DISCUSSION PAPER SERIES

No. 5346

THE MECHANISMS OF SPATIAL MISMATCH

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PUBLIC POLICY

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ABSTRACT

The mechanisms of spatial mismatch*

The Spatial Mismatch Hypothesis (SMH) argues that low-skilled minorities residing in U.S. inner cities experience poor labour-market outcomes because they are disconnected from suburban job opportunities. This assumption gave rise to an abundant empirical literature, which confirmed this hypothesis. Surprisingly, however, it is only recently that theoretical models have emerged, which probably explains why the mechanisms of spatial mismatch have long remained unclear and not properly tested. In this survey, we present relevant facts, review the theoretical models of spatial mismatch, confront their predictions with available empirical results, and indicate which mechanisms deserve further empirical tests.

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1. Introduction

In the mid 1960s, riots broke out in the black neighborhoods of several major U.S. cities (Los Angeles, 1965, Chicago, 1966, and Newark, 1967). In 1968, the Kerner commission, which investigated the causes of these riots, emphasized the frustration of black inner-city residents confronted to high unemployment rates and poor access to public services. In a seminal paper, Kain (1968) argued that a major source of adverse labor-market outcomes for blacks in US cities was to be found in the spatial disconnection between inner-city ghettos (where minorities resided) and the suburbs (where low-skilled jobs had already begun to decentralize).[1] This argument, which came down in the literature as the spatial mismatch hypothesis (SMH) inspired an abundant research literature over the following decades. In the 1980s and 1990s, the interest in the SMH was revived by two sociologists, Kasarda (1985, 1988, 1989) and Wilson (1987, 1996) who showed the existence of a black 'underclass' in inner-city ghettos and attributed the endemic problems of that underclass to the sharp decrease in the number of entry-level jobs located in inner cities.

Following Kain's intuition, numerous empirical works have tried to test the existence of a causal link between spatial mismatch and the adverse labor-market outcomes of minorities (see the empirical surveys of Jencks and Mayer, 1990, Holzer, 1991, Kain, 1992, Wheeler, 1993, or Ihlanfeldt and Sjoquist, 1998). The usual approach is to relate a measure of labor-market outcomes, typically employment or earnings, to a measure of job access, typically some index that captures the distance between residences and job locations. The weight of the evidence suggests that, indeed, distance to jobs is (partly) responsible for the adverse labor-market outcomes experienced by ethnic minorities.[2] The spatial mismatch literature has focused on race under the presumption that (inner-city) blacks are not residing close to (suburban) jobs because they are discriminated against in the (suburban) housing market. It should be said that most of this literature has focused on black workers, and it is only recently that the analysis has been extended to other minority workers, especially Hispanics in the United States. Furthermore, the SMH is only concerned with the way low-skilled minority workers residing in inner cities are affected by distant job locations. The focus is neither on the difficulties faced by skilled minority workers nor on the difficulties faced by unskilled minority workers residing in the suburbs (where entry-level jobs are relatively numerous). This is why some authors prefer the expression *spatial/skill mismatch* to more accurately depict the spatial disconnection between the residential locations of inner-city minorities and the locations of the *low-skilled suburban jobs* they could occupy (see Ong and Blumenberg, 1998, or Immergluck, 1998).

Urban economists are nevertheless divided on the magnitude of spatial mismatch as an explanation of racial unemployment disparities (see Ihlanfeldt, 2005).[3] What is very unusual in economics is that it is only in the late 1990s ─i.e. following three decades of empirical tests and changes in the structure of U.S. cities─ that theoretical models of spatial mismatch began to emerge. In other words, most of the theoretical corpus associated with spatial mismatch followed the empirical works rather than preceded them. In this rather odd context, *the general objective of the present work is to shed light on spatial mismatch by presenting the recent theoretical advances and confronting them with relevant empirical evidence from previous studies*. We show that some mechanisms of spatial mismatch have already been addressed, while others remain to be tested. This work is carried out with a view to design future relevant empirical tests that would investigate the different channels whereby distance to jobs can be harmful for ethnic minorities. Moreover, distinguishing which mechanisms prevail is crucial for the formulation of targeted and efficient economic policies.

Our work is organized as follows. In section 2, we present the main ingredients of spatial mismatch: the disconnection of black central-city residents from suburban job opportunities and their adverse labor-market outcomes. In section 3, we expose the specific theoretical mechanisms that explain how spatial mismatch can exacerbate the unemployment and low wages of central-city blacks. The empirical evidence supporting the mechanisms is also discussed. Finally, section 4 discusses the main policy implications.

2. Blacks' disconnection from jobs and their adverse labor-market outcomes

Over the second half of the twentieth century, dramatic changes have occurred in U.S. metropolitan areas. In particular, the concentration of jobs has continuously decreased in central cities and increased in the suburbs. Whites have continuously decentralized to suburban residential areas over the same period, while many black households have remained in central cities. The combination of these trends is said to have created a situation of spatial mismatch to the extent that blacks are now located far away from suitable suburban job opportunities. We provide elements of theory that explain these trends as well as empirical facts which shed some light on their intensities. We also present figures which characterize the adverse labor-market outcomes of black inner-city residents.

2.1 The suburbanization of jobs

One of the most striking feature of the American urban landscape has been the massive and continuous suburbanization of both people and jobs in the second half of the twentieth century. In the 19th century, U.S. cities were characterized by a small and dense Central Business District located close to an inter-urban transport node (typically a port or a train station). Residences were located nearby or even within this central area. Mieszkowski and Mills (1993) argue that this centrally concentrated structure emerged due to high intra-urban transport costs for both people and goods. In this context, the emergence of new transport modes such as tramways, trains, then cars, made it possible for the population to suburbanize. The decrease in intra-urban costs associated with transport innovations enabled people to move to the suburbs so as to consume more housing while keeping their jobs at the city center. The increase in population and wealth also contributed to the spatial expansion of cities and the emergence of rich suburban areas, especially in the second half of the 20th century. Our calculations from the census show that in the ten largest MSAs,[4] the proportion of central city residents declined from 53% in 1970 to 42% in 2000.[5] Today, the median resident in a US metropolitan area lives farther than nine miles away from the city center (Glaeser and Kahn, 2001). In turn, the suburbanization of the labor force has continuously attracted jobs to the periphery of U.S. cities (see Steinnes, 1977, Thurston and Yezer, 1994, White, 1999). But other causes have also contributed to the decision of firms to settle in or relocate to the suburbs. Anas, Arnott and Small (1998) evoke the agglomerations forces played by local externalities as the proximity between some agents can improve the input-output linkage by reducing intermediate goods transportation costs, foster innovation through technological spillovers, or even reduce production costs. This means that firms have

tended to relocate close to other firms in the suburbs, triggering a cumulative process of aggregation. Dispersion forces away from the CBD also contributed to job suburbanization. For instance, the intense spatial proximity between CBD firms could have intensified competition for the local labor force and for local market shares, driving firms away (see Fujita and Thisse, 2002). Land prices, congestion, or crime also constitute significant dispersion forces that probably fostered the suburbanization of jobs.[6]

A few theoretical models shed light on the process. Firms are confronted to both centrifugal and centripetal forces so that their locations within the city result from a trade-off between the advantages and disadvantages of proximity to and distance from the city center. To model this, Fujita, Thisse and Zenou (1997) adopt a monocentric urban framework (all jobs being located at the city center) and consider a linear city in which workers are uniformly distributed along the segment. In their framework, a new firm wishes to settle in the city and chooses its location but the location decision interacts with the wage policy of other firms which are already settled in the city center. Thus, the firm faces a trade-off between proximity to the city center and distance from the city center (so as to increase its market power on the labor force). This type of formalization can also explain the emergence of secondary employment centers or edge cities (see Henderson and Mitra, 1996, for a formal model, and Garreau, 1991, Giuliano and Small, 1991, McMillen and McDonald, 1998, Anas, Arnott and Small, 1998, and Cervero *et al.*, 2002, for the empirical identification of subcenters).

