ASSESSING INCLUSIONARY HOUSING POLICY IN SANTIAGO, CHILE:

RESIDENTIAL SEGREGATION BY INCOME, 2006-2016

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Abstract

In 2006, residential integration based on income was included for first time as a main goal in Chile's national housing policy. In 2015, the National Council for Urban Development (*Consejo Nacional de Desarrollo Urbano,* CNDU) challenged the homeownership voucher program employed to achieve this goal and recognized the inexistence of any official instrument to measure segregation in Chile. This thesis responds to these concerns and i) provides an index to measure residential segregation of subsidized low-income households; ii) analyzes the index's change during the last decade; and iii) uses these findings to evaluate whether the new policies introduced in 2006 have reduced the levels of residential segregation in the Region of Santiago (RS). The study demonstrates that new housing policies have not reduced the levels of residential segregation affecting subsidized low-income households in Santiago. Complementary, the thesis analyzes the relation between spatial clusters of government assistance with poverty rates, overcrowded conditions, physical deficiencies, infrastructure and social problems, to demonstrate the persistence of negative urban conditions associated to the location of subsidized stock.

List of Acronyms

AMGS	Great Santiago's Urban Area
	Acronym from Spanish: Area Metropolitana del Gran Santiago
CASEN	National Socio-economic Survey
	Acronym from Spanish: Encuesta de Caracterización Socio-Económica Nacional
CNDU	National Council of Urban Development
	Acronym from Spanish: Consejo Nacional de Desarrollo Urbano
DS. 1	Supreme Decree No.1 (Medium-Income Acquisition Voucher)
	Acronym from Spanish: Decreto Supremo No.1 (Subsidio de adquisición de vivienda para ingresos medios)
DS. 49	Supreme Decree No.49 (Low-Income Acquisition Voucher)
	Acronym from Spanish: Decreto Supremo No.49 (Subsidio de adquisición de vivienda para ingresos bajos)
DS.116	Supreme Decree No.116 (Mixed-Income Bonus 2014)
	Acronym from Spanish: Decreto Supremo No.116
DS. 19	Supreme Decree No.19 (Mixed-Income Bonus 2016)
	Acronym from Spanish: Decreto Supremo No.19 (Bono de Integración Social 2016)
ECLAC	Economic Commission for Latin America and the Caribbean
INE	National Statistics Bureau
	Acronym from Spanish: Instituto Nacional de Estadística
IRS	Index of Residential Segregation
MINVU	Ministry of Housing and Urban Development
	Acronym from Spanish: Ministerio de Vivienda y Urbanismo
RS	Region of Santiago
RSD	Relative Standard Deviation

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1. Introduction

1.1.   Conceptualizing residential segregation

The term segregation refers to the differences or inequalities within a group, which separates group's individuals in different categories with hierarchical distinctions (Rodríguez 2001). Territorial segregation, as the name indicates, is the kind of segregation that considers geographic location as the main category to separate the individuals. Consequently, the term residential segregation—one kind of territorial segregation—refers to the stratification of households made tangible through spatial proximity or territorial agglomeration of families belonging to the same social group. This stratification can be built upon socio-economic attributes, such as a household's income, educational attainment, and material wealth; or socio-cultural attributes like race, ethnicity, language, or religion (Sabatini, Cáceres and Cerda 2001, 27). Both Chilean policies employed since 2006 and this thesis, address residential segregation of subsidized low-income households. This kind of segregation will be referred from now on simply as residential segregation.

Chilean cities—as many other Latin-American cities—are known by their "large scale" residential segregation. This means the presence of i) large districts with concentrated subsidized low-income housing, and ii) notorious agglomerations of high-income districts located in specific areas of urban expansion geographically separated from the "poor" areas. However, Chilean cities also experience residential segregation at a "small scale," or the existence of small homogeneous districts sparsely located in the territory (Rodríguez 2001, Sabatini, Cáceres and Cerda 2001).

As illustrated in Figure 1, the district A4 is composed by only one kind of individuals, thus, it can be considered as a segregated district from others in the city (at a large scale); however, the idea of segregation within A4 (at a small scale) is meaningless, since there is no one to segregate. The same applies in the opposite case, where specific individuals can be sparsely located through the territory (integrated at a large scale) but segregated at a small scale. This is the case of districts A1 and A3. Both districts have 25% of *poor* (or subsidized) individuals, being equally "inclusive" at a large scale (at least more inclusive than district A2). However, at a small scale it is clear that A1— where a homogeneous hierarchy of individuals is concentrated in one specific area—is more segregated than A3, where the same individuals are randomly distributed.

Figure 1. Scales of segregation.

Group A

Categories : 1 Group, 4 districts, 64 cells (individuals)
Hierarchies: ▨ Poor   ☐ Rich
Source   : By author
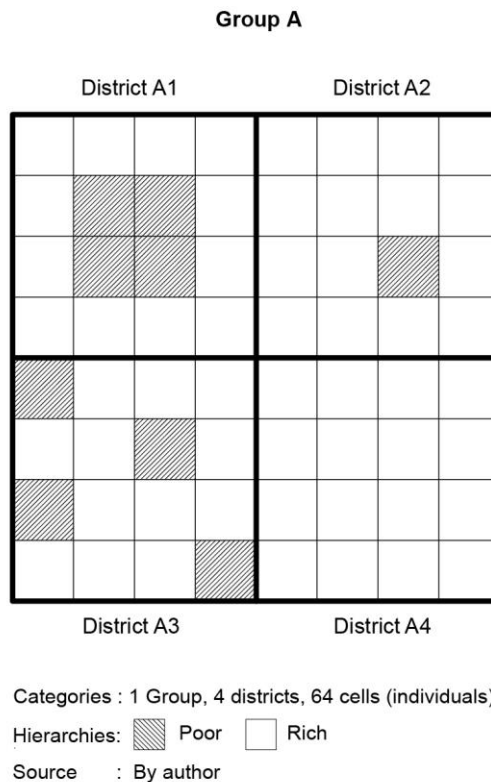
This methodological distinction between scales is important to understand the kind of segregation each policy aims to address, and to evaluate the mechanisms employed to do so. In Chile, the attention given from the Ministry of Housing and Urban Development (MINVU)[1] to residential segregation tried to address both i) vast agglomerations of subsidized housing in peripheral areas (large scale segregation), and ii) homogeneous neighborhoods where poor subsidized households have null opportunities to interact with families of different social status (small scale segregation). These two urban conditions together have created environments of subsidized low-income housing concentrations where opportunities or social mobility are limited, and where social mistrust, violence, and social fragmentation are accentuated (Katzman 2001, Tironi 2003, Sabatini , Mora, et al. 2013, Bresciani 2016).

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[1] The Ministry of Housing and Urban Development of Chile (MINVU, from Spanish *Ministerio de Vivienda y Urbanismo*) is in charge of planning and land regulations throughout the country. It is composed by the Ministry's Regional Offices (SEREMIs), and Housing and Urbanization Services (SERVIU) of each region.

1.2.   Thesis question

The *New Housing Policy* promoted by MINVU in 2006, addressed segregation of subsidized housing at both small and large scale, by introducing two specific instruments:

i)   A new voucher to finance mixed-income developments at neighborhood level (i.e. avoid homogeneous concentrations like in district A1, depicted in Figure 1).

ii)   A location voucher to increase the purchasing power of low-income families in order to facilitate their access to high quality locations (i.e. allow *poor* subsidized units to afford district A4 according to the scenario described in Figure 1).

Complementary, and just after the introduction of the new policy, the government decided to increase the public expenditures assigned through housing subsidies. During Michelle Bachelet's first administration (2006-2009) the annual provision of subsidized housing increased from 463 per 100,000 habitants (the average from 1964 to 2006) to 1,068 per 100,000 habitants. As shown in Figure 2, those levels of housing production remained through the following administration of Sebastián Piñera and the second Bachelet mandate with 1,139 units and 1,045 units per 100,000 habitants respectively (Valenzuela-Levi 2016). Despite the important increase in subsidized housing production under the 'new agenda,' by 2013 just twenty mixed-income projects were built nationwide, and only three were located in the region of Santiago (Sabatini , Mora, et al. 2013, 12). Government assistance in this context was canalized through the pre-existing housing vouchers rather than through the new 'inclusionary' ones.

Based on this and other factors, the CNDU highly criticized in 2015 the exclusionary character of the voucher system, and the disconnection between the existing planning tools (land use ordinances, FARs, and other building codes) with the goals of residential integration (CNDU 2015, Ch.5, 1). According to CNDU, residential segregation cannot be solved just through the voucher system, since without zoning tools to ensure mixed-income communities, land markets will continue to exclude vulnerable populations from the areas valued by public action. Considering the attention given to residential segregation, the structural flaws evidenced by CNDU, and the alleged exclusionary effects of the voucher system (CNDU 2015, Bresciani 2016), this thesis aims to address the problem from a planning perspective, and evaluate how the national increment of public-housing production has affected the levels of residential segregation by income in the RS.

Figure 2. Average housing units annually built in Chile per period using government resources.
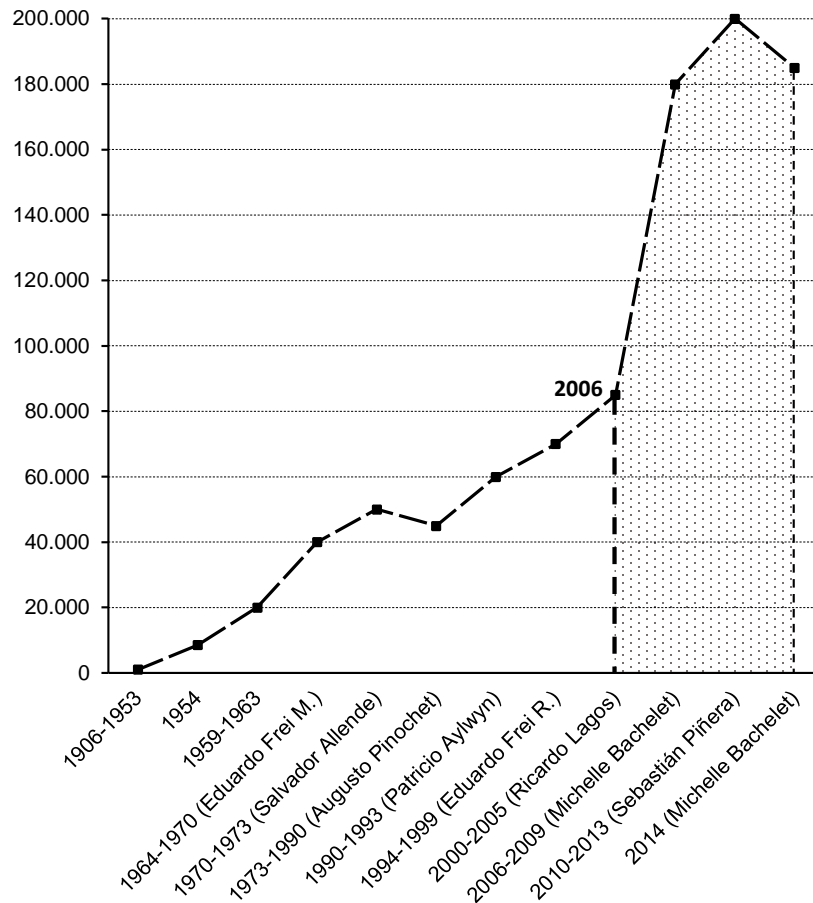
2. Background

2.1. *Chilean demand-voucher system*

Housing assistance in Chile works through a voucher system. Under this system, the state's role is limited to providing a payment to qualifying citizens with which they can purchase any unit provided by the private sector. Under this regime, the private sector is in charge of designing, distributing and building houses, while the state subsidizes the demand through vouchers, i.e. citizens are 'consumers'. According to SERVIU's coordinator of social housing, Pablo Ivelic: "SERVIU works by subsidizing demand, in effect what SERVIU does is to allow the market work (…) and the market works by pursuing the interest of for-profit companies." (Edwards 2013)

Depending on the criteria employed, the privatization of social housing in Chile[2] is an unprecedented policy success, or a shortcut for socio-economic segregation and ghettoization. The paradox of this neoliberal social housing experiment can be summarized by two facts: the first one is the dramatic quantitative reduction in the numbers of families with housing problems; in 1990, 30% of families lacked adequate housing solutions (squatter settlements or illegal occupations) and that figure has now fallen to 9% (Bresciani 2016). The second fact is that many of the social housing projects built during this period of accelerated construction (1990-today) are universally acknowledged as ghettos located in isolated outposts lacking basic facilities, prone to fires, and often high in crime and social problems (Edwards 2013, CNDU 2015, Bresciani 2016). A brief consideration that explains this phenomenon, is that by directing government assistance to consumers, there is no 'contractual arrangement' or mechanism between the government and the private sector to enforce (nor incentivize) the provision of better quality units from private developers.

In this regard, the private sector is practically under a laissez-faire regime, tending to optimize profits by cutting-corners at least in three moments of housing production. The first moment is in the definition of the project's scale; in order to optimize economies of scale, developers tend to organize serialized processes of production, designing massive developments usually for only one single niche of consumption (low-income vouchers' users). This way, developers produce large agglomerations of homogenous subsidized households that have no contact with different social classes. In a second moment, and in order to have access to these extensive quantities of land at a convenient price, developers locate these large agglomerations in peri-urban areas where these amounts of land are available at the lowest-cost (Brain, Cubillos and Sabatini 2009). Finally, a third moment is the construction phase, often characterized by the use of cheap building materials and minuscule spaces. With almost no regulation from the state, and secured demand—composed by all low-income households that have no other choice than acquiring these 'low quality units'—the proliferation of peripheral 'subsidized ghettos' became a common phenomenon throughout the country. As recognized by many urban scholars, the success

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[2] Implemented in 1975 during Augusto Pinochet dictatorship (1973-1990)

of the system from its quantitative perspective created at the same time important agglomerations of concentrated poverty, located in the outskirts of the city, and subject to progressive physical and social deterioration negatively affecting the wellbeing of its inhabitants (Katzman 2001, Tironi 2003, Zambrano 2010). These negative consequences of the demand-voucher system are exactly what the policies in 2006 aimed to combat.

2.2. *Instruments towards residential integration*

All Chilean vouchers work by subsidizing homeowners' demand. This means that MINVU provides a fixed amount of money, only granted once, to low-, moderate- and middle-income households to acquire any new property available in the market. From 1990 to 2016, MINVU granted USD $26.3 billion in subsidies; 99.6% of the subsidies were given to households to acquire or maintain their units (homeowners), and only 0.4% were designated to rental assistance (MINVU-CEHU 2016). In other words, it is a type of homeownership voucher program. Re-sales are forbidden unless the owner obtains a direct approval from authorities (the unit must have more than 5 years, no pending debts, or active SERVIU's prohibitions). With low rates of turnover, the system is an important engine of new housing stock's creation, as aforementioned in section 1.2.

The two instruments introduced in 2006 to battle residential segregation follow this same rationale in promoting the new agenda, but attaching specific requirements that the unit acquired must comply—such as quality, location, or developments' social integration—in order to qualify for voucher. The first policy analyzed in this thesis, the mixed-income bonus, applies only to low- and moderate-income households; while the second, the location voucher, mainly to middle-income households (see detailed segmentation in Table 1). Without fundamentally challenging the dynamics between housing and the real estate market, the inclusion proposed is heavily constrained by the risk and expected rates of return of developers. The inclusion at neighborhood scale only considers the mix between poor- and slightly less poor-households (usually in the periphery), while middle-income households (with higher purchasing power to afford better land) are the only beneficiaries of the "large scale inclusion"—or the ones with the opportunity to access better quality locations.

2.2.1   Mixed-income bonus

The mixed-income bonus is the only initiative explicitly designed to reduce residential segregation by income at a small scale, which means, bringing low-income households to live together with moderate-income households in the same development. The government introduced the voucher with the *New Housing Policy* (2006), restructured it with the Supreme Decree No. 116 (D.S. 116 in 2014), and readjusted it again with the Supreme Decree No. 19 (D.S. 19 in 2016)[3]. Today, it forms part of the *Extraordinary Program of Social Integration*, administered by MINVU, in collaboration with the Ministry's regional offices (*Secretarías Regionales Ministeriales* or SEREMIs).

As any other demand voucher, the government offers the bonus to households organized through social housing organizations (known as EGISs by their Spanish initials). In order for households to qualify, the property acquired (new constructions) must be part of a mixed-income development where 20% to 60% of its units are set aside for populations below the first income quintile (approximately from E2 to D). With the bonus, low- and moderate-income beneficiaries reduce the mortgage credit they need to acquire the unit, and increase their chances to obtain the loan. With safer demand, developers increase its sales speed thus reducing the financial costs of the project. The market—following these incentives—should supply customer-oriented products to satisfy the demand created by the voucher.

It is important to clarify the autonomy of this voucher compared to other acquisition subsidies available for low-income households (i.e. D.S.49), or for middle-income households (i.e. D.S. 1) which are commonly complemented with other government subsidies (i.e. the location voucher). The D.S. 19 works by itself and combines a triple assistance composed by an i) acquisition voucher, ii) an incentive depending on the percentage of subsidized units involved—a bonus for *captured subsidies*—and, iii) a mixed-income bonus. The values described in Table 2 are the maximum amounts that households can obtain based on their socio-economic characteristics. However, these maximum values are sensible not only to the administrative region of the country where the development is located, but also to the project's zoning context, design, typology, prices,

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[3] Supreme Decrees are issued by MINVU, signed by the President, and apply to all national territory.

Table 1. Income levels and socio-economic segmentation in Chile

Income levels	Groups of socio-economic segmentation	Income for a Household of 1 (Annual UDS)	Income for a Household of 3 (Annual USD)
High	A	> $ 68,667	> $ 153,769
	B1	> $ 42,045	> $ 94,135
	B2	> $ 25,113	> $ 57,415
Middle	C1a	> $ 14,340	> $ 34,200
	C1b	> $ 8,182	> $ 19,807
Moderate *	C2	> $ 4,597	> $ 11,785
	C3	> $ 2,396	> $ 6,797
Low *	D	> $ 1,189	> $ 3,780
	E1	> $ 621	> $ 2,360
Extremely Low	E2	> $0	> $0

* Income-levels considered by Inclusionary policies. Source: Asociación de Investigadores de Mercado (AIM) 2015.

Table 2. Maximum levels of assistance as defined by D.S.19 (in American dollars)

Target Population	Property value	Savings required	Acquisition Voucher	Cap/S. bonus	M-I bonus	Maximum voucher	Max.% assist.
Low-Income Households	<44,792	814-1,222	32,579	2,036	9,773	44,385	99%
	<48,864	814-1,222	36,648	2,036	9,773	48,457	99%
Mod.-Income Households	<89,584	1,629-3,258	11,198	------	------	31,558	35%
	<97,728	1,629-3,258	13,723	------	------	37,340	38%
Percentage of Subsidized Units							
20% - 25%	------	------	------	2,036	4,072	------	------
25% - 30%	------	------	------	4,072	8,144	------	------
30% - 35%	------	------	------	6,108	10,180	------	------
35% - 60%	------	------	------	8,144	12,216	------	------

Source: MINVU, D.S. N°19, DO 07.14.2016

etc. Each SEREMI evaluates and scores these variables to determine the final allocation of resources (specified in D.S. 19 regulation). To calculate the mixed-income bonus for low-income households, SEREMIs consider the difference (if any) between the total price of the unit, and the aggregate value resulting from family savings, the acquisition voucher, and the bonus by *captured subsidies* (MINVU 2016, D.S. No 19, 8).

2.2.2 Location voucher

In order to tackle large-scale segregation, the government introduced in 2006 the location voucher defined by the Supreme Decree No 174. Following the rationale of the mixed-income bonuses already explained—as demand-subsidies—the location voucher works as an extra bonus up to USD $7,700 which households may obtain when the property acquired complies with specific requirements. Among them, be located in urban areas with access to sewage systems, accessibility through major roads, proximity to transportation systems, and being located less than 1.5 miles away from health and education facilities.

