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Long-distance commuting and real estate investment linked to mining: The case study of Concepción metropolitan area (Chile)

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ABSTRACT

This manuscript discusses a little-studied aspect of mining-related long-distance commutation, such as the real estate investments of its workers in their home cities. Based on surveys conducted with miners and interviews with local experts, this work analyzes this issue specifically in Concepción, Chile. This city would act as a hinge for labor migration, which will translate into a return on investment that would greatly strengthen the housing market. The results indicate that mining emerges as a facilitator of acquisitions for first-time homeowners, something that is linked to public subsidies. This contrasts with the traditional image of miners as large investors and highlights the importance of public policies for the emergence of real estate growth linked to mining in Chilean regions.

1. Introduction

Historically, mining has been one of Chile's main sources of wealth. Since the country's independence, the export orientation of its economy has shown cycles linked to the production of saltpeter and copper, which explains Chile's economic growth in the 20th century (Arellano, 2012). As for copper, Chile's most important export today, it is mainly extracted in the northern regions of the country. From the Arica region in the north, to the O'Higgins region south of Santiago, the capital, there are 26 large mines (Fig. 1) with a production of about 5,500 tons per year, according to the Chilean Copper Commission (Comisión Chilena del Cobre, COCHILCO, 2019). The importance of copper in international markets has made such mining very profitable for companies whose employees have high wages compared to the country's average and benefits such as health insurance, educational scholarships and other incentives that have contributed to the image of copper miners as "privileged" (Leiva, 2009). As a result, there has come to be a relationship between mining and the construction and commercial sectors in mining cities, the latter being highly dependent on the health of this activity (Rehner and Rodríguez, 2018).

At the same time, at the international level, there has been a shift from a "mining camp" model, sometimes leading to the appearance of definitive settlements; to the subcontracting of workers in other regions and their mobilization through a long-distance commutation phenomenon known as FIFO, or *fly-in, fly-out* (Storey, 2001; Perry and Rowe, 2015). This phenomenon, which will be further explained in this manuscript, has not only diversified the origin of the labor force in mining, but has also expanded the flows of consumption and investment resulting from this activity to other communities, as this research will demonstrate for real estate investments. In this sense, the Chilean State has shown to have a fundamental role, through public subsidies, to facilitate access to housing, something that has been studied in other contexts (Fuster-Farfán, 2019) but not in its connection with mining workers' investments. This idea can be associated with the difficulties that exist in Chile to access housing and other controversial issues (low retirement pensions or high cost of education and health). In this context, the real estate sector would act as an additional compensation, generating extra income through leases that would act to solve these difficulties, linking this aspect to the political economy of housing (Aalbers, 2016).

Linked to the above, the main objective of this work is to analyze and interpret the importance, extent, typology and consequences of investments in the real estate sector from copper mining workers in the metropolitan area of Concepción, located in the central zone of Chile.

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This city becomes a catalyst for long-distance movements, generating an increase in capital flows to the territory, which are fixed through the purchase of housing (Harvey, 2001). So, the research question driving this work is whether or not long-distance commutation to the north of Chile has an impact on real estate growth in the metropolitan area of Concepción and, if so, what would be the characteristics of such growth. To try to answer this, a methodology was used that combines the bibliographic review with qualitative work, through in-depth interviews with local experts and the use of data through more than 700 surveys of mining workers who moved from Concepción's airport to the mining cities of northern Chile. This methodology, although it presented some limitations (detailed below) regarding the availability and focus of data collection, as well as the number of questions asked, allowed for an in-depth analysis of real estate dynamics linked to mining workers. The conclusions highlight the implications of this phenomenon and the complementary role that public aid plays in consolidating this process.

