FREEDOM OF CHOICE? SOCIAL AND SPATIAL DISPARITIES ON COMBINED HOUSING AND TRANSPORT AFFORDABILITY

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ABSTRACT

Our work seeks to understand and measure housing and transport affordability (H+TA), issues considering different types of households in Santiago, Chile. Combining income, housing, transport, and census data, we estimate H+T costs using spatial clusters and probability distribution functions, analyzing the "freedom of choice" that socially disadvantaged groups have given their financial constraints.

Results show that families with children, the elderly, and immigrants are the most limited in their choices. The three lowest-income deciles are dependents on government benefits and/or social housing. 4th to 6th income deciles can choose between 30% and 65% of all housing and transport combinations but less than 6% of those offered on the two clusters with the best transport/urban conditions. Families from these deciles are usually neither poor enough to access government housing or benefits nor rich enough to easily access mortgage loans, making their choices very limited to avoid falling into significant financial stress.

Keywords: housing, transport, affordability

1. INTRODUCTION

Developing sustainable cities and communities and reducing poverty are two critical dimensions of the Sustainable Development Goals (SDGs) set by the United Nations (United Nations, 2018). To achieve these goals, providing adequate and affordable housing, increasing access to opportunities, and expanding public transport services should be prioritized. These SDGs are particularly important for regions facing significant social inequalities, poverty, and urban segregation issues.

Latin American cities face critical housing problems associated with low incomes, lack of financial markets, and insufficient supply, leading to high prices and levels of informal housing and a lack of essential services such as water and sanitation for large sections of the population (IADB, 2012). Similar problems are observed within the transport sector. Unplanned urban growth and high inequality rates have led the poor to live in informal housing on the periphery of large cities, where traditional or formal public transport systems are challenging to provide (Cervero, 2000). According to figures from the World Bank (2018), the region allocates 17.4% of total consumption to transport compared to 10.2% of Europe and Central Asia, varying between 7.7% and 17.1% of household income depending on the city and the socioeconomic group (Gandelman et al., 2019). Although subsidies are widespread to increase affordability, their distributive impacts need to be improved (IADB, 2019).

Santiago, the capital of Chile and its largest Metropolitan area, has a population over 6.5 million people. The Greater Santiago (GS), composed of 34 municipalities, increased its surface area by over 20%, from 64,770 ha in 2002 to 78,252 ha in 2017 (INE, 2019). In this same period, the GS population grew by 17%, with a strong income stratified distribution over the urban space. Santiago has a lose and fragmented land use governance that has led the city to follow the spontaneous pattern observed by Griffin and Ford (1980) for Latin American cities in which the city center has been systematically expanding towards the most affluent neighborhoods (in this case the northeast) presenting densities of over 230 dwellings per hectare. And quite consistent with the models of these papers, the more peripheral districts of GS accommodate mostly low-income households in quite low densities (less than 40 dwellings per hectare). Beyond the GS administrative limits on the Metropolitan Region, a submarket of more sprawling projects promoted by real-estate developers has blossomed (Cox & Hurtubia, 2020; Cox & Hurtubia, 2021).

This urban development pattern and its physical sprawl impose high economic stress on low-income families due to combined housing and transport expenditures. This stress has deepened due to housing sales prices almost doubling between 2009 and 2017, while rental prices increased by about 50% in the same period (Espinoza & Urzúa, 2018). Furthermore, while the real housing price index has risen by 63.69%, workers' wages have increased by only 21.85% (Vergara-Perucich & Aguirre-Nuñez, 2020). On average, a household in Santiago spends CLP 155,000 (220 USD) monthly on transport costs (CCHC, 2019). However, this figure presents high variability, given that car-related costs usually are significantly more expensive than the alternatives. For example, considering their current modal share, the two lowest income quintiles spend over 28% of their average monthly budget on transport costs (Iglesias et al., 2019).