The location voucher complements acquisition subsidies for middle-income households (like D.S. 49 and D.S. 1 already mentioned but not detailed here) but do not complement the subsidies given under the D.S. 19. This is important since middle-income households become the main beneficiaries of large-scale integration, while small-scale integration is only planned for low- and moderate income household's which can be integrated between them using the mixed-income bonus, but not necessarily in a better location. Although the instrument has been highly criticized—as shown in the next section—it is still in operation under MINVU's decree FSEV 16 (MINVU 2015).

2.3.   *Instruments' implementation and criticisms*

2.3.1   Quantitative evaluation

After the changes introduced in 2014 to the mixed-income bonus, and just in the first two years of D.S.116 implementation (2015-2016) MINVU has assigned 50,462 D.S.116 subsidies. This is equal to 18.2% of the total housing subsidies granted from 2015 to 2016, and to 25.3% of the

total government resources given through housing subsidies during that period[4] (MINVU-CEHU 2016). An unquestioned improvement compared to the first phase (2006-2013) described in page 8. Regarding the location voucher, the lack of specificity of the instrument (Sabatini , Mora, et al. 2013) coupled with an important rise in land values, has neutralized the effects of the voucher (ProUrbana 2010, Sabatini , Mora, et al. 2013). Although the idea that location subsidies might be the causal effect on upward land values is something still debated, a general consensus exists in the fact that location subsidies tend to rise the demand and expectations from the supply side, and therefore, to rise prices in contexts with fixed supply of urban land (Zambrano 2010). An essential contradiction emerges when the very problem the voucher is trying to solve, is consequence of the voucher's effect over land markets. This is even more critical considering the hypothesis that these effects in land values are not only consequence of the location voucher, but of the voucher system, or vouchers in general, which tend to rise prices.

In a study published in 2004, Francisco Sabatini and Isabel Brain analyze the changes in land prices due to the increment of the vouchers' value. According to the study, which considers the period from 1990 to 2004, the voucher system heavily distorted land markets dynamics in Santiago. Based on evidence gathered in more than 118 developments (33,298 housing units) built through the timeframe selected, they conclude that poor districts in the RS, like *El Bosque*, *Recoleta*, or *La Granja*, experienced from 1990 to 2004 a 20% annual value increase per square meter of land. Doubling the 10.6% average value increase for the whole capital, and drastically higher than the 4% in wealthy districts like *Vitacura*, *Providencia*, or *La Reina* for that same period (Brain and Sabatini 2004). Through the vouchers' value adjustments introduced during those years, the government motivated a new low-income demand for housing; consequently, private developers built housing at a higher pace in areas where the land was cheap, and therefore, this end by increasing the land value in these low-income neighborhoods. These trends absorbed 84% of government voucher's readjustments without improving the quality or developments' location (Brain and Sabatini 2004). The overall experience demonstrates that independent of government efforts to reduce the spatial

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[4] From 2015 to July-2016, the government assigned 277,267 subsidies (a total investment of $3,300 million dollars in subsidies). The investment in D.S.116 subsidies is equal to $835 million dollars (MINVU-CEHU 2016).

segregation through the market system, the new agenda is heavily constrained by the market dynamics in place; namely risk aversion, and profits maximization from private developers to the detriment of the quality of the housing stock provided. Despite the D.S.116 program concentrates today 18.2% of the vouchers granted since 2015, the deficiencies of the whole system and the distortions it generates over land markets overshadow its apparent success.

2.3.2   *Importance of the scale in residential segregation*

The mixed-income bonuses—with the limitations already described—respond to residential segregation at a small scale. At a neighborhood level, they supposedly create more economically diverse environments, and counteract the creation of socially homogeneous neighborhoods. However, they do not deal with residential segregation at a large scale, nor tackle the displacement of low- and moderate- developments into areas of the city where land is economically accessible.

Actually, when SEREMIs define the score given to any mixed-income project, it makes no difference if the development is located in poor areas with cheap land, or in a better location. To illustrate this, a project located in the district of *El Bosque* in the province of Santiago (whose poverty rates vary around 30%, and presents severe physical deficiencies in its built environment), receives the same score than a project located in *Las Condes*, a district in the same province but with high quality built environment and poverty rates below 5%. This framework provides no incentives for private developers to pay for good quality or expensive locations. The mixed-income bonuses do not address large-scale segregation, and as proven, location subsidies are very inefficient in doing so, or definitely worsen the situation considering the land market distortions they generate. In this context, the inexistence of any official instrument to measure residential segregation provides not only the opportunity, but also the responsibility to address the matter from a planning perspective.

3. Methodology

Measuring residential segregation—even from the most intuitive approach—requires at least three criteria to be defined:

i. First, segregation must be understood in relation to a territorial or geographic scale of analysis (region, provinces, districts, etc.). In this case, the study will be focused in large scale segregation, meaning between sectors and districts. Due to the short historical distance and lack of disaggregated data in relation to the mixed-income subsidy application, the analysis of segregation at small scale remains pending for future studies.

ii. Second, it is necessary to make explicit the attribute that will differentiate the groups physically distanced (income, wealth, subsidies, etc.).

iii. Finally, the methodology to measure segregation will depend on the attributes selected; for example, measuring a dichotomous attribute like subsidized housing (i.e. subsidized units vs. market units) will require a different technique than a continuous variable such as income, in which any attribute's value is possible.

Being this the case, the thesis considers—as section 3.4 will explain—two main methodologies; the Dissimilarity Index for measuring segregation based in dichotomous variables such as subsidized stock and poverty, and the Index of Residential Segregation, for measuring segregation based on income.

3.1. *Geographic scale of analysis*

3.1.1 *Higher order: Santiago Metropolitan Region (RS)*

Regions are the higher territorial division in Chile[5], and sixteen of them conform the national territory as shown in Map 1. The RS, where the capital is located, is the smallest region in the country with only 15,209 km^2; however, it concentrates the higher population with a total of 7,399,042 habitants (40% of the national population by 2016) according to the estimates of the National Statistics Bureau (INE from Spanish *Instituto Nacional de Estadística*). As can be inferred from its GDP by 2012, the RS stands as a nationwide center of economic activity. Due to the

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[5] Regarding its political administration, a regional government composed by a regional council and a regional intendant (appointed by the President) command each region. The intendant is a territorially deconcentrated governing body and, at the same time, it is a decentralized administrative organ.

Map 1. Regions of Chile

Id	Region	Population 2016	Surface (km2)	GDP 2012 (MM USD)
XV	Arica y Parinacota	243,149	16,873	1,305
I	Tarapacá	344,760	42,225	5,123
II	Antofagasta	631,875	126,049	21,800
III	Atacama	316,692	75,176	5,704
IV	Coquimbo	782,801	40,579	6,646
IX	La Araucanía	1,005,322	31,842	4,656
SMR	Santiago	7,399,042	15,403	101,679
V	Valparaiso	1,842,880	16,396	16,747
VI	O'Higgins	926,828	16,387	9,351
VII	Maule	1,050,322	30,296	7,664
VIII	Bíobío	2,127,902	37,068	16,513
XI	Aysén	109,317	108,494	987
XII	Magallanes y Antártica	165,547	1,382,291	1,793
XIV	Los Lagos	847,495	48,583	5,136
XIV	Los Ríos	407,300	18,429	2,541
Chile		**18,191,884**	**2,006,091**	**228,667**

Source: ESRI, Subsecretaría de Desarrollo Regional y Administrativa (SUBDERE), Instituto Geográfico Militar, Instituto Nacional de Estadística 2016.

centralized character of the country, and the importance of the RS in economic demographic, and political terms, the thesis considers the RS as the larger unit of territorial aggregation, or general framework of study.

3.1.2   Intermediate order: Provinces and Santiago's internal sectors

Six intermediate geo-political subdivisions or provinces[6] compose the RS. They are: i) Chacabuco, ii) Cordillera, iii) Maipo, iv) Melipilla, v) Santiago, and vi) Talagante. As Map 2 shows,

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[6] Each province is administered by a governor, appointed and removed by the President.

Map 2. Provinces of RS and urban areas
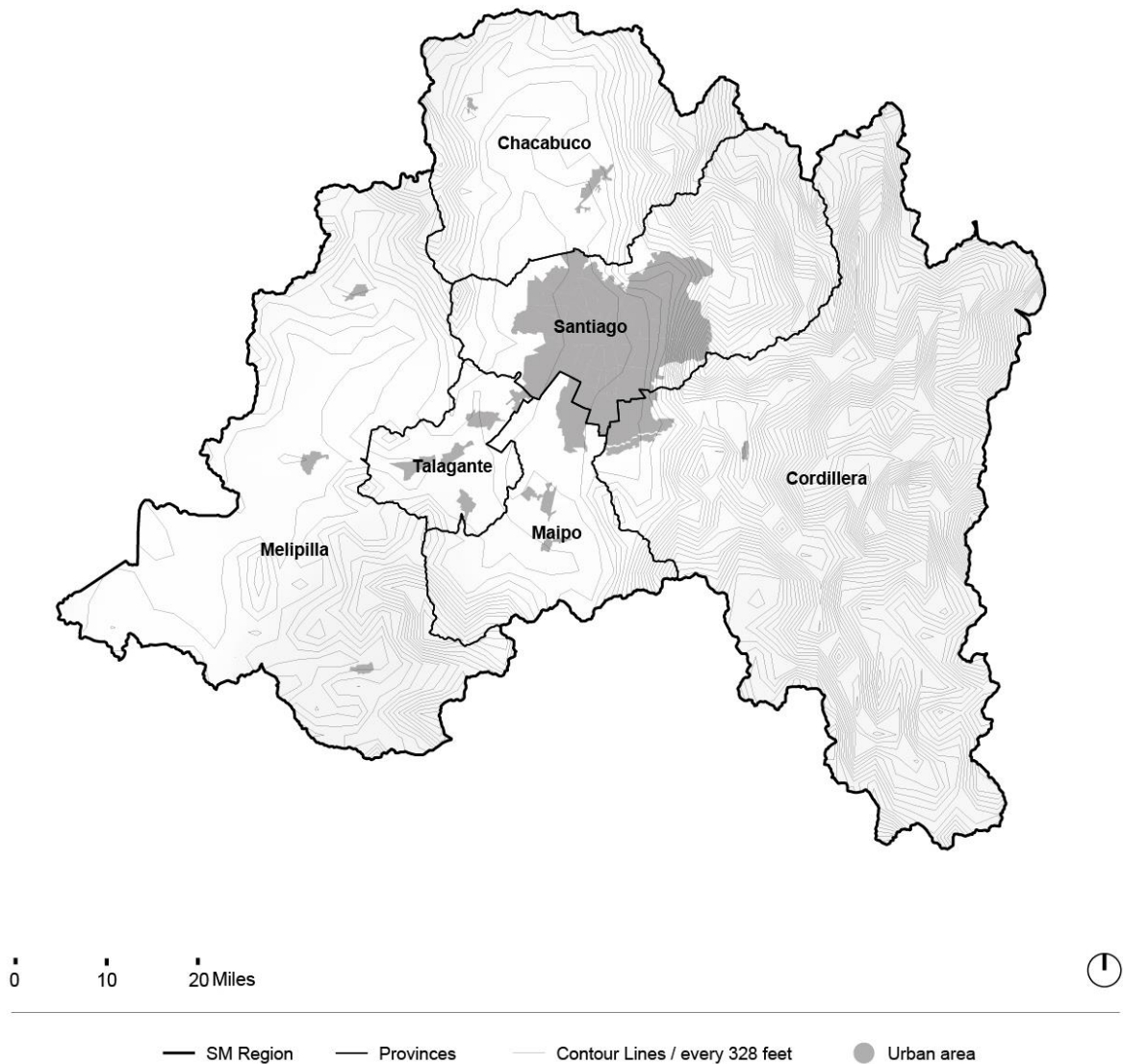

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        0        10       20 Miles
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—— SM Region   —— Provinces   —— Contour Lines / every 328 feet   ● Urban area

Source: ESRI, Subsecretaría de Desarrollo Regional y Administrativa (SUBDERE), Instituto Geográfico Militar | Projection UTM 19

most of the provinces are predominantly rural—partly due to the region's mountainous geography—

and the urban area is concentrated almost completely within the province of Santiago. This way, the

province of Santiago (the national capital) concentrates 78% of the region's population, as well as

32 of the 52 districts (the lower order of territorial aggregation) within the RS.

Santiago urban area is called *Area Metropolitana del Gran Santiago* (AMGS), and refers to

the agglomeration of districts that together conforms the "central or metropolitan city" of the region.

This "urban boundary" considers 32 districts within the province of Santiago, plus some districts

Map 3. Provinces and Districts of RS
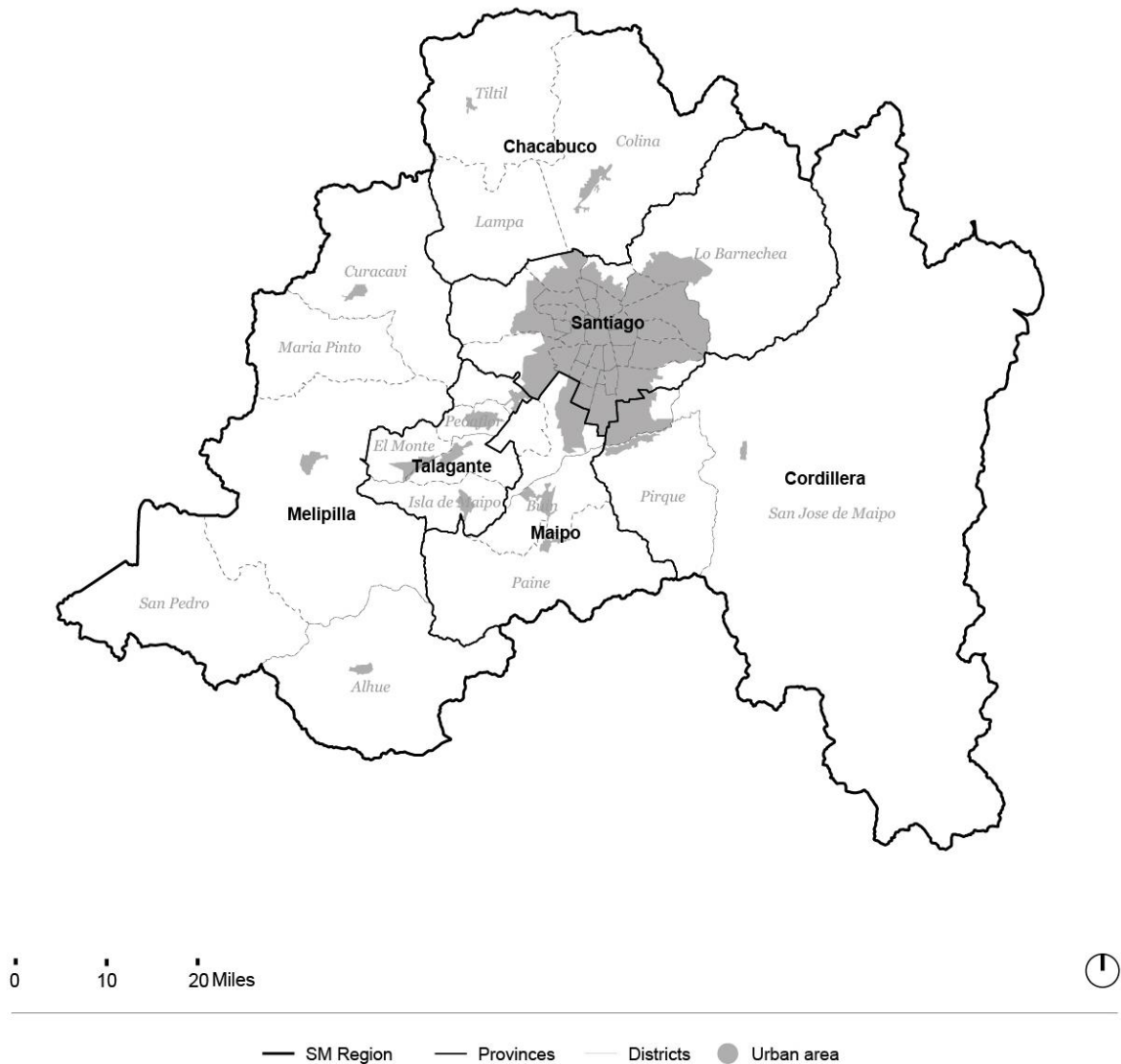
Source: ESRI, Subsecretaría de Desarrollo Regional y Administrativa (SUBDERE), Instituto Geográfico Militar | Projection UTM 19

from adjacent provinces that have been *conurbated* with AMGS's urban growth, as Map 3 shows. Given the weight of AMGS's population, it is possible to divide the urban area in six internal sectors according to their geographic location: i) east, ii) south-east, iii) south, iv) west, v) north, and vi) center (depicted in Map 4).

These two categorizations (provinces and Santiago internal sectors) conform the intermediate order of territorial aggregation; this categorization serves to analyze large-scale segregation between sectors.

Map 4. AMGS Internal Sectors and Districts
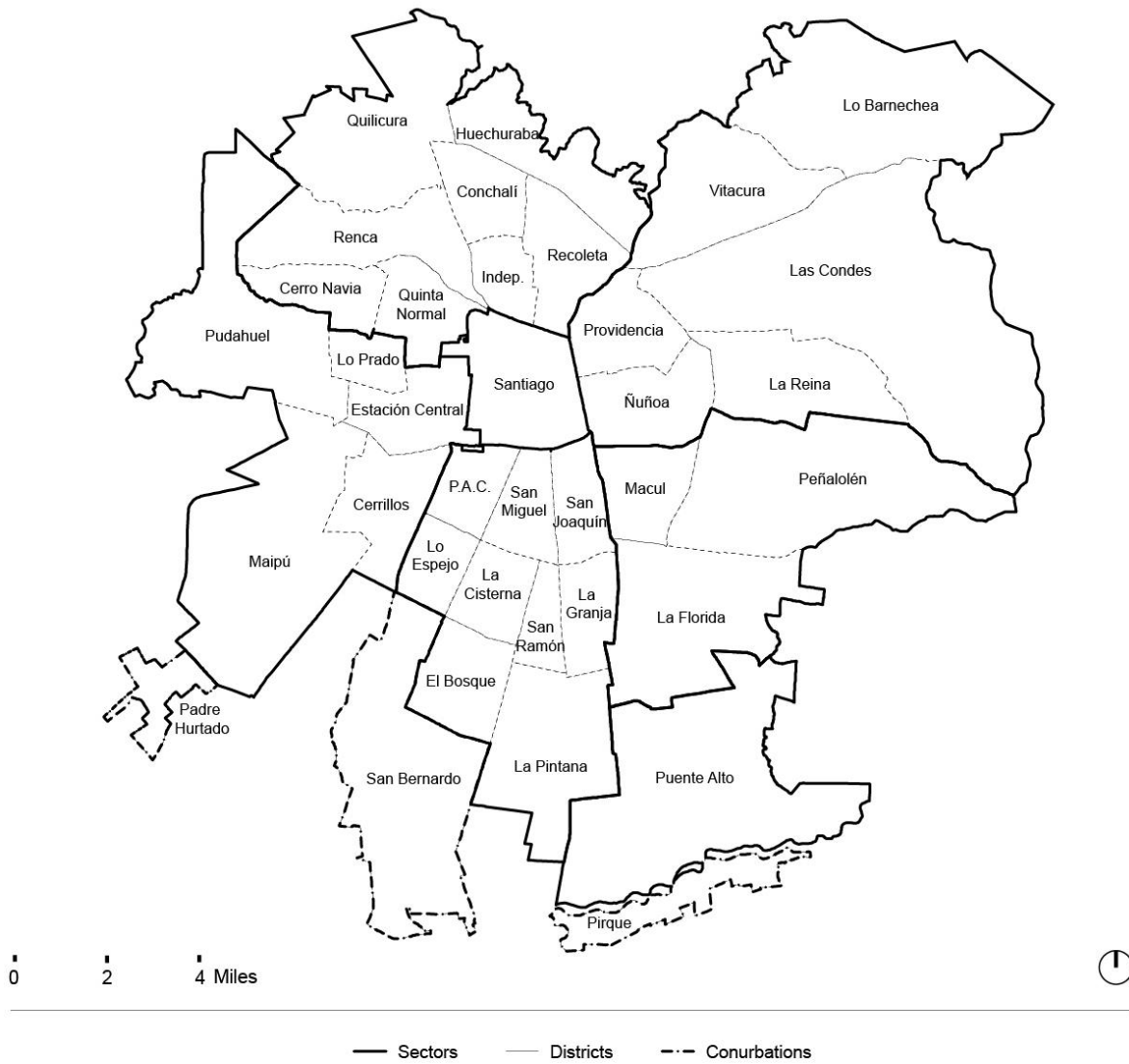
Source: ESRI, Subsecretaría de Desarrollo Regional y Administrativa (SUBDERE), Instituto Geográfico Militar | Projection UTM 19

3.1.3   Lower order: Districts or "comunas"

Comunas, the Spanish for boroughs or districts, define the lower level of territorial aggregation. These are the most basic administrative unit of the country[7] and 52 of them compose the RS. The estimated population of each district (and different levels of territorial aggregation) is detailed in Appendix 1. All dissimilarity indexes presented in the following sections are calculated for this scale of territorial aggregation (which is the one the location subsidy aimed to address).