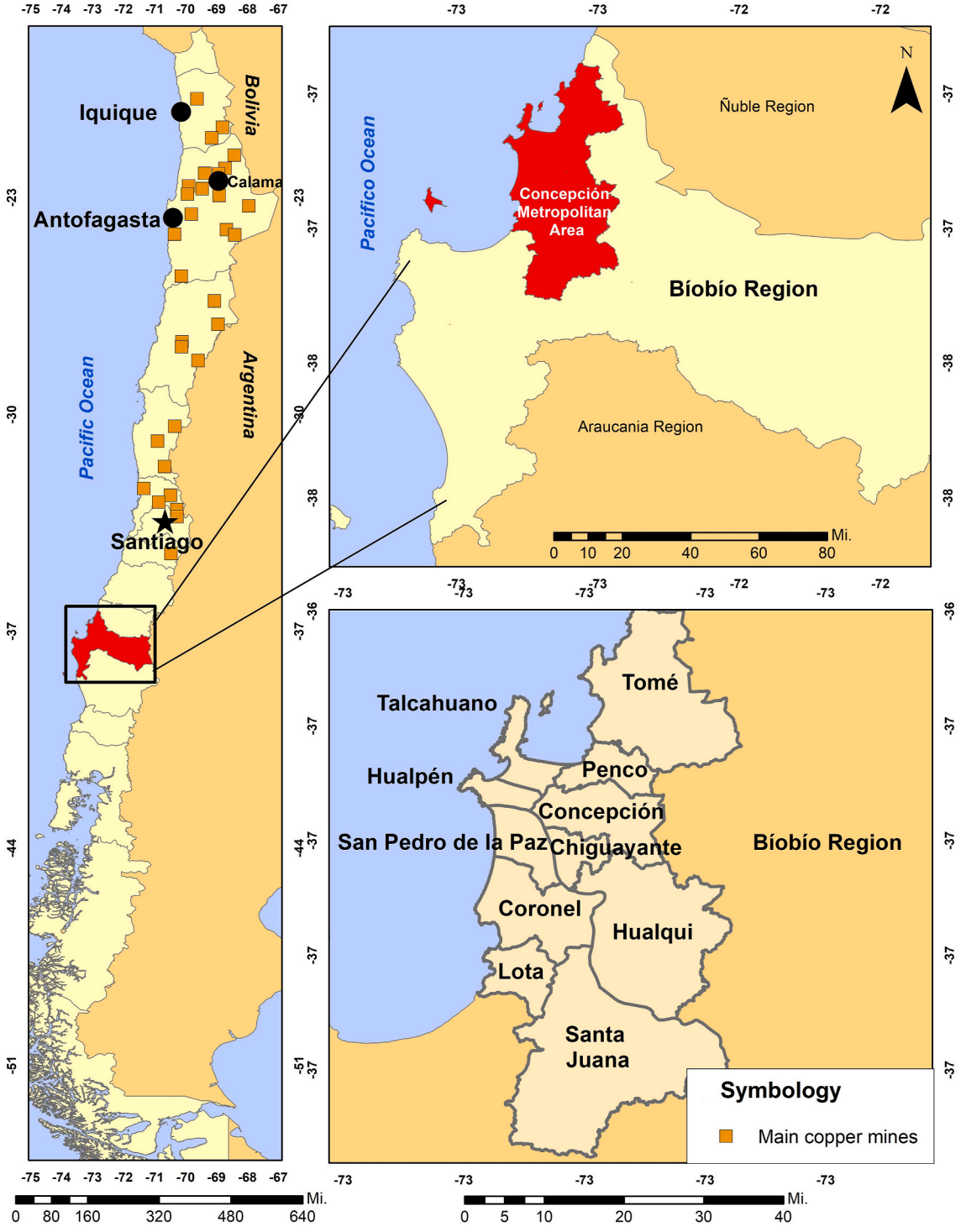

Fig. 1. Case study and location of the main copper mines in Chile.
Source: Authors.

2. Literature review: long distance commutation in mining and urban growth

Unlike what happens with industry and services, mining is an activity that appears irremediably linked to the existence of minerals in the subsoil, which is why it is concentrated in certain regions (Fleming et al., 2015; Perry and Rowe, 2015). Sometimes, these deposits are found in areas with extreme climates, sparsely populated or with substandard communications, which makes their extraction difficult (Brueckner et al., 2013). Historically, a typical strategy for companies was to settle near mineral deposits through the construction of camps that, over time, became permanent settlements that provided housing for employees, commerce and services (Garcés, 2003). However, with the advances in transportation and consequently lower costs, new communication technologies and the outsourcing of many services related to mining (Durán-Palma and López, 2009), there has been a trend towards the "importation" of workforce working in the mining sites. This has led to a new paradigm with a pendulum nature of traveling back and forth from other regions, known in the international literature as *fly-in, fly-out* (FIFO). This refers to the journeys made by mining workers from their places of origin, generally at a great distance from the mining sites. They work intensive shifts of several days and their travel and lodging are paid for by the company, after which they return home (Storey, 2001; Perry and Rowe, 2015; Haslam and Hoath, 2014).

There have been labor, social, economic and spatial effects as a consequence of FIFO (Perry and Rowe, 2015; Langdon et al., 2016; Aroca and Atienza, 2011). However, most studies have focused on mining communes, with few studies aimed at analyzing the effects of long-distance commutation in the places of origin (Haslam, 2016; Langdon et al., 2016). In these cases, some positive effects can be seen such as an increase in income from high mining wages or economic diversification. On the other hand, among the negative effects of FIFO are the problems of adaptation of traditional economies to these periodic movements of local labor and dependence on mining areas, or the lack of autonomy over the local development process itself (Storey, 2010). The importance of these effects and the opportunity to analyze them in relation to a little-explored aspect such as the consequences of FIFO on real estate growth, more than justifies the interest in this research. Although some studies in Chile have focused on the effects of mining on real estate growth in mining cities (Rehner and Rodríguez, 2018; Rehner et al., 2018), the possibility of analyzing this in the communities of origin is an opportunity to delve further into this topic. The real estate sector has become one of the most robust today, with a strong impact on GDP, employment, and an impact on investment and spending (Aalbers, 2019; Daher, 2013a). It also serves to fix capital in space (Harvey, 2001; De Mattos, 2016). As Lois, Piñeira and Vives point out, the invested capital is immobile, that is, it cannot be relocated without being destroyed and, in addition, it infers the creation of an entire physical landscape for the purposes of production, circulation, exchange and consumption, which transforms cities into mechanisms for absorbing surplus capital, integrating them into the accumulation circuit (Lois et al., 2016).

In this context, the real estate sector and the construction industry are much more relevant than in the past, giving their investments a greater weight in the profound urban metamorphosis that is being experienced today (De Mattos 2016; Waldron, 2018). However, it presents a strong trend of concentration in the territory, with a clear metropolitan bias and towards higher-income communities (Aalbers, 2020; Daher 2013b). Thus, the spaces where the highest income sectors live and where the price per square meter of land is higher, is where real estate developers and investors can see the existence of a greater solvent demand, both for housing and specialized services. On the contrary, the areas of residence of the poorest sectors and those with less solvent demand would receive less real estate investment (Sanfelici and Halbert, 2019; De Mattos, 2016), and therefore would reinforce this duality.