Despite the growing literature on housing and transport affordability, most of the work on this topic has focused on Global North settings. Moreover, these studies usually use aggregate averages of expenditure-to-income ratios and affordability thresholds (for example, devoting less than 45% of income to housing and transport expenditures) without considering households types and overlooking spatial and socioeconomic distributional considerations that potentially under-estimate the simultaneous impact of transport and housing costs on lower-income family budgets. Our work seeks to address these methodological shortfalls by disaggregating housing and transport affordability by different types of households. We use the City of Santiago, Chile, as a case study. Combining household income, housing, transport, and census datasets, we estimate combined housing and transport cost distributions considering different spatial clusters across the city and then estimating the percentage of housing and transport alternatives that a household can afford through cumulative probability functions. Our contribution is both methodological and policy-based since our work allows a more disaggregated and less biased estimate of affordability problems, analyzing the "degree of choice" that socially disadvantaged groups could make given their budget constraints and possible policy paths to address their affordability issues.

The article is structured as follows. Section 2 provides a literature review on housing and transport affordability and the research gap tackled in our study. Section 3 detailed the data and methods used for the analysis. Then, in Section 4, we discuss the main findings, and in Section 5, we analyze the key impacts of our results in policy terms. Finally, we conclude in Section 6, identifying critical paths to move forward.

2. LITERATURE REVIEW

Housing or transport affordability has been extensively studied and measured in the literature, referring to the financial stress that these two items generate. Either individually or in combination, transport and/or housing affordability has been analyzed mostly in Global North settings: Oceania (Beer et al., 2007; Mattingly & Morrissey, 2014), North America (Luckey, 2018; Salon et al., 2016), and Europe (Coulombel, 2018; Cao & Hickman, 2018).

Housing affordability is usually analyzed using the ratio between housing cost and income (Suhaida et al., 2011; Jewkes et al., 2010; Stone, 2006). This housing expenditure-to-income ratio remains a commonly used measure, especially for national governments and their policymakers. It's generally calculated at a household level (average housing cost and income) or aggregate level, using median prices and median family income (Galster & Lee, 2020), with an 'affordability threshold' defined afterward to identify households that struggle with this expenditure. This threshold is usually set between 25% and 30% of the household income being allocated to housing costs (Hulchanski, 1995; Galster & Lee, 2020).

Similarly, studies focused on transport affordability mostly calculate the ratio between transport expenses and household income after taxes or the ratio between transport and total household expenses. Affordability thresholds, in this case, usually vary between 10% and 20%, depending on the context (Dewita et al., 2020). Furthermore, Falavigna & Hernandez (2016) make a key distinction between observed mobility and potential mobility in terms of affordability metrics. Public transport fares and car-related costs can constitute a significant barrier for low-income households, depriving them of trips that they wish to make or forcing them to use non-motorized modes (Badami et al., 2004; Diaz Olvera et al., 2013). Thus, defining potential mobility (i.e., a fixed number of trips or/and distance traveled) (Carruthers et al., 2005) may be a better path to make comparisons between cities and socioeconomic groups (Gómez-Lobo, 2011).

In recent years, several studies have been developed to explore the joint effect of housing and transport costs (Guerra et al., 2018; Dewita et al., 2018; Coulombel, 2018). These studies have primarily focused on the US (Salon et al., 2016; Luckey, 2018) and Australian cities (Li et al., 2018; Mattingly & Morrissey, 2014). Notwithstanding apparent contextual differences, most of these studies show similar patterns: controlling for built surface, housing is more expensive close to the central business district (CBD) and cheaper in outer zones, as well-establish models from the urban economics literature predict (Alonso, 1964; Mills, 1967; Muth, 1969). These models also predict that if transport costs are considered, people living in the urban periphery will face higher transport expenditures because of longer journey distances, reduced supply, and more inadequate public transport connections; which, in turn, leads to a dependency on cars or forced car ownership (FCO) (Banister, 1994; Mattioli, 2017).

Despite using different methods, either based on aggregate indicators or with a residual income approach, these studies have not addressed the spatial cost variability and the percentage of housing and transport alternatives that different types of households can afford given their budgetary restrictions, which is the approach in our study.

3. DATA AND METHODS

Our main aim is to analyze housing and transport affordability (H+TA) for different household types in Santiago de Chile, focusing mainly on the "degree of choice" of low-income groups. To do this, we follow a three-step methodology. First, we analyze aggregate spatial patterns of housing and transport, using origin-destination data and average rent and purchasing prices per square meter in different municipalities of the city. Second, we divide the housing data into spatial clusters to estimate cost distribution for housing and transport in each one. Third, we calculate the joint cumulative probability of housing and transport costs in each cluster for every household type.

