_U) + y_U - (1-u_{BC})\,x \\ &\quad + e_{BC}\,|x - b_W(x)| - v_{BC}\end{aligned} \tag{12}$$

This formulation assumes that whenever a worker looses his job (with probability δ), he remains in the same residential location. There is an alternative assumption (see for example Zenou and Smith, 1995) where workers change their residential location as soon as their change their employment status. We believe that our formulation is more realistic since there are frictions in the housing market and people are in general reluctant to change their residential location.

In equilibrium, (absentee) landlords allocate land to the highest bids. Since we assume that groups always form spatially homogeneous communities and since bid rents are all linear in x (recall that generically $b'_B(x) = b'_W(x) = 0$), it is then easy to verify that six different equilibrium land-use configurations can arise depending on the relative ranking of whites (W), status-seeker blacks (BS) and conformist blacks (BC) in the city. Fortunately, we are able to show that, under a reasonable assumption, only two equilibria can be sustained: Equilibrium 1, in which, moving outward from the BD, we have the location of the following groups: W, BS, BC and Equilibrium 2, in which, starting from the BD, we have: BC, BS, W.

Proposition 1 *Assume that*

$$e_{BC} + 1 < |e_{BS}| < e_W - 1 \tag{13}$$

then we have multiple equilibria in which either whites reside close to the BD while conformist blacks locate further away from jobs (Equilibrium 1) or conformist blacks reside close to jobs while whites locate at the other end of the city (Equilibrium 2).

Proof. See the Appendix.

To understand Proposition 1, recall that in our framework, the desire to interact with one's own group is modeled as a desire not to interact with the other ethnic group. Assumption (13) thus states that the desire of conformist blacks to have contacts with other blacks (e_{BC}) is less intense than the desire of status-seeker blacks to interact with whites ($|e_{BS}| = -e_{BS}$) and that the latter is lower that the desire of whites to avoid contact with blacks (e_W).[9]

[9]It is easy to see that $e_{BC} + 1 < |e_{BS}|$ implies that $e_{BC} < |e_{BS}|$ and $|e_{BS}| < e_W - 1$ implies that $|e_{BS}| < e_W$.

In other words, assumption (13) means that whites have a very strong desire to isolate themselves from blacks by locating far away from them and that status-seeker blacks are more willing to live close to whites than conformist blacks are willing to reside far away from whites. In this context, the urban configurations are determined by the relative location of communities, which explains why we have multiple equilibria. We show in the Appendix that, because of (13), whites can never locate between the two black communities (which would be the worse location for them as far as their residential ethnic preferences are concerned). We also show that status-seeker blacks always live in the neighborhood that is adjacent to whites, and that conformist blacks are always the furthest away from the white community.

More precisely, in Equilibrium 1, whites (W) reside close to jobs, and the ethnic preferences and transport costs of both whites (W) and status-seeker blacks (BS) act as centripetal forces. Conformist blacks (BC), however, are attracted both by the BD and the other end of the city. As a result, a middle location is more advantageous for a status-seeker black (BS) than for a conformist black (BC) both in terms of the ethnic externality (since it implies being closer to whites) and in terms of transport costs (since, in this equilibrium, status-seeker blacks will be more employed and will commute more often than conformist blacks). This is why, in Equilibrium 1, status-seeker blacks (BS) bid away conformist blacks (BC) to peripheral locations. In Equilibrium 2, we have the opposite situation: whites (W) locate far away from jobs and conformist blacks (BC) are attracted to the BD in order to reside close to jobs and to live far away from whites. For whites (W) and status-seeker blacks (BS) however, there is now a conflict between ethnic preferences and transport costs. In Equilibrium 2, status-seeker blacks (BS) outbid conformist blacks (BC) to reside further away from jobs but closer to whites (W) because their desire to interact with whites outweighs the centripetal force associated with transport costs.

Observe finally that, since in both equilibria (1 and 2) all blacks live next to one another, there is only one border b^k for Equilibrium $k = 1, 2$ between blacks and whites which is the same for all individuals irrespective of race and location. This implies that, from now on, $b_B^1(x) = b_W^1(x) \equiv b^1$ (for Equilibrium 1) and $b_B^2(x) = b_W^2(x) \equiv b^2$ (for Equilibrium 2).

4.1 Equilibrium 1[10]

In Equilibrium 1, we assume that all bid rents are downward sloping (this is always the case under condition (61), see proof of Proposition 1 in the Appendix). In this urban configuration, whites reside close to the BD whereas blacks occupy peripheral locations (see Figure 1).

[*Insert Figure* 1 *here*]

In this urban configuration, both transport costs and ethnic preferences exert a centripetal force on whites and status-seeker blacks. Whites are attracted to the BD to save on commuting cost and because they would like to be as far as possible from the border distance $\overline{N}_W$ with blacks. Status-seeker blacks are attracted to the BD because of transport costs and because they would like to be as close as possible to the border distance $\overline{N}_W$ with whites. For conformist blacks, there are two opposite forces. On one hand, they would like to be close to the BD in order to save on commuting costs. On the other hand, they would like to be as far as possible from whites and thus from the BD. In Equilibrium 1, those blacks who have preferences for living among blacks (type BC) prefer to reside relatively further away from the white community and locate at the other end of the city, far away from jobs, while those blacks who prefer to live close to whites (type BS) occupy an intermediate location.

We are now able to give a formal definition of the market equilibrium (i.e. the equilibrium in both land and labor markets) :

Definition 1 *Equilibrium 1 is a 6-uple* $(v_W^{1*}, v_{BS}^{1*}, v_{BC}^{1*}, u_W^{1*}, u_{BS}^{1*}, u_{BC}^{1*})$ *such that:*

$$\Psi_W(\overline{N}_W, v_W^{1*}) = \Psi_{BS}(\overline{N}_W, v_{BS}^{1*}) \tag{14}$$

$$\Psi_{BS}(\overline{N}_W + \overline{N}_{BS}, v_{BS}^{1*}) = \Psi_{BC}(\overline{N}_W + \overline{N}_{BS}, v_{BC}^{1*}) \tag{15}$$

$$\Psi_{BC}(1, v_{BC}^{1*}) = 0 \tag{16}$$

$$u_W^{1*} = \frac{\delta}{\delta + \theta_W^{1*}} \tag{17}$$

$$u_{BS}^{1*} = \frac{\delta}{\delta + \theta_{BS}^{1*}} \tag{18}$$

[10] All variables with superscript 1 refer to Equilibrium 1.

$$u_{BC}^{1*} = \frac{\delta}{\delta + \theta_{BC}^{1*}} \tag{19}$$

Equations (14)-(16) correspond to equilibrium conditions in the land market (see Figure 1). In particular, equation (14) requires the equality of bid rents at the border $\overline{N}_W$ between whites and status-seeker blacks. Equation (15) states that bid rents must also be equal in $\overline{N}_W + \overline{N}_{BS}$, the border between status-seeker and conformist blacks. Finally, equation (16) states that, at the other end of the city (i.e. in $x = 1$), the bid rent of the 'last' conformist black must be equal to the agricultural land rent (normalized to 0 for simplicity). Equations (17)-(19) give the unemployment rate of each type of workers with

$$\theta_W^{1*} = h_W - \mu\, \overline{x}_W^{1*} \tag{20}$$

$$\theta_{BS}^{1*} = h_B - \mu\, \overline{x}_{BS}^{1*} \tag{21}$$

$$\theta_{BC}^{1*} = h_B - \mu\, \overline{x}_{BC}^{1*} \tag{22}$$

Moreover, since workers are uniformly distributed, it is easy to verify that:

$$\overline{x}_W^{1*} = \frac{\overline{N}_W}{2} \tag{23}$$

$$\overline{x}_{BS}^{1*} = \overline{N}_W + \frac{\overline{N}_{BS}}{2} \tag{24}$$

$$\overline{x}_{BC}^{1*} = 1 - \frac{\overline{N}_{BC}}{2} \tag{25}$$

Plugging (23)-(25) into (20)-(22), and (20)-(22) into (17)-(19), we obtain the values of u_W^{1*}, u_{BS}^{1*} and u_{BC}^{1*}. Since $h_W > h_B$ and $\overline{x}_W^{1*} < \overline{x}_{BS}^{1*} < \overline{x}_{BC}^{1*}$, it is straightforward to see that:

$$u_W^{1*} < u_{BS}^{1*} < u_{BC}^{1*} \tag{26}$$

Equilibrium 1 can thus be seen as a 'spatial mismatch equilibrium' in which minorities live far away from jobs and experience bad labor-market outcomes (i.e. much unemployment).