One element that has reinforced this situation is the expansion of loans for the purchase of housing, either privately through banking and credit institutions, or by the State through the granting of subsidies for the purchase of housing in the market or in tax exemptions (Ferguson and Smets, 2010). In this sense, countries like Chile have exemplified the expansion of public subsidies for the acquisition of housing from the lower to the middle classes (Hidalgo et al., 2019). With these subsidies, the momentum of economic growth closely linked to the real estate sector was expanded since the 1970s, when the land market was liberalized (Hidalgo et al., 2014). This increase in the granting of mortgages and subsidies acts as an incentive to demand, boosts the real estate market and often turns the home into a financial asset in which to invest, with which to obtain mortgages or generate a profit, through its lease or future sale (Aalbers, 2016). In this way, some areas of the city become more attractive to buyers: downtown spaces, higher quality residential areas in or near downtown, and spaces with amenities for second homes or international tourism. These processes have expanded from Anglo-Saxon countries to southern Europe and Latin America (Janoschka and Sequera, 2016; Borsdorf and Hidalgo, 2007; Vives-Miró, 2011).

According to Vergara-Arribas (2020), in Latin America there is a research deficit on the real estate sector, its logistics, mechanisms and discourses in the production of space despite its growing relevance and its influence on the reproduction of spatial inequalities and social stratification. This intersects with the aforementioned research deficit on the effects of long-distance commutation in the places of origin that will be discussed later; with the hypothesis that this process of transforming housing into financial assets and the existing socio-spatial segregation would have been reinforced with mining investments.

3. Methodology

This work was carried out using a mixed methodology, in order to know the amount, destination and characteristics of the investments of the workers who commuted from Concepción to northern Chile, to be employed in copper mining. To do this, surveys, interviews and secondary data were used, which led to triangulation of the information, a method also used in other studies on commuting (Devenin and Bianchi, 2019; Andrews, 2018; Lacey et al., 2017). First, a literature review was carried out, which revealed the scarcity of works on the subject of study developed in this manuscript. Then, an attempt was made to incorporate statistical data to identify the phenomenon of real estate investments produced by copper mining, through a survey at the Carriel Sur Airport in Concepción. With the permission of the Port Authority, a group of specially trained surveyors traveled daily for two weeks to survey passengers on flights originating in Concepción and bound for a northern mining city (Antofagasta, Iquique or Calama, depending on their frequencies) from one of the three airlines that operate these routes directly (Latam, Sky Airlines, and Jet Smart). In the airport departure lounge, more than 1,800 surveys were carried out first, with a filter question on whether or not the respondent worked in mining or in any activity related to this area (logistics, services, mechanics, health, etc.). Prior to conducting the survey, respondents were briefly informed about the nature, purpose of this study and use of the information collected.

The fact that most of the questions in the questionnaire referred to non-numerical parameters (type of property and commune in which it was invested, use that was given to the property, form of purchase financing) made it impossible to perform an analysis of internal consistency with Cronbach's Alpha to check its validity. Therefore, the validity of the questionnaire was determined by analyzing whether the questionnaire actually measured what it was intended to measure, considering content validity as a consistency parameter (Drost, 2011). In this sense, a panel of experts from the Department in which the authors work reviewed the questionnaire and confirmed that its items were representative of the theoretical construct and research objectives that the questionnaire was designed to evaluate.

Valid surveys of the 705 mining workers surveyed provided enough

statistical significance to allow analysis of the results (Table 1). The survey model consisted of 12 questions related to the sociodemographic characteristics of the workers and the details about possible real estate investments they made. The conciseness of the questionnaire was an attempt not to excessively lengthen the boarding times of the passengers. Once the work was finished, all the surveys were processed and analyzed with the statistical software SPSS v.22 to obtain the necessary information for the study. These surveys were complemented with secondary statistical information on the evolution of building permits in the study area, data that were requested by the Transparency Law from the Ministry of Housing and Urban Affairs.

Along with this, in-depth interviews were conducted with key actors related to the real estate sector. These were divided into two large groups: real estate agents and real estate companies, which were joined by a local expert who represented the Chilean Chamber of Construction (CChC) perspective and three representatives from the public sector. Here, the objective was to obtain the opinion of these actors in relation, on the one hand, to the characteristics and evolution of the real estate sector in Concepción, and on the other, to the origin and typology of the existing demand in relation to it. In total, twenty-one interviews were conducted to obtain a complementary view of the surveys (Table 2), first using a list of key actors and then applying the "snowball method" to contact other potential actors previously undetected. This was done until a "saturation point" was found in the information provided, that is, until it became redundant, which allowed to validate the information obtained. The interviews, with a semi-structured approach, were conducted in person by the authors and their duration ranged from 25 to 60 min. Before starting each interview, the interviewee was asked to sign a written consent informing the purpose of the interview, its recording and subsequent transcription, a common approach in this type of study (Creswell, 2014; Patton, 2015; McCracken, 1988). In order to promote freedom in the expression of opinions, it was decided to resort to anonymity when transcribing certain parts of the interviews in the manuscript, and a code was given to each of the interviewees to be used in this work.

Among the limitations of this study, there were three main ones, two referring to surveys and the last one to in-depth interviews. First, the primary source of information was mining workers with a shift job in mining. It is possible that having surveyed a greater number of executives would have given different results concerning real estate investments than those indicated by the workforce. However, the surveys collected the reality of mining workers residing in the BíoBío region, which has allowed us to obtain a real image of this territory, although not of the investments of all strata of mining employees. Second, the need to limit the number of questions implied not collecting some data that could have been of interest (e.g. year in which the purchase was made, size of the good purchased, neighborhood or sector in which the investment is located). These questions, despite being complementary, pose some limitations in inference terms to the results of the research. Finally, the semi-structured interview style adopted in this work allowed participants to share their experiences and perspectives. Through the implementation of semi-structured interviews with key actors, the study focused on specific issues, concerning at one point in time, which would lead to difficulties in building a longer story over time on real estate investments in the Metropolitan Area of Concepción. In this sense, an attempt was made to seek the opinion of experts with many years of experience in the sector, which would facilitate a greater temporality in their points of view. The work of the interviewers was also focused on bringing to light these dynamics of greater distance in the urban growth of the study area. This information was later contrasted with the temporal evolution of building permits, to confirm that there was a similarity between the two sources.

