A Spatial Mismatch Analysis for Curitiba Metropolitan Region Based on Mobility Conditions

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Abstract: Social Science literature has had significant advances on urban economics problems in the last decades, amongst them, Spatial Mismatch Hypothesis has been a crucial approach for urban issues analyzes related to fast growth in metropolitan cities over the last decades. The city of Curitiba is known as a well-cited example of how to deal with fast urban growth in South America. Despite that, empirical analysis of its mobility conditions still remains scarce. Based on this, the present paper aims to investigate the existence and magnitude of unbalances between jobs and workers´s home distribution over seventeen cities of Curitiba Metropolitan Region. For this purpose, a Dissimilarity index based on public transport conditions was from the Origin-Destin survey data for the referred area. Results show the existence of spatial unbalance between residences and jobs, but with low rates.

Resumo: A literatura das ciências sociais oteve avanços significativos em investigações problemas da economia urbana nas últimas décadas, entre elas, a hipótese de Mismatch Espacial tem sido uma abordagem crucial para a análises de questões urbanas relacionadas ao rápido crescimento nas cidades metropolitanas nas últimas décadas. A cidade de Curitiba é conhecida como um exemplo bem citado de como lidar com o rápido crescimento urbano na América do Sul. Apesar disso, a análise empírica das suas condições de mobilidade ainda permanece escassa. Com base nisso, o presente trabalho tem como objetivo investigar a existência e magnitude dos desequilíbrios entre empregos e distribuição de residências dos trabalhadores em dezessete cidades da Região Metropolitana de Curitiba. Para esse fim, um índice de dissimilaridade baseada nas condições de transporte público foi utilizada a partir de dados da pesquisa Origem-Destino para a referida área. Os resultados mostram a existência de desequilíbrio espacial entre residências e empregos, mas com baixas proporções.

JEL: R14; R38; O18.

Key words: Spatial Mismatch Hypothesis, Urban Mobility, land use.

1 – Introduction

According to the Brazilian Institute of Geography and Statistics (IBGE), in 2010 85.4% of the total population of Brazil resided in urban soils. That number was 36.1% in 1950,

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representing, in absolute values, an urban population growth that jumped from 18.78 in that decade to 166.34 million inhabitants in 60 years.

In that context, the city of Curitiba, as it became a space that came to attract many individuals to housing in the face of the different historical and social contexts that occurred throughout the 20th century, started adopting Toward Oriented Development plans from the 1950s, with an urbanization planning master plan guided by the Agache Plan, which proposed to promote the growth of this city in an orderly manner, so as to efficiently allocate its space and increase its development potential.

Among the challenges inherent to this increase are the efficiency in locomotion of individuals, intracity, through good accessibility indices, creating several opportunities located in the city, as well as an allocation of urban land, through economic forces, which allows the greatest generation of well-being with the available resources, among them, the soil, human capital and production inputs.The Trinário System disciplined the urban growth of Curitiba from 1970 onwards by a linear model, guiding zoning, defining the commercial, industrial and residential areas, in addition to the implementation of the BRT (Bus Rapid Transit) transport system in 1974, representing a strategy for provide efficient commuting to its residents. Its main proposal was to integrate land use, public transport and the road system with socioeconomic and environmental development.

These challenges, inherent in the growth of cities, can be investigated from the perspective of the spatial mismatch of employment due to a combination of distance and inefficiency in the means of switching certain agents to the regions that concentrate jobs, a phenomenon introduced by Kain (1968), being known as Spatial Mismatch Hipothesis

One aspect draws attention to these types of investigations in Curitiba. This city has stood out for its guidance policies on the occupation of land use, being a reference in organization for all other Metropolises in Brazil and even in other emerging countries. However, because it is a Metropolis, which according to Souza (2001), Moraes and Souza (1999) and Lima and Santos (2017) deals with social inequalities, it has the potential to raise the Space Mismatch hypothesis. Given these circumstances, this text presents an investigation on the imbalance between the distribution of homes and jobs in seventeen municipalities in the Metropolitan Region of Curitiba

(CMR), making use of the innovative Dissimilarity Index developed by Fan et al. (2014), which captures the mobility conditions.

The results of this study indicate that although there is evidence of Spatial Mismatch between jobs and homes for this region, the unbalances that support this interpretation present low rates, which may indicate some success in implementing the urban expansion policies carried out.

This text is divided into six sessions, which, in addition to this introduction, comprise a brief review of the literature on the Space Mismatch Hypothesis; a contextualization of the land occupation pattern of Curitiba throughout the 20th century; the data and a spatial analysis on them; the quantification of the spatial mismatch for this region and another with the conclusions about the results.

2 – Urban Economics and the Spatial Mismatch Hypothesis (SMH)

The Monocentric urban model proposed by Alonso (1964), Muth (1969), and Mills (1967), known as AMM, predicts a spatial equilibrium since some assumptions are respected. Among them, all of the commuting on this city are made to the central business district (CBD) for job purposes, commuting patterns and wages are equal for all of the individuals, all the houses shelter only one citizen and there are no crossing commutes. According to Brueckner (2011), if these four assumptions do not hold, the citizens may not be satisfied with their house consumptions and full employment will not be achieved in this city. Therefore, the proposed spatial equilibrium of this monocentric model will not exist as well.

Due to high negro residential segregation indexes in Detroit and Chicago, the Spatial Mismatch phenomena was first observed by kain (1968) in these two metropolitan areas of the United States through 1950 and 1960 decades. In his investigation, this author detected the economic implications of the worst access to employment of minorities on job outcomes.