Solving equations (14)-(16) yield the following equilibrium utilities:

$$\begin{aligned} v_W^{1*} \;=\; & (1 - u_W^{1*}) y_E + u_W^{1*} y_U + e_{BS}\, \overline{N}_{BS} + e_{BC}\, \overline{N}_{BC} \\ & - \left(1 - u_W^{1*} \overline{N}_W - u_{BS}^{1*} \overline{N}_{BS} - u_{BC}^{1*} \overline{N}_{BC}\right) \end{aligned} \tag{27}$$

$$\begin{aligned} v_{BS}^{1*} &= (1-u_{BS}^{1*})y_E + u_{BS}^{1*}y_U + e_{BS}\,\overline{N}_{BS} + e_{BC}\,\overline{N}_{BC} \\ &\quad - \left[1 - u_{BS}^{1*}(\overline{N}_W + \overline{N}_{BS}) - u_{BC}^{1*}\overline{N}_{BC}\right] \end{aligned} \tag{28}$$

$$v_{BC}^{1*} = (1-u_{BC}^{1*})y_E + u_{BC}^{1*}y_U + e_{BC}\,(\overline{N}_{BS} + \overline{N}_{BC}) - (1-u_{BC}^{1*}) \tag{29}$$

It is now interesting to compare the different utility levels. In fact, even though conformist blacks have the highest unemployment rate and thus experience the longest unemployment spells, their utility level is not necessarily lower than the utility of other blacks or even of whites. This is because, in this equilibrium, residing far away from jobs also entails residing far away from whites and conformist blacks value it much. We have indeed:

$$v_W^{1*} \gtrless v_{BS}^{1*} \Longleftrightarrow y_E - y_U \gtrless \overline{N}_W \tag{30}$$

$$v_{BS}^{1*} \gtrless v_{BC}^{1*} \Longleftrightarrow (y_E - y_U)(u_{BC}^{1*} - u_{BS}^{1*}) \gtrless (e_{BC} - e_{BS})\overline{N}_{BS} + (\overline{N}_W + \overline{N}_{BS})(u_{BC}^{1*} - u_{BS}^{1*}) \tag{31}$$

$$\begin{aligned} v_W^{1*} &\gtrless v_{BC}^{1*} \Longleftrightarrow \\ (y_E - y_U)(u_{BC}^{1*} - u_W^{1*}) &\gtrless (e_{BC} - e_{BS})\overline{N}_{BS} + (u_{BC}^{1*} - u_W^{1*})\overline{N}_W + (u_{BC}^{1*} - u_{BS}^{1*})\overline{N}_{BS} \end{aligned} \tag{32}$$

Inequality (30) is easy to understand. Observe that at $\overline{N}_W$, the border between status-seeker blacks and whites, land rent is the same for the two communities. The distance to the frontier between ethnic groups is null so that ethnic externalities have no effect on utilities. So, at $\overline{N}_W$, the only difference between these two communities is the time spent unemployed since this affects both income and commuting costs. Since whites experience lower unemployment spells than status-seeker blacks (see (26)), they incur higher average commuting costs. Therefore, they have a higher utility if the wage premium of being employed, $y_E - y_U$, is higher than the corresponding difference in commuting costs. Formally, at $\overline{N}_W$, the lifetime income net of commuting costs is $(1-u_W^{1*})\ y_E + u_W^{1*}\ y_U - (1-u_W^{1*})\overline{N}_W$ for whites, whereas it is $(1-u_{BS}^{1*})\ y_E + u_{BS}^{1*}\ y_U - (1-u_{BS}^{1*})\overline{N}_W$ for status-seeker blacks. It is easy to verify that whites have a higher or a lower utility if (30) holds.

Inequality (31) has a similar interpretation. Indeed, at $\overline{N}_W + \overline{N}_{BS}$, the frontier between status-seeker and conformist blacks, all blacks pay the same land rent but conformist blacks are more often unemployed and thus have

a lower lifetime income but also a lower average commuting cost. However, contrary to (30), ethnic externalities matter here and the two black communities have opposite preferences. For both status-seeker and conformist blacks, residing at $\overline{N}_W + \overline{N}_{BS}$ is the worse location of all because, for the former (who value being as close as possible to whites) it is the location that is the furthest away from whites, whereas for the latter (who value being as far as possible from whites) it is the closest location. Therefore, status-seeker blacks have a higher utility than conformist blacks whenever the wage premium of being employed is higher than the corresponding difference in commuting costs and the distance from whites is not too large. It is easy to see from (31) that when $\overline{N}_{BS}$ is very large, then status-seeker blacks are worse off because they are further away from whites and have higher commuting costs.

The interpretation of (32) is slightly different since we compare the utility of a white worker residing at $\overline{N}_W$ with the utility of a conformist black worker locating at $\overline{N}_W + \overline{N}_{BS}$ so that land rent now affects utilities asymmetrically. Apart from the role of ethnic externalities and the ambiguous role of transport costs, the trade-off is now between higher average income and higher land rents for whites and lower average income and lower land rents for conformist blacks.

The following proposition summarizes our results.

Proposition 2 *In Equilibrium 1, we have:*

- *Blacks who value most interacting with other blacks (conformist blacks) live further away from jobs, have a higher unemployment rate, experience longer unemployment spells than status-seeker blacks. Whites are the closest to jobs, have the lowest unemployment rate and shortest unemployment spells of all communities.*

- *If $y_E - y_U > \overline{N}_W$, then whites have a higher utility than status-seeker blacks but do not necessarily have a higher utility than conformist blacks. However, if whites do have a higher utility than conformist blacks then they have a higher utility than all blacks in the city.*

Proof. See the Appendix.

4.2 Equilibrium 2[11]

In Equilibrium 2, blacks reside close to the BD while whites reside close to the other end of the city. The bid rent of conformist blacks is downward sloping whereas the bid rents of status-seeker blacks and whites are upward sloping (see proof of Proposition 1 in the Appendix, and Figure 2).

[*Insert Figure 2 here*]

In this urban configuration, even though whites are attracted to the BD to save on commuting costs, they are also strongly attracted by the other end of the city because they would like to reside as far as possible from the border distance $1-\overline{N}_W$ with blacks. Similarly, status-seeker blacks are attracted to BD because of transport costs but they are also attracted to the other end of the city because they would like to be as close as possible to the border distance $1-\overline{N}_W$. Conformist blacks are only attracted to the BD, both to save on commuting cost and to physically distance themselves from whites. This is why, in Equilibrium 2, those among blacks who have preferences for living close to whites (status-seekers) prefer to reside relatively further away from jobs, occupying an intermediate location, while those among blacks who prefer to live close to blacks (conformists) also live close to jobs.

