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COMMUTING IN THE POPULATION ARRANGEMENT OF MARINGÁ (2000-2010): EXTENSION OF LIVING SPACE AND INTERMUNICIPAL SPATIAL RELATIONS

PENDULARIDADE NO ARRANJO POPULACIONAL DE MARINGÁ (2000-2010): EXTENSÃO DO ESPAÇO DE VIDA E RELAÇÕES ESPACIAIS INTERMUNICIPAIS

DESPLAZAMIENTOS EN EL ARREGLO POBLACIONAL DE MARINGÁ (2000-2010): EXTENSIÓN DEL ESPACIO HABITABLE Y RELACIONES ESPACIALES INTERMUNICIPALES

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ABSTRACT: Contemporary urbanization highlights socio-spatial dynamics at the regional scale, which underscores the need for more comprehensive analytical scales to be used in urban studies. In this context, commuting intensifies spatial relations between two or more municipalities, leading to the formation of urban agglomerations. This study adopted the idea of Population Arrangement for the territorial area of Maringá, since this delimitation considers criteria of integration between municipalities. The aim of this article is to analyze the influences of the agglomeration process on the population arrangement of Maringá, using commuting data from the 2000 and 2010 demographic censuses. The data, processed using IBM SPSS STATISTICS 20 software, were presented using origin-destination matrices, cartographic products, and other resources. The results showed a significant increase in terms of quantity and distance in commuting between municipalities, highlighting the complexity of commuting flows in the population arrangement analyzed.

KEYWORDS: Population geography. Commuting. Population arrangements. Urban agglomeration. Everyday living space.

***RESUMO**: A urbanização contemporânea realça dinâmicas socioespaciais na escala regional, o que evidencia a necessidade de serem utilizadas escalas analíticas mais abrangentes nos estudos urbanos. Nesse contexto, os deslocamentos pendulares acirram as relações espaciais entre dois ou mais municípios, levando à formação de aglomerações urbanas. Este estudo adotou a ideia de Arranjo Populacional para o recorte territorial de Maringá, uma vez que essa delimitação considera critérios de integração entre os municípios. O objetivo deste artigo é analisar as influências do processo de aglomeração no arranjo populacional de Maringá, utilizando dados de deslocamentos pendulares oriundos dos censos demográficos de 2000 e 2010. Os dados, tratados no software IBM SPSS STATISTICS 20, foram apresentados por meio de matrizes origem-destino, produtos cartográficos e outros recursos. Os resultados mostraram um aumento significativo — em quantidade e distância — dos deslocamentos pendulares entre os municípios, evidenciando a complexificação dos fluxos pendulares no arranjo populacional analisado.*

***PALAVRAS-CHAVE**: Geografia da população. Deslocamentos pendulares. Arranjos populacionais. Aglomeração urbana. Espaço de vida cotidiana.*

***RESUMEN**: La urbanización contemporánea pone de relieve la dinámica socioespacial a escala regional, lo que subraya la necesidad de utilizar escalas analíticas más amplias en los estudios urbanos. En este contexto, los desplazamientos intensifican las relaciones espaciales entre dos o más municipios, dando lugar a la formación de aglomeraciones urbanas. Este estudio adoptó la idea de Arreglo Poblacional para el recorte territorial de Maringá, ya que esta delimitación considera criterios de integración entre municipios. El objetivo de este artículo es analizar las influencias del proceso de aglomeración en el arreglo poblacional de Maringá, utilizando datos de desplazamientos de los censos demográficos de 2000 y 2010. Los datos, procesados con el software IBM SPSS STATISTICS 20, fueron presentados utilizando matrices origen-destino, productos cartográficos y otros recursos. Los resultados mostraron un aumento significativo — tanto en cantidad como en distancia — de los desplazamientos entre municipios, poniendo de manifiesto la complejización de los flujos de desplazamiento en la ordenación poblacional analizada.*

***PALABRAS CLAVE**: Geografía de la población. Desplazamientos. Arreglos de población. Aglomeración urbana. Espacio de vida cotidiana.*

Introduction

The crisis of North Atlantic Fordism in the second half of the twentieth century established the regime of flexible accumulation as the new phase of capitalism (Scott, 1988; 1998; Santos, 2008; Sposito & Sposito, 2012). The gradual transition toward this new accumulation regime was marked by the discovery of more flexible forms of production organization (Scott, 1988). The range of changes resulting from this transition—initially of an economic nature—was so profound that it can be characterized through the notions of *capitalist modernization* (Mattos, 2013)[2], *contemporary acceleration* (Santos, 1993), or *restructuring* (Brenner, 2013; Brenner; Theodore, 2005; Santos, 2008; Sposito; Sposito, 2012; Soja, 1987).

Economic restructuring directly influenced the trajectories of contemporary urbanization, a relationship examined by several authors such as Brenner (2013), Mattos (2013), Santos (2008), Scott (1980; 1998), Soja (2000), and Sposito and Sposito (2012). Consequently, significant changes occurred in the roles and functions of various cities (Santos, 2008; Sposito; Sposito, 2012), as the relocation of firms and households led to spatial transformations within both the urban network and individual cities. In this context, the *complexification* of spatial interactions stands out (Sposito; Sposito, 2012), given the intensification of spatial articulations among cities across the urban network scale. Flows and movements of various kinds—material and immaterial—"stitch together" and lend cohesion to spatial units formed by sets of municipalities, interconnected through the territorial division of labor and functional complementarity.

At the scale of the urban network, several socio-spatial dynamics emerged from economic and productive restructuring. Among these dynamics, noteworthy processes include urban agglomeration, spatial interactions, functional complementarities among groups of municipalities, and intermunicipal spatial continuity, among others (Whitacker, 2019). The daily movement of people between municipalities (*commuting*) is one of the main indicators of intensified spatial interactions and of urban agglomeration processes within the network scale. This study focuses precisely on these daily movements, analyzing pendular displacements—home-to-work/school commutes—within the Maringá population arrangement. This territorial unit—population arrangement—was defined by the Brazilian Institute of Geography and Statistics (IBGE) in its study *Arranjos Populacionais e Concentrações Urbanas do Brasil*

[2] Mattos (2013) characterizes as *capitalist modernization* the set of transformations that emerged in the final decades of the last century, driven by a new economic dynamic. These transformations are attributed to technological development—particularly the rise of Information and Communication Technologies (ICTs)—and to economic liberalization.