A few selected statistics characterize the extent of suburbanization in U.S. cities over the second half of the twentieth century. Whereas in 1950, central cities gathered nearly 70% of MSA jobs, the figure has gone down to 50% in 1980 (Mills and Lubuele, 1997). Our calculations show that, in the ten largest MSAs, the proportion of jobs located in central cities has decreased from 57% in 1980 to 51% in 1990 and 47% in 2000. If we exclude the case of New York City's center which remains very centralized, the average proportion of central-city jobs for the nine remaining MSAs goes down from 49% in 1980 to only 44% in 1990 and 40% in 2000. The decrease in the percentage of jobs located in central cities can be explained by a higher growth rate of jobs in the suburbs than in the central city. In the ten largest MSAs, between 1980 and 1990, the number of jobs increased on average by +3% each year in the suburbs, but only grew by +0.8% in central cities. Between 1990 and 2000, the number of jobs increased on average by +1.4% each year in the suburbs, but slightly decreased by -.1% in central cities.

The degree of suburbanization varies with the type of jobs. The SMH focuses on entry-level jobs only to the extent that they have grown in the suburbs but have declined in city centers where low-skilled minorities remain located. One of the theoretical justifications accounting for this trend is that there exists an important pool of consumers for low-skilled services in rich residential suburban areas. Another justification is that firms which hire low-skilled workers (especially in the manufacturing industry) consume much land and want to avoid central locations where land is scarce and expensive. The latter mechanism is central in Smith and Zenou (1997) who investigate the location of jobs in a dual labor-market framework. The authors develop a model in which there are two types of jobs differing by their quality (high or low). The high-quality jobs (primary sector) are assumed to be located in the city center. The low-quality jobs (secondary sector) are offered by a large representative firm that needs to choose its location in the metropolitan area. There are exogenous agglomeration forces that attract the firm towards the city center, whereas land rents endogenously decrease with distance and thus play the role of a dispersion force. The chosen location results from

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the confrontation of these two opposite forces. When the dispersion force is sufficiently strong, the firm (and thus entry-level jobs) locate in the suburbs. The underlying mechanism can be thought in a dynamic setting: firms with low-quality jobs tend to relocate in the suburbs in order to benefit from low rents. As a result, the number of low-quality jobs increases in the suburbs and decreases in the central city.

Empirically, it is relevant to focus on manual and services jobs, which concentrate most entry-level positions.[7] In conformity with the theory, between 1980 and 1990, manual jobs decreased in almost all city centers of the ten largest MSAs (at an average annual rate of -1.7%) and grew in the suburbs (at a rate of +1.2%). Between 1990 and 2000, these trends continued with a decrease of -1.6% in city centers and an increase of +.3% in suburbs. Services jobs, which group both skilled and unskilled positions, grew in the city center (+2.4% for 1980-1990 and +.7% for 1990-2000) but much more in the suburbs (+4.1% for 1980-1990 and +2.6% for 1990-2000). In a SMH perspective, these figures should be compared with the growth rates of unskilled workers in city centers and in suburbs. In central cities, the number of manual workers decreased continuously between 1980 and 2000 by an average annual rate of -1.5%, which is slightly less than the decrease in the number of manual jobs. In contrast, in the suburbs, the number of manual workers increased very slightly by +.1% on average each year between 1980 and 2000, whereas the number of manual jobs increased strongly. It should be clear that these figures do not depict the complete disappearance of suitable jobs for less-educated workers in city centers: for instance Shen (2001) argues that, in Boston, low-skilled job openings are still relatively concentrated in the central city. However, our figures indicate a deterioration in the jobs-to-workers ratio for inner-city low skills. Interestingly, Kawabata (2003b) shows that in Boston, Los Angeles and san Francisco, the jobs-to-workers ratio in the central city is lower for unskilled labor than for skilled labor.

2.2 The disconnection of blacks from jobs

The main assumption in the SMH is that blacks have mainly remained in the city centers of U.S. cities in spite of suburbanization. Statistics strongly support this assertion. In 2000, in the ten largest MSAs, on average 64% of all urban blacks still lived in a central city in comparison with 28% of the white urban population. Of course, this asymmetry goes along with a high level of black/white residential segregation, a phenomenon which is prevalent in U.S. cities. According to Cutler, Glaeser and Vidgor (1999), the average black/white dissimilarity index in American cities (which measures residential segregation) reaches 66% in 1990.[8] However, segregation appears to be declining. Glaeser and Vidgor (2001) show that residential segregation slightly decreased for the ten largest MSAs between 1990 and 2000 even though it remains high, between 54% (in Dallas) and 78% (in Chicago). In 2000, in the ten largest MSAs, blacks account for 27% of all central-city residents but only 11% of the suburban population. It should be said that levels of concentration and proportions of black residents vary much across cities. In Detroit for instance, a highly segregated metropolitan area, 70% of inner-city residents are blacks, whereas blacks only account for 6% of the suburban population. On the contrary, in Washington, blacks account for 44% of inner-city residents and 19% of suburban residents.

The persistence of segregation goes along with a high degree of residential inertia for blacks. This is captured by Bogart (1998) who provides estimates of the average transition probabilities between neighborhoods with different economic profiles for poor families with children. Over the 1979-1984 period (for which the transition probabilities are computed), it appears that a black household with children living in a low-income neighborhood only has a 9% chance to be living in a better neighborhood the following year, whereas for whites, this probability is above 20%. Thus, blacks living in poor areas are less spatially and socially mobile than whites residing in poor areas. This suggests that it is more difficult for blacks than for whites to escape inner-city residences. This is supported by another study which shows that blacks have a lower probability than whites to move from central city to suburbs, but a higher probability to move from suburbs to central city, even after controlling for socioeconomic characteristics (South and Crowder, 1997).

A few words should be said on the causes of segregation and the residential inertia of blacks in U.S. cities. The first set of explanations, in line with the SMH, revolves around *restrictions imposed on the residential choices of blacks*. Housing market discrimination has been shown to play a central role in the segregation of blacks: real-estate agents propose blacks to visit fewer houses than they do for their white customers (Yinger, 1986). There are two main justifications for this behavior: sheer racial discrimination (Becker, 1971), and customer discrimination (real-estate agents wanting to avoid blacks to settle in neighborhoods that they think will then become less attractive for their white customers, see Ondrich, Ross and Yinger, 2001). However, housing market discrimination can be driven by other mechanisms: *statistical discrimination* (Phelps, 1972, Aigner and Cain, 1977) in the context of imperfect information (blacks being perceived, on average, as bearing a higher default risk) and *redlining* (individuals living in minority neighborhoods ─as if circled by a red line─ being discriminated against, see Tootel, 1996). It is also worth mentioning that housing market discrimination not only concerns the screening of housing units, but can also take the form of credit, mortgage, and insurance discrimination (Yinger, 1996, Tootel, 1996, Ladd, 1998, Hillier, 2003, Ross and Tootell, 2004, Ross, 2005). Other indirect restrictions on the residential choice of black families may take the form of institutional regulations on land use such as zoning. In American cities, zoning can impose minimum lot sizes which prevent low-income minorities from settling in white suburban areas (Squires, 1996). Housing policies may also distort the set of location choices for blacks when housing projects are only concentrated in the city center (Kain, 1992).