We have the following definition for the market equilibrium:

Definition 2 *Equilibrium 2 is a 6-uple* $(v_{BC}^{2*}, v_{BS}^{2*}, v_W^{2*}, u_{BC}^{2*}, u_{BS}^{2*}, u_W^{2*})$ *such that:*

$$\Psi_{BC}(\overline{N}_{BC}, v_{BC}^{2*}) = 0 \tag{33}$$

$$\Psi_{BS}(\overline{N}_{BC}, v_{BS}^{2*}) = 0 \tag{34}$$

$$\Psi_{BS}(\overline{N}_{BC} + \overline{N}_{BS}, v_{BS}^{2*}) = \Psi_W(\overline{N}_{BC} + \overline{N}_{BS}, v_W^{2*}) \tag{35}$$

$$u_{BC}^{2*} = \frac{\delta}{\delta + \theta_{BC}^{2*}} \tag{36}$$

$$u_{BS}^{2*} = \frac{\delta}{\delta + \theta_{BS}^{2*}} \tag{37}$$

$$u_W^{2*} = \frac{\delta}{\delta + \theta_W^{2*}} \tag{38}$$

[11] All variables with superscript 2 refer to Equilibrium 2.

The meaning of these equations is similar to that of (14)-(19) in the case of Equilibrium 1 (see previous section, mutatis mutandis). Since workers are uniformly distributed in the urban space, we now have:

$$\overline{x}_{BC}^{2*} = \frac{\overline{N}_{BC}}{2} \tag{39}$$

$$\overline{x}_{BS}^{2*} = \overline{N}_{BC} + \frac{\overline{N}_{BS}}{2} \tag{40}$$

$$\overline{x}_{W}^{2*} = \left(1 - \frac{\overline{N}_{W}}{2}\right) \tag{41}$$

and

$$\theta_{BC}^{2*} = h_B - \mu\, \overline{x}_{BC}^{2*} \tag{42}$$

$$\theta_{BS}^{2*} = h_B - \mu\, \overline{x}_{BS}^{2*} \tag{43}$$

$$\theta_{W}^{2*} = h_W - \mu\, \overline{x}_{W}^{2*} \tag{44}$$

As previously, we obtain u_{BC}^{2*}, u_{BS}^{2*} and u_{W}^{2*} by plugging (39)-(41) into (42)-(44) and by applying equations (36)-(38) to (42)-(44). Solving (33)-(35) yields the following equilibrium utilities:

$$v_{BC}^{2*} = (1 - u_{BC}^{2*})\,(y_E - \overline{N}_{BC}) + u_{BC}^{2*}\, y_U + e_{BC}\overline{N}_{BS} \tag{45}$$

$$v_{BS}^{2*} = (1 - u_{BS}^{2*})\,(y_E - \overline{N}_{BC}) + u_{BS}^{2*}\, y_U + e_{BS}\overline{N}_{BS} \tag{46}$$

$$v_{W}^{2*} = (1-u_{W}^{2*})\,(y_E-(\overline{N}_{BC}+\overline{N}_{BS}))+u_{W}^{2*}\, y_U+e_{BS}\,\overline{N}_{BS}+(1-u_{BS}^{2*})\;\overline{N}_{BS} \tag{47}$$

In Equilibrium 2, since conformist blacks live closer to jobs than status-seeker blacks, it always holds that $u_{BC}^{2*} < u_{BS}^{2*}$, whereas the unemployment level of whites can be above or below that of blacks. In fact, whites are less unemployed than blacks when history compensates for the loss in job connections associated with distance to the employment center. We easily obtain:

$$u_{W}^{2*} \lesseqgtr u_{BC}^{2*} \Longleftrightarrow h_W - h_B \gtreqless \frac{\mu}{2}(1 + \overline{N}_{BS}) \tag{48}$$

$$u_{W}^{2*} \lesseqgtr u_{BS}^{2*} \Longleftrightarrow h_W - h_B \gtreqless \frac{\mu}{2}(\overline{N}_{BS} + \overline{N}_{W}) \tag{49}$$

Equations (48) and (49) mean that, even though they reside further away from jobs, whites can experience a lower unemployment rate than blacks if history sufficiently matters. In other words, if one interprets the history parameter as a group-specific social network, then whites can have strong connections with employers without being physically connected to them.

Let us now compare the equilibrium utilities of the different communities. Simple calculations lead to:

$$v_W^{2*} \gtrless v_{BS}^{2*} \Longleftrightarrow (u_{BS}^{2*} - u_W^{2*})\,(y_E - y_U) \gtrless (u_{BS}^{2*} - u_W^{2*})\,(\overline{N}_{BS} + \overline{N}_{BC}) \quad (50)$$

$$\begin{array}{rcl} v_W^{2*} & \gtrless & v_{BC}^{2*} \Longleftrightarrow \\ (u_{BC}^{2*} - u_W^{2*})\,(y_E - y_U) & \gtrless & (e_{BC} - e_{BS})\,\overline{N}_{BS} \\ & & + \left(u_{BC}^{2*} - u_W^{2*}\right)\overline{N}_{BC} + \left(u_{BS}^{2*} - u_W^{2*}\right)\overline{N}_{BS} \end{array} \quad (51)$$

$$v_{BC}^{2*} \gtrless v_{BS}^{2*} \Longleftrightarrow (u_{BS}^{2*} - u_{BC}^{2*})\,(y_E - y_U) \gtrless (u_{BS}^{2*} - u_{BC}^{2*})\,\overline{N}_{BC} - (e_{BC} - e_{BS})\,\overline{N}_{BS} \quad (52)$$

These inequalities can be interpreted in the same manner as for Equilibrium 1. The following proposition summarizes our discussion:

Proposition 3 *In Equilibrium 2,*

- *Conformist blacks always have a lower unemployment rate than status-seeker blacks ($u_{BC}^{2*} < u_{BS}^{2*}$) because they are closer to jobs. However, they can have a lower or a higher utility than status-seeker blacks.*
- *For whites, distance to jobs matters less than for blacks. Even though whites are the furthest away from jobs, they can experience the lowest unemployment rate when they have a sufficient historical advantage (i.e. when $h_W - h_B > \mu(1 + \overline{N}_{BS})/2$).*

5 Discussion and implications

In this section, we compare the two equilibria and present some illustrative simulations. Let us start with the following proposition:

Proposition 4

- *Distance to jobs matters: Members in each community experience a lower unemployment rate in the equilibrium in which they are closer to jobs, so that* $u_W^{1*} < u_W^{2*}$ *and* $u_{BC}^{2*} < u_{BC}^{1*}$. *When* $\overline{N}_W > \overline{N}_{BC}$ *(resp.* $\overline{N}_W < \overline{N}_{BC}$*) then* $u_{BS}^{2*} < u_{BS}^{1*}$ *(resp.* $u_{BS}^{2*} > u_{BS}^{1*}$*).*

- *'Race' and history matter: If whites have a sufficient historical advantage (i.e. when* $h_W - h_B > \mu \mid \overline{N}_W - \overline{N}_{BC} \mid /2$*), they experience a lower unemployment rate than conformist blacks when both groups reside close to jobs (*$u_W^{1*} < u_{BC}^{2*}$*) and when both groups reside far away from jobs (*$u_W^{2*} < u_{BC}^{1*}$*). Even if the historical advantage of whites is small, it suffices that* $\overline{N}_W < \overline{N}_{BC}$ *(resp.* $\overline{N}_W > \overline{N}_{BC}$*) to have* $u_W^{1*} < u_{BC}^{2*}$ *(resp.* $u_W^{2*} < u_{BC}^{1*}$ *).*

Proof. See the Appendix.