(Population Arrangements and Urban Concentrations in Brazil [IBGE, 2016]). Based on criteria of integration, commuting flows, and territorial contiguity, the official publication delineated 294 spatial units known as population arrangements.

That said, the central objective of this article is to analyze the influences of the urban agglomeration process and pendular commuting within the Maringá/PR population arrangement. The justification for selecting this case study lies in the fact that Maringá, throughout its historical development, evolved from a well-defined urban project—being a planned city characterized by a strategic process of poverty peripheralization toward neighboring municipalities (Gonçalves, 2022; Rodrigues, 2004; Ströher; Souza, 2011). Given these historical factors, it is reasonable to infer that this population arrangement is strongly influenced by agglomeration processes.

The extension of daily life and living space: the scale of agglomeration in population arrangements

One of the central ideas of this study is that the everyday living space of individuals—the city as concept—increasingly diverges territorially from the political-administrative boundaries of the districts where urban residents live—the city as definition. The dispersion of occupation spaces and the intensification of pendular commuting have allowed various socio-spatial dynamics to become increasingly aligned with the urban network scale, encompassing two or more municipalities at the regional or supramunicipal levels (Silva, 2024). Accordingly, authors such as Brenner (2013), Catalão (2015), Reolon and Miyazaki (2019), Whitacker (2019), and Silva (2022), among others, advocate for a scalar expansion in urban studies, going beyond the scale of the city itself. Catalão (2015, p. 262, our translation), for instance, calls for a "[…] broader understanding of the urban scale, surpassing the scale of the city or urban space." Reis (2006) characterizes this phenomenon as the regionalization of everyday life, suggesting that movements motivated by work should be analyzed at the regional scale rather than that of the city proper. In this light, Whitacker (2019) raises the question of what territorial scope is most appropriate for urban studies involving medium-sized cities. According to the author:

> This issue has become increasingly relevant, as the formation of urban spaces with growing relative fluidity—combined with socio-spatial differentiation—has resulted in spatial entities that no longer align with municipal political-administrative units, nor fully correspond to the notions of territorial

> continuity and cohesion once characteristic of the urban phenomenon (Whitacker, 2019, p. 10, our translation).

In this context, spatial practices and everyday urban experiences tend to occur across increasingly broader spaces, often encompassing more than one municipality. As a result, municipal boundaries are "breached" by the expansion of individuals' living spaces. The process of urban agglomeration emerges within this framework, driven by the daily movement of people (*commuting*) between two or more municipalities that perform different roles and functions within the urban network and are connected through functional complementarity (Miyazaki; Whitacker, 2005; Reolon; Miyazaki, 2019; Silva, 2022; Ultramari; Moura, 1994). Consequently, the presence of specialized services in a given municipality can serve as a strong attractor for residents of other municipalities, intensifying the agglomeration process among them. To formulate a general definition of urban agglomeration, several key studies can be revisited.

According to Ultramari and Moura (1994, p. 125, our translation), the notion of urban agglomeration "represents the space of daily commuting between cities, that is, the development of interdependent relationships between two or more urban areas, forming a single phenomenon." The authors, therefore, associate the process of urban agglomeration with the concept of commuting, emphasizing the daily movement between distinct cities. Miyazaki and Whitacker (2005) highlight the importance of flows in this process, even in the absence of territorial continuity within the built environment:

> [Urban agglomeration is] the process in which distinct urban centers undergo spatial expansion, generating flows and an extension of the urban fabric that ultimately surpass municipal political-administrative boundaries. In other words, a single city comes to encompass more than one municipality, although territorial contiguity of the built environment is not necessarily present, as flows must be considered in this process (Miyazaki; Whitacker, 2005, p. 3-4, our translation).

Finally, Reolon and Miyazaki (2019) note that spatial continuity—where there is no continuity of the built environment, yet intermunicipal spatial relations are maintained through pendular flows—is generally more pronounced in non-metropolitan contexts, such as agglomerations led by medium-sized cities. They further explain:

> […] urban agglomeration would thus constitute a space characterized by intense and reciprocal social and economic relationships between two or more urban centers belonging to distinct political-administrative units, where the overflow or projection of the population and activities of one or more cities

> onto adjacent areas can be observed (Reolon, 2007). Hence, two or more cities may form a complex spatial continuum, even in the absence of physical-territorial continuity of urban fabrics. This situation is commonly observed in areas referred to as 'non-metropolitan,' often designating urban agglomerations polarized by medium-sized cities (Reolon; Miyazaki, 2019, p. 58-59, our translation).

Therefore, the process of urban agglomeration pertains to the existence of spatial continuity among clustered municipalities, even when there is no territorial continuity of the built environment—the latter being more characteristic of the conurbation process.

Beyond functional complementarity between municipalities, a key question arises: what factors enable the increase—both in quantity and distance—of intermunicipal pendular commuting? To address this question, one of the main determinants can be identified: mobility and accessibility conditions. While it is important to acknowledge the relevance of multiple factors—such as variations in land prices among neighboring municipalities and the availability of specialized services in certain locations—it is crucial to highlight the growing capacity for individual mobility, which is directly linked to improvements in mobility and accessibility conditions.

Urban mobility and accessibility conditions are inseparable and essential to the realization of urban life (Sposito, 2018) and to ensuring full access to urban living (Abate, 2022). Abate (2022) emphasizes that the concept of mobility is polysemic and traverses multiple disciplines, not being confined to Geography alone. For this reason, the author employs the adjective "urban" to qualify both mobility and accessibility, in order to underscore that the analytical focus of his research lies on movements that occur within cities. This same approach was adopted by Sousa (2005), who points out that mobility pertains to the forms and reasons underlying people's movements, whereas accessibility refers to the "quality of what is accessible." However, the present study considers movements that extend beyond and traverse city boundaries, reflecting the expansion of individuals' everyday living spaces and intensifying intermunicipal relations. Accordingly, this paper: 1) treats mobility and accessibility as inseparable (Poletto, 2016; Sousa, 2005; Sposito, 2018) and as fundamental to the realization of everyday spatial practices; and 2) adopts the adjective "everyday" to qualify both mobility and accessibility, as it draws on theoretical and methodological perspectives that address spatial relations among municipalities through pendular commuting, forming cohesive units that transcend municipal boundaries.