The second set of explanations for the segregation of blacks runs contrary to the historical SMH since it *presents segregation as market-driven*. In the 1970s, economists presented models in which individuals had racial preferences that led to the spatial separation of ethnic groups (see Schelling, 1969, Rose-Ackerman, 1975, Yinger, 1976, Courant and Yinger, 1977, and more recently Selod and Zenou, 2006). In the empirical literature, this is illustrated by the white flight phenomenon according to which whites flee racially-mixed neighborhoods when the proportion of minorities reaches a tilting point (see Galster, 1990 and 2000). It has also been shown that minorities may want to live together because of their preferences to reside close to individuals of their own group (see Akerlof 1997, Ihlanfeldt and Scafidi, 2002). Other works stress the existence of negative externalities from the poor towards the rich or from the uneducated towards the educated, which fuels the flight out of those neighborhoods (as in Benabou, 1993). It has also been argued that whites and blacks may have different preferences for the provision of public goods and that this may lead to spatial sorting *à la* Tiebout across local communities (Anas, Arnott and Small, 1998). Finally, blacks may have a higher willingness to pay for housing units characterized by some specific attributes that differ from those valued by whites. Some spatial sorting consistent with the SMH occurs if these units are mainly located in the central city.

As blacks are concentrated in city centers whereas jobs have suburbanized, there exists a spatial disconnection between blacks and jobs. It has been shown that spatial mismatch has increased on the 1970-1990 period since blacks have suburbanized at a lower pace than jobs. As a consequence, the spatial disparities between black residences and jobs have increased by more than 20% (Martin, 2001a). However, spatial mismatch has been shown to have declined after 1990. This is true not only when the black residential locations are compared to that of all jobs, but also when they are compared to the location of retail jobs that may better fit low-skilled workers (Raphael and Stoll, 2002).[9] Interestingly, Ihlanfeldt and Sjoquist (1998) argue that the disconnection of blacks from jobs is prevalent mainly in big MSAs. Using Raphael and Stoll's index of spatial mismatch between residences and retail jobs, we have checked that this assertion is supported by the data. Indeed, in 2000, the correlation between MSA size and the spatial mismatch index for retail jobs and blacks is .37, whereas for whites the correlation is only .03.

2.3 The adverse labor-market outcomes of blacks

Many blacks reside in city centers whereas jobs have suburbanized. They thus face three alternatives on the labor market: holding a job in a suburban area far away from where they live; holding a (possible inadequate) job in the city center close to their place of residence; and being unemployed. We present empirical facts concerning the commuting patterns, access to jobs, unemployment and wages of inner-city blacks.

Average figures on commuting patterns capture two different phenomena: the long commutes of those who work in the suburbs and the short commutes of those who work in the city center. In 1995, white and black commutes in the U.S. last on average 23 minutes. However, in terms of distance, white workers commute on average 11.9 miles whereas black workers only commute 10.5 miles (computed from McGuckin 2000, tables 4-8, 4-15 and 4-16, using the Nationwide Personal Transportation Survey). A different source shows that the average travel time to work in the U.S. in 1990 is 24 minutes for blacks but only 20 minutes for whites (Krovi and Barnes, 2000, using the PUMS B sample). Taylor and Ong (1995) provide figures by type of neighborhood in 1985 which confirm this result. In predominantly white neighborhoods, both black and white workers commute above 11 miles and 22 minutes. In predominantly minority areas, both black and white workers commute about 9 miles but the commute time of blacks (26 minutes) is significantly longer than that of whites (21 minutes). The difference can be explained by inner-city blacks' lower access to automobiles, which makes them resort to slower transportation modes. In 1990, whereas 8.7% of white households do not have a car, this percentage reaches 30.4% for black households (McGuckin, 2000). In 1995, whereas 2% of white workers' commutes are by public transit (by bus or by rail), this percentage stands at 12% for black workers. Similarly, black workers resort more to car pooling (20% of their trips) than white workers (14% of their trips) who massively use their private vehicle to commute.

The access to suburban vacancies is particularly poor for inner-city blacks. To show this, Stoll, Holzer and Ihlanfeldt (2000) present the distribution of recently filled jobs and people for a pooled sample of MSAs (Atlanta, Boston, Detroit, Los Angeles) in the early 1990s. In their study, whereas blacks are over-represented in central cities, recently filled jobs are mainly located in the suburbs. This pattern is even more striking for the less-educated and the jobs they may occupy. While 76.3% of black high-school dropouts (low-skilled workers) live in central cities, the

suburbs gather 79.6% of recently filled low-skilled jobs. In contrast, the proportion of white high-school dropouts residing in the suburbs (77.9%) is close to that of the recently-filled low-skilled jobs located there.

Employment figures are also at the disadvantage of blacks in central cities. Brueckner and Zenou (2003) report that the average unemployment rate of inner-city blacks is high in comparison with other inner-city and suburban residents in the twenty-five largest cities in 1997: whereas the unemployment rate of central-city blacks reaches 12.5%, which is 5 percentage points above the unemployment rate of suburban blacks (7.6%) and more than three times the unemployment rate of suburban whites (3.7%). Interestingly, the contrast between central cities and suburbs is much dampened for whites since the unemployment rate of central-city whites (5.5%) is only 1.8 points above the unemployment rate of suburban whites.

There also appears to be stark disparities concerning the distribution of income across places and racial groups in American cities. In 1990 for instance, the average income of a central-city black is close to $8,700, which is little less than half the average income of a central-city white. In the suburbs, disparities are also very large although relatively narrower than in central cities: in 1990, suburban blacks have an average per-capita income of $11,000, which is one third lower than that of suburban whites but 25% higher than that of central-city blacks (Mills and Lubuele, 1997). These income differences can be explained not only by human capital differences but because blacks usually work in places where the wages are the lowest. Indeed, in a study on Atlanta, Ihlanfeldt and Young (1994) find that the wage rate for employees of fast-food restaurants increases about 1% per mile when moving outward from the CBD where blacks are more likely to work. The existence of a wage gradient is further confirmed by Ihlanfeldt (1997) who reports that the hourly hiring wage in a fast food restaurant is $4.39 in the northern suburbs of Atlanta, but only $3.84 in the city center.[10]

Consistently, the poverty rate is always higher in central cities than in the suburbs and is usually three or four times higher for blacks than for whites. In 1996, whereas only 30% of the U.S. urban population reside in a central city, central cities group more than half the poor families (U.S. Bureau of the Census, 1997) and 72% of the inner-city poor are ethnic minorities (U.S. Department of Housing and Urban Development, 1999). In 1990, 31.1% of blacks living in central cities are poor whereas the poverty rate of central-city whites only stands at 12% (Mills and Lubuele, 1997).[11]

We have described how blacks are disconnected from jobs and experience bad labor-market outcomes. The SMH stipulates a causal link. Raw descriptive statistics are consistent with this assumption. Selod and Zenou (2006) report that, in large MSAs, the larger the spatial mismatch between blacks and retail jobs, the greater the unemployment of blacks. The SMH is also supported by a series of econometric studies.[12] Raphael (1998) focuses on how differences in accessibility to areas of high employment growth can account for differences in the employment rates of white and black youth, showing that nearly 20% of the employment differential can be attributed to systematic accessibility differences. Similarly, Parks (2004) finds that a better spatial accessibility to jobs is associated with a lower unemployment rate among blacks.[13] Stoll (1998) shows that growth in job decentralization increases the unemployment incidence and duration for young blacks. Weinberg (2000) finds that the residential centralization of blacks can account for 48% to 62% of the black-white employment differential among 18-30 year olds living in the central cities of large MAs. Similarly, Weinberg (2004) shows that there is a negative effect of job decentralization on the black-white employment differential in central cities. Martin (2004) shows that between 1980 and 1990, the unemployment rates of blacks increased in cities where jobs shifted away from black locations.[14]

These recent studies confirm the effect of spatial mismatch on the labor-market outcomes of inner-city blacks. However, none of them tests a specific mechanism accounting for that effect. The next section presents the possible theoretical channels through which spatial mismatch can be harmful for inner-city minorities and discusses their empirical relevance.