This proposition is quite interesting since, because of history, it shows the fundamental asymmetry between blacks and whites: distance to jobs is crucial to the labor-market outcomes of blacks whereas it has less impact for whites because of their strong historical advantage. Indeed, in our model, proximity to jobs is crucial to blacks because it is the only way for them to gather information and thus to increase their chances to obtain a job. However, for whites, distance to jobs matters less since history can compensate for remote residential locations. For example, if one interprets history as the inherited social network, then, even though whites are physically distant to jobs, they can still gather information through their stronger social network.

An obvious question to ask is which equilibrium is socially 'better'. To investigate this issue, we define the total surplus as the weighted sum of workers' utilities and land rents:

$$S^{k*} \equiv \overline{N}_W \, v_W^{k*} + \overline{N}_{BS} \, v_{BS}^{k*} + \overline{N}_{BC} \, v_{BC}^{k*} + TLR^{k*} \qquad for \qquad k = 1, 2 \quad (53)$$

where TLR^{k*} is the sum of all land rents paid to landlords in Equilibrium $k = 1, 2$.

Unfortunately, it can be checked that, by using this measure of welfare, it is not always possible to rank the two different equilibria. Some simulations will shed more light on this issue.

(i) **Base Case**

Our first simulation (Base Case, see Table 1) corresponds to an economy in which the minority group (blacks) amounts to 20% of the urban population. This figure breaks down into 10% who are status-seekers and 10% who are conformists. In this economy, wages are four times higher than unemployment benefits ($y_E = 4,\ y_U = 1$), and the job destruction rate δ is equal to 0.15. This means that the expected duration of an employment spell is of six years and eight months as traditionally assumed in similar models (see for instance Marimon and Zilibotti, 1999). As far as job acquisition is concerned, whites have a historical advantage over blacks: h_W is equal to 6.8 while h_B stands at 3.5 only. The parameter μ —which measures the loss of information to jobs per unit of distance and the ensuing deterioration in the job acquisition rate— is equal to 2.8. These values imply that the expected duration of unemployment for a black worker residing in a neighborhood located in the middle of the city is a little less than six months, whereas it is only two months for a white worker with the same residential location.

Observe that our choice of parameters corresponds to a situation in which we have $h_W - h_B > \mu(1+\overline{N}_{BS})/2$ which means that the historical advantage of whites is significant (see Proposition 3). Furthermore, whites have strong ethnic preferences for white neighbors so that e_W stands at 2.3 while e_{BC} and e_{BS} are equal to .1 and -1.2 respectively. These parameters for ethnic preferences satisfy condition (13).

Table 1 lists unemployment rates (u_i^{k*}), utilities (v_i^{k*}), total surplus (S^{k*}), expected income, average rents, average transport costs and average ethnic externalities for each community ($i = W, BS, BC$) in each of the two possible equilibria ($k = 1, 2$). All averages are computed for average workers, i.e. for the workers residing at the center $\overline{x}_i^{k*}$ of their respective communities. Average rents are thus given by $R(\overline{x}_i^{k*})$ while average ethnic externalities are given by $e_i \left|\overline{x}_i^{k*} - b^k\right|$, where b^k is the frontier between black and white communities in Equilibrium k ($k = 1, 2$). Similarly, the average transport costs of workers are obtained by calculating $(1 - u_i^{k*})\,\overline{x}_i^{k*}$.

Table 1 shows that, in our Base Case, Equilibrium 2 is socially preferable to Equilibrium 1 since the surplus is higher. This is because all workers have a significantly higher utility in Equilibrium 2 than in Equilibrium 1 that more than compensates the average decrease in land rents. Indeed, the utility of whites is 29% higher under Equilibrium 2 than under Equilibrium 1. For status-seeker and conformist blacks, utility gains are even higher and amount to 37% and 39% respectively.

Comparing the two equilibria, the most striking observation is that unemployment is significantly lower under Equilibrium 2. The aggregate unemployment rate stands at 4.8% under Equilibrium 1 but is reduced to 3.1% under Equilibrium 2. This is due to the dramatic reduction in the unemployment levels of blacks when switching from Equilibrium 1 to Equilibrium 2. Even though the unemployment rate of whites raises from 2.6% to 2.8%, the unemployment rate of status-seeker black is more than halved, from 11.8% to 4.6% while that of conformist blacks is more than divided by three, from 15.2% to only 4.3%. In fact, *in Equilibrium 2, minorities are closer to jobs than in Equilibrium 1, which has a dramatic impact on their level of employment and increases their expected income.* Those who gain most are conformist blacks. Their expected income raises by more than 9% while that of status-seeker blacks increases by almost 6%. On the contrary, since whites are less employed in Equilibrium 2 than in Equilibrium 1, they incur a small reduction in their expected income.

In Equilibrium 2, since blacks are closer to jobs, their average transport costs are significantly lower than in Equilibrium 1, even though they are more employed and thus commute more. On the contrary, whites face higher transport costs under Equilibrium 2 than under Equilibrium 1 because their distance to jobs outweighs the reduction in trip frequency associated with their higher unemployment. Furthermore, the pattern of land rents in Equilibrium 2 is much different from Equilibrium 1 (see figures 1bis and 2bis). In Equilibrium 2, whites and status-seeker blacks pay lower land rents than under Equilibrium 1. Indeed, in Equilibrium 2, since blacks occupy central locations and whites want to be far away from blacks, there is less competition for land. However, in Equilibrium 2, conformist blacks live very close to jobs and face land prices that are 35% higher than the prices they would face in Equilibrium 1 (residing far away from job). Finally, whatever the equilibrium, communities face the same ethnic externalities. This is because the relative distance between them remains the same even though distance to jobs has changed.

To sum up, when comparing the two equilibria, status-seeker blacks gain in Equilibrium 2 because they are more employed, earn a higher expected income, pay a lower rent and incur lower transportation costs while suffering from exactly the same ethnic externality. Conformist blacks are also better off for the same reasons as status-seeker blacks even though they have to pay higher rents under Equilibrium 2 than under Equilibrium 1. For whites, unemployment is higher, expected income is lower, transport costs have in-

creased and the ethnic externality they benefit from remains the same. They nevertheless gain because, residing further away from jobs, they pay significantly lower land rents and this effect is dominant. Observe that, whereas whites have the higher utility under Equilibrium 1, it is conformist blacks who benefit most from Equilibrium 2. The key lesson to be derived from this first simulation is that urban patterns matter and that proximity to jobs plays an important role. Comparing surpluses, it can be seen that *it may be socially preferable that minority groups locate close to jobs even if it implies higher unemployment for the majority group.*

[*Insert Table* 1 *here*]

(*ii*) **Case Two**

Our second simulation (Case Two, see Table 2) only aims to prove that, in some cases, Equilibrium 1 may be socially preferable to Equilibrium 2. In Case Two, the difference in comparison with the Base Case is that history does not discriminate between races anymore ($h_B = h_W = 6.8$) while the negative effects of physical distance on job acquisition are very strong ($\mu = 6.8$ instead of 2.8 in the Base Case). There is also a large *majority* of blacks in the city who now represent 80% of the urban population. These 80% blacks subdivide in 40% conformists and 40% status-seekers.