Dupuy (1995) underscores the importance of the automobile as the principal enabler of human mobility across increasingly longer distances, expanding the living spaces of those who

rely on motor vehicles. According to the author, continuous improvements in transport systems have facilitated an increase in both the number and distance of trips. Similarly, Moura *et al*. (2005), assert that "the discussion of movement is, therefore, inseparable from mobility. It is mobility that characterizes contemporary urban life, emphasizing the importance of transport, especially individual transport" (Moura *et al.*, 2005, p. 122, our translation). Reolon and Miyazaki (2019) also emphasize the centrality of mobility, stating that:

> The expansion of mobility has contributed to spatial changes, whereby everyday activities occur within multiple centralities amid processes of urban dispersion and agglomeration, resulting in a complex morphology that includes, for instance, an intermunicipal scale (Reolon; Miyazaki, 2019, p. 58, our translation).

Regarding the enhancement of mobility and accessibility conditions, several factors stand out: the popularization of private motor vehicles, the densification of road networks connecting different municipalities, and the expansion of intermunicipal public transport routes, among others. The increasing frequency of intermunicipal pendular commuting would not be possible without constant improvements in mobility and accessibility conditions, which have enabled the occupation of increasingly distant and dispersed areas (*diffuse urbanization*). As a result, urban dwellers are now able to travel over longer distances, leading to the expansion of their everyday routines and living spaces.

Therefore, the intensification of pendular commuting within the urban network—driven by continuous improvements in mobility and accessibility—is directly linked to the deepening of urban agglomeration processes.

> Intermunicipal pendular movements have become so frequent, including in interior regions of the country, that urban agglomeration processes have come to characterize the new reality of Brazilian urbanization (Reolon; Miyazaki, 2019, p. 56, our translation).

Pendular movements reveal the spatial reach of the urban phenomenon across the territory (Moura *et al.*, 2005), and they can directly contribute to the delineation of interconnected spatial units defined by the daily mobility of individuals.

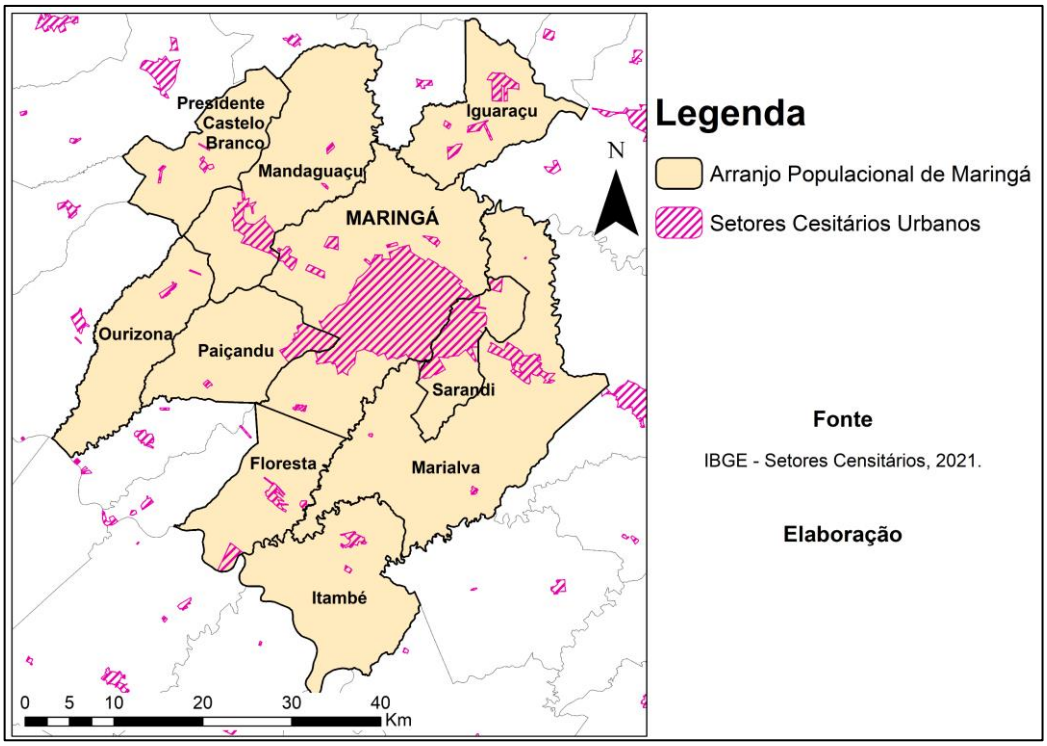
Therefore, agglomeration processes at the scale of the urban network are closely linked to intermunicipal pendular commuting. Empirical investigations of such data can support the identification of cohesive and coherent spatial units. In this regard, the present study examines pendular mobility data for the Maringá population arrangement, specifying the municipality of

origin and the municipality (or municipalities) of work or study associated with each recorded movement within this spatial unit.

Characterization of the spatial scope and methodological procedures

The Maringá/PR population arrangement constitutes a spatial unit composed of ten municipalities, as defined by the Brazilian Institute of Geography and Statistics (IBGE, 2016). Figure 1 locates the population arrangement within the state of Paraná, highlighting the urban census[3] tracts of all municipalities within this spatial unit.

Figure 1 – Location of the Maringá/PR population arrangement[4]



Source: IBGE – Census Tracts (2021). Prepared by the author (2024).