3. The mechanisms of spatial mismatch

General tests of spatial mismatch show that the SMH is empirically grounded. However, they do not shed light on the underlying mechanisms. This section presents the mechanisms put forward by the theoretical models and reports the related empirical tests in the literature. We can think of (at least) seven different underlying mechanisms that explain how distance to job opportunities could be harmful. *(i)-(iv)* adopt the point of view of minority workers (labor supply) whereas explanations *(v)-(vii)* adopt the perspective of firms (labor demand):

(i) Workers may refuse a job that involves commutes that are too long because commuting to that job would be too costly in view of the proposed wage.

(ii) Workers' job search efficiency may decrease with distance to jobs. In other words, for a given search effort, workers who live far away from jobs have fewer chances to find a job because, for instance, they get less information on distant job opportunities.

(iii) Workers residing far away from jobs may not search intensively. For instance, when housing prices decrease with distance to jobs, distant workers may feel less pressured to search for a job in order to pay their rent.

(iv) Workers may incur high search costs that cause them to restrict their spatial search horizon at the vicinity of their neighborhood.

(v) Employers may discriminate against residentially segregated workers because of the stigma or prejudice associated with their residential location (*redlining*). In particular, suburban employers may consider that, on average, inner city residents have bad work habits or are more likely to be criminal (*statistical discrimination*).

(vi) Employers may refuse to hire or prefer to pay lower wages to distant workers because commuting long distances makes them less productive (they are more tired or more likely to be absent).

(vii) Suburban employers may think that their white local customers are unwilling to have contacts with minority workers. They thus discriminate against minority workers (*customer discrimination*) and in particular against those located in the central city.

It should be noted that these arguments are not directly based on ethnicity at the exception of *(vii)* and possibly *(v)*. *(v)* and *(vii)* operate because of the separation between city centers and suburbs, but do not involve a mechanism which intensity increases with physical distance. To the best of our knowledge, all these points have been formalized in a spatial setting at the exception of *(vii)*. It should be said that a single model sometimes incorporates several of these points (even though it is not always explicitly stated by the authors)[15] and that some mechanisms are embodied in models that do not adopt always a standard spatial mismatch perspective. In some models, the spatial disconnection between residences and jobs results from free location choices and thus departs from the historical perspective of the SMH in which housing choices are supposed to be constrained. While assuming free location choice may be a modeling device used by several authors, this may nevertheless have important implications for the relevance of economic policies. In particular, should differences in labor-market outcomes be addressed if they result from free location choices? We do not take part in this debate since the focus of our paper is only to show how labor-market outcomes may be related to distance to job opportunities as was first pointed out by the SMH. This section details the above-mentioned mechanisms by discussing both models and empirical studies, distinguishing the point of view of workers and that of firms.

3.2.1 Spatial Mismatch: the workers' perspective

Commuting costs are too high in view of the wages offered *(i)*

The spatial mismatch empirical literature focused for many years on the role of commuting costs as a deterrent for central-city blacks to accept distant jobs (since the potential wages net of commuting costs would be too low). In U.S. cities, this mechanism could significantly contribute to the unemployment of inner-city minorities.

Coulson, Laing, and Wang (2001) provide a model that shows how the high commuting costs faced by central-city residents can explain their adverse labor-market outcomes when firms locate in the suburbs. The authors consider two asymmetric zones (a central city or CBD, and a suburb or SBD), which form two separate local labor markets. Whereas workers are assigned to a place of residence (for some in the central city, for others in the suburbs), firms endogenously decide whether to locate in the central city or in the suburbs, the suburbs being more attractive due to lower entry costs. Workers can hold a job in any of the two zones but incur higher transport costs if they work out of their zone of residence. In each zone, workers are heterogeneous with respect to their utility or their capacity to commute out of their zone of residence. This assumption can account for the heterogeneity of locations in each zone. In this context, different individuals anticipate different commuting costs and thus different net wages for potential job offers. The firms' differing entry costs, the heterogeneity of workers with respect to transportation costs, and the frictions in the job-matching process combine to generate a spatial-mismatch situation. The authors show that there exists an equilibrium in which the SBD residents work in their zone of residence (which is more attractive for firms) whereas some residents of the CBD commute daily to the SBD (reverse commuting). In this equilibrium, the number of job vacancies in the CBD is lower than in the SBD, in particular because the entry-cost differential favors job creation in the SBD. Moreover, in the SBD, the unemployment rate is lower and the gross wage is higher than in the CBD.

Whereas the CBD residents who bear low commuting costs find SBD jobs attractive, those with high commuting costs prefer to search in the CBD even if the unemployment rate is higher there. The model simultaneously accounts for both the low income and the high unemployment rate of city-center residents.

Following the standard version of the SMH, Brueckner and Martin (1997) and Brueckner and Zenou (2003) propose models which investigate the effect of housing market discrimination on the labor-market outcomes of blacks. The first attempt to model spatial mismatch in a standard urban economics framework was the work of Brueckner and Martin (1997)[16] which showed how job decentralization and housing market discrimination combined to depress the wages of minorities. Considering a local labor market at each end of a linear city (a central-city employment center and a suburban employment center), the authors presented a comparison 'before' and 'after' the introduction of spatial mismatch in the model, that is 'with' and 'without' housing market discrimination assigning blacks to central-city locations. However, this formalization did not model the effects of spatial mismatch on unemployment rates.

Brueckner and Zenou (2003) propose an extension that bridges this gap. As in Brueckner and Martin (1997), the authors consider a closed linear city with absentee landlords with an employment center at each end of the segment: the Central Business District (CBD) and the Suburban Business District (SBD). They assume that these centers form two separate local labor markets. Labor demand is exogenous and the same in each center so that it limits the number of local available jobs. There are two continua of individuals, blacks and whites, who are distributed in the city and go to work in one center or the other. Each individual chooses where to search for a job by comparing the expected wages offered in each center net of commuting costs. The authors assume *housing-market discrimination* so that blacks are not authorized to live in the suburbs (close to the SBD). In this context, black workers are skewed towards the CBD and blacks' residences are thus remote from the SBD. For a black worker, working in the SBD involves high-commuting costs, which deters many of them from accepting SBD jobs even though some of them accept to work in the SBD. As a result, the black CBD labor pool is large relative to the black SBD pool. In a simple version of this model, the wages of both whites and blacks are set at an exogenous level. Black workers are paid at the minimum wage and whites are better paid (which could be justified if they are more skilled). In equilibrium, the combination of fixed wages and fixed local labor demand generates unemployment so as to clear the labor market. As the black labor supply is skewed towards the CBD under housing-market discrimination, the unemployment rate of blacks is higher in the CBD than in the SBD (as described in Section 2.3). Without housing market discrimination (implying that the labor supply of blacks would be equally shared between the two centers), the unemployment rate of all blacks would lie between the CBD and SBD unemployment rates in the restricted equilibrium.