3.1. Household categories, income, and consumption

According to the last Chilean National Census (INE, 2017), around 80% of the households are comprised of a maximum of four people. For simplicity, we focus our analysis on families not exceeding this size defining six household types for the study according to sociodemographic composition. These are single, retired, couples, single parents with one child, a couple with one child, and a couple with two children.

We focus our study on five different dwelling layouts: one room and one bathroom, two rooms and one bathroom, two rooms and two bathrooms, three rooms and two bathrooms, and three rooms and three bathrooms. Using these configurations, we were able to analyze the cost distribution for the six different household types being considered. To analyze the financial impact of housing and transport costs, we use the distribution of household per capita income deciles in Chile. We use a unit measure called "Unidad de Fomento" (UF) for all rental and purchase values, which is a resettable financial unit widely used in Chile that is adjusted monthly according to inflation. During 2019, one Unidad de Fomento fluctuated between 32 and 41 USD.

3.2 Housing costs distribution

We use registered rental and purchase values for new and used housing in Santiago de Chile between 2014 and 2018 (TOC-TOC, 2019). After a data cleaning process to remove outliers and records with missing information, we retained around 90% of our sample: 110,204 records for housing rent and 201,034 for housing purchase. The housing surface range of our data is from 17 to 150 square meters, and its value up to 7,640 UF (approximately US$300,000). For each rental record, the location, surface (square meters), and the number of bedrooms and bathrooms are known. The same data is available for each purchase, except for the number of bedrooms and bathrooms, which have been imputed based on the total surface area using the housing rent database.

We made a first spatial approach calculating average costs for rent values for properties in each municipality. To obtain a comparable monthly cost per household, we estimate an average monthly expenditure for every household type. For purchase data, we assumed a monthly cost for each property, including all transaction costs and a 10% immediate payment and a mortgage loan for the remaining 90% of the housing costs, paid over 20 years with a fixed annual interest rate. This financial scenario is quite standard for Chilean banks' loans, which usually consider a mortgage loan of 80% to 90% up to 30 years. Our analysis does not assess a low-income family's feasibility of obtaining a mortgage loan or paying the initial 10%. We explore the implications of this further in the findings and discussion section of the paper.

Since the purchasing sample is larger than the rented house database and has more homogeneous and representative records of the entire city, we use this database for our analysis. We used the Ckmeans.1d.dp R package to perform optimal k-means clustering on one-dimensional data (Wang and Song, 2011). We got five different geographic clusters with similar purchase values per square meter, obtaining between 13,000 and 66,000 records per cluster. For each group, we fit a probability function for housing cost distribution using EasyFit software (Mathwave, 2004). This way, we classify each dwelling purchase record (with a given price per square meter) in one of the five clusters. Then, we denote H_xkj as the average cost of a dwelling type j of x square meters in cluster k, where x fits the square meters statistics for each dwelling type j.

3.3 Transport costs distribution

To calculate transport costs, we followed a similar methodology to the one proposed by Iglesias et al. (2019). To provide a fair comparison between transport costs of different socioeconomic groups, in each Santiago's municipality, we estimate the transport costs experienced by each household member by different modes, assuming 50 monthly trips per capita (in some low mobility cases indicating 'potential mobility') (Gómez-Lobo (2011) following Carruthers et al. (2005)). The transport modes we included are car, shared taxi, bicycle, walking, and public transport.

To estimate car costs, we disaggregate these into operation and maintenance costs. We include insurance, maintenance, permit, fuel consumption, and highway costs based on travel distances for trips originating in each municipality (SECTRA, 2015). For shared taxis, we estimated the fare using an average distance-based scheme obtained from reported fares (Domarchi et al., 2019). For public transport, we use the most expensive fare (trips involving Metro during the rush hours, which is 15% more expensive than the bus-only fare) charged for adults, students, and the elderly (Metro S.A., 2019). We use an upper bound for bicycle costs corresponding to the monthly subscription of Santiago's main bike-sharing system (Bike Santiago, 2019).