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[7] A mayor— democratically elected— and a communal council constitute their administrative body.

3.2. *Selected attributes*

To analyze whether the voucher system has affected the levels of residential segregation by income in the RS, it is important to identify first whether the voucher system has contributed to the generation of clusters (or dispersion) of subsidized developments. Second, it is important to understand how income distribution has evolved between different geographic sectors and districts. Complementary, it is relevant to consider whether this matters, or if the concentration of subsidized housing is related to other negatives aspects of social marginality. The variables considered are:

3.2.1 *Housing variables*

The housing analysis intends to calculate the percentage of subsidized stock in each district and provinces. Specifically, this section aims to identify the existence of spatial clusters of government assistance, and their evolution throughout the past decade.

3.2.2 *Income variables*

Income levels are obviously relevant since they not only define the access to better housing solutions, but also influence living standards, quality of life, and access to opportunities and consumption (Turok, Kearns and Goodlad 1999).The analysis at district level allows to identify the percentage of households' under poverty line and their concentration/dispersion within the urban fabric. Other related variables like the incomes by sector of activity (and their spatial patterns in the city) are also included in the study to provide an understanding of the spatial distribution of wealth.

3.2.3 *Contextual variables*

Finally, the thesis analyzes a set of indicators such as overcrowding, materiality index, and neighborhoods' social environment, in order to contextualize both the physical and social conditions associated to the findings of previous sections (3.2.1 and 3.2.2). Specifically, the indicators are:

i. *Physical environment:* This section considers the percentage of units facing overcrowding conditions and physical deficiencies, as well as the percentage of housing stock facing environmental pollution and infrastructure deficiencies in each district. These variables contextualize (in qualitative terms) the districts where government assistance is more common. Environmental pollution includes noises,

air, visual contamination, trash, odors, landfills and plagues; while infrastructure deficiencies look at the proximity and distance to basic urban resources like health services, schools, and transportation corridors.

ii. *Social environment*: Shows the percentage of housing units per district facing problems like robberies, drugs, street prostitution, or insufficient security. This variable was included to contextualize in social terms the aforementioned variables.

3.3. *Segregation Indexes*

There is a broad range of procedures and algorithms to measure residential segregation, and the spatial dispersion of the variables mentioned above. The next section briefly presents some of these alternatives, and explains the reasons behind the selected methodology.

3.3.1 *Duncan's Dissimilarity Index*

Duncan's dissimilarity index (D), employed by Brigitte Erbe's (Erbe 1975) and Michael White's (White 1983) among others scholars, is the most widely used indicator to measure segregation. This index is a synthetic indicator that allows the measurement of the social composition in territorial sub-units (sectors and districts) in relation to the social composition of a territorial unit of higher order (region). The indicator acquires values from 0, when there is no segregation, to 1 when there is maximum segregation. It is interpreted as the percentage of members within a minority group that should be moved into a different area to reach a situation of 0 segregation (Rodríguez 2001, 22)

D applies to any categorical variable, but it is better adapted to dichotomous variables; reason why it is very common in American contexts where criteria like race are more significant at measuring segregation (differentiating for example between *black* and *white* populations). The limitations of D has been widely addressed (Sabatini, Wormald, et al. 2008, Link, Valenzuela and Fuentes 2015) since it disregards the spatial dimension of segregation at neglecting whether neighborhoods are contiguous or not, or the clusters' size. In any case, it provides a synthetic figure which allows to track the evolution of spatial segregation like this thesis aims to measure.

3.3.2   Index of Residential Segregation (IRS) or analysis of variances

Understanding residential segregation as the weight of a particular households' or attribute's distribution (within a selected sub-unit) over the total variation of a selected attribute, the analysis of variances stands as a logical procedure to measure residential segregation when working with continuous variables. The methodology considers three variances (social attribute's variances) based on the geographic' scale of analysis: i) a total variance for the whole area of study (RS); ii) a second variance calculated between intermediate territorial order (Provinces and Santiago's internal sectors); iii) a third variance calculated intragroup between the smallest units of analysis (the districts within each sector).

Residential segregation will increase (or decrease) when the weight of the variance between territorial subunits over the total variance of the social attribute increases (or decreases). For instance, if 100% of the social attribute's variance (region's variance) can be explained by the territorial sub-unit's variance (districts' variance), the degree of residential segregation would be maximum at district level. Oppositely, if the districts' variance explains 0% of the region variance, this means that the attribute's distribution at district level has a random distribution with no segregation at all. The methodology then, allows to generate an Index of Residential Segregation (IRS, further explained in section 4) which differentiates the scales in which segregation occurs. For instance, if the variance between RS's sectors explain 0% of the total variance of the attribute in use, but the variance between districts explain 100% of the variance at stake, this means that segregation operates within sectors at a district scale but not between sectors. Consequently, as Rodriguez explains in ECLAC's report:

> *"The variance between smaller subunits must be (by logic) equal or greater than the variance between higher subunits, and the gap between these two figures will indicate the degree of aggregated segregation resulting from the segregation between smaller subunits (within the larger region) suggesting the geographic scale at which segregation operates."* (Rodríguez 2001, 33)

In order complement the IRS analysis, the study also calculate the coefficient of variation, or relative standard deviation (RSD) in each sector. The RSD is a percentage defined by the ratio of the standard deviation to the mean, in other words, it shows the variability of the sample in relation to its mean. In this context, it is included as a standardized measure of dispersion of a frequency distribution in order to evaluate the heterogeneity or homogeneity within sectors.

3.4.   *Research design*

Based in the methodologies described, the research design is defined as follows:

i.   The *Index of Dissimilarity (D)* was used to analyze segregation's evolution through dichotomous variables, such as poverty levels, percentage of subsidized stock per district, overcrowding, stock presenting physical deficiencies, percentage of population actively engaged in the labor market, or the percentage of units presenting environmental and social deficiencies per territorial sub-units. *D* is calculated as follows:

$$\frac{1}{2}\sum_{i=1}^{N}\left|\frac{x_i}{X} - \frac{y_i}{Y}\right| \qquad\qquad [1]$$

Where x_i is the target population of the ith area (e.g. population below poverty line in district i). X Is the total population below the poverty line at the higher order of territorial aggregation for which *D* is being calculated (region), y_i is the population above the poverty line in the ith area, and finally, Y is the total population above the poverty line at the higher order of territorial aggregation.

ii.   For continuous variables like income, the thesis employs the analysis of variances and the *Index of Residential Segregation* (IRS) briefly explained in section 3.3.2. This allows analyzing to what extent segregation occurs between districts or between sectors. Based in the methodology suggested in ECLAC's report (Rodríguez 2001, 28), the IRS is calculated as follows:

Given a quantitative attribute X (i.e. income) of elemental socio-demographic entities (households), and a large scale territorial unit I (RS) which contains different levels of territorial sub-units geographically ordered $(II, III, IV..., I\!I)$, it is possible to calculate:

The total variance of X, in the territorial unit I

$$\sigma^2_{total} = \frac{\sum_I^i (x_i - \bar{x})^2}{N_I} \qquad [2]$$

The average value of X, in each territorial subunit $II, III, IV...,\eta$

$$\bar{x}_{II,III,IV...,\eta} = \frac{\sum_l^i (x_{i\,\eta})^2}{N_\eta} \qquad [3]$$

The variance of the sample mean of X, between η territorial sub-units $II, III, IV...,\eta$. That is, the variance between territorial sub-units within I. This calculation requires to weigh the relative importance of each sub-unit's component (h_n) i.e. the total number of households in each component

$$\sigma^2_{between} = \frac{\sum_I^n h_n (\bar{x}_n^2 - \bar{x}^2)}{N} \qquad [4]$$

With the total variance [2] and the variance between territorial sub-units [4] it is possible to calculate the IRS [5]. The IRS is the proportion of the total variance that can be explained by the variance between sub-units (the geographic component of social heterogeneity).

$$IRS = \frac{\sigma^2_n}{\sigma^2} * 100 \qquad [5]$$

iii.   Finally, as mentioned in 3.3.2, the coefficient of variation (CV), or relative standard deviation (RSD) complements the IRS calculating the level of dispersion within districts. The RSD is calculated as follows:

$$RSD = \frac{\sigma}{\mu} \qquad [6]$$

3.5. Sources, assumptions, and limitations

3.5.1 CASEN Survey of Socio-economic Characterization

All the data for this study comes from the National Survey of Socio-economic Characterization (CASEN, from Spanish *Encuesta de Caracterización Socioeconómica Nacional*), currently carried out in a biennial or triennial periodicity by the Ministry of Social Development. The survey includes household's socio-economic information throughout all national territory (urban and rural areas). CASEN includes demographic information, as well as education, health, housing, labor engagement, and income indicators. This study considers the last 12 available surveys corresponding to the years 1990, 1992, 1994, 1996, 1998, 2000, 2003, 2006, 2009, 2011, 2013 and 2015. CASEN has a probabilistic and stratified survey design, and as any sample survey, it presents estimates of the population. For year 2015, the survey presented an average absolute error (at a regional level) of 1.7 percentage points, and an average relative error of 17.7%.

3.5.2 Assumptions and limitations

The first assumption to clarify relates to the geographic units of analysis, since depending on how they are defined, they will shape the results. The smallest level of aggregation (RS's districts) have local political structures (municipalities) associated to them, and their boundaries have been relatively stable through history. However, Santiago's internal sectors (intermediate order) are delimitations broadly applied in formal and informal contexts, but they do not have any government structure associated to them, and consequently, the criteria might be questionable.

Secondly, the CASEN survey, where the bulk of data for this study comes from, is a sample survey and therefore, it does not allow an accurate analysis like with Census data (which disaggregates the information at a block scale), neither to obtain robust results since, as a sample survey, it is subject to sampling and non-sampling errors as previously mentioned. Consequently, the results presented in this thesis are estimates of the true value of the variables. Despite this fact, CASEN was selected since it allows a more up-to-date information than the Census Data, portraying a richer dynamic process than decennial snapshots (in Chile the last Census available is from 2002).

4. Analysis I: Spatial segregation of subsidized housing

As mentioned so far, the first and most relevant step is to calculate the percentage of subsidized stock at each level of territorial aggregation, and look how these figures have evolved through the last decade. The analysis goes back to the year 1990 to understand the major trends regarding where subsidized housing has been historically built, and to evaluate if there has been any change since the implementation of inclusionary policies in 2006.

The subject of study allows its subdivision in two groups (subsidized units vs. market units) and therefore the most pertinent mechanism to measure segregation here is the Dissimilarity index. *D* indicates the percentage of one of the two groups (i.e. subsidized housing units) that would have 'to move' to different geographic areas in order to produce a distribution that matches that of the larger area (RS).

4.1   Subsidized housing stock by district

As a result of the continuous public incentives encouraging the creation of subsidized stock, the percentage of subsidized housing (from the total stock) rose from 18.8% in 1990, to 26.7% in 2015 (Table 3A). Regarding its location—between sectors (Table 3B)—there is currently a high concentration of government assistance in peripheral areas (Chacabuco, Cordillera, Maipo, Melipilla, and Talagante) where the amount of subsidized housing averages 34% of their total stock. This figure is almost 10% higher than in Santiago, which averages of just 25%.

Within the AMGS (between districts) there is also significant disparities. As indicated in Table 3-B the government assistance goes up to 41.3% in Santiago West, while sectors like Santiago East—the cones of elites—barely reach 9%. In Table 4-B1, it is possible to see how the subsidized stock built post 2006—year in which the new inclusionary policies were announced— has been located primarily in sectors like Santiago North, South, and Cordillera; and almost no stock has been provided for Santiago Center or East. Thus, it is possible to infer that subsidies under the "new" agenda have not been significantly efficient at reverting large-scale segregation patterns, since the majority of new stock provided, was located exactly in districts and sectors where government assistance has been historically high.

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Table 3. (A) Historical evolution of subsidized stock as a percentage of total housing stock. (B) Distribution of subsidized housing stock by sector of analysis. Year: 2015.

A. Percentage of subsidized housing (from the total housing stock) in RS

Year	Subsidized
1990	18.78%
1992	5.11%
1994	5.11%
1996	0.79%
1998	22.57%
2000	27.77%
2003	27.76%
2006	25.60%
2009	27.47%
2011	27.55%
2013	31.40%
2015	26.70%

B. Percentage of subsidized housing by sector of RS. Year: 2015

Sector	Mean
Chacabuco	31.69%
Cordillera	45.55%
Maipo	38.01%
Melipilla	28.28%
Talagante	26.67%
Santiago Center	6.13%
Santiago East	8.58%
Santiago North	24.81%
Santiago South	27.33%
Santiago South East	32.38%
Santiago West	41.30%
Average	28.25%

Table 4. Concentration of housing stock. (A) Historical. (B) Only considering stock built post-2006 (*) Extremes rates.

	(A) Historical - Subsidized Housing Stock (Number of units)	(A1) Historical - Subsidized Housing Stock (as % of district total stock)	(B) Post 2006 – Subsidized Stock Built (Number of units)	(B1) Post 2006 – Subsidized Stock Built (as % of district total stock)
Chacabuco	500	3.22%	125	3.94%
(*) Cordillera	2,688	17.32%	427	13.46%
Maipo	899	5.79%	211	6.65%
Melipilla	440	2.83%	105	3.31%
Talagante	526	3.39%	83	2.62%
(*) Santiago Center	109	0.70%	24	0.76%
Santiago East	945	6.09%	206	6.49%
(*) Santiago North	2,971	19.14%	680	21.43%
(*) Santiago South	2,861	18.43%	641	20.20%
Santiago South-East	1,364	8.79%	231	7.28%
Santiago West	2,219	14.30%	440	13.87%
TOTAL	**15,522**	**100.00%**	**3,173**	**100.00%**

Figure 3 (Above) "*D*" evolution (subsidized-market units) between districts. (Below) Evolution of subsidized units as percentage of total stock per sector. Santiago East, in black; Cordillera, in blue.
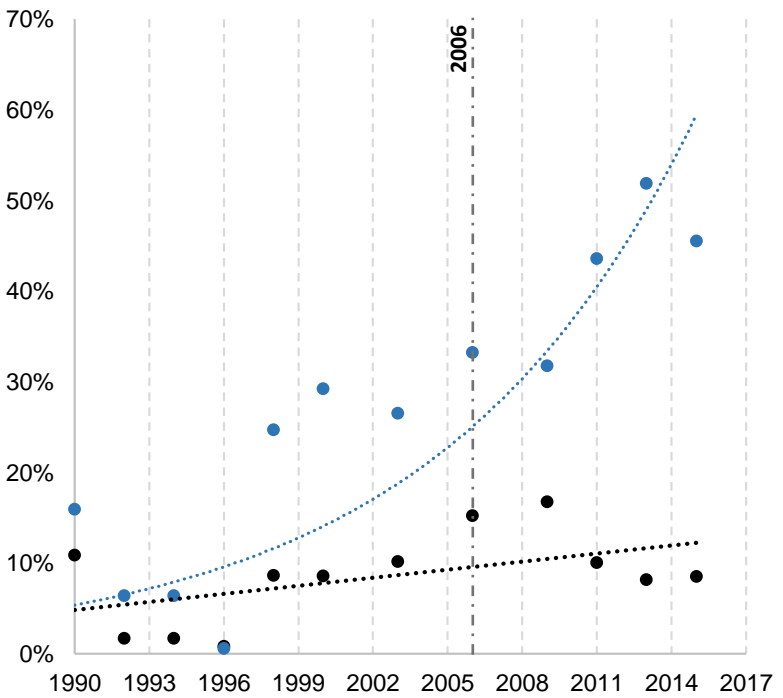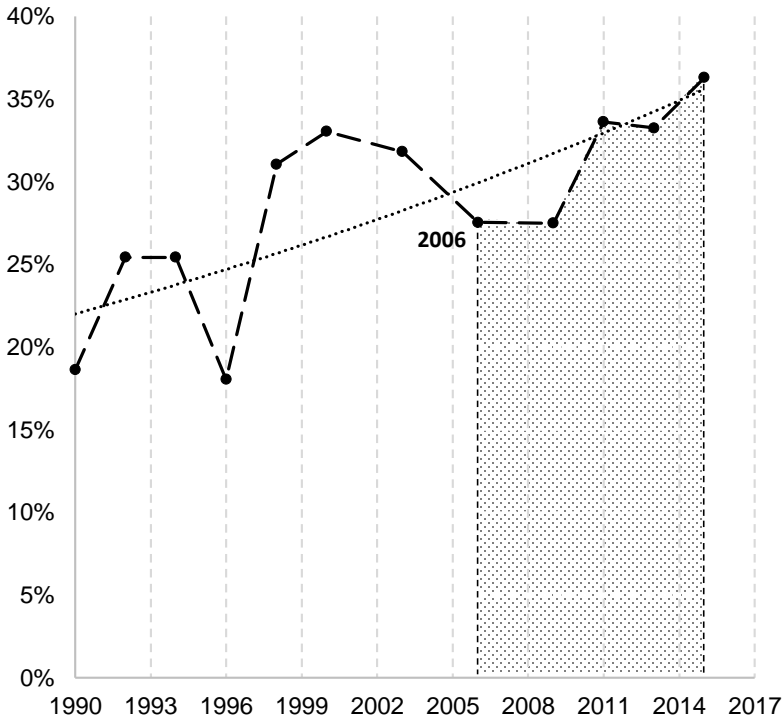
These sectors directly relate with low-income and high poverty levels, as next sections will show. This, which might be a positive assessment praising the system efficiency in addressing less favored sectors' needs, can also be interpreted as a system failure concentrating poverty through the housing system. However, the intention is not establishing causalities (understand if subsidized housing provision follows low-income consumers' preferences, or whether the location of subsidized stock creates those low-income sectors), but rather to understand the effectiveness of the policies implemented since 2006, which as can be seen in Table 4 has been very modest.

Figure 3 (Above) presents the evolution of *D* for the whole region of Santiago considering the total number of observations grouped by district level (the smaller level of territorial aggregation considered in the study). *D* indicates the percentage of subsidized housing that would have to move to a different district in order to produce a distribution that matches that of the SMR. As the tendency line of *D* shows, the indicator has been increasing over the whole timeframe selected; and specifically, it does not show any tendency to diminish during last years (or at least since 2006). Figure 3 (Below) complements the aforementioned observations by comparing the historical increase in subsidized housing—as a percentage of the total housing stock in each sector— between Santiago East (represented in black) and the sector of Cordillera (in blue).