An origin for this phenomenon comes from implications of the city's growth, since intracity travels cost decreased after the establishment of many cities, it's citizens tended to spread out to suburbs from the mid-twentieth century onward, so they became able to consume more residential space. In that context, Fujita and Thisse (2013) defend that firms might be incentivized to open new sub quarters on suburbs, being attracted by gravitational forces of new employment subcenters (SBDs), keeping its head offices on the CBD. Among some factors, the response for the population

shift to new areas depends on their desire to live near the employment centers, given the amenities or adversities near then, as well as the city's mobility infrastructure. Another decisive aspect of the response shift of the population cited by Martin (2004) is the response of the housing market through land prices and discrimination of minorities, being able to generate low choice power responses for some citizens groups.Taken together, all of these aspects have a great potential to create spatial segregation, which might hinder difficult the job access of some citizens, being a mechanism for the Spatial Mismatch, as will be explained below.

Among the main mechanisms[3] of the Spatial Mismatch, the scarcity of information about job opportunities might be positively correlated with distance from the job offered, embodying friction on the efficiency of job seeking, and diminishing the probability of a job matching for the ones who live farther from employment centers, as Gobillon, Selod and Zenou (2003) defend. These authors bring some evidences of many studies which conclude that segregated inner-city citizens tend to present lower incomes and higher unemployment rates, including for a longer time.

An illustration for this mechanism is brought by Haddad and Brufi (2017), where they justify a Spatial Mismatch Hypothesis for the São Paulo Metropolitan Region by observing that many of its low skilled residents live far from the biggest employment centers, as well as from their most used transport mode, which is by the public system, so they might face more difficulties to find vacant job than citizens which are in the opposite situation, because bus stops or subway stations are not necessarily close to these vacancies.

Another Mechanism of Spatial Mismatch refers to the high cost of commuting trips. According to Brueckner (2011), as the assumption of a unique wage for all individuals on a monocentric city model is relaxed, given the opportunity time spent to job travels, the commuting costs will differ among citizens with different wages. The author also brings a commuting issue when a city presents more than a unique employment center, the wasted commuting, caused by the so-called reverse commuting, meaning that residents who work on a CBD live near a SBD,

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[3] Gobillon, Selod, and Zenou (2003) indicate seven of the most present mechanism on Spatial Mismatch Hypothesis empirical literature developed throughout three decades, since John Kain's first investigation. They consist of: i) decreasing in the efficiency of job searching as the distance to job increases; II) low incentives for intense searching for individuals who live far away from jobs; III) workers tend to refuse jobs which involve too long commutes; IV) inadequate transport mode; V) employers may discriminate against residentially segregated workers; VI) employers may refuse to hire or pay lower wages to distant workers because commuting long distances make them less productive; VII) employers may not think that their white local costumers are unwilling to have contacts with minority workers. Three of them are discussed on this section.

and so on (Gobillon, Selod, and Zenou, 2003). On this framework, the empirical analysis of Zax and Kain (1996) concluded that when the firms moved to a different zone which lengthened its employees' trips, the ones who were able to move closer to the firms would do so, bringing some evidence that individuals with greater purchasing power might face shorter commutes to work.

Low productivity related to the distance of commuting to job is a third mechanism which potentially causes Spatial Mismatch. The net wage of the AMM model is formulated by

$$c + pq = y - t\mathbf{x} \qquad (1)$$

where c represents all of the daily goods consumed, p is the price of the consumed house area, q is the quantity of house area, y is the wage paid by the firm, t is the price of a unit of commuting and x is the distance of commuting. However, Zenou (2002) introduces a model which consider disposition to work, "e", where $e'(x) < 0$. From this, the effort at work from individuals who live far from job is less than for the ones who live closer, because the first ones tend to arrive more tired at work than the second ones.

According to the author, the implications of this on the firms is a distance bound to hire employees, based on a linear distance "x_b" which is able to cover the workers, who after commuting to job, will be disposed to offer the quantity of effort that will maximize its profits, resulting in a spatial mismatch. Gobillon, Selod and Zenou (2003) argue that this mechanism might outbid unemployed or segregated individuals from that firm's bound, worsening their work outcomes.

The commuting conditions are an important aspect to capture the geographic involvement on economic gains and opportunities through jobs on economic agents. The Spatial Mismatch literature commonly finds evidences of worse job outcomes for the ones who are spatially segregated, either by living far from opportunities or by having bad information about them.

3 – A Spatial Mismatch Hypothesis for the Curitiba Metropolitan Region

3.1 – The Curitiba Land Occupation

Curitiba is widely known as a pioneer city regarding planned urban growth. According to Oliveira (2016), since 1895 this city has adopted the Código de Posturas, which covered the initial set of regulatory laws on commerce and industry sectors. Thereafter, the modifications on this set of regulatory laws concerned about the development of the central region, requiring, for example, at least two pavements on buildings located in central areas, also these regions became prioritized on infrastructure investments throughout the three first decades the of 20th century.

After intense population growth and at the influence of the Estado Novo regime (1937-1946), the local administration contemplated the idea of planned government investments to foment city developments. Thus, this idea of urban development was brought to Curitiba by hiring the urbanist Alfred Agache, releasing in 1943 the Plano Agache for this city, influenced by the Modernist architecture (IPPUC, 2015). Initially implemented along the 1950 decade, Carmo (2018) claims that this consisted of a plan based on a radial growth for this city, connecting the central region to neighborhoods through wide avenues.

Another important aspect of this planning development concerns the establishment of new administrative, educational, industrial, and cultural centers in some neighborhoods along the city, influenced by the zoning urban system (Curitiba, 2015). However, Carvalho (2013) argue that this was based on gentrification polices, by strategically pushing poor individuals away from central areas, which were the most benefited by the huge development investments made.   Souza (2001) states that within the intense migratory flow to Curitiba in the (1940-1970) period, most of the poorest migrants were pushed up to river banks. This was because these residential lands proved to be less attractive, due to risk of flooding during raining times (Lima, 2000).