We calculate the average transport costs by mode originating in each municipality in Santiago. These costs are used with the main spatial mobility trends in the city in each mode to compute the distribution of monthly per capita transport costs for households in every municipality, replicating the trip distances and current modal share for trips of work or education purpose (SECTRA, 2015). The lower bound for the transport cost of a household member corresponds to assuming that the person walks to every trip destination, while the upper bound corresponds to using a car every time. By using the modal share reported for each municipality in each previously defined k-cluster, we attached a probability value to each possible cost for each household type j (T_kj). This estimation implicitly assumes that if a household wishes to locate in a particular place, (i) its members will follow the patterns of transport use (observed modal share) in that place and (ii) the modal share determines different types of people that use just one of the modes for every trip.

3.4 Joint cumulative probability of housing + transport costs

Theoretically, the joint cumulative distribution function of two random variables, X and Y, is defined in Equation 1. If X and Y are independent, the function can be expressed as Equation 2.

$$F_{XY}(x,y) = P(X \leq x, Y \leq y) \qquad (1)$$

$$F_{XY}(x,y) = F_X(x) \cdot F_Y(y) = P(X \leq x) \cdot P(Y \leq y) \qquad (2)$$

We apply this to our H+T model. After proving the independence of our housing and transport data[1], we can estimate our H+T model as the joint cumulative probability $P_{H,T|k,j}$ of housing (H) and transport (T) costs in the cluster k for a particular household type *j* as the following expression:

$$P_{H,T|x,k,j}\left(H_{xkj} \cap T_{kj}\right) = P_H\left(H_{xkj}\right) \cdot P_T\left(T_{kj}\right)$$

where

$P_T(T_{kj})$: represents the cumulative probability of a particular monthly transport cost in spatial cluster k for household type j

$P_H(H_{xkj})$: represents the cumulative probability of a particular dwelling cost (x square meters in spatial cluster k) for household type j

Finally, considering a maximum expenditure of 45% of income devoted to housing and transport, we estimated the probability of a household j to live in a specific type of dwelling and use a particular transport combination in each cluster.

4. FINDINGS

Santiago's high incidence of residential segregation can be seen in Figure 1. Using over 200,000 housing transaction records, we created 5 clusters (used for all analyzes hereafter) based on the average price per square meter (the higher the cluster, the more expensive its land). Similar patterns

[1] We used distance correlation to perform a statistical test of dependence with a permutation test. We apply this test between the housing and transport vectors using the energy R package, measuring both linear and nonlinear relation between variables. For each cluster, we obtain 0.02 ≤ dCor ≤ 0.03, leading us to treat both vectors as independents.

were found in terms of rental values. The Northeast sector is the most expensive (Clusters 4 and 5), while average city values are mainly concentrated in central and pericentral sectors (Cluster 3). The lowest housing cost values focus mainly on peripheral sectors (Clusters 1 and 2), with some exceptions in few northern, southern, and western areas around the City center. When analyzing the distribution of monthly mortgage values by cluster, we found that the variance within each cluster increases as prices increase. Despite this variability, there is a relatively small intersection among clusters. For example, 85% of monthly mortgage values of the Cluster 5 are above 0.3 UF per square meter, which corresponds to the 92nd percentile of 'medium class' Cluster 3.

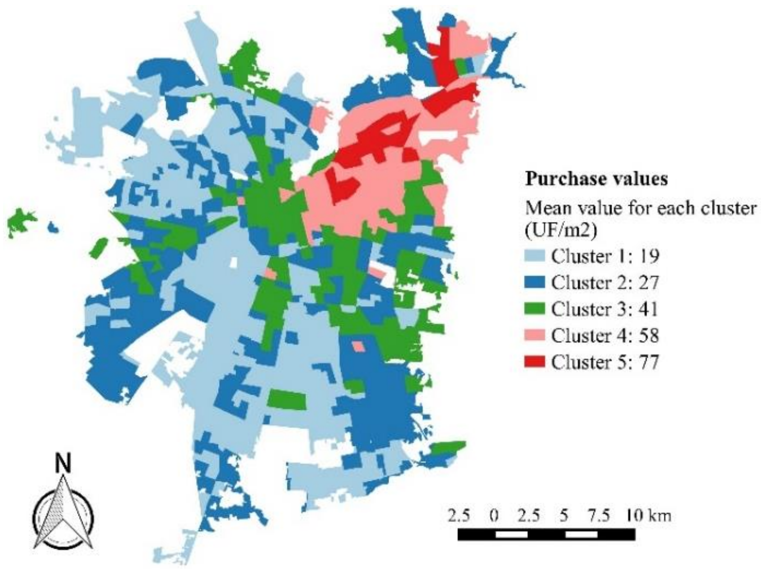

Figure 1. Housing clusters and its mean purchase value in Santiago (left) and average rent values in Santiago (right) (Source: Own elaboration based on TOC-TOC, 2019)