A limit of the fixed-wage setting however is that it does not yield any prediction on the effect of spatial mismatch on wages. This limit is addressed in an extension of the model in which the wages of blacks are endogenously determined to deter shirking. In this efficiency-wage setting, unemployment acts as a worker discipline device which enables employers to pay lower wages when unemployment is higher (see Shapiro and Stiglitz, 1984). In this context, the authors obtain exactly the same result as in the fixed-wage setting concerning the unemployment rates. In addition, they also show that black CBD workers have lower wages than black SBD workers in the spatial mismatch equilibrium (see Section 2.3). The wage of all blacks in the unrestricted equilibrium lies between the CBD and SBD wages of blacks in the restricted equilibrium.

Some authors have tried to empirically test the effect of commuting costs in the acceptance or refusal of jobs. Zax and Kain (1996) analyze the impact of a firm's relocation from Detroit's central city to a white suburb on workers' mobility and employment. They show that as white employees are confronted with longer commutes, they move to get closer to the firm's new location. On the contrary, few black employees change their place of residence (maybe because they are discriminated against on the housing market in the white suburbs). The increase in the commuting distances of black workers induces many of them to quit their jobs. Fernandez (1994) obtains similar results studying the relocation of a food-processing firm from the center of Milwaukee to one of its suburbs.

The mechanism can be amplified when distant workers do not have access to a fast and efficient transport mode. In particular, as cars may be too expensive for some workers, they may have to rely on public transit which may not reach all job locations. Commuting can thus be very time consuming. In this respect, Kawabata (2003a) finds that a better job-access by public transit increases the likelihood of working and the number of hours worked for individuals who do not have a car. The effect is bigger in cities such as San Francisco and Los Angeles because of the city structure than in Boston which is more compact. Ihlanfeldt and Young (1996) show that in Atlanta, one third of the differences in black employment share between central city and suburban fast-food restaurants is attributable to the fact that suburban firms are less frequently served by public transit. Holzer, Quigley, and Raphael (2003) find that the expansion of the railway system in San Francisco to a predominantly white, high-growth, and low-unemployment suburb increases the relative employment of minority workers near the station. Raphael and Rice (2002) show that car ownership increases the employment rate and the number of hours worked but, surprisingly, decreases hourly earnings. Ong and Miller (2005) show that the "transportation mismatch" (the lack of access to a private automobile) is the most important factor in generating poor labor-market outcomes, particularly for disadvantaged neighborhoods in the Los-Angeles metropolitan area. Raphael and Stoll (2001) find that raising minority car-ownership rates to the white car ownership rate would considerably narrow inter-racial employment rate differentials.

Job-search is inefficient far away from jobs *(ii)*

The second mechanism revolves around the decrease with distance in the available information on job opportunities. It suggests that a worker who resides far away from job opportunities has less information about jobs than an individual who resides closer to job opportunities. Indeed, several empirical studies support the idea that physical distance to jobs reduces the available information on the existence and characteristics of job vacancies (see Ihlanfeldt and Sjoquist, 1990, Ihlanfeldt, 1997). One possible reason is that job seekers do not know exactly where to search in distant places they are not accustomed to. They may be less efficient because they search in the wrong locations. Another reason could be that many firms resort to local recruiting methods (such as ads in local newspapers or by posting 'wanted' signs) which disadvantage distant workers (see Turner, 1997). In this context, Davies and Huff (1972) find that individuals looking for a job can only search efficiently in a restricted perimeter centered around their residence, even though there are only low-quality and low-salary jobs in the area. Stoll (2005) finds that among the less-educated population of Atlanta and Los Angeles, blacks and Latinos search for a job in areas with higher level of job skill requirements than do whites. Similarly, Holzer and Reaser (2000) show that in Atlanta, Boston, Detroit and Los Angeles, unskilled black workers apply less to suburban jobs than to central city jobs.

The role of spatial frictions in job-search efficiency was first modeled by Wasmer and Zenou (2002) who formalize the link between distance to jobs and unemployment in a search-matching model (Mortensen and Pissarides,

1999, Pissarides, 2000). In their paper, the authors consider a linear city in which individuals endogenously sort themselves at a greater or shorter distance from a unique employment center, which should be considered as a suburban employment center if one has in mind the configuration of a U.S. city (see Section 2.1). The main idea is that search efficiency is deteriorated with the distance between a searcher's residence and the prospected center of employment. At the aggregate level, the number of matches between the two sides of the market (workers and firms) depends on the average search efficiency of unemployed workers (given their locations) and on labor-market tightness (the number of vacant jobs per unemployed worker) as in traditional job-search models. In this model, individuals change their residential location whenever they experience a change in their employment status, so that occupied and unemployed workers reside in distinct portions of the city.[17] The model's contribution lies in the existence of several forces that attract unemployed and occupied workers with different intensities. The first one is the fact that the employed workers travel to the job center more frequently than the unemployed workers so that residing closer to the job center becomes relatively more attractive for employed workers than for unemployed workers. On the contrary, there exists an attraction force towards the job center that only concerns unemployed workers: *the increase in their job-search efficiency associated with proximity to jobs*. The confrontation of these two opposite forces leads to two possible urban configurations in equilibrium. A first equilibrium, the 'Integrated-City Equilibrium', has unemployed workers residing close to the employment center whereas employed workers reside further away. In a second equilibrium, the 'Spatial-Mismatch Equilibrium', the opposite is true: employed workers reside close to the employment center whereas unemployed workers reside at a distance from job opportunities. Which equilibrium prevails depends on a trade-off between the difference in commuting costs per unit of distance for employed and unemployed workers and the expected return of being more efficient in search when unemployed workers reside marginally closer to the employment center. The Spatial-Mismatch Equilibrium prevails when the expected return associated with search efficiency is lower than the difference in commuting costs between employed and unemployed workers. In this case, employed workers are willing to pay higher land rents than unemployed workers to live closer to the suburban employment center and bid away unemployed workers at a distance from jobs (i.e. close to the historic center). In this spatial mismatch configuration, unemployed workers have little chances to find a job. This model generates a city structure where the unemployed workers live far away from jobs. The overall unemployment rate is higher and the search efficiency is lower when unemployed workers reside at a distance from jobs than in the other equilibrium in which they reside close to jobs.

The empirical evidence is consistent with the model's findings. Rogers (1997) and Immergluk (1998) argue that, for informational reasons, the workers who reside close to jobs remain unemployed for a shorter period of time. In U.S. cities, blacks are far away from job opportunities (see Section 2.2) and the mechanism should apply to them. Stoll and Raphael (2000) show that whites have a better job-search quality than blacks because they search in areas where employment growth is higher and that the difference in spatial job search quality between whites and blacks explains nearly 40% of the difference in their employment rates. Holzer and Reaser (2000) show that less educated black males (who search less in the suburbs) are less likely to be hired in the suburbs. They attribute this result to low information flows (but also to higher costs of applying). More accurate studies would be needed to explicitly determine how distance affects unemployment through its negative effect on job-search efficiency. One could think of a two-equation model. In a first equation , the number of job offers would be explained by distance to job opportunities. In a second equation, the individual probability of unemployment would be explained by the number of job offers reaching the

individual and by an index of distance to job opportunities. The reason for introducing the latter index is to control for all other mechanisms affecting unemployment and involving distance. It is then possible to rewrite the second equation in reduced form using the first equation. Estimating both the reduced form and the first equation makes it possible to evaluate the effect of distance on unemployment through job search.[18] Of course, this would require very specific individual and spatial data.