To understand why surplus is higher under Equilibrium 1, observe that, since ethnic externalities remain the same across equilibria, and since land rents are a pure transfer between agents, the only sources of variation in the model are the expected income of workers (via unemployment rates) and transport costs (via distance and unemployment rates). Since whites form a very small community, their distance to jobs is greatly increased in Equilibrium 2 when they locate further away from jobs and blacks (who now occupy 80% of the urban space). Since space matters a lot ($\mu = 6.8$), the job acquisition rate of whites is very low and they face a very high unemployment rate. This causes the average unemployment rate in Equilibrium 2 (6.8%) to be higher than under Equilibrium 1 (5.8%). In turn, the average expected income is lower in Equilibrium 2, and, in spite of lower average transportation costs, the surplus is also lower.

Our interest in presenting Case Two was to show that Equilibrium 2 is not necessarily better than Equilibrium 1. However, we have been able to obtain situations such as Case Two (in which Equilibrium 1 is socially preferable) only by assuming extreme conditions for the economy (like e.g. 80% of blacks

in the city). It is most likely that reality corresponds to a situation such as the Base Case where Equilibrium 2 —in which disadvantaged communities are close to jobs— is socially preferable to Equilibrium 1. Coming back to the Base Case, we will now investigate how changes in the initial parameters affect the urban equilibria.

[*Insert Table 2 here*]

(*iii*) **Variations from the Base Case**

Table 3 was built by having the parameters of the Base Case vary. The first column summarizes our results from Table 1. The second column considers the case of $\mu = 0$ while all the other parameters remain as before. This corresponds to a situation in which *only history matters so that space does not matter at all*. In other words, distance to jobs does not influence the job acquisition rate. As a result, unemployment rates are strictly identical under Equilibrium 2 and Equilibrium 1 but utilities are much higher under Equilibrium 2 for all workers. This is mainly because they pay much lower land rents.

In the third column, we have a situation in which *differences in history do not matter* so that whites and blacks are treated equally on the labor market ($h_W = h_B = 6.8$). This means that *only space discriminates between the two groups* depending on their respective locations in the urban space. As previously, the unemployment rate of whites is higher under Equilibrium 2 whereas blacks face a lower unemployment. This is because Equilibrium 2 is associated with a longer distance to jobs for whites but a shorter distance for blacks. It can be seen that, in the absence of an asymmetry caused by history, the further away a group resides from jobs, the higher its unemployment rate.

The fourth column simulates a *technological shock* that increases the job destruction rate ($\delta = .3$ instead of $\delta = .15$) and reduces the expected duration of an employment spell (from six years and eight months to three years and four months). In both equilibria, unemployment rates are now higher, ranging from 5% to 26.3%. In this simulation, a technological shock has more effect on unemployment under Equilibrium 1 than under Equilibrium 2. Indeed, if we compare with the Base Case, we see that, following the technological shock, the unemployment rates of status-seeker and conformist blacks increase by 9.3 and 11.2 points respectively under Equilibrium 1. Under Equilibrium 2, increases in unemployment rates only amount to 4.3 and 3.9 points. For whites, however, the increase in the unemployment rate is

higher under Equilibrium 2 (+2.7 points) than under Equilibrium 1 (+2.4 points). In other words, *space amplifies technological shocks: a group is more affected by a technological shock when it lives farther away from jobs.*[12]

Observe that in all these variations from the Base Case, workers always have a higher utility under Equilibrium 2.

[*Insert Table 3 here*]

6 Conclusion

This paper has emphasized the role of ethnic preferences in explaining the high unemployment rates among minorities or 'blacks'. In our model, workers endogenously chose their location by trading off commuting costs and ethnic preferences. If some blacks value very much interacting within their own group and, because of that, are ready to segregate themselves by residing far away from jobs, then they will experience longer unemployment spells and higher unemployment rates but will not necessarily have a lower utility than that of other blacks or even of whites. In this context, we show that there are multiple equilibria in which either whites reside close to the business district while conformists locate further away from jobs (Equilibrium 1) or conformists reside close to jobs while whites locate at the other end of the city (Equilibrium 2). In both cases, status-seekers live in between the two other communities. It is then natural to try and rank these two equilibria. By using numerical simulations, we show that, in the most plausible cases, Equilibrium 2 —i.e. the equilibrium in which minorities live close to jobs— leads to a higher surplus than Equilibrium 1. This is because there is a fundamental asymmetry between blacks and whites: distance to jobs is crucial for the labor-market outcomes of blacks whereas it has less impact for whites because of their strong historical advantage. For example, if one interprets history as the inherited social network, then even though whites are physically distant from jobs, they can still gather information by using their social network and

[12] Analytically, it is easily shown that

$$\frac{\partial u_i^*}{\partial \overline{x}_i^* \partial \delta} = \mu \frac{(h_i - \delta - \mu \overline{x}_i^*)}{(h_i + \delta - \mu \overline{x}_i^*)^3}$$

which is positive for $h_i - \mu \overline{x}_i^* > \delta$.

thus face a lower unemployment rate than blacks who may reside closer to jobs.

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7 Appendix

Proof of Proposition 1:

We have assumed that groups form spatially homogeneous communities and all bid rents are linear (recall that, generically, $b'_W(x) = b'_B(x) = 0$), so there are six possible urban configurations depending on the relative locations of the three groups: W (Whites), BS (Status-Seeker Blacks), BC (Conformist Blacks) within the urban space.

- Equilibrium 1, in which, moving outward from the BD, we have the location of the following groups: W, BS, BC;
- Equilibrium 2: BC, BS, W;
- Equilibrium 3: BS, W, BC;
- Equilibrium 4: BC, W, BS;
- Equilibrium 5: W, BC, BS;
- Equilibrium 6: BS, BC, W

The aim of this proof is to show that under (13), only equilibria 1 and 2 can exist. As it is standard in urban economics (see e.g. Fujita, 1989), in order to determine an equilibrium configuration with heterogeneous workers, bid rents must be ranked in order of relative steepness. This is straightforward since bid rents are always linear (see (10), (11) and (12)).

Let us show that equilibria 3, 4, 5 and 6 do not exist under (13).

(a) Equilibrium 3

For Equilibrium 3 to exist, since conformist blacks locate further away from status-seeker blacks, it must be that

$$\frac{\partial \Psi_{BS}(x, v^3_{BS})}{\partial x} < \frac{\partial \Psi_{BC}(x, v^3_{BC})}{\partial x}$$

Let us show that this is impossible. Using (11) and (12), we have:

$$\frac{\partial \Psi_{BS}(x, v^3_{BS})}{\partial x} = -e_{BS} - (1 - u^3_{BS})$$

$$\frac{\partial \Psi_{BC}(x, v^3_{BC})}{\partial x} = e_{BC} - (1 - u^3_{BC})$$

Our condition on bid rents rewrites:

$$-e_{BS} - (1 - u^3_{BS}) < e_{BC} - (1 - u^3_{BC})$$

$$\Leftrightarrow \qquad u^3_{BS} - u^3_{BC} < e_{BC} + e_{BS} \tag{54}$$

However, since conformist and status-seeker blacks inherited the same history h_B, we know from this urban configuration (in which status-seeker blacks are closer to jobs than conformist blacks) that $\theta^3_{BS} > \theta^3_{BC}$ or equivalently $u^3_{BS} - u^3_{BC} < 0$. Since unemployment rates are between 0 and 1, we have: $0 < u^3_{BC} - u^3_{BS} < 1$ or equivalently $-1 < u^3_{BS} - u^3_{BC} < 0$.

Now, using the LHS of (13), we have:

$$e_{BC} + e_{BS} < -1 < u^3_{BS} - u^3_{BC}$$

This contradicts (54).