The presence of areas with subsidized low-income housing concentrations, notoriously separated from the areas with almost no subsidized stock (Map 5), demonstrates that despite the efforts to promote dispersion, new housing policies have not been efficient enough in reverting the patterns of residential segregation at a large-scale. As shown in Map 5, the areas with higher concentration of subsidized stock are mainly peripheral areas of West Santiago; areas where the government assistance has been historically high. As section 4.3 will demonstrate, areas such as Santiago North, West, and South—where government assistance through housing vouchers is mostly concentrated—are precisely the places where poverty rates are most critical (22.1%, 20.7%, and 24.9% respectively). The upward trends on income inequality, shown in section 4.2, also complement the aforementioned observations confirming this increase in large-scale residential segregation. As analyzed so far, by providing cash assistance to 'consumers' the government has null incidence in the location of the new housing stock, leaving "location" to be decided by market

Map 5. Subsidized housing stock by district – AMGS 2015

Includes: VSDsD, Vivienda Básica (all), Vivienda Progresiva (all), Renovación Urbana, PET, Lote con Servicios, and others.
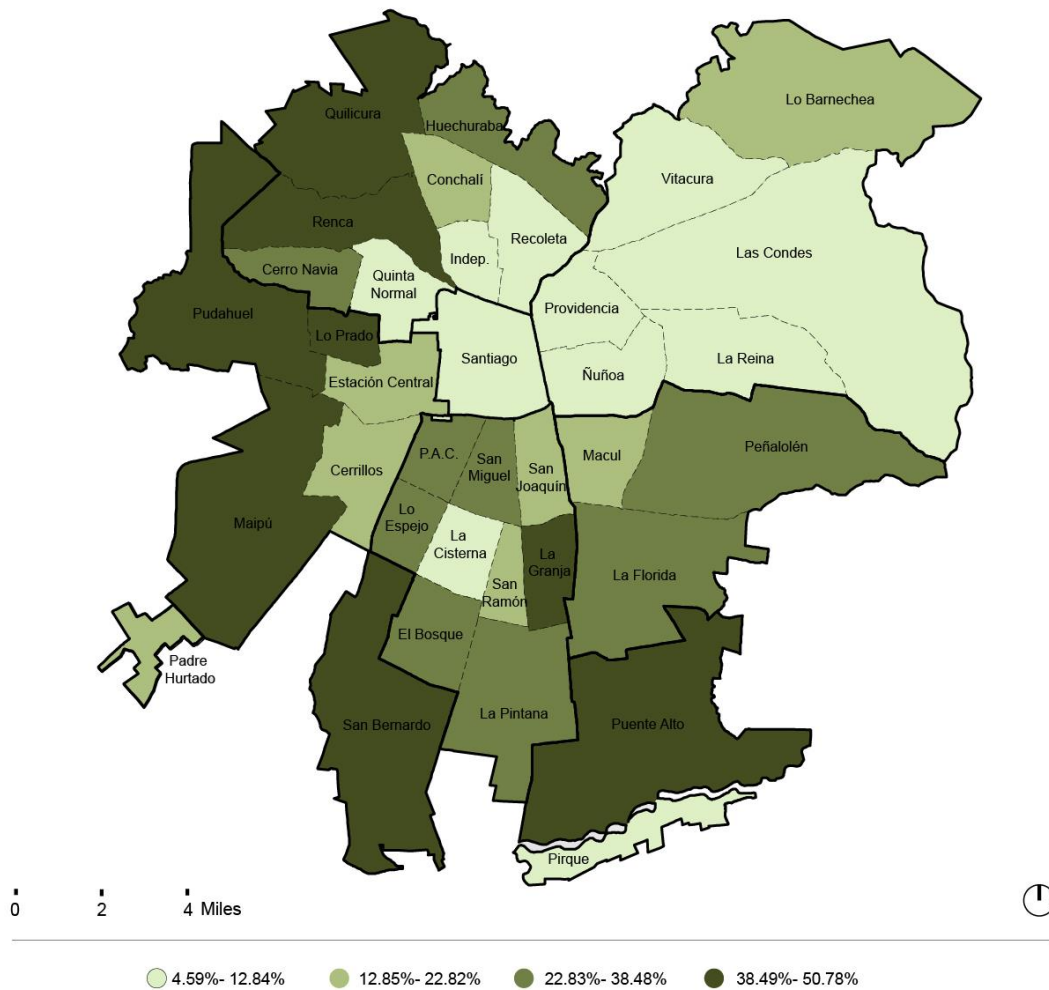
dynamics. Consequently, wealthy neighborhoods like Santiago East (with higher land values) has been losing subsidized housing stock (with a total percentage change of -2.3% between 1990 and 2015) contrasting with low-income sectors like Cordillera, where the increase has been of almost of 30% (more details in Appendix 2).

4.2   Income distribution

In order to complement the analysis of the subsidized housing stock—its concentration and dispersion—the income analysis pretends to understand how wealth is distributed within the region. Unlike the previous section that can be analyzed using *D*, the segregation based on income levels

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(a continuous variable) must be studied using the Index of Residential Segregation. The IRS presented is based in three variances obtained from grouping the datasets (for each year) in three scales of territorial aggregation. A first variance (the most general one) was calculated using all observations corresponding to the RS, available from CASEN survey. This "general" variance, calculated using R-Studio statistical software, represents the spread of the whole range of dataset's observations for the largest area of territorial aggregation. A second variance was calculated between the averages obtained from grouping the observations by sectors (it is the variance between the incomes' average in each sector). Finally, a third variance was calculated from the values obtained by grouping the observations by district.

With these three variables, it is possible to obtain two IRS, the first one corresponds to the sectors' variance over the total variance (the percentage of the total variance that can be explained by sectors' variance) while the second is the districts' variance over the total variance (the percentage of the total variance that can be explained by districts' variance). Both IRSs allow understanding segregation between districts, as well as between sectors.

The income analysis considers the total household income, calculated as the sum of household's autonomous money-income and all money-subsidies. The former refers to earnings coming from wages, salaries, self-employment, bonuses, rents, interests, private pensions, and transfers between private individuals; and the latter (money subsidies) refers to all cash contributions from state to individuals as public pensions, health bonuses, etc. (it does not considers housing vouchers). All incomes since 1990 to 2015 were adjusted by the Consumer Price Index (CPI published by INE), and converted to USD according to the exchange rate to date.

Incomes have significantly increased throughout the region during the period of study. The average annual income for the RS in 1990 was USD $111,720, and it doubled by 2015 to USD $276,452 (more details in Appendix 3). This probably reflects the overall economic improvements that have positioned the country as one of the strongest economies in Latin America during the last decade[8]. As indicated in Table 5, the average annual percentage change (AAPC) in the province of

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[8] According to El Mercurio, by 2016 Chile's GDP (US $22,316) far exceeded the one of Brazil (US $15,000) and that of México (US $17,000) two of the most important economies in Latin America (El Mercurio 2016). That

Table 5. Income AAPC by sector (First year: 1990, End year: 2015). Annual incomes adjusted by CPI. Currency exchange CLP $1 = USD $ 0.001514

| Sectors | Income (USD) | | |
	1990	2015	AAPC
Chacabuco	74,164	173,883	5.85%
Cordillera	136,825	213,701	3.02%
Maipo	93,659	181,930	4.53%
Melipilla	73,217	169,765	5.77%
Talagante	91,007	199,834	5.38%
Santiago Center	100,876	231,038	5.68%
Santiago East	333,501	596,253	3.95%
Santiago North	86,795	186,029	5.21%
Santiago South	82,912	195,183	5.87%
Santiago South East	112,390	265,379	5.90%
Santiago West	95,334	206,211	5.28%

Figure 4. IRS evolution based on income 1990-2015. District's IRS (in black) Sector's IRS (in blue)
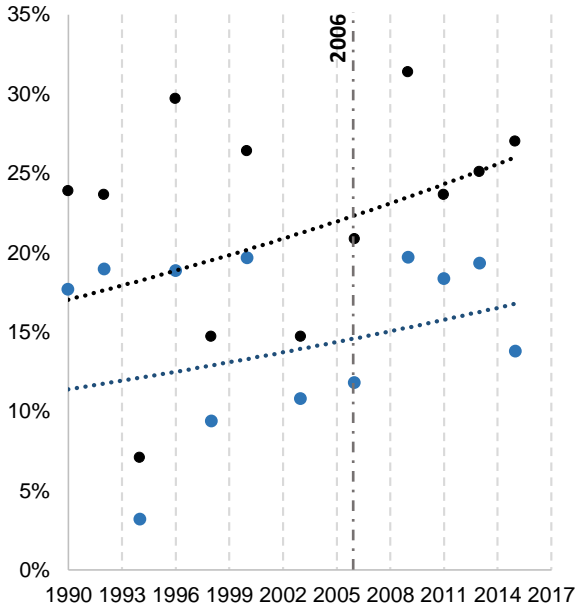
same year, Chile stood out as the country with greater income disparity among the Organization for Economic Co-operation and Development (OECD). According to the latest OECD's report, Chile presents a Gini Index of 0.46—being "0" perfect equality, and "1" total inequality—followed by Mexico (0.45) and the United States (0.39). (El Mercurio 2016)

Map 6. Annual Median Income by District – AMGS 2015*

Adjusted by CPI to December 2016 / Currency conversion at 02.2017 : 1 USD = 641,5 CLP
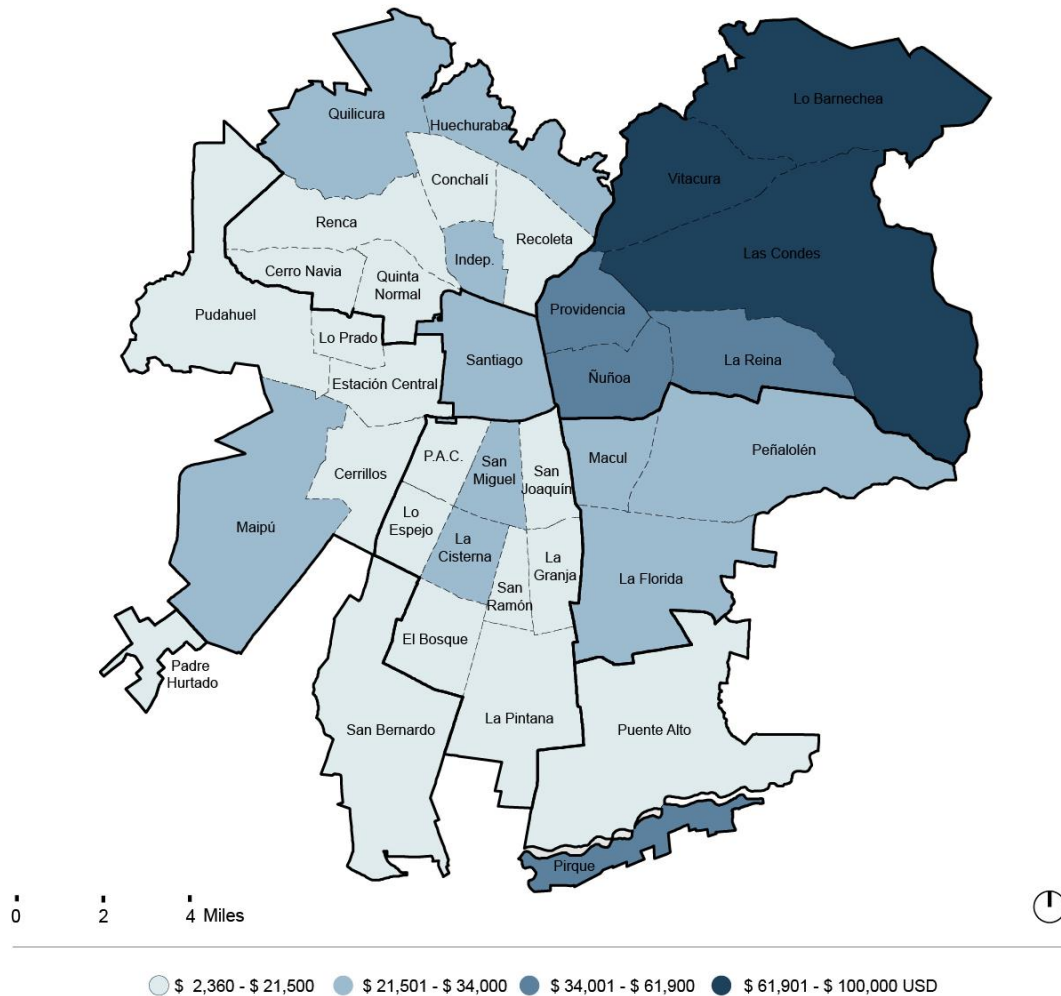
Legend: ⚪ $ 2,360 - $ 21,500   🔵 $ 21,501 - $ 34,000   🔵 $ 34,001 - $ 61,900   🔵 $ 61,901 - $ 100,000 USD

Source: ESRI, Casen 2015 Ministerio de Desarrollo Social, Desarrollo Regional y Administrativa (SUBDERE), Instituto Geográfico Militar | Projection UTM 19

Santiago (5.32%) was slightly higher than in the peripheral provinces (with an AAPC of 4.9%) and although "poor areas" have a comparative higher AAPC's increase, there are still important income inequalities, as can be seen between Santiago East (averaging USD $596,253 by 2015) and Santiago North or Santiago South (averaging incomes of USD $186,029 and USD $195,183 respectively). The IRS analysis in Figure 4 complement these statements by providing an idea about how large-scale segregation has evolved (at both district levels, as well as sector's level).

By 2015, the IRS analysis in Figure 4 shows a diminution of residential segregation at sectors' level, however, considering the variability of the sample, it is not enough to support a consolidated trend backing up this statement. In any case, as depicted in Map 6, higher incomes

are concentrated in a few districts of Santiago East—known as the *cone of elites*—referring to the districts of Providencia, Vitacura, Las Condes, and Lo Barnechea. Which is precisely the sector where public assistance is null. These trends has been maintained through the period of study, which explains the IRS upward trends shown in Figure 4. Regarding small-scale segregation, the overall reduction of internal RSDs (see Appendix 3) suggest a homogenization of the internal composition of each sector, but it is not enough to reach a strong conclusion about the spatial dynamic associated to it.

4.3   Distribution of poverty rates

While incomes have been increasing at a constant rate since 1990, poverty rates have decreased from 37.3% in 1990, to 18.0% in 2015. The reduction of poverty is more significant in Santiago (with an average change of -24.76%) than in peripheral provinces (with an average change of -17.59%). This is consistent with the previous findings and the fact that it is precisely the urban

Figure 5. *D* evolution (above/below poverty line) at district level.
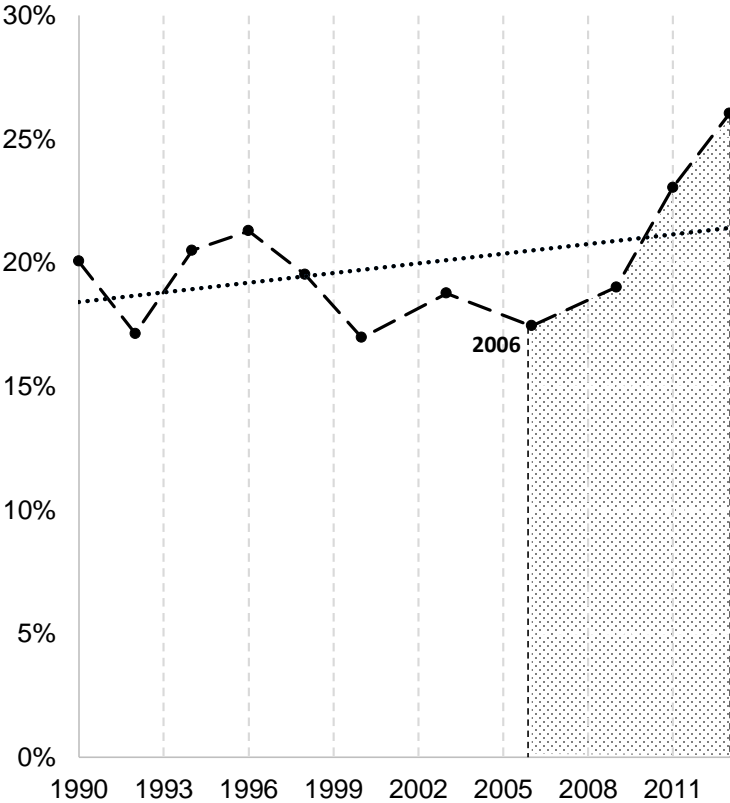
Map 7. Poverty rates by District – AMGS 2015

The poverty line (PL) identifies a basic food basket (CBA) and a multiplier factor / PL(Urban): 2 x CBA / PL(Rural) 1.75 x CBA

0   2   4 Miles

○ 4.62%- 11.24%   ● 11.25%- 20.34%   ● 20.35%- 29.57%   ● 29.58%- 40.00%

Source: ESRI, Casen 2015 Ministerio de Desarrollo Social, Desarrollo Regional y Administrativa (SUBDERE), Instituto Geográfico Militar | Projection UTM 19
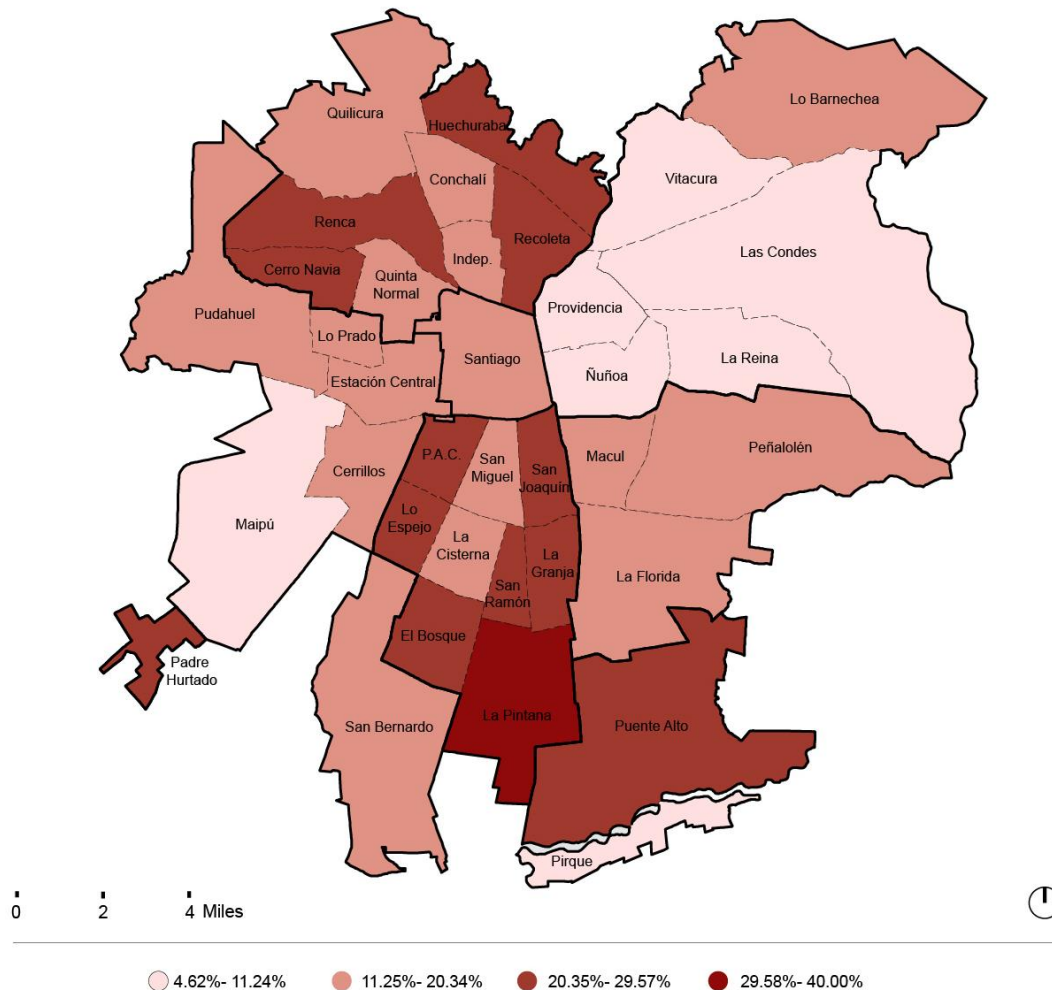
area where better opportunities are provided. As well as the analysis of subsidized stock, poverty is a dichotomous variable that allows its analysis through *D*, (considering two categories: as populations below or above the poverty line). The upwards trends of *D*, as detailed in Figure 5 (specially since 2006) show an increase in the levels of segregation based in poverty levels. One particular fact of interest is the 10% increase in *D*, which rose from 17.4% in 2006 to 26.0% in 2013. What *D* indicates, is coherent with the contrast between sectors and their poverty rates: sectors like Chacabuco (with a poverty rate of 25.86% by 2015), Cordillera (22.13%), or Santiago North and South (20.7% and 24.9% respectively) contrast with sectors like Santiago Center of East, with poverty rates of 12.6% and 7.3% respectively (See map 7).