Distant workers do not search intensively for a job *(iii)*

Another mechanism which can explain unemployment patterns in U.S. cities relies on the incentives to search for a job. Smith and Zenou (2003) propose a model that focuses on the job-search intensity of workers. The authors consider a search-matching framework with housing in an urban context similar to that of Wasmer and Zenou (2002, 2005) except that *land consumption is now endogenous*. In their model, when an unemployed worker increases his search intensity, he incurs a loss in utility in the short run because of higher transportation costs (more frequent search trips) and a lower housing consumption (because of a lower net disposable income, housing being a normal good). However, he gains in the long run because searching more intensively increases his chances of obtaining a job and thus his lifetime surplus (because he can expect a higher expected income). In this context, each unemployed worker determines his optimal search intensity by equating the short-run losses with the long-run gains. When it comes to choosing their residential location, unemployed workers face the following trade-off: because of high rents, locations near the employment center are costly in the short run but allow higher search intensities, which in turn increases the long-run prospects of reemployment. Conversely, locations far away from the employment center are more desirable in the short run (because of low rents) but allow only infrequent trips to the employment center and hence reduce the long-run prospects of reemployment. Under some assumptions, the authors show that three different equilibria can prevail. The 'Integrated-City Equilibrium' and the 'Spatial-Mismatch Equilibrium' (as in Wasmer and Zenou, 2002) and a 'Core-Periphery Equilibrium', where short-run unemployed workers reside close to jobs while those who are long-run unemployed live far away from jobs, the employed living in between them. In the last two equilibria, there is a group of unemployed workers who reside far away from jobs, live in cheap dwellings and are thus not induced to search very hard for jobs. They will remain unemployed for a long time. This model formalizes a mechanism supporting the spatial mismatch hypothesis: if black workers live far away from jobs where housing is cheap, then they will be induced to search less intensively than if they lived closer to jobs in more expensive dwellings.

Using English sub-regional data, Patacchini and Zenou (2006) empirically confirm that living in areas where rents are higher induces workers to search more for a job: a one-standard deviation increase in housing prices raises search intensity by about one third of a standard deviation. However, a complete test of the model should relate distance to jobs to land rents, search intensities and employment outcomes.

Search costs deter workers from searching far away *(iv)*

When search costs are high, workers may be deterred from searching far away from their residential location and may restrict their search horizon to their neighborhood or its close vicinity, even if the neighborhood only offers a few low-

quality jobs. Some empirical evidence already mentioned in *(ii)* are also consistent with the assumptions in *(iv)* (Stoll, 2005, Holzer and Reaser, 2000).[19] Other studies however are more specific to *(iv)*. For instance, Stoll (1999) shows that increasing blacks' access to cars or decreasing their average distance to search areas (thus decreasing their search costs) should lead to a greater geographic job search. Holzer, Ihlanfeldt and Sjoquist (1994) found that blacks cover less distance than whites while searching.

High search costs may deter inner-city minorities to search in the suburbs where jobs are located, explaining their bad labor-market outcomes. The mechanism was first modeled by Ortega (2000) in a two-area search-matching framework. Contrary to Wasmer and Zenou (2002), the author assumes that jobs are located in two different areas (that we will interpret as a city center and its suburbs). Workers choose in which area to search. At each point in time, some jobs are destroyed, but the destruction rate is exogenous and higher in the central city than in the suburbs. The main assumption in this model is that *the search costs differ depending on whether workers search in their area of residence or in the other area*.[20] Indeed, searching in the other area involves additional travel: search costs are assumed to be zero in the home area and strictly positive in the host area. Under this assumption, central-city residents (respectively suburban residents) have higher costs to search in the suburbs (respectively in the city center) than to search in the city center (respectively in the suburbs). The efficiency of job search is endogenously determined in each area and depends on the local labor-market tightness. Individuals choose where to search for a job by trading off the efficiency and the cost of job search. When the probability of finding a job is higher in the suburbs than in the central city, central-city residents face a trade-off between the benefit of a more efficient job search in the suburbs and its higher cost. The main result of the model is that, when the search cost is too high, central-city residents have no incentive to search for a job in the suburbs, and the unemployment rate in the city-center is higher than in the suburbs. Suburban wages bargained by central-city residents are lower than those bargained by suburban residents for suburban jobs. This asymmetry results from the high search cost that lowers the bargaining power of individuals at a distance from their place of residence.

We do not know of any paper providing a relevant empirical test of how distance to job opportunities can explain labor-market outcomes through search costs. As in *(ii)*, one may want to rely on a two-equation specification. In a first equation, search costs would be explained by distance to job opportunities. In a second equation, the individual probability of unemployment would be explained by the search-cost variable and an index of distance to job opportunities. This strategy would make it possible to isolate what part of the effect of distance on unemployment can be attributed to search costs. However, it is hard to think of a relevant variable for search costs as an adequate proxy should be unrelated to commuting costs to avoid identification problems. In particular, a car-ownership dummy cannot be used as the transport mode also has an effect on commuting costs.

3.2.2 Spatial Mismatch: the firms' perspective

Distance may yield bad labor-market outcomes because employers are reluctant to hire workers that live far away from their workplace or in other neighborhoods. The next three mechanisms provide justifications to this behavior.

Territorial discrimination *(v)*

A segregated spatial-structure in which ethnic minorities are spatially disconnected from jobs can give rise to employer discrimination on the basis of the applicant's residential location (*redlining*). As far as the labor market in U.S. cities is concerned, suburban employers may discriminate against inner-city residents, for instance because they view them as more likely to be criminal, dishonest or having bad work habits.

Zenou and Boccard (2000) provide a model in which redlining can amplify unemployment problems. The authors consider a linear city in which all jobs are grouped in a single employment center. There are two continua of black and white workers that can be employed or unemployed. Both groups commute to the employment center, endogenously decide where to locate in the city and the quantity of land they want to consume, land being a normal good. The two groups differ since blacks bear a higher commuting cost per unit of distance than whites and since they are discriminated against by employers (so that it is more difficult for them to get a job). Irrespective of their residential location, blacks are thus more unemployed than whites. Two different urban equilibria can occur depending on a trade-off between transportation costs and land consumption: when the transport cost of blacks is high enough, they bid away all whites from the vicinity of the employment center which thus gathers all unemployed and employed blacks (Equilibrium 1). When the transport cost of blacks is sufficiently low, then black and white unemployed workers alike locate close to the employment center whereas black and white employed workers locate at the other end of the city where they can consume more land since they are richer (Equilibrium 2). In other words, when the transportation cost of black workers is sufficiently large, a city is segregated by race. When the transportation cost of black workers is sufficiently small, a city is segregated by employment status. In this framework, the authors introduce redlining which they model as an additional labor-market discrimination on all the workers residing close to the employment center. In the first equilibrium, blacks are discriminated against both racially and spatially (because of redlining) and thus their unemployment rate is very high. In the second equilibrium, redlining increases the unemployment rate of both blacks and whites since all unemployed workers gather around the employment center. An interesting feature of that model is that it shows how redlining can differently affect minorities depending on the city structure and on whom resides below the "red line". In a truly SMH perspective, however, it would have been more relevant to have blacks located far away from jobs and employers redline this zone instead of the employment center.[21]

To our knowledge, the effect of redlining on the labor-market outcomes of black workers has not been investigated empirically. It would be interesting to test whether redlining matters. Indeed, the popular press often relates stories about firms that do not want to hire workers living in "bad" neighborhoods (see Wilson, 1996) and which in addition are in general not well-connected to job centers. An empirical test of the mechanism could rely on the standard methodology used to investigate the existence of redlining on the housing market (see Section 2.2 for references).