Overall, the differences among cluster housing prices are consistent with urban and transport conditions seen in those places. In Clusters 4 and 5, mostly located in the northeastern cone, the high housing prices are correlated with the attractiveness and convenience that those places offer to different households. On the built environment side, these clusters have high-quality urban environments (Tiznado-Aitken et al., 2018; Rossetti et al., 2019), more green areas (Reyes & Figueroa, 2010), and a high concentration of economic activities and basic services (Iglesias et al., 2019; Suazo-Vecino et al., 2020) compared to Clusters 1 and 2. This is not just an outcome of market equilibrium in the city. In fact, the wealthiest quintile benefits from 2.5 times more 'non-housing public investment than the poorest quintile (Iglesias et al., 2019). On the transport side, Clusters 4 and 5 experience shorter travel times by public transport (1.5 to 3.7 times less), and their average car trip distance is 13.4% lower than Clusters 1 and 2. These shorter travel times allow a better multimodal accessibility level and enable the use of active modes.

Transport costs show a spatial pattern that mimics the one arising from the high socioeconomic segregation observed in the city, as Cox & Hurtubia (2016) found. The use of the car in Santiago is mainly concentrated in high-income households that usually possess more than one car (SECTRA, 2015). Beyond purchase, they can afford the high costs associated with their operation, maintenance, parking, and urban highway fees. Meanwhile, the modal share of public and active transport modes is particularly high in central, peri-central, and peripheral areas (Clusters 1, 2, and

3). The mobility habits of people living in peripheral areas suggest an optimistic scenario for environmental sustainability but pose relevant challenges on social sustainability since the accessibility to services is restricted by the distant location of key urban opportunities and the high dependence on walking and cycling (Sagaris & Tiznado-Aitken, 2020).

While the walking share (with zero cost) is similar among all clusters, public transport use (in contrast to car use) has a strong impact on the density differences among clusters. Comparing Clusters 1 and 5, on average and for the same number of trips, the latter group spends 15% more on transport than the former. Moreover, only income deciles 9 and 10 can assign less than 15% of their income to this item regardless of the mode used. To accomplish that threshold, income deciles 2 to 6 are forced to use active and public transport modes, spending otherwise on average, between 28% and 79% of their income on daily car use.

These trends in housing and transport costs can generate a variety of scenarios when analyzed together. Figure 2 allows us to depict one of the most critical household types in our analysis: a 4-member family (two adults and two children) from deciles 1 to 6, devoting a maximum of 45% of their income to housing and transport expenditures. The oblique lines represent 45% budget for households in the first six income deciles, in ascending order from left to right. The denser (blue) the area, the more that particular housing and transport costs combination exists in the city. Thus, the greater the volume under the oblique lines, the more housing and transport alternatives are available for that income decile.

Notice how in low-cost locations, the variability of the sum of housing and transport costs is very low, yielding a distribution with a very pronounced peak density. This contrasts with the more expensive locations where the alternatives offer a wide variety of combined costs (which implies a much lower peak density). The five figures show that almost no feasible options really exist for the lowest income decile in any of the clusters. The few viable alternatives for the second-lowest income decile are mostly located on Cluster 1 and Cluster 2 (Figures 2a and 2b, respectively), in peripheral areas of the city with poor public transport services and opportunities. In contrast, low-medium and medium-class (Deciles 3 to 6) can afford every combination on Cluster 1, but they cannot afford the car-based locations in Clusters 4 and 5 (Figures 2d and 2e, respectively), where the best accessibility levels and public space quality concentrates. As we expect, mixed alternatives can be found in Cluster 3 (Figure 2c), and clear trade-offs can be made to fulfill the 45% threshold: more cheap housing using a combination of public transport and car, or more expensive housing using mainly active transport modes.