Map 8. Percentage of housing units facing overcrowding conditions – AMGS 2015

Overcrowding is considered with 2.5 people or more per room.
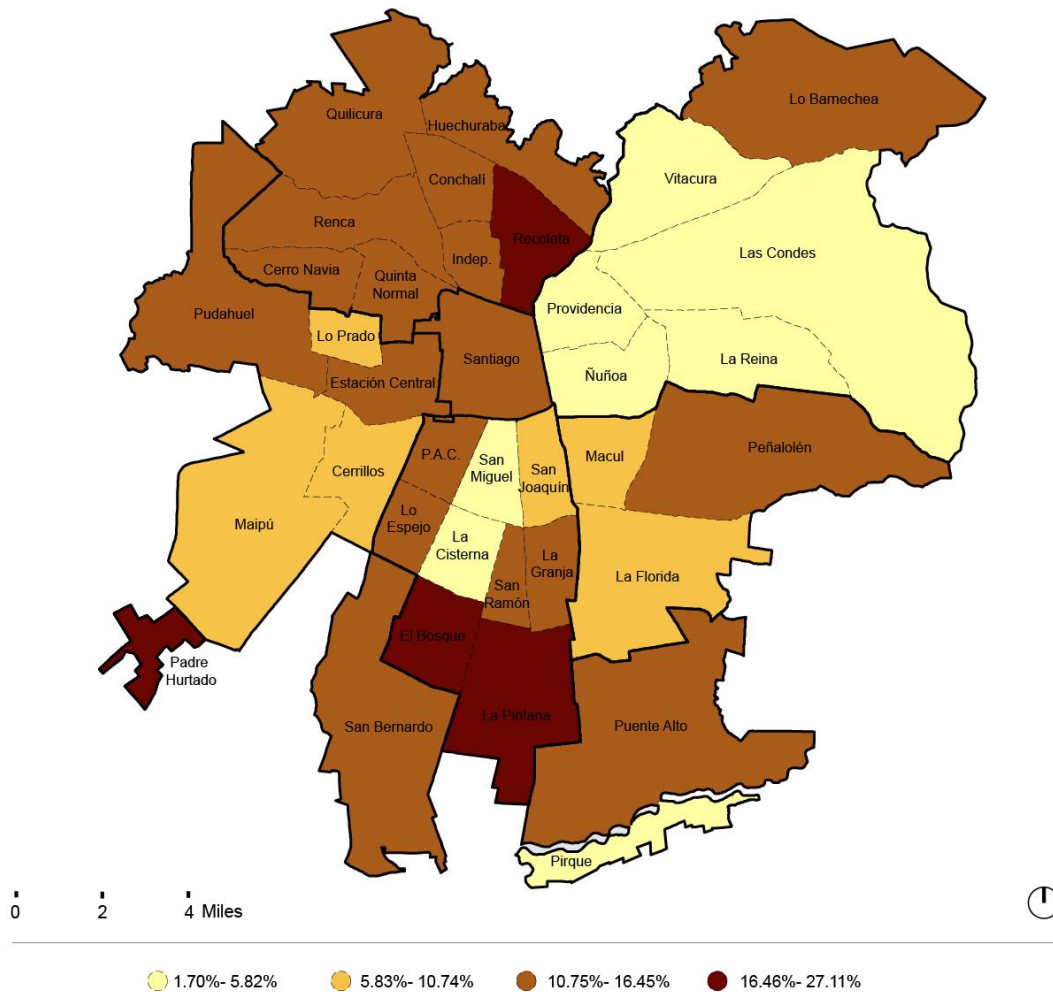
⬤ 1.70%- 5.82%	⬤ 5.83%- 10.74%	⬤ 10.75%- 16.45%	⬤ 16.46%- 27.11%

5. Analysis II: Residential segregation, does it matter?

As shown in the previous sections, residential segregation by income has not been reversed with the policies implemented since 2006; contrarily, it has been increasing ever since. However, why does this matter? The literature reviewed, considers residential segregation as one of the causes negatively affecting opportunities and social mobility, and a factor accentuating violence, social fragmentation and social mistrust. The following sections aim to complement these statements, and identify some pressing aspects that may help to guide future housing policies. Among the housing indicators analyzed, the ones worth to discuss are i) overcrowding indexes, ii) housing stock facing physical deficiencies, and the ii) environmental analysis focused in

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infrastructure (proximity to health services, schools, and transportation corridors) and social

problems (presence of drugs, prostitution, and street violence).

5.1.   *Overcrowding rates per district*

Overcrowding in the context of this thesis refers to units presenting more than 2.5 person

per room. Although the empirical evidence correlating overcrowding with broader urban problems is

thin, higher rates might induce psychological and social stress, and cause health problems. In

general, the percentage of housing stock facing overcrowding conditions has diminished

consistently since 1990 (from 36.5% in 1990 to 11.3% in 2015). However, there are still significant

differences between districts (see Appendix No.6). Complementary, map 8 shows higher

percentages of overcrowded conditions in Santiago South and North with overcrowding rates up to

27%, contrasting with the west-east corridor whose figures varies between 1% and 10%.

These contrasts, coupled with the income and poverty disparities already demonstrated,

can have "very damaging health effects through feelings of personal failure, inferiority, insecurity,

stress, depression and anxiety [which] can dominate people's consciousness and severely

undermine their all-important subjective quality of life" (Turok, Kearns and Goodlad 1999, 376)

5.2.   *Percentage of units facing physical deficiencies per district*

Complementing the overcrowding analysis, this thesis analyses the percentage of units

facing physical deficiencies per district. This indicator was built based in the Materiality Index (only

included in CASEN 2013-2015) which looks at the material quality of roofs, walls, and floors of the

dwellings. In order to build this indicator for the whole period of analysis, this study provides a score

between "0" to "1" to each category (0 if "good", 0.5 if "acceptable", and 1 if deficient); then, all units

scoring more than 2.0 were considered "deficient units".

As expectable after previous analysis, the higher percentages of units facing physical

deficiencies are located in peripheral areas and Santiago's poor sectors (North and South as shown

in Map 9). This is significant since agglomerations of units facing deficiencies may produce health

hazards, fire hazards and overall negative impacts on neighbors. It is even more critical if the

Map 9. Percentage of housing units facing physical deficiencies – AMGS 2015

Based in Materiality Index of walls, ceilings and floors.
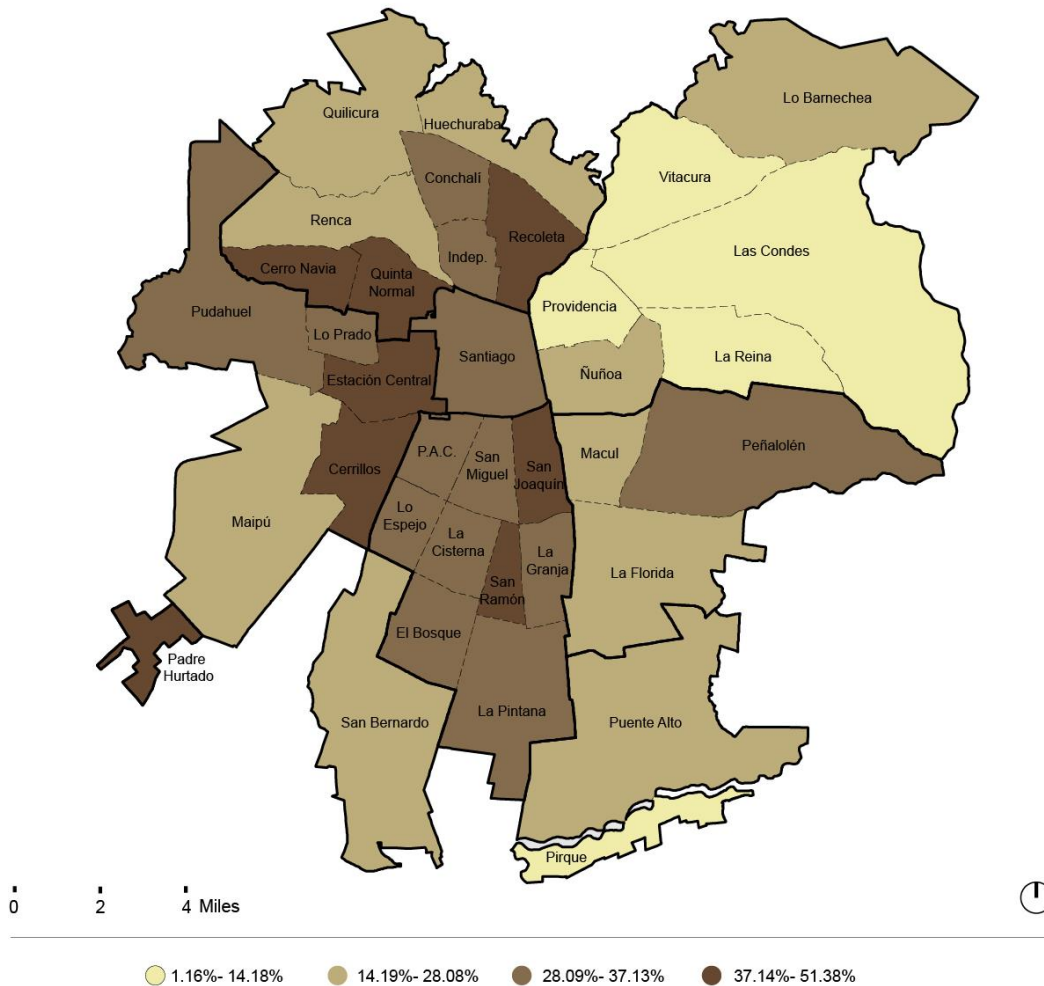
| 1.16%- 14.18% | 14.19%- 28.08% | 28.09%- 37.13% | 37.14%- 51.38% |

Source: ESRI, Casen 2015 Ministerio de Desarrollo Social, Desarrollo Regional y Administrativa (SUBDERE), Instituto Geográfico Militar | Projection UTM 19

subsidized units are the ones contributing to the creation of deficient housing stock. One example that summarizes the negative consequences of substandard subsidized housing—not only presenting physical deficiencies, but also high overcrowding rates—is Bajos de Mena, a massive housing complex privately-built between 1990 and 2004 in Puente Alto using government assistance, today known as Chilean's largest ghetto. The housing development of 25,466 units, accommodates 122,278 low-income residents. According to CASEN, after its construction, the subsidized stock in Puente Alto rose from 11% in 1990, to 60% by the year 2000.

In 1997—even after the project was fully built—the units began experiencing physical deficiencies; and although the government has been investing (ever since) to solve those problems,

Images 1(Above) Aerial view over Bajos de Mena (Below) Bajos de Mena's Demolition. Source: (Kilometrocero 2015)

by 2012 it finally decided to announce a special plan to demolish the buildings and relocate Bajos de Mena's population. The decision was based in the deficient quality of the units, the high rates of overcrowding, and the concentration of poverty affecting the social being of its inhabitants. The total aggregated cost of building and demolishing the complex—without considering repairs and the cost of relocation—was more than USD $ 280,165,434 (Edwards 2013, Kilometrocero 2015). Bajos de Mena is one example that evidences the pernicious consequences of the low-quality housing stock provided with government assistance, but also the inherent moral hazards present in the voucher system, created by the lack of incentives for private developers to provide a genuine social good, against the social goals (and whole economic efficiency) of the housing policy.

5.3. *Environment*

In order to characterize the physical and economic environment where subsidized housing is concentrated, the previous sections have evaluated the relationship between subsidized clusters and low-income levels, poverty rates, and housing indicators such as overcrowding and physical deficiencies. The last step is the environmental assessment, which considers the access to urban infrastructure (proximity to health services, schools, and transportation corridors); and their socio-spatial conditions (presence of drugs, prostitution, and street violence).

5.3.1. Infrastructure

The infrastructure assessment aims to evaluate the quality of neighborhoods and availability of local services and facilities, a significant factor influencing "people's views of their home area and whether their community matters to society at large" (Turok, Kearns and Goodlad 1999). At the same time, this variable aims to counteract the lack of information in CASEN regarding commuting times—or jobs-homes balance—in order to understand the isolation of less favored populations in some areas of the city, something that might affect their sense of social inclusion, self-esteem and psychological wellbeing. The analysis considers whether the units are located a more than:

i. 0.6 miles from a transportation corridor

ii. 1.5 miles from an educational facility

iii. 1.5 miles from a health center

iv. 1.5 miles from a supermarket

v. 1.5 miles from a ATM

vi. 1.5 miles from a sport facility

vii. 1.5 miles from a green public space (parks or plazas)

viii. 1.5 miles from a community center

ix. 1.5 miles from a pharmacy

If a unit is facing more than 50% of these conditions, then is considered by this study as presenting infrastructure problems. Although there is a relatively good provision of facilities within

Figure 7. Units presenting infrastructure problems by sector

Sector	Infrastructure Problems
Melipilla	32.24%
Cordillera	24.49%
Talagante	20.99%
Chacabuco	20.79%
Maipo	18.22%
Santiago West	4.67%
Santiago North	4.14%
Santiago South-East	4.06%
Santiago Center	3.82%
Santiago South	1.98%
Santiago East	1.07%
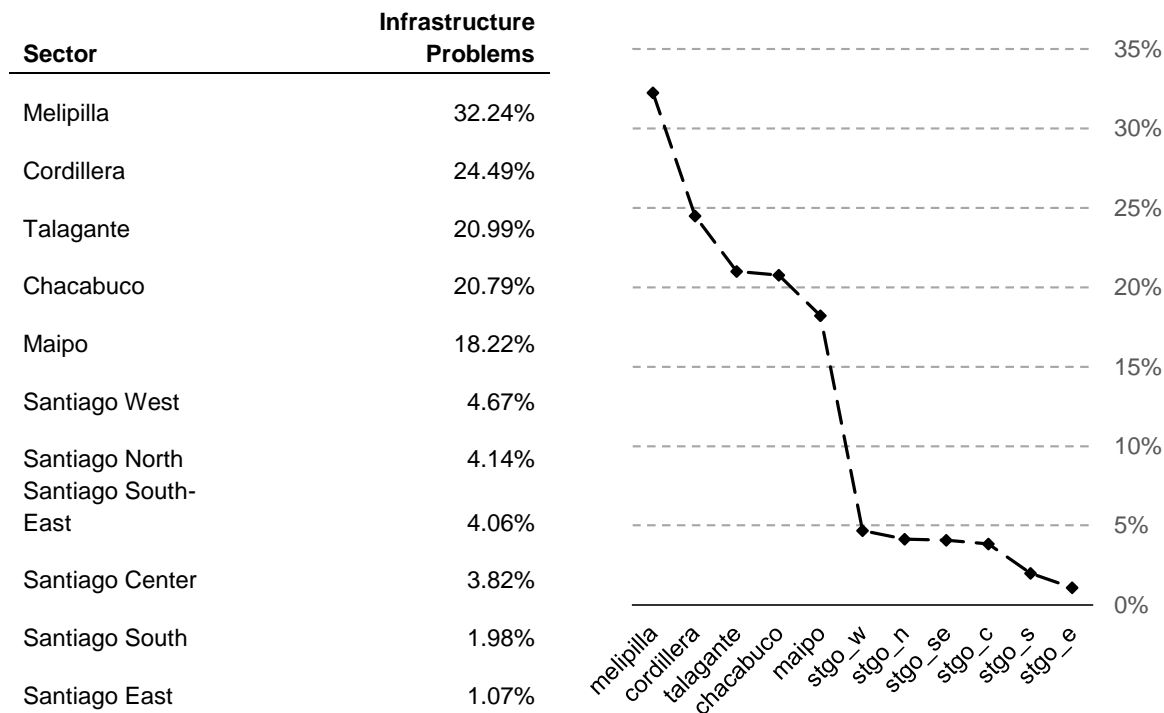
Santiago, as shown in Figure 7, there is a critical situation in peripheral areas like Melipilla, Cordillera and Talagante, where 20% to 32% of the units are facing infrastructure problems. It is important to highlight that these sectors present an important concentration of subsidized housing. In Melipilla, Cordillera, and Talagante, 28%, 45%, and 26% of their respective housing stock is subsidized (see Appendix 2). In addition, as shown in Table 4 in page 29, those three sectors concentrate not only 23.5% of the total subsidized stock historically built by 2015, but also 20% of the subsidized housing built since 2006.

These factors are critical since condemn people with government assistance—which usually are tied to the unit through housing mortgages up to 25-30 years—to live in places lacking adequate infrastructure or far from transportation corridors that allow them access better jobs opportunities. Based on these findings, it is important to envisage a more active role for planning at influencing infrastructure provision; in order to mobilize investment from other public and private sources into land improvement, strategic development sites and the provision of appropriate infrastructure accommodating the subsidized stock currently being build.

Figure 8. Percentage of units presenting social problems by sector by 2015

Sector	Social Problems
Santiago south	31.42%
Cordillera	27.28%
Maipo	27.10%
Santiago North	22.47%
Santiago Center	21.93%
Santiago West	20.86%
Chacabuco	19.77%
Santiago South-East	19.70%
Talagante	15.77%
Melipilla	10.66%
Santiago East	4.68%
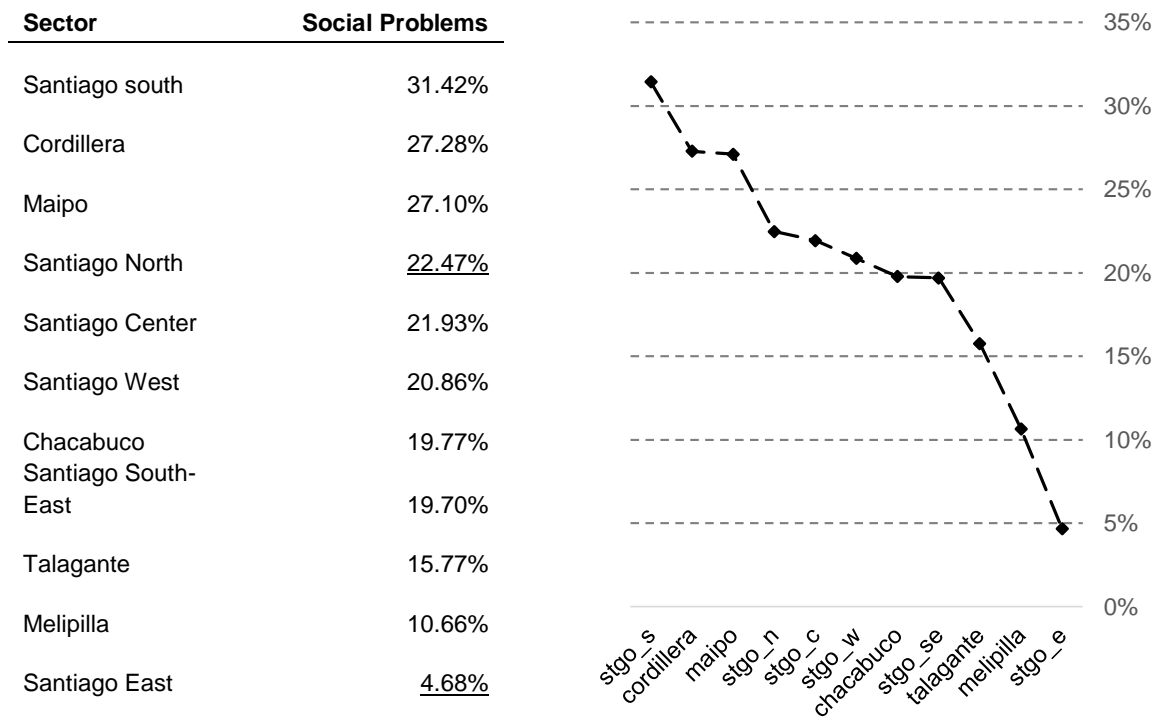
5.3.2. Social Problems

The social assessment complements the aforementioned analysis by looking at social problems affecting human relations and social capital of the community. Street violence, presence of drugs, and prostitution not only erode community values such as tolerance, solidarity or trust, but also affect the neighborhood quality, image, stability, cohesion and connections within the community. The analysis considers whether: units have witnessed i) graffiti and other street damage, ii) street prostitution, iii) people consuming or trafficking drugs in the public space, vi) street fighting, and v) shootings. If a unit is facing two or more of these conditions, then is considered by this study as presenting social problems.