Table 1
Design of the survey sample to mining workers.

Universe	Travelers in a departure lounge
Environment	Carriel Sur Airport–Concepción, Chile
Collection method	Personal survey with structured questionnaire
Sampling unit	Workers linked to the mining sector
Population size	Non-defined
Sampling type	Non-probability convenience
Confidence level	95%
Sample error	±3.7%
Fieldwork	September 2018
Number of valid surveys conducted	705
Sample control	Implementation and monitoring of the fieldwork by the authors of the research

Source: Author.

Table 2
Local actors interviewed: name, position and company or institution.

Actor	Position	Company/Institution
Diego Poblete	Head of Studies	Chilean Chamber of Construction
Christian Kother	Commercial Manager	San Sebastian Real Estate Consortium
Giancarlo Carro Donna	Manager	Carro y Cía. Real Estate agent
Tirso Ortiz	Manager	LG Real Estate agent
Carlos Mena	Project Director-Region VIII	Aconcagua Real Estate
Patricio Reyes	Manager	Andalué Real Estate
Patricio Pacheco	South Zone Chief	Arms Real Estate
Joaquín Cortés	Sales Manager	FG Real Estate
Nathalie Dubois	Development Manager	Future Real Estate
Roberto Schmidlin	Commercial Manager	Future Real Estate
Álvaro Greene	Central-Southern Commercial Assistant Manager	Icuadra Real Estate
Felipe Alcerreca L.	Commercial Manager	Madesal Real Estate
Cristian Páez	East Area Sales Manager	Paz Real Estate
Jorge Guardia	Regional Manager	Pocuro Real Estate
Valeska Reyes	South Area Sales Manager	Socovesa Real Estate
Gonzalo Chávez	Neighborhood Development Deputy Manager	Valmar Real Estate
Jaime Laucirica Cohn	Manager	J.L. Real Estate Management
Paula Bórquez S.	Manager	Scarabelli Properties
Jorge Urrea	Head of the Planning and Territorial Planning Department	Bío Bío Regional Government
Rodrigo Ulloa	Urban Planning Advisor	Municipality of San Pedro de la Paz
Karen Rudiger	Urban Planning Advisor	Municipality of Concepción

Source: Author.

4. The metropolitan area of Concepción and its real estate growth linked to mining

The metropolitan area of Concepción is located in the south-central area of Chile, about 310 miles from the capital, Santiago (Fig. 1). According to the 2017 Population Census, it has a population of 985,034 inhabitants, concentrating 63% of the total population of this region (INE 2019). The Metropolitan Regulatory Plan of Concepción defines this area as a functional and hierarchical territory, made up of eleven communes: Talcahuano, Hualpén, San Pedro de la Paz, Santa Juana, Penco, Tomé, Coronel, Lota, Hualqui, Chiguayante and Concepción, all well connected to each other. Concepción is also the city with the greatest access to the country's capital as Carriel Sur Airport is only 10 min from downtown, offering more than ten daily flights to Santiago as well as other direct flights to the country's mining areas.

As for the real estate sector, the metropolitan area has experienced strong growth in recent years, with an increase in housing supply in various areas, mainly in Concepción, San Pedro de la Paz and Chiguayante (Forcael et al., 2013). In this sense, the building permits

approved in the metropolitan area have experienced a notable increase from the beginning of the 21st century to the present. Even after the 8.8 earthquake (Richter scale) that affected this area in 2010, dynamic growth was maintained as a result of public funds granted for reconstruction. Thus, in recent years, the Metropolitan Concepción has experienced horizontal urban growth (within its urban limits) as well as vertical growth (in its center) due to the increase in real estate investment (Pérez et al., 2019). On the one hand, the real estate market underwent a renovation with the construction of new apartment buildings in downtown due to the limited supply of land for urban expansion in those sectors, which translated into higher land costs and more expensive housing. On the other hand, in sectors that also belong to the metropolitan area, such as San Pedro de la Paz, Penco and Coronel, a horizontal urban expansion model would be maintained because there is still a large area of land available for construction. Therefore, the general trend in the periphery is the appearance of new housing promotions for different social strata, according to the possibility of benefiting from public sector subsidies. This produces phenomena of socio-spatial segregation similar to what occurs in other Chilean cities (Fuentes and Pezoa, 2017; Valenzuela et al., 2017; Águila and Prada-Trigo, 2020).

In a first review of the validated surveys, it was possible to characterize the surveyed mining workers, establishing a profile that corresponded, on average, to high masculinization (94.4%) and predominantly middle age (26–45 years in 68.2% of the cases). Most of the interviewees carried out periodic or shift work (83.1%), these being outsourcing and external or auxiliary mining services. This occurs thanks to cheaper modes of transport and high competition in low-cost flights in the Chilean air market (Contreras, 2018). Thus, the aforementioned disconnection of the mining company with its environment is evident, as well as the subcontracting and segmentation of activities within the companies, which facilitate this type of employment with long distance commutation and contribute to curbing the traditional labor emigration from Concepción to Santiago. In reference to this, interviewee ACT2 pointed out that *the professionals who study here [Concepción], unlike before, begin to stay here, and begin to have more purchasing power and thus develop their families here, and they come and go […] to Antofagasta, to the mining area.*

Another element relevant for the research is the work seniority of the respondents, which was relatively short, with the majority having worked from a few months to five years (39.7%), and with 75.3% of the cases corresponding to a work seniority of less than ten years, which means that the average number of years of work in mining is 8.7. This figure is generally consistent with the start dates of low-cost flights in the BíoBío region. This strategy of the airlines was generated in response to the need to import labor by the mining industry, thus allowing them to disassociate themselves from their direct environment and "import" cheaper labor. This also reduces the possibilities of unionization, which in previous years had caused complications for mining companies (Nem, 2012).