(b) Equilibrium 4

For Equilibrium 4 to exist, it must be that

$$\frac{\partial \Psi_{BC}(x, v^4_{BC})}{\partial x} < \frac{\partial \Psi_{BS}(x, v^4_{BS})}{\partial x}$$

Let us show that this is impossible. Using (11) and (12), this rewrites:

$$-e_{BC} - (1 - u^4_{BC}) < e_{BS} - (1 - u^4_{BS})$$

$$\Leftrightarrow \qquad u^4_{BC} - u^4_{BS} < e_{BC} + e_{BS} \tag{55}$$

However, since conformist and status-seeker blacks have the same inherited history h_B, we know from this urban configuration (in which conformist blacks are closer to jobs than status-seeker blacks) that $\theta^4_{BC} > \theta^4_{BS}$ or equivalently $u^4_{BC} - u^4_{BS} < 0$. Since unemployment rates are bounded by 0 and 1, we have: $0 < u^4_{BS} - u^4_{BC} < 1$ or equivalently $-1 < u^4_{BC} - u^4_{BS} < 0$.

Now, using the LHS of (13), we have:

$$e_{BC} + e_{BS} < -1 < u^4_{BC} - u^4_{BS}$$

This contradicts (55).

(c) Equilibrium 5

For Equilibrium 5 to exist, it must be that

$$\frac{\partial \Psi_{BC}(x, v^5_{BC})}{\partial x} < \frac{\partial \Psi_{BS}(x, v^5_{BS})}{\partial x}$$

Let us show that this is impossible. Using (11) and (12), this rewrites:

$$e_{BC} - (1 - u^5_{BC}) < e_{BS} - (1 - u^5_{BS})$$

$$\Leftrightarrow \qquad u^5_{BC} - u^5_{BS} < -e_{BC} + e_{BS} \tag{56}$$

However, since conformist and status-seeker blacks inherited the same history h_B, we know from this urban configuration (in which conformist blacks are closer to jobs than status-seeker blacks) that $\theta^5_{BC} > \theta^5_{BS}$ or equivalently $u^5_{BC} - u^5_{BS} < 0$. Since unemployment rates are between 0 and 1, we have: $0 < u^5_{BS} - u^5_{BC} < 1$ or equivalently $-1 < u^5_{BC} - u^5_{BS} < 0$.

Now, using the LHS of (13), we have:

$$-e_{BC} + e_{BS} < e_{BC} + e_{BS} < -1 < u^5_{BC} - u^5_{BS}$$

This contradicts (56).

(d) Equilibrium 6

For Equilibrium 6 to exist, it must be that

$$\frac{\partial \Psi_{BS}(x, v^6_{BS})}{\partial x} < \frac{\partial \Psi_{BC}(x, v^6_{BC})}{\partial x}$$

Let us show that this is impossible. Using (11) and (12), this rewrites:

$$-e_{BS} - (1 - u^6_{BS}) < -e_{BC} - (1 - u^6_{BC})$$

$$\Leftrightarrow \qquad u^6_{BS} - u^6_{BC} < -e_{BC} + e_{BS} \tag{57}$$

However, since conformist and status-seeker blacks have the same inherited history h_B, we know from this urban configuration (in which status-seeker blacks are closer to jobs than conformist blacks) that $\theta^6_{BS} > \theta^6_{BC}$ or equivalently $u^6_{BS} - u^6_{BC} < 0$. Since unemployment rates are bounded by 0 and 1, we have: $0 < u^6_{BC} - u^6_{BS} < 1$ or equivalently $-1 < u^6_{BS} - u^6_{BC} < 0$.

Now, using the LHS of (13), we have:

$$-e_{BC} + e_{BS} < e_{BC} + e_{BS} < -1 < u^6_{BS} - u^6_{BC}$$

This contradicts (57).

So far, we have shown that under assumption (13), equilibria 3, 4, 5 and 6 cannot exist. Let us now show that equilibria 1 and 2 always exist.

(e) Equilibrium 1

Using (10), 11) and (12), we have:

$$\frac{\partial \Psi_W(x, v^1_W)}{\partial x} = -e_W - (1 - u^1_W) < 0$$

$$\frac{\partial \Psi_{BS}(x, v^1_{BS})}{\partial x} = e_{BS} - (1 - u^1_{BS}) < 0$$

$$\frac{\partial \Psi_{BC}(x, v^1_{BC})}{\partial x} = e_{BC} - (1 - u^1_{BC})$$

Now, for Equilibrium 1 to exist, it must be that

$$\frac{\partial \Psi_W(x, v^1_W)}{\partial x} < \frac{\partial \Psi_{BS}(x, v^1_{BS})}{\partial x} < \frac{\partial \Psi_{BC}(x, v^1_{BC})}{\partial x}$$

Let us first show that

$$\frac{\partial \Psi_{BS}(x, v^1_{BS})}{\partial x} < \frac{\partial \Psi_{BC}(x, v^1_{BC})}{\partial x}$$

This rewrites:

$$u^1_{BC} - u^1_{BS} > -e_{BC} + e_{BS} \tag{58}$$

Since conformist and status-seeker blacks inherited the same history h_B, we know from this urban configuration (in which status-seeker blacks are closer to jobs than conformist blacks) that $\theta^1_{BS} > \theta^1_{BC}$ or equivalently $u^1_{BC} - u^1_{BS} > 0$. Now, using the LHS of (13), we have that $-e_{BC} + e_{BS} < -1 < 0$ and thus (58) is always true.

Let us now show that

$$\frac{\partial \Psi_W(x, v_W^1)}{\partial x} < \frac{\partial \Psi_{BS}(x, v_{BS}^1)}{\partial x}$$

This rewrites:

$$u_W^1 - u_{BS}^1 < e_{BS} + e_W \tag{59}$$

Since whites are closer to jobs and since $h_W > h_B$, we have that $\theta_W^1 > \theta_{BS}^1$ or equivalently $u_W^1 - u_{BS}^1 < 0$. Now, using the RHS of (13), we have that $e_W + e_{BS} > 0$ and thus (59) is always true. Equilibrium 1 always exist.

Note that in theory, the bid rent of conformist blacks (BC) can either be increasing or decreasing. Let us express the condition under which the bid rent of BC is decreasing. This implies that

$$e_{BC} < 1 - u_{BC}^1 \tag{60}$$

Let us now rewrite (60). By using (7), we obtain:

$$1 - u_{BC}^1 = \frac{\theta_{BC}^1}{\theta_{BC}^1 + \delta} = \frac{h_B - \mu\,(1 - N_{BC}/2)}{h_B - \mu\,(1 - N_{BC}/2) + \delta}$$

and thus (60) can be written as

$$e_{BC} < \frac{h_B - \mu\,(1 - N_{BC}/2)}{h_B - \mu\,(1 - N_{BC}/2) + \delta}$$

Since the RHS of the previous inequality is increasing in N_{BC}, let us consider its lower bound which is obtained for $N_{BC} = 0$. It follows that if

$$e_{BC} < \frac{h_B - \mu}{h_B - \mu + \delta} \tag{61}$$

then (60) is always verified.

In the model and in the simulations, we have assumed that (61) always holds so that the bid rent of conformist blacks is decreasing in Equilibrium 1. Equilibrium 1 is plotted in Figure 1.