Following the trends described so far, the neighborhoods presenting higher social problems (as depicted in Figure 8) are Sectors like Santiago South, Cordillera, Maipo, and Santiago North. All neighborhoods with high concentration of subsidized stock (historically, and built post 2006), high poverty levels, and where physical and infrastructure deficiencies are more common.

Map 10. Percentage of units facing social problems – AMGS 2015
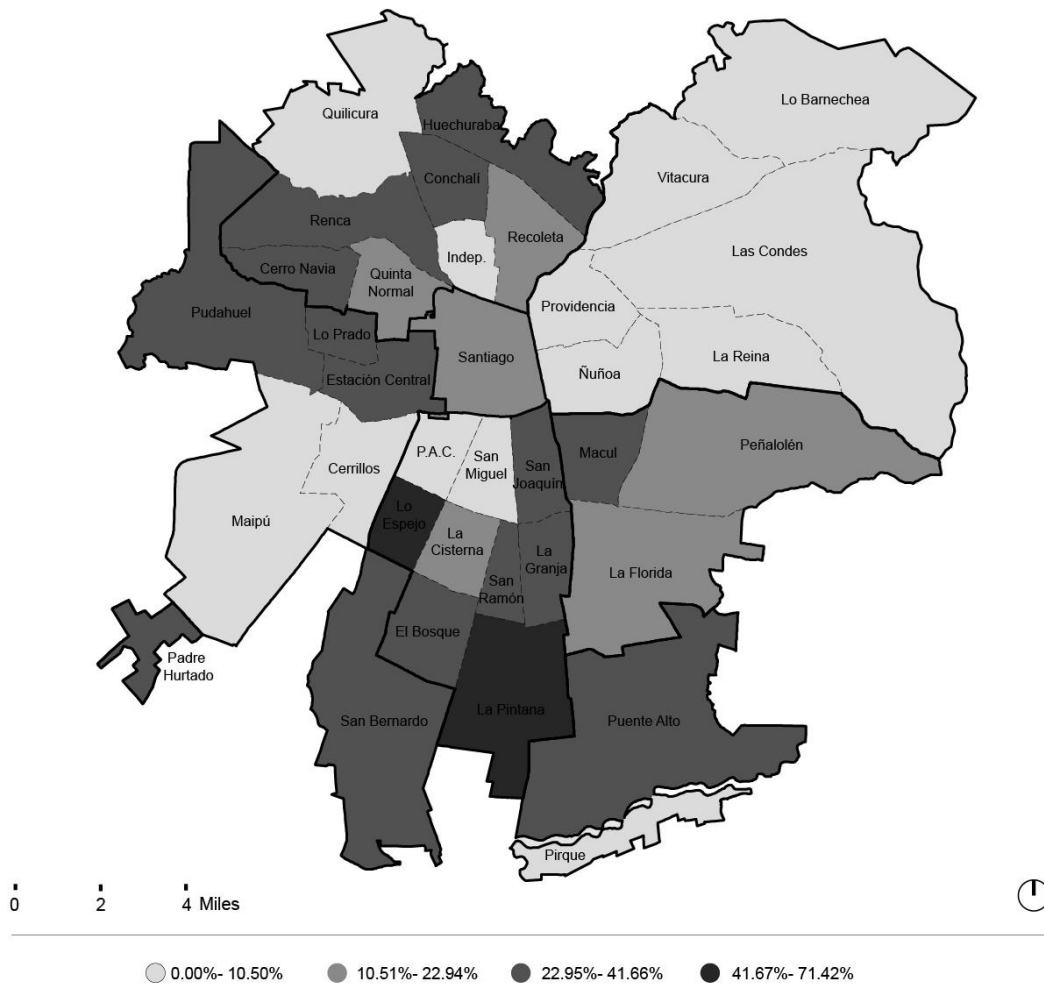
Source: ESRI, Casen 2015 Ministerio de Desarrollo Social, Desarrollo Regional y Administrativa (SUBDERE), Instituto Geográfico Militar | Projection UTM 19

6. Major findings and policy recommendations

Both *D* and the IRS (employed to analyze income) are two indicators that can effectively provide an idea about how residential segregation has evolved during last decades. Although they allow analyzing large-scale segregation (at sectors and districts' scale), it is not possible to analyze small-scale segregation using CASEN data. The diminution of internal RSD in each sector (regarding incomes, subsidized stock, etc.) suggests that neighborhoods have been experiencing processes of internal homologation and therefore, differentiating the total population in different sectors according to their wealth. However, without disaggregated data at block level, it is difficult to

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reach a more precise conclusion regarding the internal dynamics or small-scale segregation within each district. This analysis will remain pending until new census data is available.

Regarding large-scale segregation, the study evidences the existence and ongoing production of important clusters of subsidized housing in peripheral areas. The increase of large scale residential segregation based on income implies that location subsidies, as structured under MINVU's decree FSEV 16, are not being neither efficient enough to battle the large-scale residential segregation, nor promoting better locations or low-income housing dispersion. Secondly, it is possible to relate the location of those clusters of government assistance, with negative urban conditions such as overcrowding (see section 5.1), physical deficiencies (see section 5.2), and infrastructure and social problems (see section 5.3). These conditions not only erode the opportunities of people receiving government vouchers, but also devaluate the government's investments made through the housing system; perpetuating environments of poverty concentration where opportunities or social mobility are limited, and where social mistrust, violence, and social fragmentation are accentuated.

The attempt by the Chilean government to improve the location of subsidized housing and generating inclusive communities through the private market is not a novel idea, it has been tried in many places including UK, Spain, Italy, among many other European countries. The findings depicted through this thesis confirm the general experience worldwide; while private markets are efficient partners at encouraging productivity and providing housing, they will never generate social benefits without the required incentives. The reason is simple: in the end, someone has to pay for the good provided (in this case, the quality guaranteed price for prime locations) and to ensure the minimum risk for developers. This makes privatization of social housing a viable yet expensive strategy for the government in order to work as desired, since not only is it necessary to "buy" from developers (through subsidies, zoning allowances, or tax exemptions) the land that low-income households cannot pay, but also to provide the resources that deal with the developments' risk, and thus, maintaining the developers' *rates of return*.

The "inclusion" proposed by Chilean policies almost only occurs today between poor- and slightly less poor-households in the periphery without fundamentally challenging the dynamics

between housing and the real estate market. In spite of some scholars still arguing for the liberalization of urban limits to reduce the value of land, or for increasing (even more) the value of subsidies to improve location standards, the Chilean government has already applied those strategies without mayor success (Brain and Sabatini 2004). Coming back to the centralized government alternative is not a viable solution either, given its lack of productivity (see Figure 2) in battling housing shortages. Notwithstanding, and based in the analysis portrayed by this study, multiple planning strategies can be implemented to improve the current situation according to the goals stated, while dispersing at the same time the economic burden of providing quality-housing solutions. Some of them are:

i.   *Improve contractual conditions under which vouchers are assigned.*

As described throughout the thesis, government vouchers are assigned based on projects' conditions (location, or a development's social composition). Therefore, the most direct strategy to improve the quality of the stock provided is to improve the government's requirements at assigning the vouchers. Evidently, requiring better locations (proximity to services and transportation corridors, quality public space, health facilities, etc.), better quality units (size and material-quality) or deeper social mixture, will increase the cost of land, the cost of the building itself, and will increase the risk involved in the business; therefore, diminishing the private interest in participate. One way to counteract this cost—without increasing the vouchers value—is to adjust the benefits provided by the government in form of bonuses or zoning allowances. A brief look into international experience in this issue provides a diverse range of instruments such as FAR bonuses, tax credits and exemptions, that may be mechanisms easily transferable to a neoliberal context like Chile.

ii.   *Implement inclusionary zoning in underutilized areas near transportation corridors.*

The creation of zoning ordinances in underdeveloped areas—mandatory inclusionary areas requiring future developments to include a fixed percentage of affordable units in every development—will create permanent mixed-income communities in neighborhoods where demand increases is expected in the future due to public intervention. This works as a tax—in the form of affordable units—to return a fraction of the private benefits received by government investment.

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One situation in which this can be applied, is in the areas surrounding the two new subway lines projected throughout Santiago that will feed Santiago North and West (Lines 3 and 6), precisely the less advantaged areas of the city.

These new transportation corridors will increase the demand in those sectors, and land markets will inevitably displace vulnerable populations from these areas valued by public action. Today, without introducing any change in current building codes, 236,806,029 sqf of residential FAR are available in less than 0.3 miles of these new subway stations, which equals approximately to 411,000 housing units (Greene, et al. 2015). Without specific planning or zoning tools to ensure mixed-income communities, households with higher willingness to pay will capture them, displacing the low-income communities today living in those zones.

iii.   *Apply new subsidies (location and mixed-income subsidies) in existing housing stock as well as in new developments.*

Considering location as a scarce resource with fix supply, the requirement to apply acquisition subsidies only for new constructions implies its use mainly in peripheral areas (where land is available to new developments), usually far from public services which commonly grow at a significantly slower pace than urban expansion. Allowing the purchase of second-hand units, would save the associated cost of urbanization and will provide a new affordable stock in already consolidated neighborhoods.

iv.   *Encourage rental tenure:*

The current voucher system works only by subsidizing homeownership. This model is diverting an important amount of public resources—and low-income households' resources tied to mortgages up to 20 or 30 years—to acquire a unit that very often gets devaluated given its low quality emplacement. This way, the focus in homeownership not only implies an important loss for the state and a household's wealth, but also affect households' mobility in terms of job opportunities, or the adaptability of the voucher system to the changes experienced through a household's life, both in economic terms, and family composition (labour sources, mobility, etc.).

v.   *Affordability outside the market rationale:*

Considering the historical performance and market reactions to the existing voucher system, it is expectable that issuing rental vouchers will raise rents. This consideration also applies for recommendation "iii" regarding issuing vouchers for second-hand units. One direct solution is simply to rely more heavily in regulations, among which rent controls are definitely the most effective strategy for keeping housing prices down. Although a "cheap" solution for the State, it transfers all the cost to the private sector, with the multiple consequences it has on productivity levels.

The five points depicted above are just a few considerations to improve two specific housing policies implemented in Chile under the conditions depicted in this thesis; however, they do not pretend to solve a complex issue that involves a multidisciplinary approach. Inclusionary policies not only rely in the housing policy itself, but also in the cultural acceptance or willingness to build a more inclusionary society. This must be achieved through the educational curriculum, and supported by multiple other policies that seek to improve the working conditions, increase the minimum wages, provide better public spaces throughout the city, better transportation corridors, health plans and pensions, among many other variables improving life conditions in our cities. Despite these facts, one important take away is that housing policies in Chile have not only failed due to the complexity of a multidisciplinary problem, but due to the unbalance between the dual condition of housing policies: "the dual condition of housing as social policy [wealth distribution] and as industrial policy [housing production and the benefits it brings to the national economy]" (Valenzuela-Levi 2016).

Although the voucher system in Chile has reduced the housing deficit from a 'successful' industrial perspective, it has not been able to provide a genuine social good, and its economic success has been coupled with important failures in terms of distribution. To revert this, it is crucial to introduce new zoning tools designed for the new inclusionary agenda, and start focusing in the social aspect of the policies to meet the minimum quality standards required. Otherwise, land markets will continue to exclude vulnerable populations from areas valued by public action, and the qualitative housing deficit will endure.

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8. Appendixes

8.1. *Appendix 1: Population by territorial subunits*

i	**Chacabuco**	**205,718**		26	Providencia	126,595
1	Colina	119,557		27	Vitacura	78,313
2	Lampa	69,730		**viii**	**Santiago North**	**928,217**
3	Tiltil	16,431		28	Cerro Navia	129,630
ii	**Cordillera**	**819,206**		29	Conchalí	101,796
4	Pirque	24,779		30	Huechuraba	86,542
5	Puente Alto	779,984		31	Independencia	48,565
6	San José De Maipo	14,443		32	Quilicura	230,871
iii	**Maipo**	**490,446**		33	Quinta Normal	83,187
7	Buin	74,692		34	Recoleta	119,303
8	Calera De Tango	28,589		35	Renca	128,323
9	Paine	67,648		**ix**	**Santiago South**	**961,603**
10	San Bernardo	319,517		36	El Bosque	164,572
iv	**Melipilla**	**163,198**		37	La Cisterna	68,370
11	Alhué	4,634		38	La Granja	120,144
12	Curacaví	30,514		39	La Pintana	201,726
13	María Pinto	11,879		40	Lo Espejo	95,503
14	Melipilla	108,122		41	Pedro Aguirre Cerda	88,229
15	San Pedro	8,049		42	San Joaquín	73,197
v	**Talagante**	**285,156**		43	San Miguel	68,855
16	El Monte	31,752		44	San Ramón	81,007
17	Isla De Maipo	32,554		**x**	**Santiago South-East**	**741,397**
18	Padre Hurtado	51,498		45	La Florida	396,684
19	Peñaflor	89,190		46	Macul	93,943
20	Talagante	80,162		47	Peñalolén	250,770
vi	**Santiago Center**	**156,049**		**xi**	**Santiago West**	**1,471,245**
21	Santiago	156,049		48	Cerrillos	64,307
vii	**Santiago East**	**847,410**		49	Estación Central	107,335
22	La Reina	94,037		50	Lo Prado	88,305
23	Las Condes	291,971		51	Maipú	931,211
24	Lo Barnechea	115,963		52	Pudahuel	280,087
25	Ñuñoa	140,531				

Source: (Observatorio Social 2014)

8.2. Appendix 2: Distribution of subsidized stock

A. IRS

Year	Pop. Mean	IRS-District	IRS-Sector
1990	18.78%	na	na
1992	5.11%	na	na
1994	5.11%	na	na
1996	0.79%	na	na
1998	22.57%	na	na
2000	27.77%	na	na
2003	27.76%	na	na
2006	25.60%	na	na
2009	27.47%	na	na
2011	27.55%	na	na
2013	31.40%	na	na
2015	26.70%	na	na

B. RSD | Coefficient of Variation

Year	RSD-District	RSD-Sector
	11.41%	14.29%
1990	36.71%	22.42%
1992	58.77%	35.10%
1994	58.77%	35.10%
1996	76.93%	58.74%
1998	61.39%	32.77%
2000	57.02%	36.15%
2003	53.91%	35.52%
2006	50.35%	29.77%
2009	47.84%	22.58%
2011	54.96%	40.33%
2013	48.12%	36.71%
2015	50.39%	43.53%

C. Variances Ratio

Year	Sv/Dv
1990	37.30%
1992	35.66%
1994	35.66%
1996	58.31%
1998	28.50%
2000	40.20%
2003	43.40%
2006	34.95%
2009	22.28%
2011	53.86%
2013	58.19%
2015	74.63%

D. Dissimilarity Index

Year	D
1990	18.62%
1992	25.42%
1994	25.42%
1996	18.04%
1998	31.05%
2000	33.04%
2003	31.80%
2006	27.53%
2009	27.49%
2011	33.62%
2013	33.24%
2015	36.29%

E. Sector Comparison at 2015

Sector	Mean
chacabuco	31.69%
cordillera	45.55%
maipo	38.01%
melipilla	28.28%
talagante	26.67%
stgo_c	6.13%
stgo_e	8.58%
stgo_n	24.81%
stgo_s	27.33%
stgo_se	32.38%
stgo_w	41.30%
AVG	28.25%

F. Sector Change

Sector	Change
chacabuco	7.51%
cordillera	29.57%
maipo	23.11%
melipilla	15.14%
talagante	7.59%
stgo_c	-14.16%
stgo_e	-2.34%
stgo_n	0.50%
stgo_s	5.72%
stgo_se	12.12%
stgo_w	20.04%
AVG	9.53%

Interpretation / Observations:

General:
(1) From "A": The subsidized stock has increased significantly since 2000 (from 18% to 31%)
(2) From "E": The higher concentrations of public housing are located in peripheral areas; being the subsidized units about 34% of its total stock, compared to the 25% in santiago (from "E").
(3) From "E": By 2013, the higher concentration of subsidized stock was located outside Santiago.

Large scale dispersion
(4) The RSD by sector and district, have remained relatively stable
This means that residential segregation at large scale has remained relatively stable independent of the government attempts in reducing it. Moreover, both according to the RSD, and D --to different levels-- it seems to be a rise in the segregation indexes since 2006.

Small scale dispersion
(5) The IRS by district has experienced less increase than the IRS by Sector

This means that the percentage of the total variance that can be explained by the subunits' variance has increased slightly more for sectors than for districts (more segregation by sector than by district). It demonstrates that small scale segregation hasn't increased as much as large scale segregation
(6) The Internal RSD shows in which sectors have been important changes (3b). Seen in detail it is possible to appreciate how in certain districts heterogeneity is built based on displacement (or the loss of subsidized stock), while in others through the concentration of subsidized housing.

Conclusions:
(5) The aforementioned points reflect that the government, although has been assisting the correct tarjet population, has been reproducing the patterns of spatial segregation based on income carried from previous years. The relevance of this finding will be measured in the following analyses regarding social and environmental disparities.