Regarding the effects of long-distance commutation in the Metropolitan Concepción real estate market, 38.3% of those surveyed indicated having bought or invested in real estate, using the funds earned from their mining work. This represents an important transfer of resources from the mining regions to others in the south of the country, which in the metropolitan area of Concepción corresponds to about 260 investments out of the total of 705 respondents. The interviewees pointed out that there is a comparative advantage between income, and therefore the ability to obtain credit, for those who work in mining compared to workers from other productive areas, who lack direct investment capacity:

[ACT15] Mining started two or three years ago [after] a major slowdown and this also brought consequences afterwards, because the people of Concepción who had their families here, went to work there. These *gallos* [dudes] came along and boom! They bought two apartments, a house, left their families loaded and returned [to mining]. Then there was a strike, they got their money and boom! [They bought an] apartment. So, they were investing a lot, they came and bought new cars, which was noticed.

[ACT17] [Investment comes] this last time obviously from mining and from service companies … I meet many clients who are from service companies. Yes, the mining people bring cash to Concepción, earn it elsewhere and bring it to Concepción.

These investments have been made mainly in the communities of San Pedro de la Paz (19.8%), Talcahuano (15.8%), Coronel (15%), Chiguayante (12.6%) and Concepción (13.4%), which coincides with the workers' places of residence and are the main urban expansion areas of the Metropolitan Concepción, as well as with the sectors that have more opportunities for state subsidies when purchasing real estate. This, because the greater profitability and availability of land imply lower building costs, and housing may be eligible for subsidies. Likewise, a spatial relationship is observed between the sectors where the real estate investments of mining workers are concentrated, and those areas of predominantly middle and lower-middle class socioeconomic strata or E, D, and C3 groups (Fig. 2). These areas have had a real estate boom in recent years based on 2002–2015 building permits. This was particularly evident after the 2010 earthquake with the subsidies associated with reconstruction and the boost to urban growth that has continued ever since. The increase in housing supply, added to the new social development policies for access to housing, and the possibility of commuting as a more profitable activity in fields such as mining, would make a target customer invest in housing, thus supporting urban growth in the aforementioned sectors.

Regarding the characteristics of the properties resulting from the investment of mining workers, "houses" figure in 81.9% of the cases, followed by "apartments" in 15.1%, well above "rural plots" and "urban land" (2.7% overall). This may be due to the fact that, in many cases, it was a first-time investment in real estate, such as a house for the family, having received a large number of respondents public subsidies for its acquisition. This showed a marked preference for a "neighborhood life" for the family instead of living closer to the city center in the areas of verticality and urban densification. This decision is explained from an economic point of view because the cost of housing in parts of the metropolitan area such as San Pedro de la Paz, Talcahuano and Coronel, is lower, and as such, more likely to receive public subsidies than an apartment with the same square meters built in Concepción. In the same way, it is possible to explain this investment choice from the demographic characterization of the mining worker, due to their young age range and the fact that they have been working in mining for a relatively short period of time. This means that the miner buys a first house with a short horizon of use, while thinking of buying another one in the future with a higher value, by increasing their purchasing power and using the first house as an investment. As ACT15 pointed out: *today people are projecting up to five years in a house, because they calculate that in five more years they will have a* "delta" *[higher income] and will be able to make a change.*

Against this, the respondents expressed that the destination of the investment corresponds in 74.9% of the cases to a main family home, and therefore, it is a "neighborhood house". In this sense, there is a positive correlation (0.43) according to Pearson's bivariate analysis, between the type of housing in which it is invested and the destination of said investment, associating a house with a residence for the family's main residence, and an apartment with investment in a second home for rent (10.1% of cases), as well as a second residence for recreation in tourist or rural areas (9.8% of investments). The purchase of a property to lease, to the general public or specifically to students (who alone constitute 2.5% of total real estate investments) is recognized as an investment engine, a perspective shared by the experts interviewed as indicated by ACT15: *yes, that* [rent to students] *is evident near the universities, in downtown Concepción … they buy one-bedroom apartments, without parking, it has to be within walking distance* [of the University].

At the same time, it is possible to relate the previous data to the investment amounts: 52.9% of the cases had a total amount invested in