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The productivity of distant workers is too low *(vi)*

Employers may consider that distance to jobs deteriorates productivity because of long commuting trips. This can be the case if distant workers are more likely to be late or tired or reluctant to provide high levels of effort than those who reside closer to jobs. This is particularly true for some jobs (e.g. working in a restaurant) which involve long breaks during the day (typically between 2 p.m. and 6 p.m.). The workers who lives nearby can go back home and relax whereas the workers that live further away cannot rest at home, which certainly affects their productivity. Also, because of the lack of good public transportation in U.S. metropolitan areas, downtown workers living far away from jobs may have relatively low productivity at suburban jobs because they arrive late to work due to the unreliability of the mass transit system that causes them to frequently miss transfers. As a consequence, firms may decide of a geographical boundary beyond which they will not recruit workers.

This idea has been modeled by Zenou (2002) in the context of a monocentric city where all firms are located in the city center. Each worker chooses whether to shirk or not. When shirking, the worker provides no effort. When not shirking, he provides an effort that contributes to production but decreases his utility. In accordance with the above remarks, the author assumes that the provided effort decreases with distance to the workplace. The worker's contribution to production depends on its effort (and thus on its proximity to the firm). Unemployed workers commute to the employment center to search for a job, but at a less frequent pace than employed workers. This means that employed workers would lose more in terms of utility than unemployed workers from residing marginally further away from the employment center. Consequently, employed workers always bid away unemployed workers to reside closer to the employment center. As in the Brueckner and Zenou (2003), the wage is determined in an efficiency-wage setting to deter workers from shirking. If a worker is caught shirking, he is automatically fired. As employed workers differ in their locations and thus in their productivities, the per-worker profit decreases with distance to jobs. Firms anticipate that remote workers will provide lower effort levels and do not recruit workers beyond a certain distance where the per-worker profit is zero. This model yields a realistic city structure (unemployed workers residing far away from jobs) as in other spatial mismatch models that adopt the workers' perspectives. It also explains why some areas that are stigmatized are also far away from jobs.

To our knowledge, no empirical test of the mechanism has been carried out yet. Estimating this mechanism would require to have a dataset with information on firms' evaluation of candidates for given vacancies. The different categories should include a statement about the candidate's productivity with respect to his distance from the job location considered. A two-equation specification could be used. First, the productivity statement would be explained by distance. Second, the probability of rejection would be explained by the different evaluation categories and by the distance between the vacancy and the worker's residence. This would separate the productivity effects from other effects involving distance.

Customer discrimination *(vii)*

Finally, another type of spatial discrimination consistent with spatial mismatch involves the preferences of customers. Customer discrimination corresponds to a situation in which an employer discriminates against ethnic minorities to please local customers who do not wish to be in contact with other racial groups. In the context of U.S. cities where segregation and prejudice are high, this means that services firms located in white suburbs are likely to discriminate against black workers, most of them residing in inner-cities. Borjas and Bronars (1989) propose a theoretical model of customer discrimination in which white customers are reluctant to pay for a good when it is sold by a self-employed black. However, we do not know of a spatial model which would relate customer discrimination in the suburbs to the centralization of blacks in the city.

A series of recent empirical studies have shown that customer discrimination could contribute to the poor labor-market outcome of minority workers. In their study of the wage gradient of fast-food restaurants within Atlanta, Ihlanfeldt and Young (1994) find evidence that consumer prejudice affects the wages paid to black workers. More precisely, they find that as distance from the CBD increases, there exists a negative effect on wages from greater customer discrimination (even though this negative effect is strongly dominated by a positive wage gradient effect). Other studies focus on how customer discrimination might affect the hiring of minority workers. For instance, Ihlanfeldt and Young (1996) find that the share of fast-food restaurant jobs held by blacks is smaller in the suburbs of Atlanta than in the central city, and that 29 percent of the difference in black employment share between central city and suburban firms is attributable to the city/suburban differences in the race of managers and customers. In a similar perspective, Holzer and Ihlanfeldt (1998) estimate that the racial composition of an establishment's customers has sizeable effects on the race of who gets hired, particularly in jobs that involve direct contact with customers. More recently, Raphael, Stoll and Holzer (2000) show that both suburban black and white employers hire fewer blacks than their central-city counterparts, but are not able to assess whether this is due to spatial frictions or to the discriminatory preferences of suburban employers relative to their central-city counterparts.

4. Discussion

The spatial mismatch hypothesis originally formulated by Kain (1968), supports the view that because black workers reside in segregated zones that are distant and poorly connected to major centers of growth, they are confronted to barriers in finding and keeping well-paid jobs. The objective of our work was to present the most recent theoretical contributions to the spatial-mismatch literature and to confront them to the existing empirical evidence, as it had not been done before.

We presented the structure of American cities (in which unemployed of poorly-paid central-city black workers are disconnected from suburban job opportunities) and explained how this structure emerged using urban economic theory. We reviewed recent theoretical models related to the spatial mismatch literature to shed light on why residing at a distance from jobs can be harmful for ethnic minorities, and discussed how these models and their findings fit in the

spatial mismatch debate. We identified seven different mechanisms that can lead to adverse labor-market outcomes in a spatial mismatch context. Each mechanism takes the perspective of either workers or firms. Workers who reside far away from job opportunities may be confronted to high commuting costs that may deter them from accepting distant job offers. They may experience poor efficiency and high costs in the job-search process. They may also have little incentives to search for a job if, for instance, they do not have to pay high rents. Concerning suburban firms, they may discriminate against black inner-city residents for redlining motives, or against blacks to satisfy the prejudice of their local customers. They may also be reluctant to hire long-distance commuters because of the negative effect of commuting on productivity. To our knowledge, all these mechanisms have been modeled in a spatial perspective at the exception of customer discrimination.

On the empirical side, there is some clear evidence supporting the effect of commuting costs and customer discrimination on unemployment. There is also suggestive evidence that the increase in search costs and the decrease in search efficiency with distance can cause unemployment. However, it appears that the search incentive, productivity and redlining assumptions have not been empirically investigated. Further empirical studies are required to test these mechanisms and to assess their relative intensities.

Spatial mismatch has inspired policies around three main strategies: (a) attracting adequate jobs to the city center, (b) helping blacks move to suburban locations, or (c) improving informational or physical connections between inner-city black workers and suburban jobs (see Hugues, 1995, or Ihlanfeldt and Sjoquist, 1998). (a) and (b) would directly suppress the causes of spatial mismatch whatever the mechanism at work. The general tests of the SMH which have been conducted recently are supportive enough to justify these types of policies. On the contrary, the focus of (c) is to alleviate the adverse consequences of spatial mismatch. Which policies should be implemented depends on the mechanisms that prevail empirically.

Policies belonging to these three types have been implemented in U.S. cities. Concerning (a), programs have been designed to attract firms to city centers in specific enterprise zones where they receive government subsidies. The results are mixed, even though they lean toward a positive effect of the enterprise zone programs on employment (Papke, 1994, Boarnet and Bogart, 1996, Mauer and Ott, 1999, Bondonio and Engberg, 2000, Bollinger and Ihlanfeldt, 2003).

Concerning (b), social mixing policies have been implemented. The most recent experience is the Moving to Opportunity (MTO) program carried out in Baltimore, Boston, Chicago, Los Angeles and New York since 1994. In this program some families were given housing assistance and mobility counseling enabling them to move to low-poverty neighborhoods. The results mainly showed a clear improvement of the labor market outcomes of participants (Ladd and Ludwig, 1997, Katz, Kling and Liebman, 2001, Rosenbaum and Harris, 2001, Kling, Ludwig and Katz, 2005).