The choice of the analytical territorial unit—Population Arrangement—is based on the delimitation proposed by the Brazilian Institute of Geography and Statistics (IBGE) in its

[3] Census tracts are the smallest territorial units delineated by the Brazilian Institute of Geography and Statistics (IBGE) for statistical surveys. Among the various data collected by the Institute for each tract, particular attention is given to those that classify them into eight types of territorial situations: (1) Rural Area (excluding settlements); (2) Urban Area with High Building Density; (3) Urban Area with Low Building Density; (4) Hamlet; (5) Water Body; (6) Rural Nucleus; (7) Urban Nucleus; and (8) Village. In Figure 1, types 2, 3, and 7 were used to delineate the urban census tracts.

[4] Subtitle translation (from top to bottom): Population Arrangement of Maringá; Urban Cesitarian Sectors.

publication Population Arrangements and Urban Concentrations in Brazil (IBGE, 2016). According to the IBGE (2016):

> A population arrangement is the grouping of two or more municipalities that exhibit strong population integration due to pendular movements for work or study, or due to the contiguity between their main urbanized areas (IBGE, 2016, n.p., our translation).

The publication also outlines the criteria used to define these spatial units:

> The criteria employed in identifying population arrangements rely on the notion of integration, measured through pendular movements for work and study or through urban contiguity, which synthesize the various processes involved (IBGE, 2016, n.p., our translation).

Accordingly, population arrangements were established based on the criteria of integration among municipalities (Reolon; Miyazaki, 2019). In addition, the IBGE (2016) considered intermunicipal pendular flows in delimiting these spatial units. Therefore, the delineation of population arrangements fully aligns with the central premise of this article: to analyze the extension of urban dwellers' living spaces through pendular commuting between clustered municipalities.

Maringá, the core of the population arrangement, shares borders with all but three municipalities within the delineated area: Itambé, Ourizona, and Presidente Castelo Branco. Furthermore, a single contiguous urbanized area can be identified among the municipalities of Maringá, Paiçandu, and Sarandi, as also noted by the IBGE (2016). Table 1 provides a general characterization of the ten municipalities that comprise the arrangement.

Table 1 – Population and urban hierarchy in the population arrangement of Maringá/PR

Municipalities	Population		Urban Hierarchy (2020)
	2000	2010	
Floresta	5,122	5,931	PA from Maringá/PR
Iguaraçu	3,598	3,982	PA from Maringá/PR
Itambé	5,956	5,979	PA from Maringá/PR
Mandaguaçu	16,828	19,781	PA from Maringá/PR
Marialva	28,702	31,959	PA from Maringá/PR
Maringá	288,653	357,077	Regional Capital B
Ourizona	3,396	3,380	PA from Maringá/PR
Paiçandu	30,764	35,936	PA from Maringá/PR
Presidente Castelo Branco	4,305	4,784	PA from Maringá/PR
Sarandi	71,422	82,847	PA from Maringá/PR
Total population of the arrangement	*458,746*	*551,656*	-

Source: IBGE (2000; 2010; 2020). Organized by the author (2024).

Maringá is the third-largest municipality in the state of Paraná, with a resident population of 409,657 inhabitants (IBGE, 2022), ranking behind only Curitiba (the state capital) and Londrina. In 2010, Maringá's population accounted for approximately 64.73% (357,077 inhabitants) of the total population of the arrangement (551,656 inhabitants). According to IBGE (2020), Maringá is classified as a *Regional Capital B* due to the city's intermediary roles and functions within the urban network. For this reason, this study considers it a *medium-sized city*.

To understand the influence of the urban agglomeration process within the Maringá/PR population arrangement, methodological procedures were adopted to conduct a detailed analysis of commuting data from the 2000 and 2010 demographic censuses. These data enabled the construction of commuting indicators and the breakdown of homework/study information, allowing the identification of residents' municipalities and their respective work or study destinations. Such information supported the preparation of the results presented in this article (charts, tables, and maps).

The commuting data were organized using IBM SPSS STATISTICS 20 software through the creation of databases encompassing the ten municipalities that make up the Maringá/PR population arrangement. The study conducted by Silva (2018) serves as an important methodological reference, as the author also worked with commuting data derived from demographic censuses using IBM SPSS STATISTICS, performing both quantification and qualification of commuting flows.

The census questionnaires from both years provide information on the commuting behavior of the surveyed population. The following question from the 2000 census was used in this study: "*In which municipality and federal unit or foreign country do you work or study?*" The 2010 census, in turn, divided these inquiries into two separate questions: "*In which municipality and federal unit or foreign country do you work?*" and "*In which municipality and federal unit or foreign country do you attend school (or daycare)?*" An operational procedure was implemented to harmonize the 2000 and 2010 data, given that the latter separated work and study information.

Commuting movements within the Maringá population arrangement (2000-2010)

Before discussing the empirical results, it is essential to clarify which definitions are most appropriate to accurately describe the concept of *commuting* adopted in this study. In this regard, the discussion returns to Moura *et al*. (2005):

> In this paper, the terms *pendular movement* or *commuting movement* were adopted, as this dynamic involves daily travel and, therefore, does not imply relocation to or permanent settlement in another place (Moura *et al.*, 2005, p. 123, our translation).
>
> Thus, while migration entails a change of residence, commuting is characterized by travel between the municipality of residence and other municipalities for specific purposes (Moura *et al.*, 2005, p. 124, our translation).

Accordingly, this article adopts the expressions *commuting* or *pendular movement*, both conceptually similar to the English term *commuting*, to refer to daily travel between one's municipality of residence and other municipalities without permanent relocation. Hence, the term *pendular migration* is not applicable here, as it involves residential change, which is not addressed in this study.

Given the relevance of commuting movements to the process of urban agglomeration (Miyazaki, 2008; Moura *et al.*, 2005; Reolon; Miyazaki, 2019; Ultramari; Moura, 1994), the empirical results in this section detail commuting flows among the municipalities comprising the Maringá population arrangement. Table 2 presents an origin–destination matrix based on homework/study data from the 2000 demographic census.