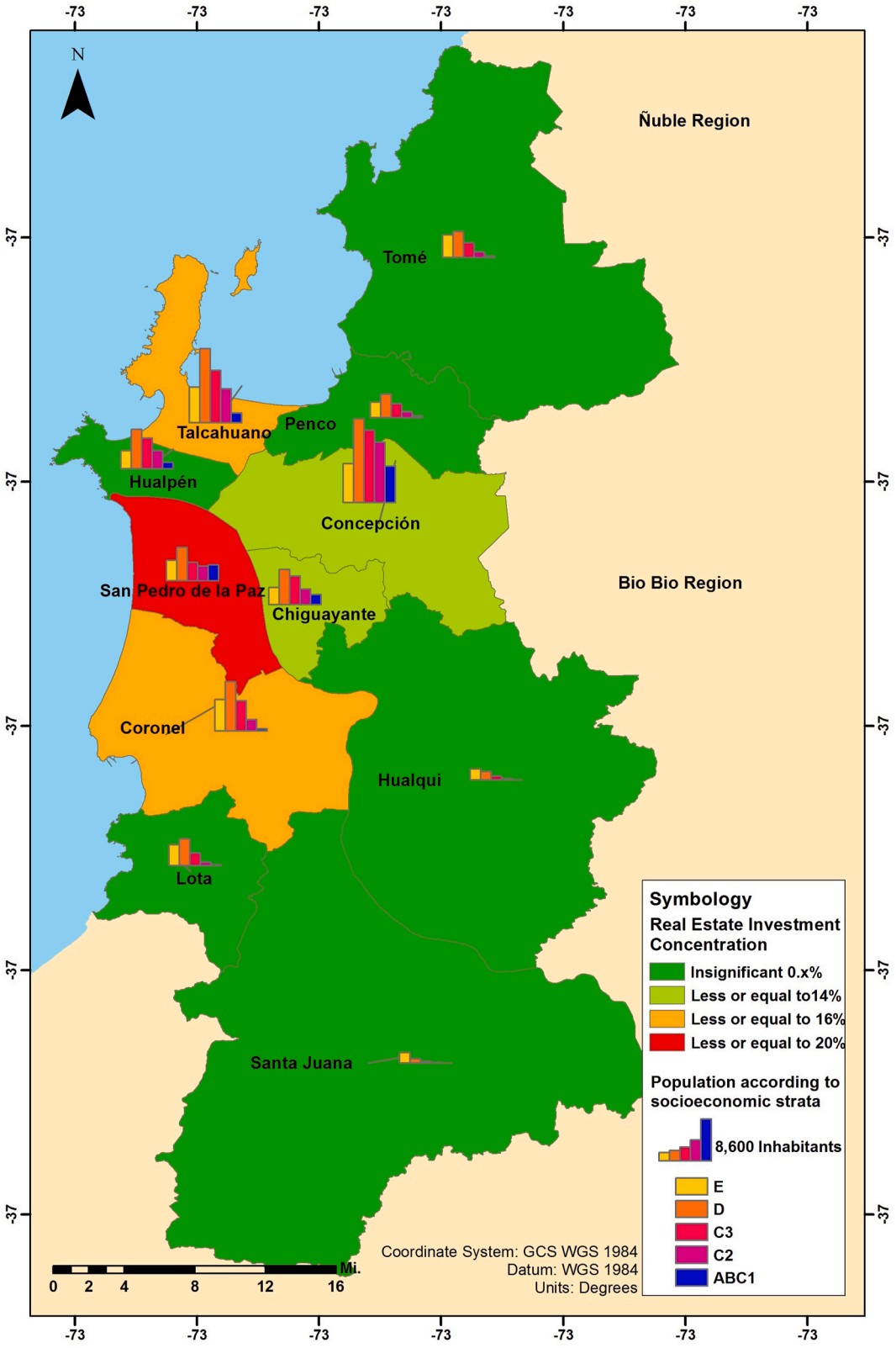

Fig. 2. Concentration of Real Estate Investments and Distribution by Socioeconomic Strata (A-E categories) by Sector in the metropolitan area of Concepción. Source: Author, with data from the survey and INE (2010).

the real estate sector of less than 50 million Chilean pesos (approximately 71,000 dollars[4]), which is attributable to two reasons. First, that most of the respondents were middle-aged contract workers; therefore, their income is low compared to those with direct and older employment in the mining sector, which explains why their purchasing power and investment capacity are moderate. Second, that the maximum amount to access the state subsidy is close to 2000 UF[5] (81,000 dollars or approximately 57 million Chilean pesos) and for those surveyed, a large part of the properties purchased have a state contribution through subsidies, so the amounts invested cannot exceed that figure. Table 3 shows how as the age range of workers increases, the percentage weight in larger investments also increases. On the contrary, those under the age of 25 do not make any investment greater than 100 million Chilean pesos (approximately 142,000 dollars), with which a greater number of years or work would imply a greater amount to invest in the real estate sector. This would have consequences in the commune in which they invest, as can be seen in the concentration of high investments in San Pedro de la Paz, Concepción, and Talcahuano (Fig. 3).

In this sense, when performing a cross analysis according to the type of housing in which mining workers invest, the amount invested and the areas of the Metropolitan Concepción where their investment is located (Fig. 3), it can be observed that Talcahuano, Hualpén and Coronel excel in housing. Other more peripheral communes, such as Penco, Tomé and Lota also stand out, but the lower number of investments explains in these cases the strong representation of houses in their pie charts. Regarding apartments, Concepción, Chiguayante and San Pedro de la Paz stand out, areas that have seen a recent phenomenon of verticalization (Schovelin, 2013). This can be explained as these are the sectors with the highest land prices and where skyscrapers are most profitable. In relation to the plots, 26% are located in Concepción, although Chiguayante and Hualqui encompass 30%, these being the furthest from the metropolitan center and that are typically used as expansion areas for second residences due to their lower levels of urbanization (Rojas et al., 2013). There are two sectors in which the number of rural plots exceeds the other categories: Hualqui and Santa Juana, sectors considered areas of expansion in the future of real estate development in the metropolitan area and, together with Tomé, spaces for leisure, but also for social housing, according to the interviews. As ACT7 pointed out:

Table 3
Investments in real estate by amount invested and age range of investors (percentage) in the metropolitan area of Concepción.