At the time of the 1960's decade, urban development based on technical analysis became the desired standard for the elaboration of master plans to guide Curitiba's expansion. In this context, a new city planning master plan was elaborated in 1966, inspired by the Plano Preliminar de Urbanismo [4](PPU). This new growth orientation was now based on linear expansion, ruled by a tripod set of elements (the so-called Eixos Trinários), which targeted to interact Curitiba's land use with mass public transport expansion and an effective road system, such as Crocetti (2014) confirms. The essencial effect of this set of rules was a new hierarchy of land occupation and road system in this town, significantly affecting the pattern of residential and commercial density over

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[4] Which can literally be translated to Preliminary Town Planning Plan. According to Souza (2001), its elaboration was started after public assembleys promoved by

new areas of this City. Crocetti (2014), Souza (2001) and Campos (2005) claim that this pattern of expansion was mostly toward the southwestern region of Curitiba.

A related consequence of this oriented growth was the genesis of the Brazilian Rapid Transport System (BRT) by the year of 1974. This public transport system proposed to vastly improve the mobility conditions of this Town, by implementing exclusive bus lanes for speed commuting improvement and bus access platforms, contributing to an efficient flow for both individual and collective transport modes (Oliveira, 2000), which according to Cervero and Dai (2014), is a world widely reference transport system.

However, The thorough analysis of Souza (2001) about PPU shows that previous studies that fed the posterior city planning master plan have many mistakened conclusions about the most promising socioeconomic regions of this city based on population density, which became, given the scarcity of public resources, a crucial guide to urban rigging and infrastructure investment.

3.2 – Evidences of Spatial Segregation in Curitiba

Despite being a reference as a model of urban development, at least in Brazil, there are some evidences that the benefits of such policies were not distributed to the whole town. This has been attributed to a non capacity of its planning policies to be adapted to the fast population growth of this region during the 20th century, given that according to IBGE, in 1943, when the Plano Agache was formulated, it had 140 thousand of inhabitants, reaching 600 thousand in 1960 and over 1 million in 1980.

Oliveira (2016) indicates that since 1906[5] this town has sanctioned excluding regulations, as well as the banning on wooden constructions in downtown region, given this was a more accessible material at that time. Moraes and Souza (1999) and Crocetti (2014) argue that this was a strategical marketing building politics of valuation for some city regions, at the expense of excluding other ones from the development circuit. Regarding the growth of the regional economic importance of Curitiba due to its development over the 20th century, Lima and Santos (2017) dissertates about another inequality forwarder problem, based on the response of this town on integration with its neighbor cities (which compose the other Metropolitan Region cities), by

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[5] Based on municipal law number 177, from April 30th.

prioritizing investments in BRT infrastructure on the road axis, excluding remote regions of these fast commuting benefits.

From these statements, we found some evidence that there was a strong development in central areas of Curitiba with regards to the provision of employment and mobility infrastructure, while this city faced urban sprawl. Given this evidence, there is a potential for great inequality in access to jobs between your residents, which pressures a Spatial Mismatch phenomenon.

4 – Employment, Residential Distribution and evidences of a Spatial Mismatch for CMR

4.1 – Data

Spatial Mismatch Analysis often require information about residential and job spatial distribution. Related to this, IPPUC has released an Origin Destiny survey, which covered 17 counties of this Curitiba Metropolitan Region at the year of 2017, which was used as the data source of the present investigation. When expanded, the sample space of this survey refers to about 3,2 million inhabitants on 6,2 million trips all over the 17 towns, divided in 954 interest zones based on IBGE 2010 census tracts.

Origin Destiny searches are suitable for a spatial mismatch analysis because it has as main characteristic detailed information about trips over a determined space and time[6], categorized into modes and motivation, as well as social and economic aspects of the participants, aiming to support mobility detailed analyses on the quality of urban mobility among citizens.

Table 1 – Quartiles Division of the Sample.

| Group	Monthly earnings in R$ reais
First Quartile – Group 1	130 – 1.100
Second Quartile - Group 2	1.101-1.500
Third Quartile – Group 3	1,501-2.500
Forth Quartile – Group 4	2.500-40.000

Source: Ippuc (2017), own elaboration.

With this data base, the present paper divided RMC employees into 4 different groups, as it can be shown at Table 1, based on quartile division of their monthly wages, representing over 449 thousand of individuals who commuted to or from job exclusively by public transport.

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[6] Often on a cross-section specification, which is a 24 hour period in the case of the referred research.

4.2 – Analysing Spatial Distribution of Residents and Jobs

Data show unbalance between job and residential distribution, as well as pattern of spatial segregation among workers who used public transport for commuting. Figures 2, 3, 4 and 5 illustrate the effects of the mentioned zoning rules elaborated by urban planning master plans of Curitiba in the 20th century.