Turning to (c), several policies may be implemented depending on the possible mechanism at work. To our knowledge however, only transport policies have been carried out in U.S. cities (see Pugh, 1998, for an enumeration). A number of states and counties have used welfare block grants and other federal funds to support urban transportation services for welfare recipients. The effects of these programs have not yet been fully evaluated. If the lack of information on distant vacancies is proven to be crucial, then a specific policy should be designed to ameliorate the information inner-city blacks have about jobs (such as the existence of job openings, the locations of vacancies, and the types of jobs offered). This would enhance the search efficiency of inner-city black residents and lower the frictions in

the labor market. If search costs are too high, this justifies transport subsidies to job-seekers. If redlining is prevalent, the residence-blind recruitment methods should be favored (such as forbidding employers to ask questions about the area of residence). If customer discrimination is important, then positive discrimination in favor of inner-city residents is justified.

Footnotes

1. For more details on the legacy of Kain, see Kain (2004) and Glaeser, Hanushek and Quigley (2004).

2. It should be clear that the SMH does not argue that distance to jobs is the *unique* cause of the difficulties faced by inner-city minorities, but only that it has an adverse and significant impact on the wages and the level of unemployment of unskilled minority workers residing in central cities. In no way does it rule out the possibility of alternative explanations (such as labor-market discrimination for instance or the direct labor-market implications of social segregation).

3. An empirical controversy was initiated by Ellwood (1986) for whom race is a much more important factor than job accessibility in explaining the adverse labor market outcomes of minorities. According to that author, '*race, not space, remains the key explanatory variable*'. A discussion of this empirical controversy in the 1980s and 1990s is provided by Kain (1992) and Ihlanfeldt and Sjoquist (1998). In general, recent studies are more supportive of the SMH.

4. According to the 1999 NECMA number (MSA-PMSA Number for Non-New England Metro Areas), the ten largest MSAs are in decreasing order (1) Los Angeles-Long Beach, (2) New York, (3) Chicago, (4) Boston, (5) Philadelphia, (6) Washington, (7) Detroit, (8) Houston, (9) Atlanta, (10) Dallas. In 2000, these 10 MSAs host 85 million inhabitants, which represents 27% of the total U.S. population living in MSAs. All our figures are calculated from the State of the Cities Data System (http://socds.huduser.org).

5. In this section, we provide figures for city centers and suburbs using the Census Bureau's definition. However, the definition of a city center could be problematic as it is based to a large degree on political boundaries. In some metropolitan areas, it could make more sense to redefine the boundaries of city centers using a density criterion as proposed by Cervero et al. (2002).

6. For a fixed distribution of population, suburbanization can also be driven by the discriminating behavior of some firms which flee minority neighborhoods located in city centers. For instance, using data from a representative sample of employers in Boston, Atlanta, Los Angeles and Detroit, Iceland and Harris (1998) show that the higher the proportion of blacks in a neighborhood, the more likely firms are to express relocation intentions.

7. Manual jobs are those held by machine operators and other laborers. Services jobs are protective, private household and other services. Unfortunately, the data does not distinguish skilled and unskilled services jobs.

8. Residential segregation can be measured by the dissimilarity index, also known as the Duncan and Duncan index (1955). By definition, the dissimilarity index is equal to $\frac{1}{2}\sum_{i}\left|\frac{Blacks_i}{Blacks}-\frac{Non-blacks_i}{Non-blacks}\right|$ where i is a district.

It measures the percentage of blacks (or similarly of non-blacks) that should be relocated in order to obtain a homogenous distribution of population in the city. A dissimilarity index of less than 30% is considered to be low. Between 30% and 60%, it is medium. Over 60%, it is considered to be high (Cutler, Glaeser and Vidgor, 1999). The dissimilarity is sensitive to the size and shape of districts.

9. It should be kept in mind however that these features are average trends and that American cities present a wide range of configurations (see Pugh, 1998, or Glaeser and Kahn, 2001, for city categorizations).

10. Of course this increase is not observed for all jobs. As a matter of fact, the wage gradient of high- and low-skilled jobs are thought to be of opposite signs. The high-skilled jobs that pay the most are located within the CBD, whereas the low-skilled jobs that pay the most are located in the suburbs. In theory, the positive wage gradient of low-skilled jobs in US cities could be explained by the decentralization of these jobs combined with the suburban residential exclusion of low-skilled workers. The negative gradient of high-skill jobs could be explained by the specialization of CBDs. When one considers all jobs taken together, wages are 10% to 35% higher in city centers than in the suburbs (Stanback, 1991).

11. In the suburbs, poverty rates are lower for both whites and blacks, but, as in central cities, blacks are also more affected by poverty than whites: only 6.6% of suburban whites but 19.5% of suburban blacks are poor (Mills and Lubuele, 1997).

12. Only studies published after 1998 are reviewed here. For previous references, see the empirical survey by Ihlanfeldt and Sjoquist (1998). For evidence of spatial mismatch in Great Britain, see Fieldhouse (1999), Houston (2005) and Patacchini and Zenou (2005).

13. Measuring "access to job opportunities" is challenging. Obviously, what matters for a given worker is the number of job vacancies per job seeker within the worker's maximum commuting area, possibly weighted with a distance-decay function (Ihlanfeldt, 2005) or taking into account available transport modes (Kawabata, 2003a). In this class of indicators, competition for jobs is accounted for by the local pool of job seekers. The main problem is data availability: job vacancies are seldom available at a local level. Local employment levels or local employment growth are thus often used as proxies. The number of job seekers is also often lacking and proxied by the number of unemployed workers or by the total number of workers in the area. Whether these approximations are too crude remains a source of debate. The relevance of these proxies could be tested with a dataset including information on job vacancies and job seekers.

14. Numerous other studies pretend to test spatial mismatch by comparing the average commuting times or distances of blacks and whites (see DeRango, 2001, for a list). However, as DeRango notes, this approach is inappropriate since 'spatial mismatch is theoretically consistent with both the null and alternative hypothesis'. Indeed, if inner-city blacks only had the choice between holding a suburban job and being unemployed, one would expect to observe long commuting times and distances. However, disconnection from jobs might induce some workers to accept possibly inadequate jobs close to their residence in the central city, which mechanically lowers the average commute of inner-city occupied black workers.

15. See in particular Arnott (1998) and Anas (2003).

16. See also Martin (1997).

17. In a recent contribution, Wasmer and Zenou (2005) have extended this model to the case where workers incur mobility costs when changing residence. Their main conclusion concerning the mechanism of spatial mismatch remains unchanged.

18. Formally, the first equation writes OFFERS = a.DIST + X.b + ε. The second equation writes UNEMP = c.OFFERS + d.DIST + Z.e + η. To address a potential endogeneity problem (OFFERS can be correlated with η through ε), the second equation should be rewritten in reduced form: UNEMP = (a.c+d).DIST + X.(c.b) + Z.e + φ. The reduced form and the first equation then makes it possible to identify the effect of distance on unemployment through job search (a.c) provided that an exclusion restriction is imposed. Namely, a variable in the vector X should be excluded from the vector Z.

19. In these two studies, it is not possible to distinguish whether the findings support the assumptions in *(ii)* or *(iv)*. The distinction would be possible with more precise data on the job search of workers.

20. In the original model the areas are two countries and the cost is one of migration.

21. The model would have blacks locate far away from the employment center under the assumption that they have a lower commuting cost per unit distance than whites. In practice, it can be debatable whether blacks have higher or lower transportation costs than whites. In fact, blacks resort more to public transport than whites, which involves a smaller monetary unit transport cost but a high time cost.

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