Investment range	Buyer's age range				Total
	15–25 years	26–45 years	46–60 years	Over 60 years	
Less than 50 million pesos (71,000 dollars)	2.5	65.5	31.9	0.0	100
Between 50 and 100 million pesos (71,000 to 142,000 dollars)	1.2	68.2	29.4	1.2	100
More than 100 million pesos (142,000 dollars)	0.0	47.1	49.0	3.9	100
Total	1.6	62.7	34.5	1.2	100

The table shows how as the age range of workers increases, the percentage weight in larger investments also increases. On the contrary, those under the age of 25 do not make any large investment.

Source: Own elaboration based on survey data.

[ACT7] New projects were chosen, one for example, on a land that was considered in Hualqui, which is a new decree, a DS19 [Social Integration Program], where there were 394 houses and today they are all sold in Hualqui, where nobody was interested in building, we went and got recognition from the people and they are houses of very good quality, and that is why the boom, the success it has had.

Likewise, ACT1 indicated that *urban landowners speculate with their price, which makes land cheaper in peripheral areas and, therefore, also explains the expansion of development, which would be possible in the aforementioned areas.* The financing of the real estate investment of the respondents comes partially or totally from mining in 95.6% of the cases, receiving a state subsidy for the acquisition of housing in 24.4% of the cases, which facilitated the investment. Added to this is the fact that, when considering only the large real estate investments made by mining workers (more than 100 million pesos, approximately 142.000 dollars), and the sector where these are located, the results show certain nuances. Most of these investments are concentrated in Concepción and San Pedro de la Paz (more than 50%); followed by Talcahuano and Chiguayante, which together represent 25% of the total. It is observed that large investments are concentrated in the central parts of the metropolitan area.

On the contrary, Lota and Santa Juana (located near the boundaries of the metropolitan area) or Hualpén (industrial zone) are not attractive for investments of this size, thus establishing a clear contrast with respect to the bulk of investments. These sectors correspond to areas with a socio-economic stratification that stands out for its mostly lower class concentration. So, logically, they do not attract higher value real estate investments (Fig. 3), according to what was indicated in the literature review. The results agree with that expressed by Daher (2013b), who affirms that it is in urban spaces where the higher income sectors reside and the price of land is higher where real estate developers and investors see the existence of greater demand for solvency both for housing as for services. This can be spatially observed as Concepción, San Pedro de la Paz and Chiguayante are the areas that concentrate both the majority of investments and the population with the highest socio-economic stratification (ABC1), these being areas where the largest volume of real estate investments is directed.

5. Discussion and conclusions

The results of this work demonstrate that the dynamism of long-distance commutation linked to mining is generating an expansion of mobility throughout the Chilean territory, with the appearance of cities like Concepción that act as a hub when it comes to capturing and redirecting the flow of workers, something similar to the situation identified by other studies (Perry and Rowe 2015; Langdon et al., 2016). Most of the commuters are young, have a relatively short work history and, possibly as middle or operational cadres, turn to mining as an "aid" to acquire their first home, which contrasts with the classic image of miners as large investors identified by Leiva (2009). This may be because large investors (executives, mid-level and senior managers) probably reside in Santiago (where the headquarters of many mining companies are located) and not in those other regions. Therefore, the investments have reinforced the centrality of Concepción and its metropolitan area in a regional context, but surely in a national perspective the reality is different.

This work, in addition to considering the historical understanding of workflows from the places of origin, already addressed in the international literature (Storey, 2010; Langdon et al., 2016), also considers an analysis of capital flows. These stream from the mining areas to the cities of origin and, in doing so, generate expansion throughout the territory of the benefits linked to copper mining. However, the characteristics of the workers lead to an investment that, although important, seems to be largely linked to the complementarity of state aid for housing that has become a fundamental support for real estate development in Chile (Fuster-Farfán, 2019). In relation to the mining sector, this research

[4] The rate of 1 dollar = 703.25 Chilean pesos was used, which corresponds to the average value of the dollar in 2019, according to data from the Banco Central de Chile (2019).

[5] The UF (Unidad de Fomento) is a unit of account developed for the real estate sector. This index is updated daily, subject to revaluation in accordance with the variations in inflation.