Figure 2 – Residences and jobs percentage distributions over CMR area for group 1.
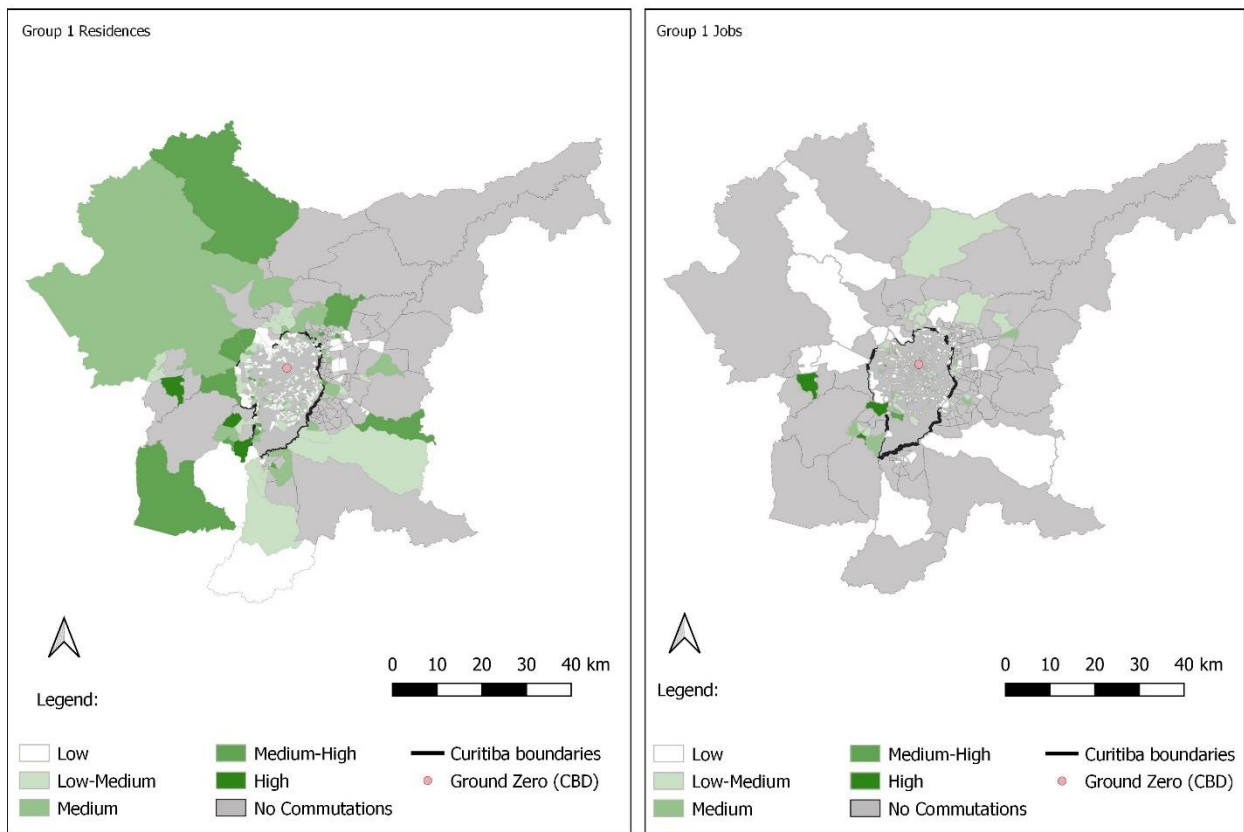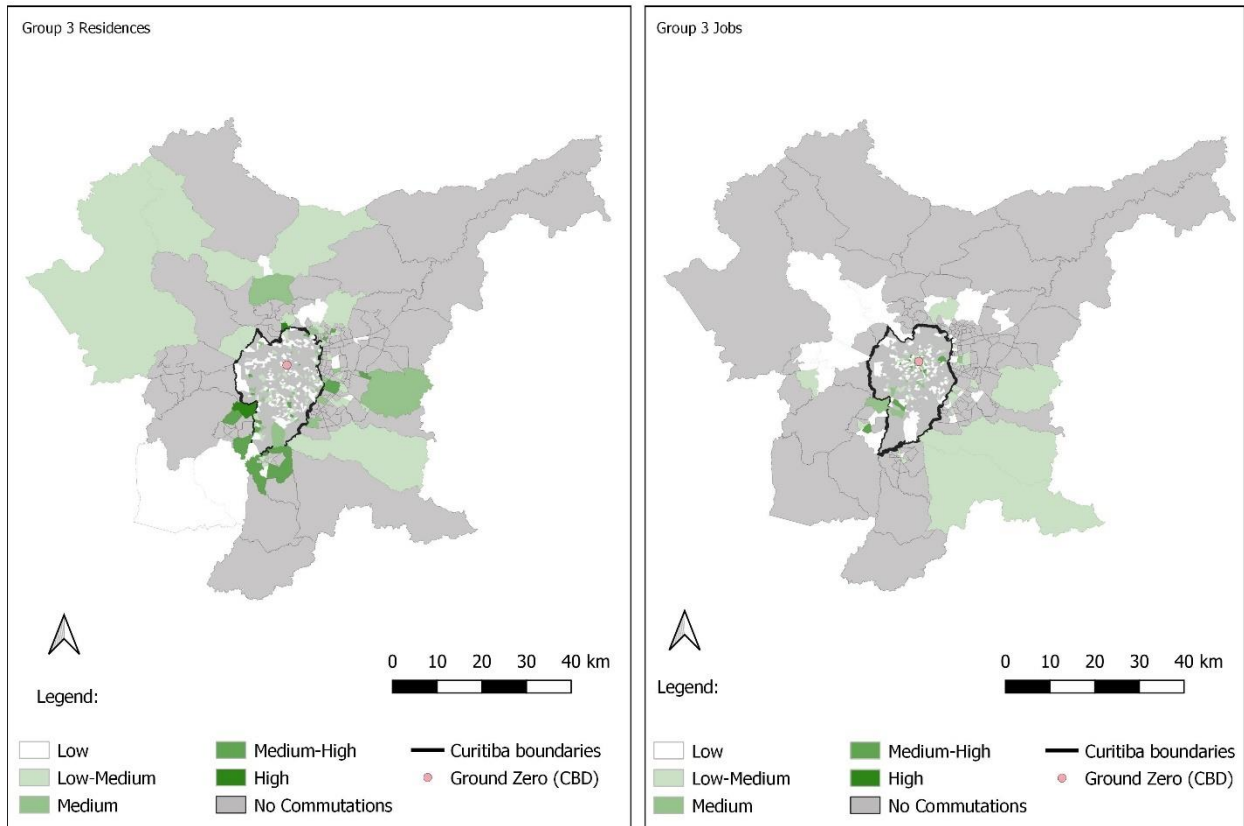

Source: IPPUC (2017), own elaboration.