Table 2 – Origin-destination matrix: population arrangement in Maringá/PR, 2000

Origin - Municipality of Residence in 2000	Destination - Municipality of Work or Study in 2000										Total (source)
	Floresta	Iguaraçu	Itambé	Mandaguaçu	Marialva	Maringá	Ourizona	Paiçandu	Presidente Castelo Branco	Sarandi	
Floresta	0	0	14	0	4	401	0	8	0	0	**427**
Iguaraçu	0	0	0	0	0	113	0	0	0	0	**113**
Itambé	4	0	0	0	8	182	0	0	0	0	**194**
Mandaguaçu	0	0	0	0	0	1,712	0	7	16	28	**1,763**
Marialva	15	0	0	0	0	1,139	0	0	0	96	**1,250**
Maringá	22	26	30	45	227	0	0	242	32	737	**1,361**
Ourizona	0	0	0	90	0	167	0	11	0	0	**268**
Paiçandu	0	0	0	16	0	5,482	0	0	0	21	**5,519**
Presidente Castelo Branco	0	0	0	29	0	99	0	0	0	0	**128**
Sarandi	0	7	0	0	405	13,798	0	64	0	0	**14,274**
Total (destination)	**41**	**33**	**44**	**180**	**644**	**23,093**	**0**	**332**	**48**	**882**	**25,297**

Source: IBGE (2000). Organized by the author (2024).

The matrix above shows that 25,297 pendular movements occurred among the municipalities of the Maringá population arrangement in 2000. As the principal integrative center of the arrangement, Maringá was the destination for 91.29% of all movements (23,093 individuals), primarily originating from residents of Sarandi (13,798 individuals) and Paiçandu (5,482 individuals), which together accounted for 83.49% of the flows toward the arrangement's core.

In the opposite direction, with Maringá as the municipality of residence, the main destinations for its residents were Sarandi (737 individuals), Paiçandu (242 individuals), and Marialva (227 individuals), the only municipalities with more than 50 recorded movements.

The 2000 commuting data reveal strong spatial integration among Maringá, Sarandi, and Paiçandu, which can be explained by the historical process of spatial interaction among these municipalities. Rodrigues (2004) highlighted that the rapid urban growth of Sarandi was closely linked to the peripheral relocation of a portion of Maringá's lower-income population. Due to real estate pressures and the high costs of maintaining permanent residence, many poorer residents of Maringá moved to neighboring municipalities, primarily Sarandi and Paiçandu (Rodrigues, 2004). Gonçalves (2022) also emphasized the historical and spatial relationships among Maringá, Sarandi, and Paiçandu, noting that the latter two consolidated in the periphery of the neighboring medium-sized city.

In this context, because maintaining a permanent residence in Maringá was often unfeasible, many individuals relocated to neighboring municipalities, particularly Sarandi and Paiçandu. Nonetheless, they were able to maintain connections with their former municipality, Maringá, through work or study activities. This historical process was a significant driver of pendular commuting within the arrangement.

Table 3 presents another origin–destination matrix, this time based on data from the 2010 demographic census.

Table 3 – Origin–destination matrix: Maringá/PR population arrangement, 2010

Origin - Municipality of Residence in 2010	Destination - Municipality of Work or Study in 2010										Total (source)
	Floresta	Iguaraçu	Itambé	Mandaguaçu	Marialva	Maringá	Ourizona	Paiçandu	Presidente Castelo Branco	Sarandi	
Floresta	0	0	59	0	4	961	0	7	0	0	**1,031**
Iguaraçu	0	0	0	0	6	426	0	4	0	0	**436**
Itambé	30	0	0	0	0	587	0	3	0	3	**623**
Mandaguaçu	0	7	0	0	0	3,337	15	5	28	33	**3,425**
Marialva	13	0	0	12	0	2,638	0	0	0	476	**3,139**
Maringá	133	145	38	482	637	0	55	632	0	2,129	**4,251**
Ourizona	0	0	0	88	0	495	0	0	0	3	**586**
Paiçandu	0	20	0	31	26	9,890	0	0	0	54	**10,021**
Presidente Castelo Branco	0	0	0	29	0	644	3	0	0	4	**680**
Sarandi	9	0	32	47	431	22,064	8	66	0	0	**22,657**
Total (destination)	**185**	**172**	**129**	**689**	**1,104**	**41,042**	**81**	**717**	**28**	**2,702**	**46,849**

Source: IBGE (2010). Organized by the author (2024).

In 2010, Sarandi and Paiçandu remained the two main municipalities of residence for individuals commuting to Maringá, together accounting for 77.86% of such movements. However, an increasing number of residents from other municipalities began commuting daily to Maringá. Among these, in addition to Sarandi (22,064 individuals) and Paiçandu (9,890 individuals), the municipalities of Mandaguaçu (3,337 individuals) and Marialva (2,638 individuals) also stood out, each recording more than one thousand commuting flows toward the core of the arrangement.

There was also a notable rise in “counterflow” commuting, particularly among Maringá residents traveling to Sarandi (2,129 individuals), Marialva (637 individuals), Paiçandu (632 individuals), and Mandaguaçu (482 individuals). This movement reflects the increasing