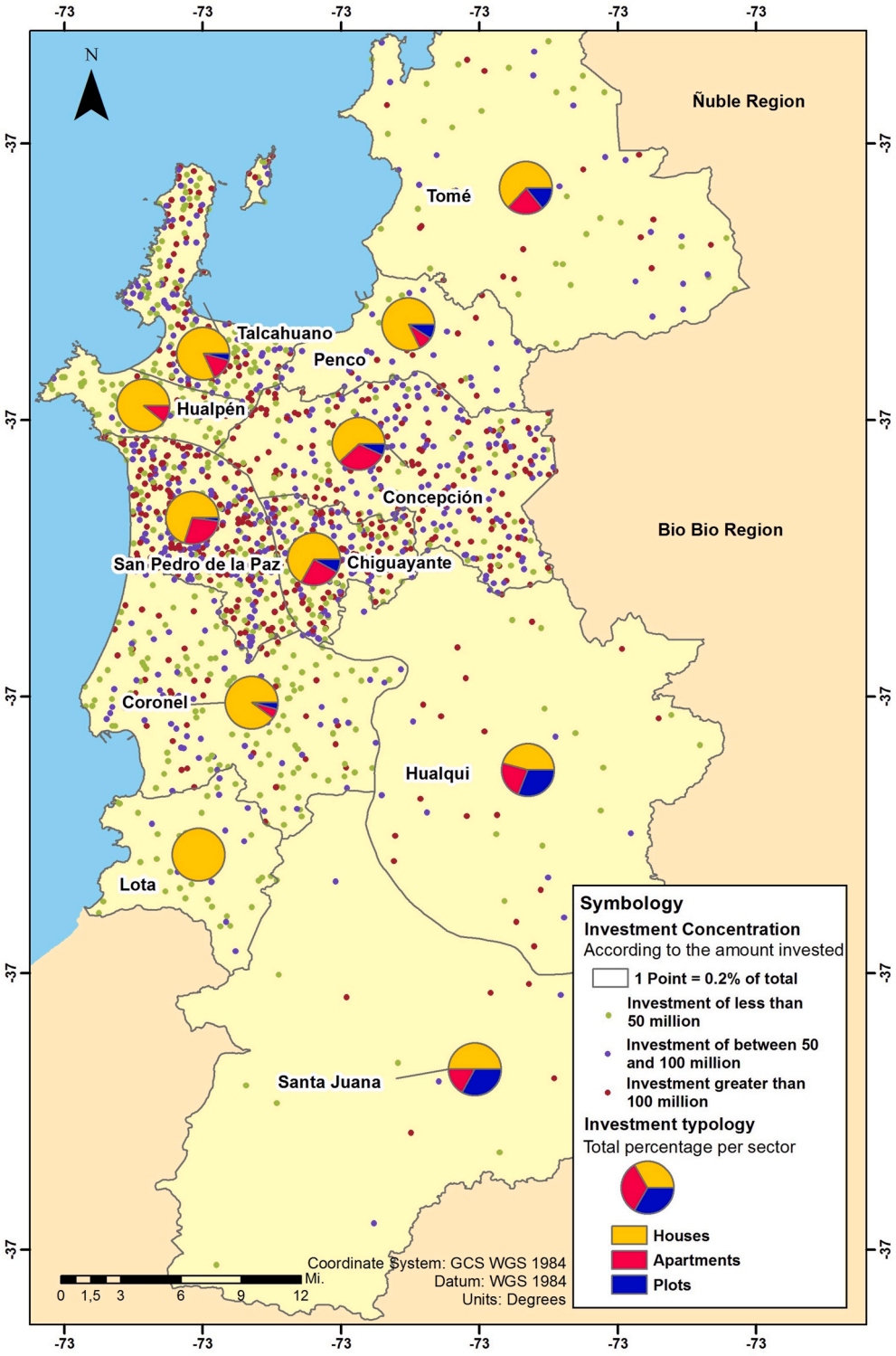

Fig. 3. Real estate investments by type of home and amount invested by sector in the metropolitan area of Concepción.
Source: Author.

highlights the importance of the public sector for the emergence of real estate growth linked to mining in Chilean regions. In this sense, mining workers would have benefited from the expansion of state subsidies towards the middle class (Hidalgo et al., 2019) and from the consolidation of an economic model with a strong weight of the real estate sector and a predominance of the rental model, based on the indebtedness of small investors (Hidalgo et al., 2014; Gasic, 2018).

This idea can be correlated with the difficulties that exist in Chile in accessing housing and with certain basic aspects such as a sufficient retirement pension and the cost of education or medical care. In this sense, the real estate sector would act as a complement, generating extra income through leases that would act to solve these difficulties, as indicated by Prada-Trigo (2019). Therefore, the public sector, supporting access to housing, would in turn be supporting a subsidiary model that could be linked to the political economy of housing (Aalbers, 2016). It would serve to remedy the deficiencies of a neoliberal state model,

paradoxically through state subsidies. Thus, copper would generate economic liquidity that is reinvested in the real estate sector, driving the increase in demand and price of housing (Rehner and Rodríguez, 2018). In this way, the idea of Devenin and Bianchi (2019) that the mining companies would have a direct and indirect influence in the development of public policies would be reinforced and expanded to the places of origin, materialized in the urban growth that the Metropolitan Concepción is currently experiencing.

In this sense, the case study indicates that these investments are concentrated in Concepción, San Pedro de la Paz, Talcahuano, Coronel and Chiguayante, central sectors of metropolitan area of Concepción. On the contrary, more peripheral sectors such as Hualqui, Lota and Santa Juana are the ones that count the least investments in the surveys carried out and that are very focused on rural plots and social housing. Thus, a preference for buying homes in the surroundings of the regional capital is demonstrated, perhaps due to its attractiveness as a service center and the future rental possibilities that are found there. As the real estate agents and brokers interviewed indicated, a key target customer for their product is the "ant investor" or conservative, long-term investors. This, with its injection of capital into the secondary production circuit, would encourage real estate growth and the appearance of "financialized landscapes" (Lois et al., 2016). The result is a phenomenon of urban segregation, which clearly differentiates between a few older and more economically capable investors, who invest in higher-value areas, and a majority of young and subcontracted workers who flock to areas that offer affordable housing at lower cost. This produces a marked urban segmentation and a socio-spatial segregation that Daher (2013a) and De Mattos (2016) identified in Santiago.

Therefore, this work has made it possible to detect the presence, scarcely studied, of mining capital in areas far from the mining zones and destined to the acquisition of housing. The results show the importance of public subsidies for the purchase of housing in the phenomenon of real estate investment linked to mining and the characteristics of workers, as well as the leading role that cities such as Concepción play in enabling mobility from more distant places, consequently allowing real estate investment in them. Finally, this research, beyond the contributions it makes in itself, represents an advance in the understanding of the complex consequences that activities such as mining have on the territory at different scales through capital flows, which, although intangible, have their spatial materialization in the urban growth of cities.

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CRediT authorship contribution statement

José Prada-Trigo: Conceptualization, Methodology, Writing - original draft, Supervision, Project administration, Writing - review & editing, Funding acquisition. **Pablo Barra-Vieira:** Validation, Investigation, Formal analysis, Writing - review & editing. **Natalia Aravena-Solís:** Data curation, Resources, Formal analysis, Writing - review & editing.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.resourpol.2020.101973.

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