Figure 3 – Residences and Jobs percentage distributions over CMR area for group 2.
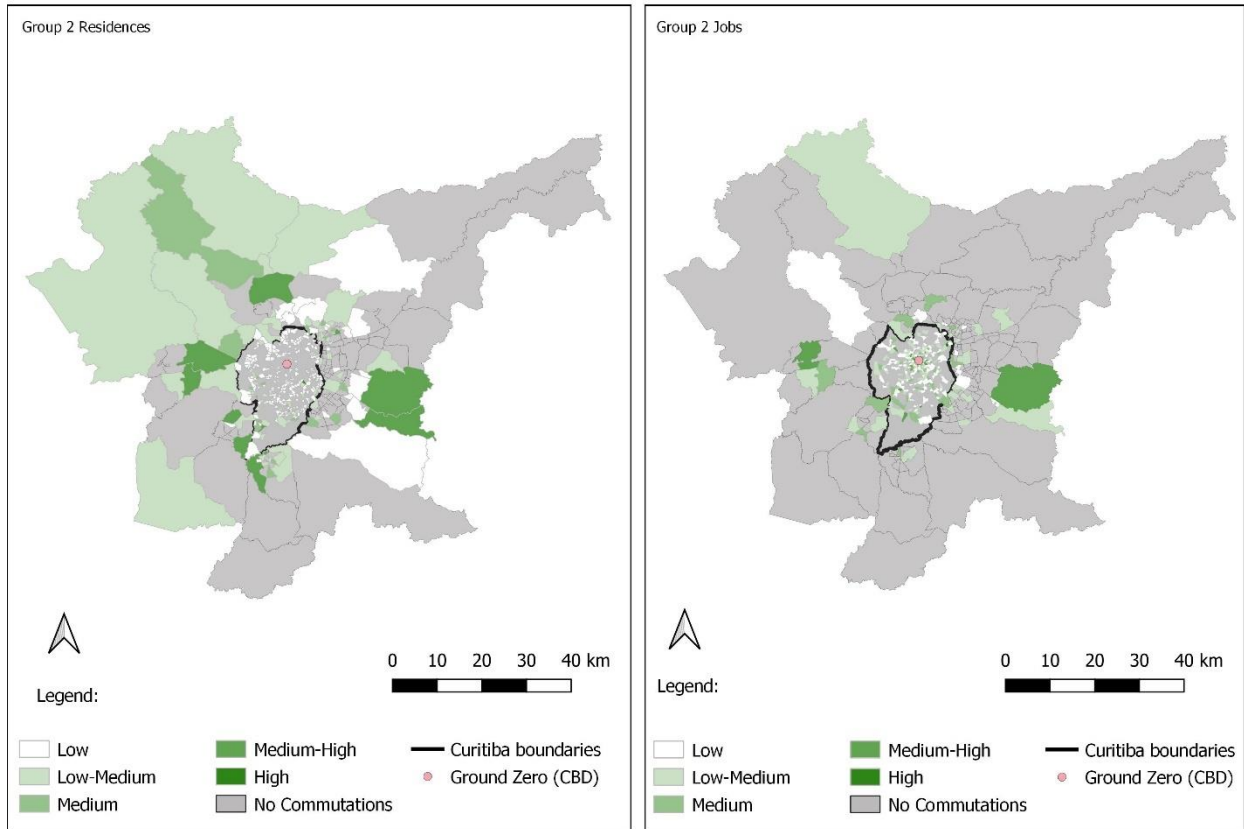
Related to residential spatial distributional patterns, Figures 2 and 3 show that workers who monthly earned up to R$ 1.500,00 reais (groups 1 and 2) tended to live in metropolitan cities, having little presence near Eixos Trinários (Structural axis) and CBD areas. The most distant metropolitan areas shelter less group 3 workers (who monthly earn between R$ 1.500 and R$ 2.500 reais) than groups 1 and 2 workers. They tend to be more present at some of the Eixos Trinários areas, living at its borders at most, as well as the nearest Curitiba's neighbor cities.

Figure 4 – Residences and Jobs percentage distributions over CMR area for group 3.

Source: IPPUC (2017), own elaboration.

Group 4, which composes the highest wage workers, show the lowest participation in metropolitan cities residences. Those who don't live in Curitiba are located in the border at most, with exception to the city of Campo Largo, the only one not neighbor that shows high densities. This group also shows the highest density in Eixos Trinários and Central areas among all of the groups, although very similar to group 3. These higher densities of groups 3 and 4 near Structural Axis show preference of living near to better public transport infrastructure. Using Hedonic prices analysis, Branco and Porsse (2016) evidence a trend of appreciation in the prices as apartments get closer to these structural axes. Regarding investigations on mobility conditions, this can be explained by the founds of Pereira et al. (2020) and Boisjoly et al. (2020) for Curitiba in 2018 and 2019, respectively, which consist of the highest accessibility to job for the residences near the structural axis.