We assessed the population's overall freedom of choice, considering different income deciles and their probability to afford the combined cost of housing and transport in different parts of the City (Figure 3). The blue curve represents the cumulative probability of a household across the whole city requiring given transport and housing cost. The black curves represent exactly the same for houses within each of the 5 clusters (Cluster 1 being at the extreme left and Cluster 5 at the extreme right in the Figure). Vertical dotted lines in green represent the average 45% budget for the first six deciles. Therefore, the intersection between dotted lines and curves represents the percentage of feasible options considering combined housing and transport costs.

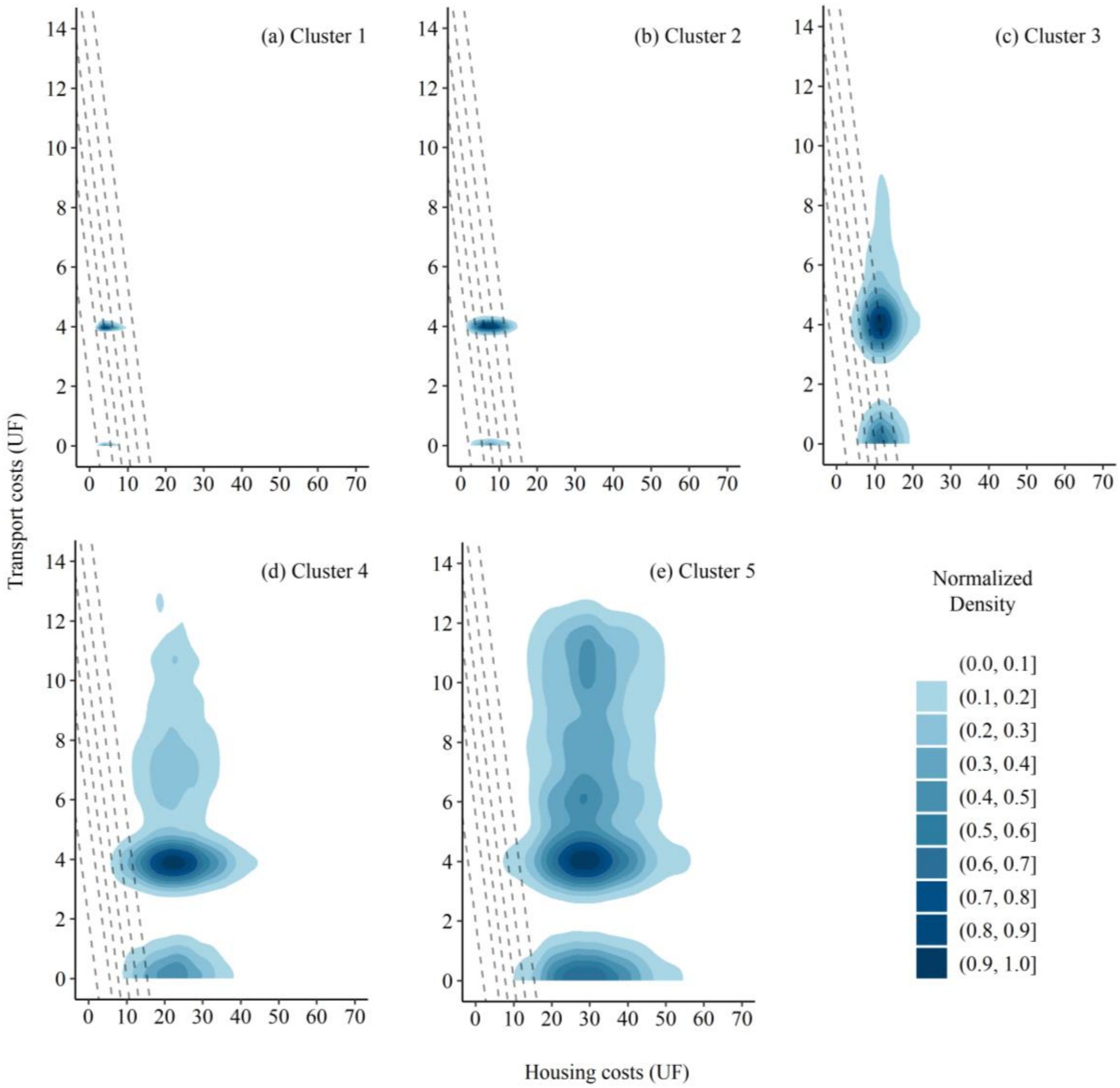

Figure 2. Density of housing and transport costs in Santiago for a two adults and two children. The clusters are ordered starting from the top left with the cheapest Cluster 1 to the bottom right with the most expensive Cluster 5 (Source: Own elaboration based on TOC-TOC, 2019 and SECTRA (2015))