(f) Equilibrium 2

Using (10), 11) and (12), we have:

$$\frac{\partial \Psi_{BC}(x, v_{BC}^2)}{\partial x} = -e_{BC} - (1 - u_{BC}^2) < 0$$

$$\frac{\partial \Psi_{BS}(x, v_{BS}^2)}{\partial x} = -e_{BS} - (1 - u_{BS}^2)$$
$$\frac{\partial \Psi_{W}(x, v_{W}^2)}{\partial x} = e_{W} - (1 - u_{W}^2)$$

Let us first show that the bid rents of both whites (W) and status-seeker blacks (BS) are increasing with x. In this case, it must hold that

$$e_W > 1 - u_W^2$$

and

$$-e_{BS} > 1 - u_{BS}^2$$

The RHS of (13) implies that $e_W > 1$, which in turn implies that $e_W > 1 - u_W^2$. Moreover, the LHS of (13) implies that $|e_{BS}| > 1$, which in turn implies that $-e_{BS} > 1 - u_{BS}^2$. The conditions ensuring that the bid rent of whites and that of status-seeker blacks are increasing are thus verified.

Equilibrium 2 is plotted in Figure 2. Furthermore, since $\Psi_{BC}(x, v_{BC}^2)$ is decreasing and $\Psi_{BS}(x, v_{BS}^2)$ is increasing, it is obvious that

$$\frac{\partial \Psi_{BC}(x, v_{BC}^2)}{\partial x} < \frac{\partial \Psi_{BS}(x, v_{BS}^2)}{\partial x}$$

We thus only need to show that

$$\frac{\partial \Psi_{W}(x, v_{W}^2)}{\partial x} > \frac{\partial \Psi_{BS}(x, v_{BS}^2)}{\partial x}$$

This rewrites:

$$e_{BS} + e_W > u_{BS}^2 - u_W^2 \tag{62}$$

In this urban configuration, whites are further away from jobs but benefit from a better history since $h_W > h_B$, so that nothing can be said concerning the comparison of θ_W^2 and θ_{BS}^2 and of u_W^2 and u_{BS}^2. However, by using the RHS of (13), we have: $e_{BS} + e_W > 1$ and since $-1 < u_{BS}^{2*} - u_W^{2*} < 1$, we have $e_W + e_{BS} > u_{BS}^{2*} - u_W^{2*}$ and thus (62) holds.

Proof of Proposition 2:

Most of the proof is in the core of the chapter. In this Appendix, we only need to prove that, in Equilibrium 1, if whites have a higher utility than

conformist blacks, then they also have a higher utility than status-seeker blacks. Indeed, if $v_W^{1*} > v_{BC}^{1*}$, then, according to (32), we have:

$$(y_E - y_U)(u_{BC}^{1*} - u_W^{1*}) > (e_{BC} - e_{BS})\overline{N}_{BS} + (u_{BC}^{1*} - u_W^{1*})\overline{N}_W + (u_{BC}^{1*} - u_{BS}^{1*})\overline{N}_{BS}$$

Since, $e_{BC} - e_{BS} > 0$, $u_{BC}^{1*} - u_{BS}^{1*} > 0$ and $u_{BC}^{1*} - u_W^{1*} > 0$, it is immediate that we also have:

$$y_E - y_U > \overline{N}_W$$

which, according to (30), means that $v_W^{1*} > v_{BS}^{1*}$.

Proof of Proposition 4:

Proving the first part of this proposition is straightforward for whites and conformist blacks, using (5) and the equilibrium distances to the BD given by (23), (25), (39) and (41). For status-seeker blacks, it suffices to observe that:

$$u_{BS}^{2*} \lesseqgtr u_{BS}^{1*} \Longleftrightarrow \theta_{BS}^{2*} \gtreqless \theta_{BS}^{1*} \Longleftrightarrow \overline{N}_W \gtreqless \overline{N}_{BC}$$

Now, to prove the second part of the proposition, observe that:

$$u_W^{1*} \lesseqgtr u_{BC}^{2*} \Longleftrightarrow \theta_W^{1*} \gtreqless \theta_{BC}^{2*} \Longleftrightarrow h_W - h_B \gtreqless \frac{\mu}{2}(\overline{N}_W - \overline{N}_{BC})$$

and

$$u_W^{2*} \lesseqgtr u_{BC}^{1*} \Longleftrightarrow \theta_W^{2*} \gtreqless \theta_{BC}^{1*} \Longleftrightarrow h_W - h_B \gtreqless \frac{\mu}{2}(\overline{N}_{BC} - \overline{N}_W)$$

so that our results are immediate.