Figure 5 – Residences and Jobs percentage distributions over CMR area for group 4.
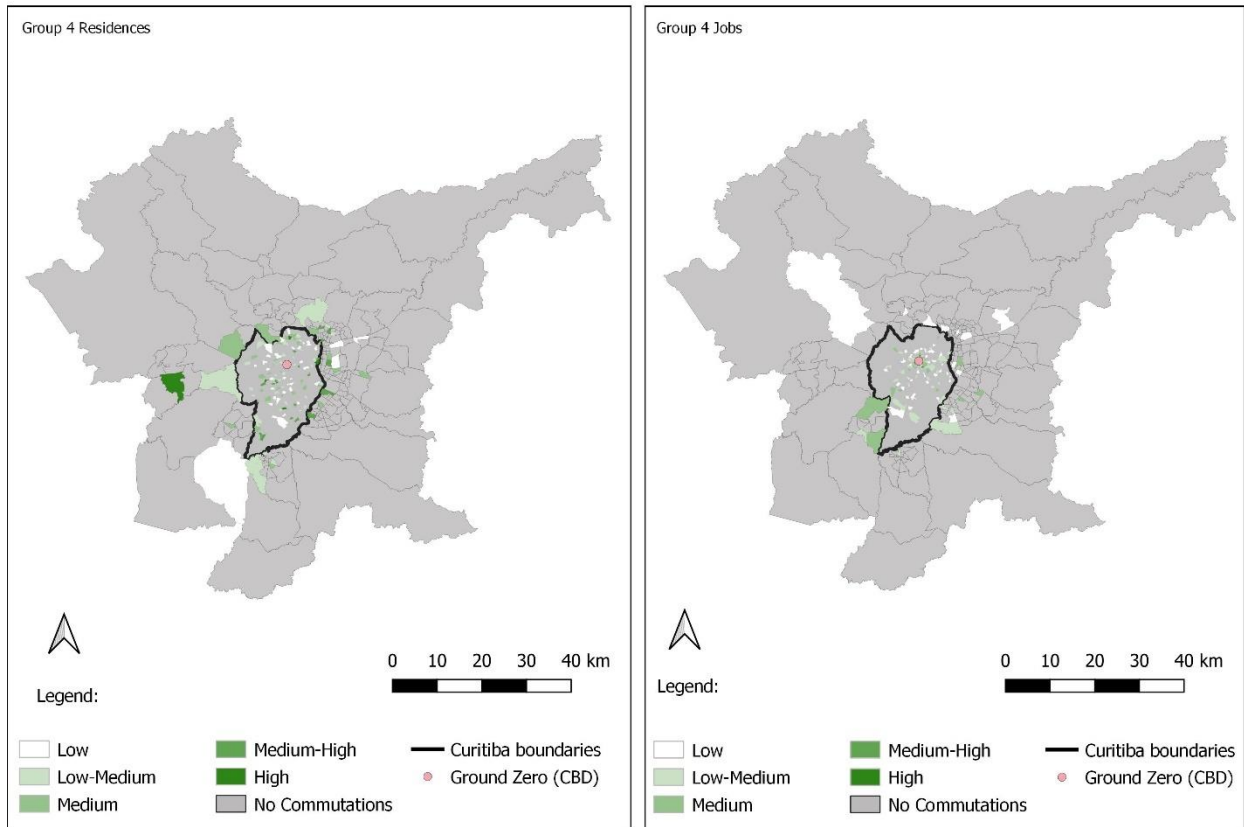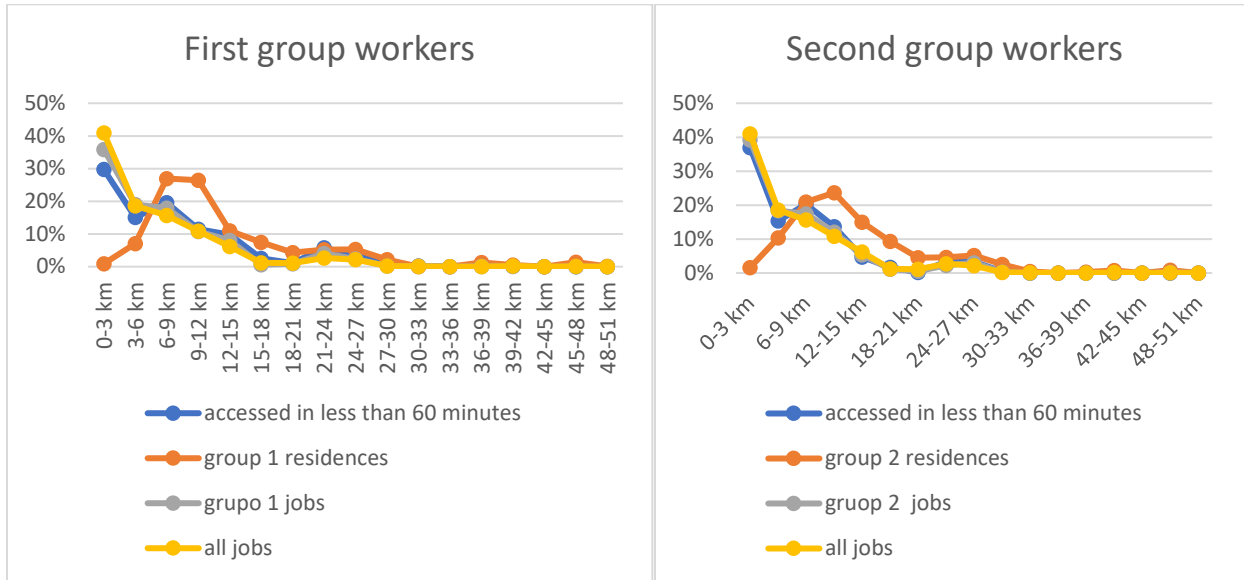

Source: IPPUC (2017), own elaboration.

Within the Urban Sprawl phenomena, two results are predominant: The higher wage residents go from CBD to suburbs or they remain at central area and the lower wage residents spread out in periphery areas. As the above results shown, the second case seen to be applied to this sample in Curitiba Metropolitan Region. It is important to emphasize that the above maps are based on the available sample for the requirements of this analysis, which means that although not all of the zones don't show residents or jobs on the density maps, it doesn't necessarily mean no one resides or work on them.