The figure shows that the first three (lowest income) deciles can choose from less than 20% of housing and transport combinations across the city, while the most affordable options for these deciles are concentrated in Clusters 1 and 2. This is a conservative scenario since our analysis does not consider the feasibility of getting a mortgage credit or having the 10% of the purchase cost for the down payment. In Santiago's context, these population groups cannot access any private housing type since they do not meet the minimum income requirements established, being highly dependent on state intervention (social housing or focalized subsidies) which has exacerbated their peripheral location and social segregation.

The figure shows that these affordability issues are not only suffered by low-income families but also by low-middle- and middle-income groups. For example, the 4th to 6th income deciles can afford between 30% and 65% of the existing housing and transport combinations but can choose from less than 6% of those offered in Clusters 4 and 5. These groups usually are neither poor enough to access government housing or benefits nor rich enough to easily access mortgage loans, making their housing and transport choices very limited, unless incurring in practices that translate into significant financial stress.

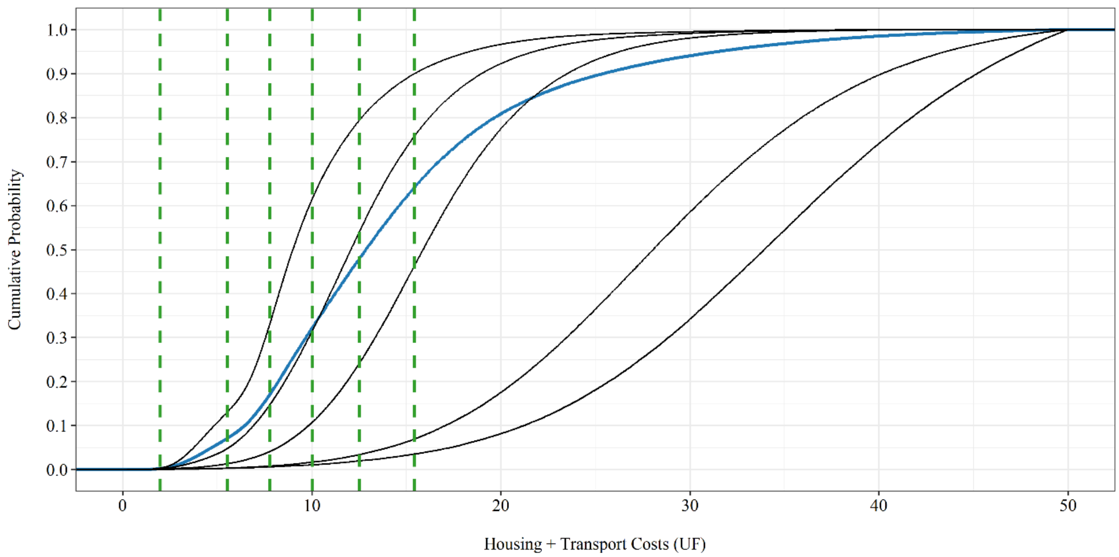

Figure 3. Cumulative probability of housing and transport costs in Santiago (Source: Own elaboration based on TOC-TOC, 2019 and SECTRA (2015))

Similar overall results (as shown in Figures 7 and 8) were found for the other household structures studied: single, retired, couple, single parent with one child, and couple with one child. Two particular cases that are important to highlight are retired people and immigrants, given their high economic vulnerability. In December 2018, 50% of the 684,000 retirees who received an old-age pension (the most massive pension modality in Chile) earned less than 5.5 UF each month, which assigns them to deciles 1 and 2. Even at locations with the least transport expenditures (like for the Municipality of Pedro Aguirre Cerda, in Cluster 1, where almost 60% of all trips are on foot and, thereby, with zero cost), the 45% housing and transport threshold leave no feasibly affordable housing options for retired people. This means that living alone for over 300,000 retirees is literally impossible. Therefore, they have to live with their families, live in zero-cost informal housing, or have their housing costs paid for by their family or someone else.