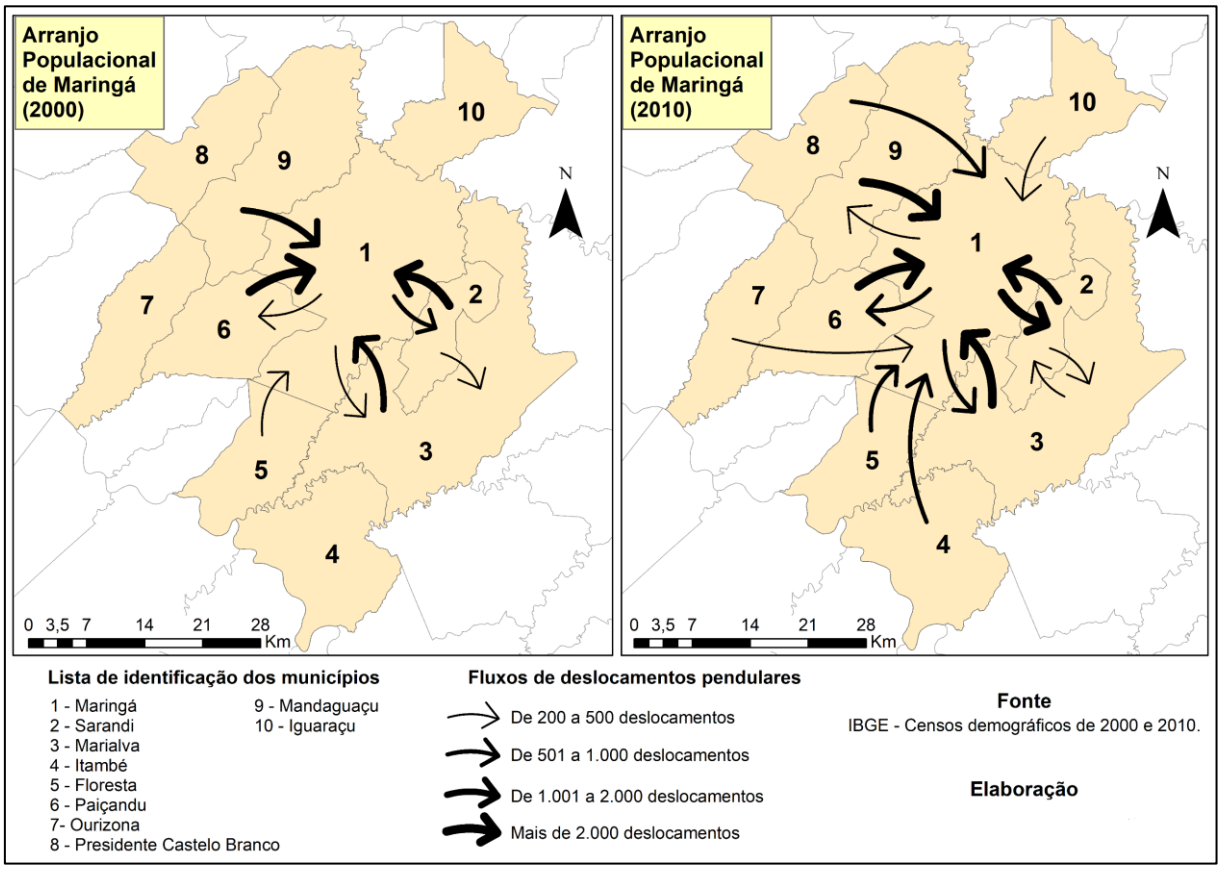
availability of employment opportunities in these secondary municipalities, which gradually become emerging centralities within the population arrangement.

Furthermore, indications emerged of intensified pendular flows that did not involve Maringá as either the municipality of residence or destination. These included commuting movements occurring solely between municipalities already polarized by Maringá. Among these, flows between Marialva and Sarandi were particularly significant in both directions. For instance, in 2010, 476 residents of Marialva commuted to Sarandi, while 431 residents of Sarandi traveled in the opposite direction, reflecting strong intermunicipal interaction.

Based on the 2010 commuting data, several questions arise: Is Maringá losing its centrality within the arrangement, or are the centralities of other municipalities being strengthened? What explains the substantial increase in Maringá residents commuting to other municipalities within the arrangement?

To address these questions, Figure 2 provides a cartographic synthesis of the pendular commuting data for 2000 and 2010.

Figure 2 – Pendular commuting flows of 200 or more individuals (2000–2010) in the Maringá/PR population arrangement[5]



Source: IBGE (2000; 2010). Prepared by the author (2024).

The comparative representation indicated a growing complexity in the structure of commuting flows within the Maringá population arrangement. In 2000, for instance, the most significant pendular flows did not encompass all municipalities of the arrangement, with the majority directed toward Maringá. By 2010, however, the significant commuting flows had increased in both quantity and diversity, involving all municipalities within the arrangement.

Therefore, it can be concluded that Maringá has not lost its centrality nor its role as the integrative center of this spatial unit. Nevertheless, a notable complexity in the commuting flows of this arrangement was observed. Secondary municipalities have increasingly attracted pendular movements, emerging as new centralities, without compromising Maringá's integrative capacity.

[5] In the figure, the numbers represented by the arrows indicate the identification of the municipalities, as follows: 1 - Maringá, 2 - Sarandi, etc. The thickness of the arrows represents the number of displacements (the thicker the arrow, the greater the displacement), so look at the numbers described in the middle of the figure at the bottom.

Table 4 presents commuting data weighted against municipal populations between 2000 and 2010, providing a clearer understanding of the relative increases in commuting within the population arrangement.

Table 4 – Comparative summary: population and commuting in the Maringá/PR population arrangement (2000–2010)

Municipalities	Population		People who commute to other municipalities in the arrangement		Proportion of people who commute to other municipalities in the arrangement, in relation to the municipality's population	
	2000	2010	2000	2010	2000	2010
Floresta	5,122	5,931	427	1,031	8.34%	17.38%
Iguaraçu	3,598	3,982	113	436	3.14%	10.95%
Itambé	5,956	5,979	194	623	3.26%	10.42%
Mandaguaçu	16,828	19781	1,763	3,425	10.48%	17.31%
Marialva	28,702	31,959	1,250	3,139	4.36%	9.82%
Maringá	288,653	357,077	1,361	4,251	0.47%	1.19%
Ourizona	3,396	3,380	268	586	7.89%	17.34%
Paiçandu	30,764	35,936	5,519	10,021	17.94%	27.89%
Presidente Castelo Branco	4,305	4,784	128	680	2.97%	14.21%
Sarandi	71,422	82,847	14,274	22,657	19.99%	27.35%
Total	**458,746**	**551,656**	**25,297**	**46,849**	**5.51% (average in the arrangement)***	**8.49% (average in the arrangement)****

* Proportion calculated by dividing the number of people commuting in 2000 (25,297 individuals) by the total population of the arrangement in the same year (458,746 individuals). The result was expressed as a percentage (%).
** Proportion calculated by dividing the number of people commuting in 2010 (46,849 individuals) by the total population of the arrangement in the same year (551,656 individuals). The result was expressed as a percentage (%).
Source: IBGE (2000; 2010).