The subsequent analysis shown at Figures 6 and 7 gives support to a spatial mismatch between residences and jobs for each group of workers. The graphics bellow quantifies the percentual of jobs, residences and accessed jobs in less than 60 minutes at euclidean distances for any direction from the Central Business District[7] of Curitiba shown in the horizontal axis.
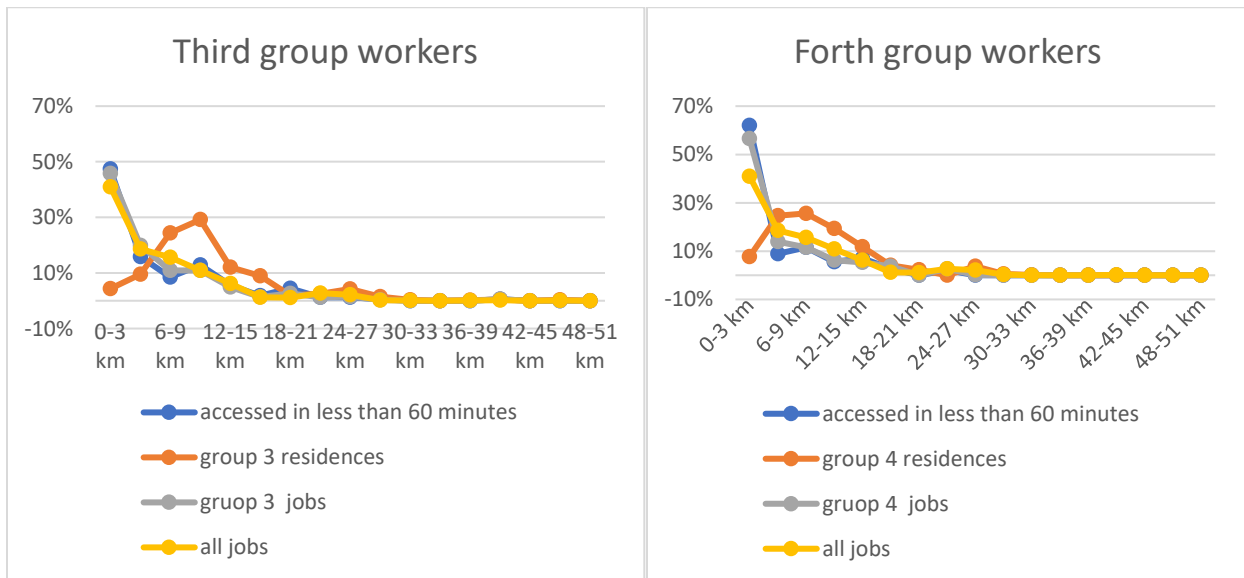
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[7] The specific centroid in the Ground Zero of Curitiba, located at Tiradentes Square is considered at this analysis.

Figure 6 – Graphics with job and home percentages spatial densities for groups 1 and 2.

Source: IPPUC (2017), own elaboration.

Figure 7 – Graphics with job and home percentages spatial densities for groups 1 and 2.

Source: IPPUC (2017), own elaboration.

A necessary but not sufficient condition for perfect matching between jobs and residences would be that the lines representing the jobs and residences distribution of each specific group coincide all along the space considered. However, it is important to notice that as Fan et al. (2014) states, even at this situation, a group located on the 9-12 km distance from CBD, for exemple, can reside on the north direction from it, while the interval 9-12 km job distribution can be at south direction of this central point.

Figure 4 graphics illustrates no matching of the quantity of jobs and residences on a radial distance shorter than 6 kilometers from Ground Zero. It means that most of the job opportunities are located at this region of Curitiba, about 60%, as yellow line (all jobs) shows. Moving to the 9 kilometers CBD radial distance, there is a decline on job opportunities, which is the opposite trend of household distributions, mostly to group 2, which has its peak inside the 12-15 kilometers radius.

As Figures (2-5) illustrate, Figures (5-6) reinforce that most of the central region residences are occupied by the workers with higher wages, as it shows a higher concentration of households in the 0-12 kilometer ray from CBD for groups 3 (67%) and 4 (72%), while the lowest wage groups have no more than 60% of the workers living at this area. These groups tend to be more spreaded out to farther houses, at regions with less job opportunities.

5 – Quantifying Spatial Mismatch For Curitiba

5.1 – The *DTransit* Dissimilarity Index

For the purpose of quantitatively measuring the reported spatial mismatch between jobs and residences for Curitiba, this study applied the Dissimilarity Index developed by Fan et al. (2014), (*DTransit*). This index can be represented as:

$$DTransit = \frac{1}{2} * \sum_{i=1}^{n} \left| \frac{Wi}{\sum_{i=1}^{n} Wi} - \frac{Cai}{\sum_{i=1}^{n} Cai} \right| \tag{2}$$

$$Cai = \sum_{i=1}^{n} eif(Tij) \tag{3}$$

$$f(Tij) = \begin{cases} 1; if\ Tij \leq 60\ minutes \\ 0; if\ Tij > 60\ minutes \end{cases} \tag{4}$$

Where *Wi* is the total workers at zone i, divided by the total of workers of all the selected sample. *Ca* is the measure of workers that arrived at their jobs in less than one hour by public transport, divided by all the jobs reached in less than one hour by this mode.

The essence of Spatial Mismatch dissimilarity indexes is to quantatively measure the unbalance between job and residences over a specific space. According to Ducan and Daucan (1955) and Horner and Marion (2009), these indexes aim to measure distribution patters between individuals in social analyzes, including spatial segregation. However, preliminary indexes applied to spatial segregation have some limitations in capturing important aspects of work and jobs distribution unbalance.

Based on this, *DTransit* is more reliable dissimilarity index for a Spatial Mismatch analysis, as it incorporates public mobility issues, very present in emerging countries, as well as claims Fan et al. (2014), so that 0 indicates total balance and 1 total unbalance between jobs and residences, having these two as the limit values. Thus, the application of *DTransit* in the present study was based on quartile groups, in which each of them received a dissimilarity index, for comparison purposes. Another further application of this index was made for private vehicle[8] modes users, for comparison purposes.

5.2 – Results

The obtained spatial mismatch measurements based on *DTransit* demonstrate low values for the Curitiba Metropolian Region, ranging between 0,26 and 0,33 for the all the groups. These values evidence better results on balance than the ones obtained for the city of Beijing, which according to Fan et al. (2014), ranges between 0,33 and 0,61 for low wage[9] workers. Despite this, it is important not to neglect differences between the two analyzes, that go from sample aspects to regions sizes.