Immigrants represent 7% of the Metropolitan Region population (INE, 2017). Although their average educational level is higher than that of Chilean residents, very different realities coexist. The municipalities with the highest proportion of immigrants are Independencia with 31.2%, followed by Santiago with 27.5% and Estación Central with 16.6% (INE, 2017). These municipalities are located around the city's historic center with good accessibility, alleviating possible affordability issues on this dimension. However, more than half of immigrant workers earn less than 1.4 mínimum salaries (Observatorio Laboral Metropolitana, 2019), rendering them unlikely to afford housing in the formal market.

The housing expense for immigrants exceeds monthly income for the first income quintile and represents around 40% of the second and third income quintiles (CASEN, 2017). This affordability crisis translates into a considerable housing deficit in the region. As of 2017, around 30,000 new housing units are required for immigrants in the Metropolitan Region for several reasons. The cohabitation of two or more family groups in the same household ("allegamiento") is the main one (64%), meanwhile living in overcrowded conditions, e.g., large families sharing studios designed for single persons or couples, representing 27.8%. Finally, the remaining 7.7% corresponds to families that require a new home given low standards of habitability and poor construction quality of their current one (Fundacion Vivienda, 2018).

6. CONCLUSIONS

Combined H+TA analysis has received increasing attention among academics and practitioners worldwide in the context of the improved development of social welfare policies to support vulnerable population groups. Most of these studies have defined an affordability threshold for H+TA using average indexes. Moreover, a large body of literature has been devoted to Global North settings, with Latin American cities receiving much less attention, despite facing significant higher inequality, poverty, and urban segregation issues.

Our work contributes to addressing some of these research gaps by measuring transport H+TA distribution for different types of households in different areas of Santiago de Chile. We demonstrate that the high combined cost of housing and transport severely limits the housing location choices of many families, especially disadvantaged household types as low-income families with children, older people, and immigrants. The prices in locations with high accessibility and urban standards (Clusters 4 and 5) are out of reach of all of the families mentioned above, leaving peripheral and poor-connected areas almost as the only option for these households. Nevertheless, they still spend a disproportionately high share of their income on H+T costs anyway. Even in these locations, the choice alternatives are below 20% for the three lowest income deciles. The income deciles 4th to 6th can choose between 30% and 65% of the housing and transport combinations, but less than 6% of the most vibrant and best-served areas in the City (Clusters 4 and 5).

These results show the importance of designing joint housing and transport policies that address the economic stresses of Santiago's lower- and middle-income households. State policies and local housing and transport development projects do not as yet appear to be sufficient, so more decisive action is needed to locate affordable housing in locations with good public transport connections for the most vulnerable groups. An integrated social impact and accessibility evaluation of housing, land use, and transport policies for different groups in Santiago would be a key step ahead of this study. As discussed in the previous section, housing subsidies, regulatory incentives, road pricing, or public transport subsidies could have a strong redistribution power to avoid deepening the inequities that these households live in other social dimensions in their everyday life.

Further work should also seek to include a time poverty dimension in this analysis. Despite the vast literature on social exclusion, a still limited number of researchers have started to investigate the uses, causes, and potential consequences of time poverty (Williams et al., 2015). According to Encalada (2015), if we consider the population between 18 and 65 years in Santiago, 26% work at least 12 hours a day (including the time involved traveling to/from work), and 32% have less than 2 hours of free time a day. Moreover, the time use among socioeconomic quintiles and the household members shows deep inequalities. For example, when we analyze gender, women spend less time in leisure, social life, paid work and studies, and spend more time in unpaid work. These imbalances are another inequality dimension conditioned by housing and transport affordability since time use and income are strongly linked. Therefore, the impact of urban configuration on TCP dimensions, which are in turn affected by H+TA, has not been directly analyzed in the literature. However, affordable housing and transport studies usually approach the income dimension of poverty, ignoring the time poverty aspects associated with people's daily activity and mobility needs, which is highly dependent on location and transport "choices".

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