All ten municipalities within the arrangement exhibited proportional increases in the number of individuals commuting to other municipalities in the arrangement. Therefore, the growth in the number of commuters was proportionally greater than the population growth in these municipalities. Considering the aggregated data for the entire arrangement, the proportion of commuters increased from 5.51% in 2000 to 8.49% in 2010. These findings indicate an intensification of commuting and, consequently, of agglomeration processes within the Maringá population arrangement.

The increase in commuting was accompanied by a growing complexity in the architecture of commuting flows. As a result, there was not only an absolute increase in the number of movements but also a diversification in the directions of these flows.

It is important to note that commuting data from the 2022 demographic census were not used in this study, as a significant portion of the results has not yet been published or made available. Nevertheless, certain trends can be anticipated for the 2022 censu:

a) An increase in the absolute and relative number of pendular movements between municipalities within the population arrangement;
b) An increase in "counterflow" movements and flows between polarized municipalities;
c) The emergence or strengthening of secondary centralities, establishing themselves as significant municipalities attracting pendular movements;
d) Greater complexity in the architecture of commuting flows within the population arrangement.

If confirmed, these expected trends for the 2022 census would reinforce the current dynamics of improved mobility and accessibility across an increasingly broad space, extending the daily living space of residents.

Final considerations

This article analyzed the influences of the agglomeration process within the Maringá population arrangement, based on measurements of home-to-work/study commuting data. Over the empirically examined period (demographic censuses of 2000 and 2010), a significant increase in the complexity of commuting flow architecture among the ten municipalities of the arrangement was identified. From 2000 to 2010, there was not only an absolute increase in the number of commuting movements, but this dynamic was also accompanied by a substantial proportional increase in nondominant flows[6]. Practically, this indicates a marked rise in "counterflow" movements, with Maringá serving as the municipality of residence for commuters, as well as flows between polarized municipalities.

For the commuting data from the 2022 demographic census, which had not yet been published at the time of writing this article, it is expected that the trends identified between 2000 and 2010 will continue, namely: i) an increase, both in absolute and relative terms, in the number of pendular movements; ii) a proportional increase in the number of non-dominant commuting flows; iii) the emergence or strengthening of municipalities receiving pendular movements, such as Sarandi and Marialva; iv) an intensification in the complexity of commuting flow architecture within the arrangement.

[6] In the population arrangement in question, the dominant commuting flow has Maringá as the destination municipality for work or study.

Commuting data can open new empirical research avenues, providing significant contributions to Geography. When spatially analyzed, these data can assist in defining the extent of the urban phenomenon or in identifying cohesive spatial units, allowing for the delineation of new urban areas, new urban configurations, or new spatial delineations. In this study, the delimitation established by the Population Arrangements (IBGE, 2016) was adopted, recognizing that these spatial units may be confirmed or challenged through empirical analyses investigating commuting movements and their implications.

By exploring new research avenues related to commuting, it is possible to perform enriching cross-analyses with other indicators, such as age, income, education, occupation, and gender. These data can be used to identify typologies between individuals who commute and those who do not. It is important to emphasize that mobility conditions vary among individuals, and this analysis can contribute to understanding the characteristics of commuters. Demographic censuses, in turn, provide valuable information that can be integrated into this investigative process.

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REFERENCES

ABATE, A. A. **As vozes da fragmentação socioespacial**: uma leitura pelas lentes da mobilidade e da acessibilidade urbanas de citadinos que habitam a periferia de Ribeirão Preto – SP. 2022. Dissertation (Master's in Geography) – Faculdade de Ciências e Tecnologia, Universidade Estadual Paulista, Presidente Prudente, 2022.

BRENNER, N. Reestruturação, reescalonamento e a questão urbana. **GEOUSP**, São Paulo, n. 33, p. 198-220, 2013. Available at: https://revistas.usp.br/geousp/article/view/74311. Accessed in: 15 Jul. 2025.

BRENNER, N; THEODORE, N. Neoliberalism and the urban condition. **City**, v. 9, n. 1, p. 101-107, 2005. DOI: 10.1080/13604810500092106

CATALÃO, I. Dispersão urbana: apontamentos para um debate. **Revista Cidades**, v. 12, n. 21, 2015. DOI: 10.36661/2448-1092.2015v12n21.11943

DUPUY, G. **Les territoires de l'automobile**. Paris: Antropos, 1995.

GONÇALVES, B. L. **Da produção da cidade sob a égide liberal à reprodução das desigualdades socioespaciais**: o caso da aglomeração urbana de Maringá em foco. 2022. 115 f. Dissertation (Master's Degree) – Universidade Estadual Paulista, Faculdade de Ciências e Tecnologia, 2022.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA (IBGE). **Arranjos populacionais e concentrações urbanas do Brasil**. 2. ed. Rio de Janeiro: IBGE, 2016.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA (IBGE). **Regiões de influência das cidades – Regic 2018**. Rio de Janeiro: IBGE. 2020.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA (IBGE). **Estimativas da população residente no Brasil e unidades da federação com data de referência em 1º de julho de 2022**. Rio de Janeiro: IBGE, 2022. Available at: https://www.ibge.gov.br/estatisticas/sociais/populacao/9103-estimativas-de-populacao.html?=&t=downloads. Accessed in: 10 Nov. 2024.

MARANDOLA JR., E.; OJIMA, R. Pendularidade e vulnerabilidade na Região Metropolitana de Campinas: repercussões na estrutura e no habitar urbano. **Revista Brasileira de Estudos Urbanos e Regionais**, v. 16, n. 2, p. 185, 2014. DOI: 10.22296/2317-1529.2014v16n2p185. Available at: https://rbeur.anpur.org.br/rbeur/article/view/4750. Accessed in: 25 Sep. 2025.

MATTOS, C. Reestructuración económica y metamorfosis urbana en América Latina: de la ciudad a la región urbana. *In*: NOYOLA, J.; MATTOS, C.; ORELLANA, A. (org.). **Urbanización en tiempos de crisis**: impactos, desafíos y propuestas. Santiago: Instituto de Estudios Urbanos y Territoriales, 2013. p. 13-43.