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[8] This sample is composed by individuals who used cars, motorcycles, taxis, and commuted as passengers of motor vehicles.
[9] The referred study considers wage workers as the individuals who have annual earnings bellow the Chinese average for the year of analysis.

Figure 8 – Results of *DTransit* indexes for CMR.
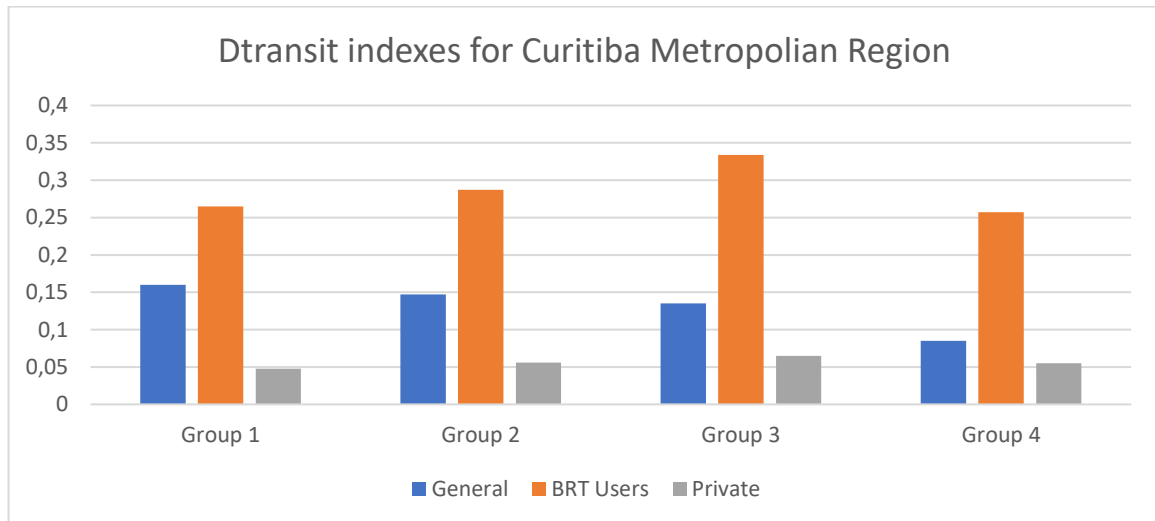
Source: IPPUC (2017), own elaboration.

Figure 8 shows that the lowest dissimilarity indexes among individuals who commuted to work by public transport are obtained by groups 1 and 4. This result can be corroborated by Figures 2 and 5, which show that these two individual groups tend to be near their jobs than groups 2 and 3, consequently reducing their commuting time. A possible implication of the aforementioned result is that individuals of group 1 might have better access to job vacancies in the periphery, with the opposite being true for group 4[10].

The higher dissimilarity indexes obtained for groups 2 and 3 might be related to a bigger area shown at Figure 7 between jobs and residences over the 9-12 km radius for group 3 and a longer spatial unbalance (from 9-12 km to 18-21km) of it for group 2 at Figure 6. Another possibility for the worst results for these two groups can be shown at Figures 3 and 4, as it is

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[10] According to Zenou (2002) statements, these individuals might have a better chance of earning the highest salaries, reinforcing a virtuous circle of wage inequality among groups. However, this specific conclusion is beyond the scope of this present study.

possible to identify higher densities spread (more than groups 1 and 4) over the study area, that together with crossing and wasting commutes might increase the travel distances of these workers.

Another interesting result is related to the very low values of *DTransit* for workers who commute to job by private vehicles, showing there is an almost perfect balance between jobs and residences for them. This may be related to a highway infrastructure that is well spread across the study area, as a result of the Toward Oriented Development adopted to this Region. An important evidence of this comparison between workers using both types of modes is *DTransit's* ability to capture mobility inequalities among citizens, that by comparing these results with General indexes[11], showed higher indexes for BRT users (above average) than private vehicle ones.

6 – Final remarks

The present study aimed to investigate and quantify a Spatial Mismatch Hipothesys for seventeen cities of Curitiba Metropolitan Region, as a consequence of its big urban population growth during the last 50 years. All the spatial analyzes applied to the interest groups show unbalance between residences and jobs over the study area. However, based on the dissimilarity index, which captures mobility conditions the most among them, this Metropolitan area doesn't see to present a high unbalance between the interested variables, being considerably close to perfect balance for individuals who use private vehicles for job commuting trips.

The hypothesis of the found results is that they are related to the effectiveness urban of master plan policies during this region's urban expansion. Not surprisingly, many of these policies are widely known as good references, mostly the ones related to its public transport system, the Brazilian Rapid Transport. although optimistic, the results need to be interpreted carefully, given the limited number of samples.

Even though low unbalances indexes were found for periphery residents, it doesn't necessarily mean great welfare consumption. These founds can be related to mobility quality, but not directly to other urban amenities, such as public security, leisure[12]and health infrastructure. That is, the found results are related to good conditions of time allocation for workers[13] and job

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[11] Composed by BRT and Private Vehicle user.

[12] Which means some of the related aspects about inequality provision of infrastructure since Plano Agache among residents in section 3 still remain uncovered by this study. But the issue about very low interaction with the boundaries cities doesn't see to be sustained by the found results.

[13] That could contribute to better welfare conditions.

accessibility for the analyzed individuals, what suggest that some of its solutions could be applied to other metropolitan areas with worse results.

A contribution of this study is to identify individual groups based on salary, residential areas and work zones that have better accessibility conditions related to job commutations to work by different modes, as well as providing some initial support for further analyzes that seek solutions for the ones with worse results. Some more specific Spatial Mismatch analyzes could investigate causalities between job accessibility conditions and individual salaries or employment rates, aiming to further capture economics outputs related to the spatial setting of that region.

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