Avg. Subsidized Stock (1990 1993 1996 1999 2002 2005 2008 2011 2014 2017)

RSD - Districts (black) Sectors (yellow) (1990 1993 1996 1999 2002 2005 2008 2011 2014 2017)

Dissimilarity Index (1990 1993 1996 1999 2002 2005 2008 2011 2014 2017)

Change in Sub. stock Stgo-East (black) - Cordillera (blue) (1990 1993 1996 1999 2002 2005 2008 2011 2014 2017)
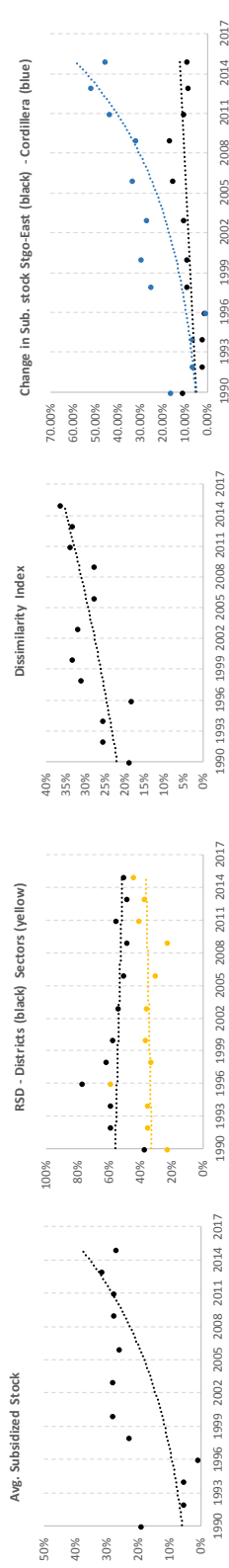
3b. Subsidized Housing Stock - Dispersion within sectors

Internal RSD	Avg.	1990	1992	1994	1996	1998	2000	2003	2006	2009	2011	2013	2015	Change
chacabuco	36.17%	45.88%	14.80%	14.80%	0.00%	70.19%	63.05%	43.35%	35.62%	na	25.10%	34.08%	36.25%	-9.6%
cordillera	54.05%	12.02%	57.96%	57.96%	0.00%	94.97%	87.84%	61.65%	77.19%	61.65%	49.72%	64.06%	47.77%	35.7%
maipo	42.56%	44.18%	60.06%	60.06%	58.25%	55.40%	55.62%	46.45%	35.36%	17.53%	42.06%	18.96%	16.78%	-27.4%
melipilla	39.57%	50.12%	43.87%	43.87%	44.69%	29.20%	46.88%	27.81%	37.02%	39.34%	31.81%	42.15%	38.06%	-12.1%
talagante	42.94%	28.37%	81.78%	81.78%	39.49%	35.14%	21.36%	24.24%	24.44%	25.43%	43.09%	58.73%	51.46%	23.1%
stgo_c	na	na	na	na	na	na	na	na	na	na	na	na	na	na
stgo_e	84.43%	46.35%	116.71%	116.71%	34.51%	76.69%	94.84%	72.78%	72.04%	113.88%	127.79%	94.04%	46.80%	0.5%
stgo_n	52.39%	9.96%	57.39%	57.39%	33.02%	62.40%	54.79%	53.83%	56.84%	60.90%	52.37%	71.44%	58.33%	48.4%
stgo_s	44.66%	16.27%	31.75%	31.75%	40.61%	61.18%	50.89%	52.04%	44.68%	62.16%	44.17%	49.84%	50.58%	34.3%
stgo_se	25.32%	9.90%	32.49%	32.49%	30.57%	33.88%	30.40%	33.13%	20.57%	27.56%	14.59%	20.35%	17.96%	8.1%
stgo_w	37.56%	28.92%	29.38%	29.38%	57.02%	34.74%	31.99%	25.59%	38.55%	36.53%	62.59%	38.26%	37.75%	8.8%

3c. Selected sub-units detailed

G. Max. / Min. Comparative evolution

		1990	1992	1994	1996	1998	2000	2003	2006	2009	2011	2013	2015	%Change
stgo_e	la_reina	17.76%	0.48%	0.48%	0.62%	11.72%	6.73%	10.93%	18.04%	4.94%	10.15%	33.06%	9.62%	-8.14%
stgo_e	las_condes	8.39%	0.29%	0.29%	0.99%	9.54%	2.90%	7.64%	11.34%	8.06%	3.70%	5.76%	8.18%	-0.21%
stgo_e	lo_barnechea	na	5.33%	5.33%	1.67%	16.19%	19.91%	19.09%	30.95%	50.91%	44.27%	11.51%	17.90%	12.57%
stgo_e	nunoa	10.76%	2.83%	2.83%	0.85%	6.84%	17.26%	12.80%	11.36%	19.86%	4.37%	4.97%	10.73%	-0.03%
stgo_e	providencia	4.56%	0.36%	0.36%	0.95%	0.17%	0.65%	0.17%	3.10%	6.15%	0.93%	2.59%	5.26%	0.69%
stgo_e	vitacura	na	0.40%	0.40%	na	0.61%	1.23%	2.18%	3.85%	0.27%	6.36%	7.63%	4.61%	4.20%
cordillera	pirque	16.76%	1.95%	1.95%	na	8.00%	12.76%	13.08%	28.17%	18.27%	55.02%	32.87%	12.84%	-3.92%
cordillera	puente_alto	17.66%	10.99%	10.99%	0.59%	55.43%	60.03%	51.56%	52.02%	52.35%	43.24%	57.11%	47.83%	30.17%
cordillera	san_jose_de_maipo	13.24%	6.18%	6.18%	na	7.54%	7.70%	9.43%	14.14%	13.53%	19.64%	6.60%	29.11%	15.88%
Weighted Avg.	stgo_e	10.92%	1.74%	1.74%	0.86%	8.67%	8.59%	10.19%	15.24%	16.79%	10.09%	8.22%	8.58%	-2.34%
Weighted Avg.	cordillera	15.98%	6.44%	6.44%	0.59%	24.76%	29.26%	26.57%	33.27%	31.76%	43.61%	51.88%	45.55%	29.57%

8.3. *Appendix 3: Analysis of income distribution*

Interpretation / Observations boxed text and charts (rendered below as text and figures).

A. IRS

Year	Pop. Mean	IRS-District	IRS-Sector
1990	$ 111,720	23.91%	17.68%
1992	$ 155,296	23.67%	18.98%
1994	$ 166,122	7.10%	3.20%
1996	$ 172,602	29.73%	18.86%
1998	$ 169,329	14.71%	9.40%
2000	$ 152,684	26.44%	19.67%
2003	$ 196,695	14.73%	10.82%
2006	$ 188,598	20.86%	11.81%
2009	$ 174,436	31.39%	19.71%
2011	$ 251,081	23.65%	18.38%
2013	$ 231,656	25.12%	19.33%
2015	$ 276,452	37.95%	19.35%
	6.2%	$ 276,452	

B. RSD | Coefficient of Variation

Year	RSD-District	RSD-Sector
1990	na	na
1992	na	na
1994	na	na
1996	na	na
1998	na	na
2000	na	na
2003	na	na
2006	na	na
2009	na	na
2011	na	na
2013	na	na
2015	na	na

C. Variances Ratio

Year	Sv/Dv
1990	73.94%
1992	80.17%
1994	45.04%
1996	63.45%
1998	63.91%
2000	74.42%
2003	73.45%
2006	56.61%
2009	62.79%
2011	77.71%
2013	76.96%
2015	50.98%
	mean 5%

D. Sector Change (%)

Sector	Change
chacabuco	5.85%
cordillera	3.02%
maipo	4.53%
melipilla	5.77%
talagante	5.38%
stgo_c	5.68%
stgo_e	3.95%
stgo_n	5.21%
stgo_s	5.87%
stgo_se	5.90%
stgo_w	5.28%
AVG	5.13%
	SD 1%

E. Sector Comparison at 2015

Sector	Mean
chacabuco	$ 173,883
cordillera	$ 213,701
maipo	$ 181,930
melipilla	$ 169,765
talagante	$ 199,834
stgo_c	$ 231,038
stgo_e	$ 596,253
stgo_n	$ 186,029
stgo_s	$ 195,183
stgo_se	$ 265,379
stgo_w	$ 206,211
AVG	$ 238,110

F. Sector Change (No)

Sector	Change
chacabuco	$ 99,719
cordillera	$ 76,876
maipo	$ 88,270
melipilla	$ 96,548
talagante	$ 108,827
stgo_c	$ 130,162
stgo_e	$ 262,752
stgo_n	$ 99,234
stgo_s	$ 112,271
stgo_se	$ 152,988
stgo_w	$ 110,877
AVG	$ 238,110

Interpretation / Observations:

General:
(1) From "A": Total average income has doubled since 1990
(2) From "F": Incomes within Santiago have increase at a higher rate than on peripheral provinces
(3) From "E": By 2013, average incomes in Santiago are 38% higher than other provinces

Large scale dispersion
(4) Supporting what stated in (2) and (3), the IRS shows an increasing tendecy, both for districts, and from sectors -> Overall disparities have increased

Small scale dispersion
(5) The IRS by district has experienced less increase than the IRS by Sector
This means that the percentage of the total variance that can be explained by the subunits' variance has increased slightly more for sectors than for districts (more segregation by sector than by district). Considering a possibly margin of error this may be not considerably significant, but it suggests that small scale segregation hasn't increased as much as large scale segregation
In other words, sectors remain as homogeneous areas, but more segregated between each others.

(6) As expectable from (5) the variances' ratio has remain relatively stable
The coefficient of variation in a wealthy neighborhood like Santiago east averages 38%, doubling the RSD in a peripheral province like Cordillera (16%). Meaning that Santiago stands as a more diverse neighborhood than Cordillera.

(7) The IRS' results show a tendency towards increase regarding Residential Segregation by income at a large scale. The internal RSD by sector shows a loss of heterogeneity across sectors, specially in those where incomes are lower (less segregation at small scale, and major concentration of low-income households). At the same time The sector analysis (detailed per neighborhood in "G") shows important disparities between districts. This disparities have remained constant (IRS Graph) maintaining better wages within Santiago's boundaries.

Conclussion: Small scale segregation has increased less than large scale segregation, conforming homogeneous neighborhoods (poor and rich neighborhoods) separated between them.

Change in Income - Stgo_e (blue) Cordillera (black)

Variances Ratio

IRS - Districts (black) Sector (yellow)

Mean Income (Annual USD)
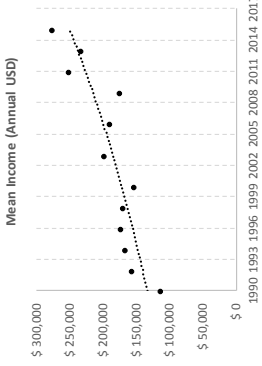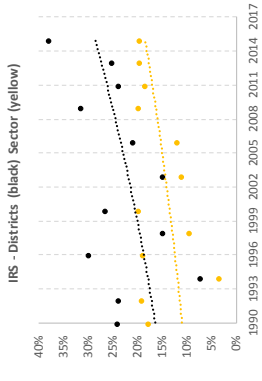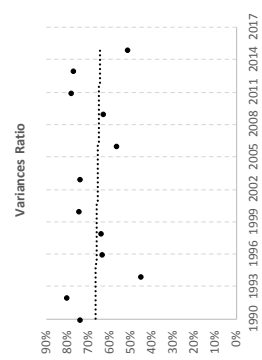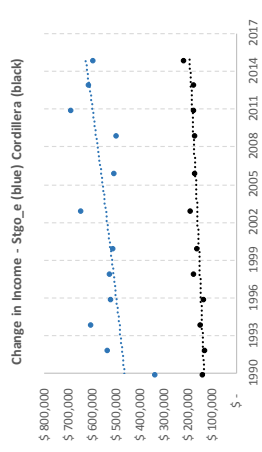
1b. Income distribution - Dispersion within sectors

Internal RSD	Avg.	1990	1992	1994	1996	1998	2000	2003	2006	2009	2011	2013	2015	Change
chacabuco	11%	13%	9%	7%	0%	14%	3%	27%	28%	4%	5%	9%	10%	-3.0%
cordillera	18%	40%	18%	11%	0%	26%	16%	25%	10%	12%	3%	14%	40%	-0.1%
maipo	25%	25%	9%	38%	69%	14%	20%	36%	28%	9%	33%	6%	11%	-13.5%
melipilla	18%	26%	16%	10%	8%	17%	19%	31%	24%	16%	12%	21%	10%	-15.4%
talagante	16%	15%	23%	8%	15%	12%	7%	30%	27%	14%	15%	15%	13%	-1.6%
stgo_c	na	na	na	na	na	na	na	na	na	na	na	na	na	na
stgo_e	32%	20%	26%	76%	28%	29%	25%	32%	39%	31%	28%	25%	27%	6.5%
stgo_n	17%	17%	18%	18%	12%	20%	18%	14%	14%	17%	30%	10%	14%	-3.1%
stgo_s	27%	20%	47%	21%	30%	27%	25%	34%	35%	21%	11%	23%	27%	6.9%
stgo_se	14%	32%	12%	8%	20%	13%	9%	17%	15%	15%	12%	9%	9%	-23.0%
stgo_w	14%	26%	17%	21%	13%	9%	7%	10%	12%	10%	18%	11%	13%	-12.4%

1c. Selected sub-units detailed
G. Max. / Min. Comparative evolution

		1990	1992	1994	1996	1998	2000	2003	2006	2009	2011	2013	2015	Change
stgo_e	la_reina	$ 275,940	$ 497,510	$ 479,363	$ 435,479	$ 481,447	$ 517,181	$ 522,217	$ 352,141	$ 480,304	$ 588,514	$ 507,343	$ 524,168	190.0%
stgo_e	las_condes	$ 414,429	$ 545,782	$ 511,353	$ 745,889	$ 505,321	$ 710,128	$ 708,968	$ 567,785	$ 696,977	$ 760,450	$ 699,861	$ 697,802	168.4%
stgo_e	lo_barnechea	$ -	$ 678,485	$ 298,994	$ 601,524	$ 677,617	$ 455,583	$ 842,688	$ 464,236	$ 384,823	$ 564,242	$ 517,237	$ 851,784	125.5%
stgo_e	nunoa	$ 263,660	$ 250,107	$ 247,997	$ 340,489	$ 383,463	$ 355,047	$ 326,202	$ 361,455	$ 258,108	$ 457,752	$ 526,401	$ 408,345	154.9%
stgo_e	providencia	$ 399,588	$ 625,804	$ 459,241	$ 427,142	na	$ 486,110	$ 428,934	na	$ 574,108	$ 590,614	$ 498,707	$ 602,097	150.7%
stgo_e	vitacura	$ -	$ 534,954	$ 1,584,780	na	$ 871,139	$ 688,859	$ 890,845	$ 951,740	$ 698,748	$ 1,032,139	$ 909,296	$ 927,242	173.3%
cordillera	pirque	$ 210,932	$ 95,752	$ 140,226	na	$ 234,653	$ 197,062	$ 254,293	$ 181,462	$ 192,177	$ 161,838	$ 233,007	$ 476,900	226.1%
cordillera	puente_alto	$ 96,377	$ 151,442	$ 164,709	$ 131,508	$ 123,476	$ 144,016	$ 154,750	$ 172,027	$ 142,061	$ 175,114	$ 164,526	$ 200,101	207.6%
cordillera	san_jose_de_maipo	$ 96,119	$ 131,502	$ 126,075	na	$ 166,133	$ 142,803	$ 155,544	$ 143,453	$ 180,719	$ 168,511	$ 218,682	$ 238,581	248.2%
Weighted Avg.	stgo_e	$ 333,501	$ 534,957	$ 603,429	$ 520,339	$ 523,770	$ 511,190	$ 644,432	$ 508,562	$ 496,714	$ 685,894	$ 612,184	$ 596,253	178.8%
Weighted Avg.	cordillera	$ 136,825	$ 126,413	$ 144,664	$ 131,508	$ 173,498	$ 160,372	$ 186,246	$ 167,361	$ 166,760	$ 172,848	$ 173,770	$ 213,701	156.2%

8.4. Appendix 4: Income analysis by industry

INDUSTRY'S PARTICIPATION IN THE MARKET (by number of observations)

	2015	2013	2011	2009	2006	2003	2000	1998	1994	1992	1990	Change
Agriculture, livestock, fishing	2.58%	3.61%	5.21%	8.85%	10.46%	11.02%	11.40%	12.29%	12.90%	14.34%	22.48%	-19.90%
Wholesale trade	29.19%	36.50%	37.69%	22.48%	20.80%	20.35%	20.39%	19.35%	18.02%	16.57%	18.73%	10.46%
Energy (Electricity, Gas and Water supply)	0.65%	0.45%	0.82%	0.74%	0.62%	0.66%	0.77%	0.87%	0.77%	0.79%	0.00%	0.65%
Finance, Insurance	3.21%	2.83%	2.92%	9.07%	8.57%	8.24%	7.94%	7.20%	6.43%	5.11%	7.68%	-4.47%
Real Estate and Construction	21.53%	21.09%	19.94%	8.30%	9.27%	8.44%	7.93%	8.05%	8.99%	9.09%	7.96%	13.57%
Manufacturing	12.99%	14.80%	14.01%	13.43%	15.35%	15.15%	16.50%	16.82%	19.24%	21.87%	22.44%	-9.45%
Mining	1.11%	1.18%	1.14%	1.11%	0.81%	0.66%	0.64%	0.54%	0.82%	0.95%	1.11%	0.00%
Other services (exept public administration)	19.69%	10.37%	9.91%	28.40%	27.33%	28.96%	27.54%	28.16%	26.76%	25.61%	11.95%	7.75%
Transportation and Warehousing	9.04%	9.64%	9.17%	8.36%	7.41%	7.19%	7.65%	7.58%	6.84%	6.46%	7.66%	1.39%
Total Observations	23875	14632	10530	19888	21763	21208	19413	20147	15274	15101	10905	

AVERAGE INCOME BY INDUSTRY

	2015	2013	2011	2009	2006	2003	2000	1998	1994	1992	1990	Change
Agriculture, livestock, fishing	$ 223,179	$ 191,130	$ 210,565	$ 136,845	$ 129,158	$ 126,296	$ 117,223	$ 121,209	$ 88,074	$ 96,184	$ 81,574	49.2%
Wholesale trade	$ 276,903	$ 210,307	$ 239,454	$ 202,870	$ 199,810	$ 215,525	$ 175,581	$ 204,971	$ 199,968	$ 191,080	$ 139,997	35.6%
Energy (Electricity, Gas and Water supply)	$ 362,952	$ 267,678	$ 416,800	$ 198,474	$ 195,983	$ 237,832	$ 166,316	$ 172,479	$ 149,171	$ 242,394	na	27.0%
Finance, Insurance	$ 420,906	$ 421,491	$ 504,029	$ 301,758	$ 330,810	$ 384,184	$ 281,167	$ 352,786	$ 276,965	$ 299,046	$ 215,846	35.1%
Real Estate and Construction	$ 330,692	$ 306,315	$ 347,409	$ 182,765	$ 185,380	$ 204,308	$ 144,689	$ 181,387	$ 145,218	$ 186,815	$ 105,784	56.3%
Manufacturing	$ 302,136	$ 220,519	$ 239,773	$ 181,573	$ 189,409	$ 199,071	$ 166,017	$ 181,224	$ 201,125	$ 159,640	$ 120,901	45.0%
Mining	$ 421,696	$ 362,482	$ 472,582	$ 273,082	$ 260,326	$ 233,716	$ 207,836	$ 211,015	$ 168,418	$ 185,537	$ 95,244	79.7%
Other services (exept public administration)	$ 316,013	$ 328,249	$ 374,118	$ 224,891	$ 250,085	$ 264,422	$ 200,857	$ 239,714	$ 268,217	$ 225,598	$ 177,585	32.0%
Transportation and Warehousing	$ 320,021	$ 240,937	$ 243,811	$ 214,757	$ 225,226	$ 212,184	$ 203,299	$ 189,204	$ 164,106	$ 179,171	$ 145,330	39.6%

3a: Incomes categorized by industry and districts

1b. Average Income by Industry (adjusted by CPI)