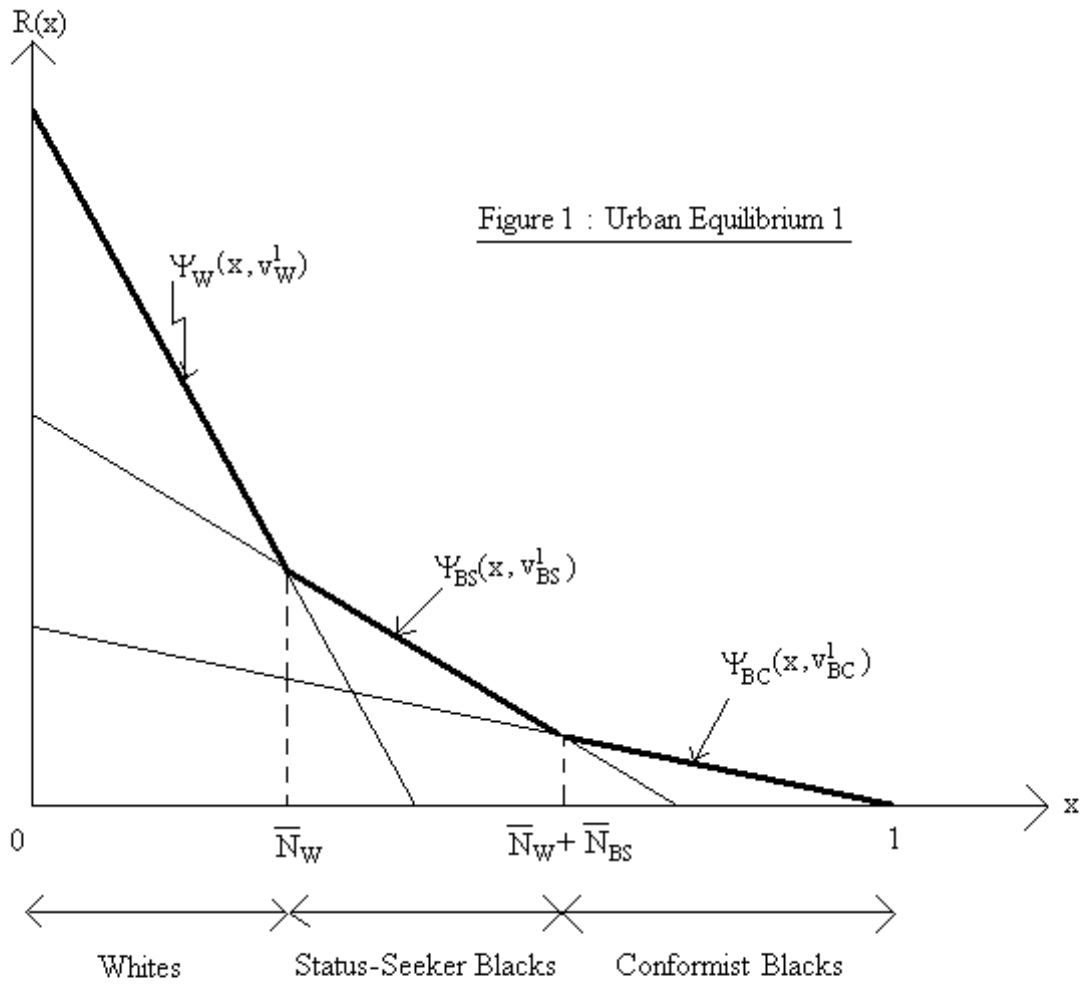

Figure 1 : Urban Equilibrium 1

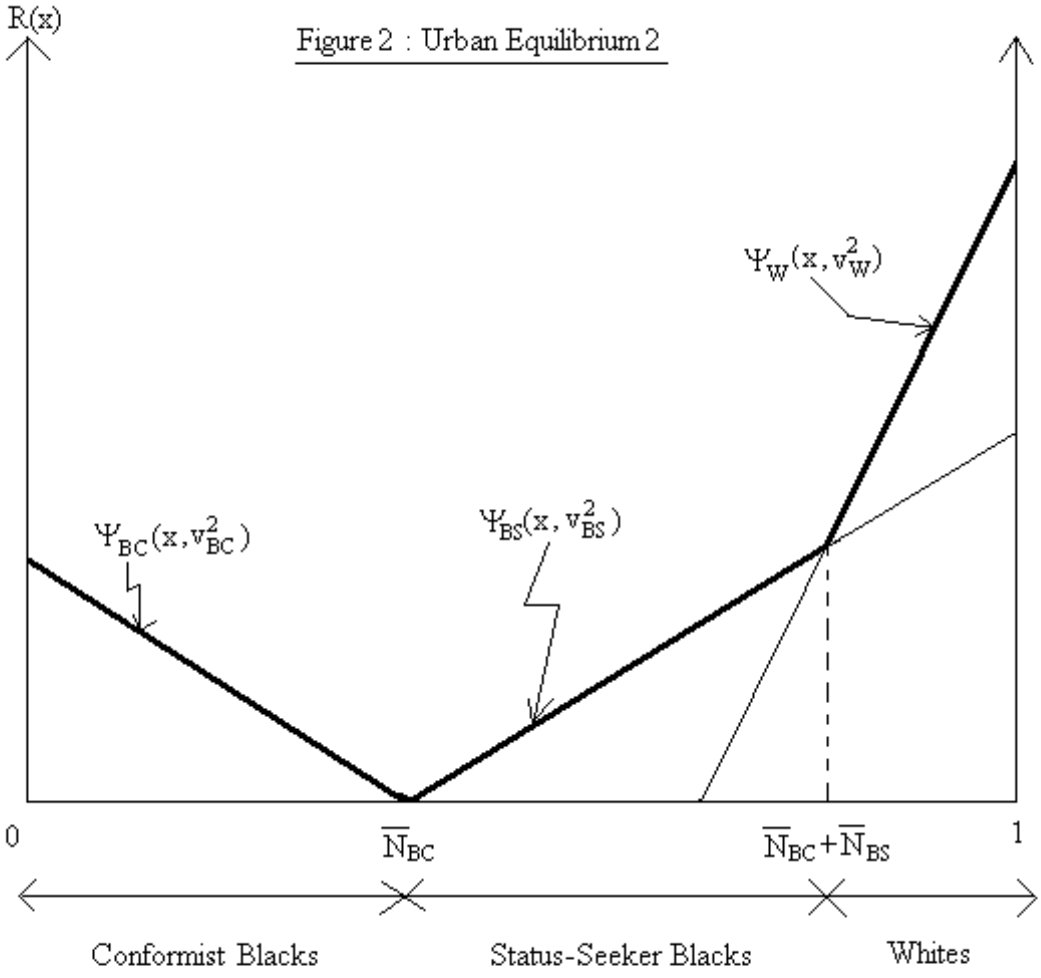

Figure 2 : Urban Equilibrium 2

Table 1: Base Case

	Equilibrium 1	*Equilibrium* 2	$1 \rightarrow 2$
u_W^{k*}	2.6%	2.8%	+
u_{BS}^{k*}	11.8%	4.6%	−
u_{BC}^{k*}	15.2%	4.3%	−
v_W^{k*}	2.86	3.70	+
v_{BS}^{k*}	2.66	3.65	+
v_{BC}^{k*}	2.72	3.79	+
S^{k*} $(Surplus)$	4.12	4.15	+
Expected income (W)	3.92	3.91	−
Expected income (BS)	3.65	3.86	+
Expected income (BC)	3.55	3.87	+
Average rent (W)	1.59	.56	−
Average rent (BS)	.18	.01	−
Average rent (BC)	.04	.05	+
Average transport cost (W)	.39	.58	+
Average transport cost (BS)	.75	.14	−
Average transport cost (BC)	.81	.05	−
Average ethnic externality (W)	.92	.92	=
Average ethnic externality (BS)	−.06	−.06	=
Average ethnic externality (BC)	.02	.02	=

$y_E = 4,\ y_U = 1,\ \delta = .15,\ \mu = 2.8,\ h_W = 6.8,\ h_B = 3.5,\ \overline{N}_{BC} = 10\%,$
$\overline{N}_{BS} = 10\%,\ \overline{N}_W = 80\%,\ e_{BC} = .1,\ e_{BS} = -1.2,\ e_W = 2.3$

Table 2: Case Two

	Equilibrium 1	*Equilibrium* 2	$1 \rightarrow 2$
u_W^{k*}	2.4%	18.1%	+
u_{BS}^{k*}	3.5%	5.2%	+
u_{BC}^{k*}	9.9%	2.7%	−
v_W^{k*}	2.55	2.70	+
v_{BS}^{k*}	2.51	2.98	+
v_{BC}^{k*}	2.88	3.57	+
S^{k*} $(Surplus)$	3.34	3.32	−
Expected income (W)	3.93	3.46	−
Expected income (BS)	3.89	3.84	−
Expected income (BC)	3.70	3.92	+
Average rent (W)	1.51	.25	−
Average rent (BS)	.75	.05	−
Average rent (BC)	.16	.21	+
Average transport cost (W)	.10	.74	+
Average transport cost (BS)	.39	.57	+
Average transport cost (BC)	.72	.19	−
Average ethnic externality (W)	.23	.23	=
Average ethnic externality (BS)	−.24	−.24	=
Average ethnic externality (BC)	.06	.06	=

$y_E = 4,\ y_U = 1,\ \delta = .15,\ \mu = 6.8,\ h_W = 6.8,\ h_B = 6.8,\ \overline{N}_{BC} = 40\%,$
$\overline{N}_{BS} = 40\%,\ \overline{N}_W = 20\%,\ e_{BC} = .1,\ e_{BS} = -1.2,\ e_W = 2.3$

Table 3: Variations from the Base Case

	Base Case	$\mu = 0$	$h_B = h_W = 6.8$	$\delta = .3$
Equilibrium 1				
u_W^{1*}	2.6%	2.2%	2.6%	5.0%
u_{BS}^{1*}	11.8%	4.1%	3.3%	21.1%
u_{BC}^{1*}	15.1%	4.1%	3.5%	26.3%
v_W^{1*}	2.86	2.85	2.84	2.83
v_{BS}^{1*}	2.66	2.81	2.83	2.47
v_{BC}^{1*}	2.72	2.94	2.95	2.49
TLR^{1*}	1.30	1.31	1.31	1.27
S^{1*}	4.12	4.17	4.16	4.03
Equilibrium 2				
u_W^{2*}	2.8%	2.2%	2.8%	5.5%
u_{BS}^{2*}	4.6%	4.1%	2.3%	8.9%
u_{BC}^{2*}	4.3%	4.1%	2.2%	8.2%
v_W^{2*}	3.70	3.72	3.70	3.62
v_{BS}^{2*}	3.65	3.66	3.71	3.52
v_{BC}^{2*}	3.79	3.79	3.85	3.67
TLR^{2*}	.45	.45	.45	.46
S^{2*}	4.15	4.17	4.16	4.08