MIYAZAKI, V. K. **Um estudo sobre o processo de aglomeração urbana**: Álvares Machado, Presidente Prudente e Regente Feijó. 2008. 171 f. Dissertation (Master's Degree) – Universidade Estadual Paulista, Faculdade de Ciências e Tecnologia, 2008. Available at: http://hdl.handle.net/11449/96699. Accessed in: 15 Jul. 2025.

MIYAZAKI, V. K.; WHITACKER, A. M. O processo de aglomeração urbana: um estudo sobre Presidente Prudente e Álvares Machado no Estado de São Paulo, Brasil. **Scripta Nova (Barcelona)**, v. 9, n. 194, 2005. Available at: https://www.ub.edu/geocrit/sn/sn-194-110.htm. Accessed in: 15 Jul. 2025.

MOURA, R.; CASTELLO BRANCO, M. L. G.; FIRKOWSKI, O. L. C. Movimento pendular e perspectivas de pesquisas em aglomerados urbanos. **São Paulo em Perspectiva**, v. 19, p. 121-133, 2005. DOI: 10.1590/S0102-88392005000400008. Available at: https://www.scielo.br/j/spp/a/NWrbPYkHk5DXS3sh7yGBnSf/?format=html&lang=pt. Accessed in: 15 Jul. 2025.

POLETTO, P. **Mobilidade e acessibilidade urbana**: o ir e vir por meio do transporte público coletivo. 2016. 233 f. Dissertation (Master's Degree in Geography) – Universidade Estadual do Oeste do Paraná, Francisco Beltrão, 2016.

REIS, N. G. **Notas sobre urbanização dispersa e novas formas de tecido urbano**. São Paulo: Via das Artes. 2006.

REOLON, C. A.; MIYAZAKI, V. K. Urbanização, dispersão das cidades e aglomeração urbana: um olhar sobre as cidades médias. **Terr@ Plural**, v. 13, n. 3, p. 55–72, 2019. Available at: https://revistas.uepg.br/index.php/tp/article/view/13213. Accessed in: 25 Sep. 2025.

RODRIGUES, A. L. Características do processo de urbanização de Maringá, PR: uma cidade de "porte médio". **Cadernos Metrópole**, n. 12, p. 95-121, 2004.

SANTOS, J. Reestrutura urbana x reestruturação da cidade: o caso de Salvador. *In*: **X Colóquio Internacional de Geocrítica**. Barcelona, 2008. Available at: http://www.ub.es/geocrit/-xcol/388.htm. Accessed in: 7 Mar. 2022.

SANTOS, M. A aceleração contemporânea: tempo mundo e espaço mundo. *In*: SANTOS, M.; SOUZA, M. A. S.; SCARLATO, F. C.; ARROYO, M. (org.). **O Novo Mapa do Mundo: Fim de Século e Globalização**. São Paulo: Hucitec/Anpur, 1993.

SCOTT, A. J. **New Industrial Spaces**. London: Pion, 1988.

SCOTT, A. J. **Regions and the world economy**: the coming shape of global production, competition and political order. Oxford: Oxford University Press, 1998.

SCOTT, A. J. **The urban land nexus and the state**. London: Pion, 1980.

SILVA, K. A. A. **Novas formas urbanas e o olhar através da demografia**: a estruturação da Cidade-Região Paulista. 2018. Thesis (Doctorate in Demography) – Instituto de Filosofia e Ciências Humanas, Universidade Estadual de Campinas (IFCH/Unicamp), Campinas, 2018.

SILVA, L. Y. W. Dispersão da cidade e os espaços residenciais fechados: o processo de aglomeração urbana entre Presidente Prudente/SP e Álvares Machado/SP. **Boletim de Geografia**, v. 40, 2022. DOI: 10.4025/bolgeogr.v40.a2022.e63092. Available at: https://periodicos.uem.br/ojs/index.php/BolGeogr/article/view/63092. Accessed in: 15 Jul. 2025.

SILVA, L. Y. W. **Dispersão e aglomeração nos arranjos populacionais de Presidente Prudente/SP e Maringá/PR (2000-2010)**. Orientador: Arthur Magon Whitacker. 2024. 261 f. Dissertation (Master's Degree in Geography) – Faculdade de Ciências e Tecnologia, Universidade Estadual Paulista, Presidente Prudente, 2024.

SOJA, E. W. W. **Postmetropolis**: critical studies of cities and regions. Oxford, UK; Cambridge, MA: Blackwell, 2000.

SOJA, E. W. W. **Postmodern geographies**: the reassertion of space in critical social theory. Londres; Nova Iorque: Verso, 1987.

SOUSA, M. T. R. Mobilidade a acessibilidade no espaço urbano. **Sociedade & Natureza**, Uberlândia, v. 17, n.33, p. 119-129, 2005.

SPOSITO, M. E. B. (org.). **Fragmentação socioespacial e urbanização brasileira**: escalas, vetores, ritmos, formas e conteúdos. Projeto de pesquisa. Presidente Prudente, 2018.

SPOSITO, M. E. B.; SPOSITO, E. S. Reestruturação econômica, reestruturação urbana e cidades médias. *In*: Seminário da Rede Iberoamericana de Pesquisadores sobre Globalização e Território (RII), 2012, Belo Horizonte. **Trabalhos**. Belo Horizonte: UFMG, 2012. v. 1, p. 1-17.

STRÖHER, L. E. M.; SOUZA, G. B. De vilarejo à cidade conurbada: a expansão de Sarandi condicionada pela ação de três agentes imobiliários e pelo parcelamento rural. **Revista Tecnológica Maringá**, v. 20, p. 63-74, 2011.

ULTRAMARI, C.; MOURA, R. **Metrópole**: Grande Curitiba: teoria e prática. Curitiba: Ipardes, 1994.

WHITACKER, A. M. **Expansão, dispersão, complexificação e fragmentação**: formas e processos espaciais em câmbio no Brasil não-metropolitano. Projeto de pesquisa – Bolsa de Produtividade em Pesquisa. Brasília: Conselho Nacional de Desenvolvimento Científico e Tecnológico/CNPq, 2019.

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