Wholesale trade	2015	2013	2011	2009	2003	2000	1998	1994	1992	1990
chacabuco	$ 194,777	$ 184,028	$ 174,964	$ 155,793	$ 197,337	$ 142,677	$ 187,399	$ 124,203	$ 102,411	$ 120,549
cordillera	$ 222,888	$ 169,271	$ 170,573	$ 217,060	$ 172,247	$ 174,765	$ 216,066	$ 201,183	$ 234,541	$ 159,822
maipo	$ 209,572	$ 160,163	$ 177,133	$ 161,301	$ 267,580	$ 135,540	$ 166,827	$ 202,393	$ 156,870	$ 155,554
melipilla	$ 178,621	$ 149,013	$ 151,124	$ 207,231	$ 172,887	$ 219,557	$ 149,260	$ 115,088	$ 141,696	$ 104,731
talagante	$ 240,599	$ 181,662	$ 215,628	$ 162,571	$ 154,936	$ 143,304	$ 149,690	$ 116,024	$ 171,365	$ 112,622
stgo_c	$ 233,666	$ 228,605	$ 238,678	$ 175,570	$ 208,820	$ 219,739	$ 201,474	$ 336,412	$ 147,256	$ 102,853
stgo_e	$ 491,914	$ 532,663	$ 635,421	$ 516,817	$ 652,457	$ 491,648	$ 638,514	$ 563,094	$ 525,583	$ 359,644
stgo_n	$ 192,063	$ 165,341	$ 181,225	$ 175,525	$ 162,509	$ 161,478	$ 156,982	$ 160,691	$ 151,886	$ 116,722
stgo_s	$ 187,807	$ 169,487	$ 172,267	$ 169,381	$ 147,797	$ 151,193	$ 151,227	$ 135,635	$ 156,450	$ 105,866
stgo_se	$ 243,676	$ 205,154	$ 192,309	$ 205,066	$ 195,068	$ 165,545	$ 178,799	$ 196,815	$ 132,732	$ 111,251
stgo_w	$ 217,259	$ 193,702	$ 207,737	$ 195,395	$ 168,903	$ 165,524	$ 161,530	$ 163,923	$ 155,988	$ 112,807
Energy (Electricity, Gas and Water supply)										
chacabuco	$ 305,404	$ 264,244	na	$ 141,966	$ 553,707	$ 117,527	$ 187,736	$ 81,579	$ 95,935	na
cordillera	$ 223,699	$ 199,297	$ 211,245	$ 172,997	$ 163,148	$ 148,621	$ 105,441	$ 127,375	$ 90,154	na
maipo	$ 210,425	$ 184,456	$ 359,798	$ 201,333	$ 220,874	$ 232,438	$ 100,932	$ 165,077	$ 49,621	na
melipilla	$ 228,027	$ 88,075	$ 145,779	$ 168,446	$ 68,296	$ 161,472	$ 149,511	$ 37,882	$ 94,850	na
talagante	$ 300,327	$ 100,235	$ 175,752	$ 177,900	$ 216,217	$ 103,146	$ 90,777	$ 73,788	$ 95,507	na
stgo_c	$ 279,076	na	$ 513,656	$ 75,979	$ 87,711	$ 196,183	$ 215,342	$ 131,499	$ 341,355	na
stgo_e	$ 790,999	$ 669,557	$ 959,949	$ 440,284	$ 703,344	$ 441,304	$ 450,638	$ 360,798	$ 625,511	na
stgo_n	$ 214,753	$ 255,510	$ 145,745	$ 141,932	$ 224,385	$ 161,853	$ 149,094	$ 122,075	$ 107,632	na
stgo_s	$ 216,663	$ 197,493	$ 214,716	$ 165,504	$ 160,445	$ 90,171	$ 144,284	$ 161,800	$ 587,562	na
stgo_se	$ 567,034	$ 264,482	$ 588,295	$ 252,203	$ 281,926	$ 190,116	$ 240,909	$ 237,613	$ 133,125	na
stgo_w	$ 218,214	$ 218,722	$ 197,050	$ 208,000	$ 125,248	$ 146,430	$ 146,408	$ 141,793	$ 117,682	na
Real Estate and Construction										
chacabuco	$ 216,452	$ 159,250	$ 211,150	$ 134,166	$ 168,392	$ 95,962	$ 124,955	$ 84,357	$ 80,333	$ 79,929
cordillera	$ 231,667	$ 197,236	$ 212,421	$ 152,950	$ 198,060	$ 111,292	$ 183,912	$ 157,221	$ 117,605	$ 102,899
maipo	$ 197,439	$ 180,039	$ 189,213	$ 170,075	$ 217,672	$ 130,799	$ 128,600	$ 123,471	$ 94,300	$ 100,392
melipilla	$ 193,548	$ 155,482	$ 327,427	$ 150,895	$ 138,167	$ 124,695	$ 167,294	$ 106,078	$ 80,487	$ 53,711
talagante	$ 238,201	$ 266,030	$ 252,723	$ 146,265	$ 174,782	$ 143,152	$ 148,603	$ 95,949	$ 133,904	$ 108,444
stgo_c	$ 273,781	$ 365,016	$ 350,319	$ 252,405	$ 135,948	$ 152,546	$ 138,382	$ 119,824	$ 172,430	$ 61,255
stgo_e	$ 700,276	$ 732,288	$ 792,311	$ 532,685	$ 734,783	$ 565,324	$ 583,699	$ 458,361	$ 805,853	$ 380,709
stgo_n	$ 219,219	$ 192,327	$ 198,566	$ 158,250	$ 152,184	$ 131,472	$ 130,127	$ 108,960	$ 105,336	$ 92,040
stgo_s	$ 225,898	$ 207,618	$ 170,058	$ 147,944	$ 134,899	$ 123,303	$ 125,575	$ 110,913	$ 99,043	$ 85,891
stgo_se	$ 321,580	$ 235,490	$ 262,330	$ 149,497	$ 178,774	$ 124,549	$ 136,485	$ 132,277	$ 113,539	$ 92,650
stgo_w	$ 239,013	$ 232,950	$ 248,144	$ 244,796	$ 163,436	$ 126,439	$ 128,374	$ 124,044	$ 101,485	$ 84,922
Manufacturing										
chacabuco	$ 165,515	$ 185,029	$ 161,304	$ 141,832	$ 135,863	$ 112,367	$ 111,664	$ 115,900	$ 103,721	$ 75,001
cordillera	$ 235,075	$ 191,908	$ 166,041	$ 156,429	$ 191,752	$ 182,137	$ 197,430	$ 176,845	$ 161,998	$ 189,939
maipo	$ 194,931	$ 177,369	$ 190,986	$ 160,748	$ 199,050	$ 129,372	$ 296,343	$ 126,304	$ 123,624	$ 112,212
melipilla	$ 199,937	$ 129,944	$ 213,991	$ 156,354	$ 151,227	$ 171,485	$ 127,630	$ 106,614	$ 93,113	$ 88,133
talagante	$ 190,052	$ 208,545	$ 178,705	$ 152,793	$ 134,034	$ 133,363	$ 128,092	$ 105,290	$ 128,581	$ 127,509
stgo_c	$ 220,545	$ 338,072	$ 249,505	$ 225,803	$ 180,986	$ 165,134	$ 205,216	$ 167,113	$ 123,295	$ 112,072
stgo_e	$ 539,390	$ 633,515	$ 786,873	$ 560,601	$ 720,239	$ 614,203	$ 595,915	$ 1,340,908	$ 586,808	$ 327,575
stgo_n	$ 198,971	$ 180,125	$ 173,052	$ 174,431	$ 139,618	$ 139,742	$ 130,111	$ 120,499	$ 122,175	$ 90,688
stgo_s	$ 205,208	$ 191,907	$ 165,652	$ 159,519	$ 152,018	$ 134,173	$ 134,256	$ 120,923	$ 123,683	$ 89,277
stgo_se	$ 245,598	$ 207,287	$ 255,781	$ 168,648	$ 188,378	$ 167,157	$ 184,331	$ 152,294	$ 110,450	$ 120,243
stgo_w	$ 212,957	$ 199,426	$ 209,906	$ 180,913	$ 153,049	$ 137,523	$ 155,597	$ 136,265	$ 130,815	$ 105,672
Other services (exept public administration)										
chacabuco	$ 192,831	$ 192,709	$ 304,333	$ 157,530	$ 202,727	$ 120,275	$ 152,602	$ 102,211	$ 88,714	$ 86,669
cordillera	$ 228,451	$ 235,291	$ 228,027	$ 186,644	$ 218,075	$ 171,305	$ 198,734	$ 190,807	$ 131,639	$ 138,860
maipo	$ 222,889	$ 200,322	$ 172,563	$ 179,686	$ 215,362	$ 168,925	$ 153,044	$ 161,122	$ 119,274	$ 152,273
melipilla	$ 196,044	$ 220,340	$ 155,562	$ 177,299	$ 157,221	$ 129,156	$ 129,565	$ 116,697	$ 94,849	$ 120,453
talagante	$ 181,553	$ 213,525	$ 389,903	$ 176,105	$ 170,958	$ 152,807	$ 140,920	$ 110,582	$ 165,587	$ 148,402
stgo_c	$ 219,705	$ 395,138	$ 319,361	$ 235,940	$ 196,326	$ 267,039	$ 231,233	$ 213,102	$ 139,788	$ 131,603
stgo_e	$ 704,254	$ 664,882	$ 770,540	$ 538,516	$ 670,106	$ 576,337	$ 622,960	$ 743,882	$ 554,852	$ 374,171
stgo_n	$ 201,058	$ 217,982	$ 235,676	$ 175,132	$ 169,292	$ 149,875	$ 147,513	$ 133,656	$ 123,025	$ 99,959
stgo_s	$ 227,211	$ 234,795	$ 173,084	$ 182,269	$ 148,156	$ 146,967	$ 152,268	$ 132,137	$ 149,760	$ 117,517
stgo_se	$ 275,654	$ 270,955	$ 280,712	$ 186,525	$ 186,619	$ 167,532	$ 186,708	$ 175,188	$ 119,958	$ 162,793
stgo_w	$ 208,264	$ 238,099	$ 245,932	$ 212,796	$ 155,972	$ 143,294	$ 159,750	$ 155,221	$ 127,206	$ 138,626
Transportation and Warehousing										
chacabuco	$ 205,738	$ 177,502	$ 175,044	$ 168,428	$ 152,275	$ 108,179	$ 151,646	$ 133,603	$ 116,838	$ 86,428
cordillera	$ 229,490	$ 203,076	$ 228,367	$ 228,254	$ 175,111	$ 254,177	$ 222,966	$ 229,861	$ 202,861	$ 147,718
maipo	$ 188,331	$ 168,069	$ 191,031	$ 179,606	$ 163,109	$ 194,698	$ 134,650	$ 115,900	$ 155,605	$ 124,552
melipilla	$ 168,842	$ 145,186	$ 219,195	$ 178,855	$ 209,867	$ 139,236	$ 152,288	$ 139,757	$ 117,132	$ 121,582
talagante	$ 194,071	$ 188,273	$ 229,710	$ 182,042	$ 181,432	$ 179,651	$ 139,180	$ 106,368	$ 155,868	$ 120,315
stgo_c	$ 269,688	$ 284,709	$ 251,630	$ 161,750	$ 168,536	$ 290,382	$ 257,897	$ 355,823	$ 154,575	$ 111,100
stgo_e	$ 566,435	$ 552,899	$ 605,476	$ 529,274	$ 568,699	$ 577,013	$ 424,260	$ 378,503	$ 412,244	$ 432,006
stgo_n	$ 215,636	$ 200,895	$ 184,728	$ 190,614	$ 184,482	$ 180,998	$ 154,867	$ 126,500	$ 156,887	$ 102,979
stgo_s	$ 231,169	$ 204,562	$ 201,981	$ 199,538	$ 168,257	$ 181,055	$ 165,628	$ 122,847	$ 159,227	$ 104,339
stgo_se	$ 314,062	$ 243,633	$ 217,240	$ 198,715	$ 212,719	$ 200,199	$ 222,360	$ 184,301	$ 123,397	$ 134,688
stgo_w	$ 269,069	$ 223,082	$ 214,275	$ 223,152	$ 164,283	$ 160,972	$ 171,563	$ 177,769	$ 146,182	$ 115,058

v

8.5. *Appendix 5: Distribution of poverty rates*

Interpretation / Observations:

General:

(1) From "A": Total population under poverty line has decreased throughout the time frame selected

(2) From "F": Moderate income sectors (i.e. Talagante) were the ones w/best improvements

However, the reduction in poverty rates is still higher in Santiago (Avg. -24.76%) compared to the other provinces (Avg.-17.59) which also is consistent with the findings from "Median Income" analysis.

(3) From "E": The higher indexes of poverty rates were located outside Santiago by 2013.

Large scale dispersion

(4) The RSD by sector and district has experienced a significant increase (double)

This means that the square root of the variance (standard deviation) has increased in relation to the districts/sectors mean, therefore, increasing the difference between subunits.

The RSD by sector reflects how large scale segregation (or concentration of poverty in certain areas) has increased.

Small scale dispersion

(5) There is an overall increase in the RSD within sectors. However the detailed analysis show that that's that's mainly based in the fact that some districts have succeed in eliminating poverty, while others not. This may explain the low rate-increase in RSD by sector, compared to the high increase in RSD by district

Conclusions:

(5) Supporting points No. (3) and (4) the D index has been increasing through the time-frame selected.

(6) Although poverty levels have diminished considerable during the last decade there are still important disparities between neighborhoods (see "G") which support previous points.

(7) While small scale segregation heterogeneity within sectors) has diminished, large scale segregation has increased.

A. IRS

Year	Pop. Mean	IRS-District	IRS-Sector
1990	37.27%	na	na
1992	29.46%	na	na
1994	24.41%	na	na
1996	17.41%	na	na
1998	18.08%	na	na
2000	18.47%	na	na
2003	15.81%	na	na
2006	11.29%	na	na
2009	13.43%	na	na
2011	11.30%	na	na
2013	10.38%	na	na
2015	18.06%	na	na

B. RSD | Coefficient of Variation

Year	RSD-District	RSD-Sector
	28.34%	17.55%
1990	32.26%	23.98%
1992	30.67%	21.72%
1994	38.00%	33.89%
1996	41.07%	33.29%
1998	41.26%	28.83%
2000	35.25%	29.18%
2003	36.91%	25.59%
2006	37.84%	16.71%
2009	43.59%	25.20%
2011	52.04%	32.78%
2013	60.60%	41.53%
2015	39.28%	28.47%

C. Variances Ratio

Year	Sv/Dv
1990	55.25%
1992	50.15%
1994	79.54%
1996	65.71%
1998	48.81%
2000	68.52%
2003	48.06%
2006	19.50%
2009	33.41%
2011	39.68%
2013	46.96%
2015	52.52%

D. Dissimilarity Index

Year	D
1990	20.05%
1992	17.13%
1994	20.49%
1996	21.28%
1998	19.52%
2000	16.96%
2003	18.76%
2006	17.44%
2009	19.00%
2011	23.04%
2013	26.03%
2015	20.34%

E. Sector Comparison at 2015

Sector	Mean
chacabuco	25.86%
cordillera	22.13%
maipo	18.39%
melipilla	20.57%
talagante	18.46%
stgo_c	12.65%
stgo_e	7.37%
stgo_n	20.76%
stgo_s	24.93%
stgo_se	18.13%
stgo_w	14.66%
AVG	18.54%

F. Sector Change

Sector	Change
chacabuco	-12.39%
cordillera	-7.81%
maipo	-20.12%
melipilla	-21.40%
talagante	-28.49%
stgo_c	-17.67%
stgo_e	-4.49%
stgo_n	-19.36%
stgo_s	-17.16%
stgo_se	-17.58%
stgo_w	-23.86%
AVG	-17.30%

Average Population under poverty line

RSD

Dissimilarity Index

Change in Poverty Santiago East (black) - Maipo (blue)

2b. Poverty rates - Dispersion within sectors

Internal RSD	Avg.	1990	1992	1994	1996	1998	2000	2003	2006	2009	2011	2013	2015	Change
chacabuco	16.89%	33.05%	17.53%	19.95%	0.00%	20.42%	11.36%	8.98%	9.32%	3.20%	4.02%	0.56%	5.39%	-27.7%
cordillera	24.27%	16.67%	9.19%	14.80%	0.00%	26.89%	23.96%	24.17%	11.21%	3.84%	0.96%	3.53%	51.84%	35.2%
maipo	26.27%	16.45%	12.33%	26.53%	32.63%	24.61%	30.38%	14.49%	37.10%	7.62%	8.30%	6.82%	16.40%	0.0%
melipilla	24.76%	8.17%	12.89%	20.32%	0.87%	11.94%	22.85%	30.47%	19.22%	5.55%	4.97%	0.76%	14.45%	6.3%
talagante	26.70%	14.58%	9.07%	13.55%	47.28%	30.45%	21.51%	29.70%	39.62%	1.23%	0.31%	3.76%	27.38%	12.8%
stgo_c	na	na	na	na	na	na	na	na	na	6.38%	0.25%	2.06%	na	na
stgo_e	48.25%	23.49%	58.47%	40.85%	32.69%	49.56%	31.39%	40.49%	33.52%	10.26%	11.22%	10.66%	55.77%	32.3%
stgo_n	29.26%	27.47%	19.07%	25.06%	33.76%	30.57%	23.74%	27.75%	36.95%	11.94%	0.79%	14.83%	21.00%	-6.5%
stgo_s	35.39%	18.27%	29.89%	18.52%	36.57%	46.66%	30.32%	36.24%	47.09%	13.03%	7.51%	19.84%	27.16%	8.9%
stgo_se	20.85%	33.76%	13.14%	32.71%	30.49%	25.08%	17.93%	23.22%	18.22%	15.49%	18.54%	17.95%	9.43%	-24.3%
stgo_w	23.61%	20.28%	19.27%	38.98%	27.95%	22.30%	15.47%	20.90%	18.76%	4.65%	2.73%	2.99%	22.76%	2.5%

2c. Selected sub-units detailed

G. Max. / Min. Comparative evolution		1990	1992	1994	1996	1998	2000	2003	2006	2009	2011	2013	2015	%Change
stgo_e	la_reina	16.12%	10.71%	10.17%	7.08%	6.99%	7.25%	6.40%	9.80%	5.43%	4.02%	0.56%	6.01%	-10.11%
stgo_e	las_condes	10.87%	10.36%	7.46%	10.96%	5.31%	6.01%	9.80%	5.43%	3.84%	0.96%	3.53%	4.79%	-6.07%
stgo_e	lo_barnechea	na	31.12%	21.43%	6.67%	13.62%	9.29%	11.23%	11.23%	7.62%	8.30%	6.82%	16.54%	-14.59%
stgo_e	nunoa	8.61%	10.47%	15.00%	4.06%	4.05%	4.48%	5.22%	5.22%	5.55%	4.97%	0.76%	11.25%	2.64%
stgo_e	providencia	11.13%	7.51%	6.51%	10.48%	4.07%	12.34%	4.87%	2.97%	1.23%	0.31%	3.76%	4.63%	-6.51%
stgo_e	vitacura	na	11.28%	14.42%	na	12.12%	8.59%	10.03%	9.82%	6.38%	0.25%	2.06%	4.78%	-6.50%
maipo	buin	40.21%	40.47%	26.50%	na	24.10%	25.81%	12.63%	18.18%	10.26%	11.22%	10.66%	16.08%	-24.12%
maipo	calera_de_tango	39.30%	31.31%	27.77%	12.00%	11.44%	11.61%	5.99%	14.50%	11.94%	0.79%	14.83%	19.08%	-20.21%
maipo	paine	45.16%	29.51%	34.65%	28.05%	18.62%	14.40%	11.63%	18.64%	13.03%	7.51%	19.84%	24.32%	-20.84%
maipo	san_bernardo	28.00%	33.57%	15.36%	26.60%	19.42%	20.30%	18.81%	21.99%	15.49%	18.54%	17.95%	17.28%	-10.72%
Weighted Avg.	stgo_e	11.86%	14.55%	12.98%	7.64%	8.33%	6.68%	8.09%	8.02%	4.65%	2.73%	2.99%	7.37%	-4.49%
Weighted Avg.	maipo	38.51%	33.75%	26.42%	25.45%	18.24%	18.08%	12.47%	18.56%	12.96%	13.16%	16.94%	18.39%	-20.12%

8.6. *Appendix 6: Overcrowding analysis*

A. IRS

Year	Pop.Mean	IRS-District	IRS-Sector
1990	36.50%	na	na
1992	31.24%	na	na
1994	30.41%	na	na
1996	26.23%	na	na
1998	26.27%	na	na
2000	24.84%	na	na
2003	20.09%	na	na
2006	17.07%	na	na
2009	14.13%	na	na
2011	15.10%	na	na
2013	15.14%	na	na
2015	11.33%	na	na

B. RSD | Coefficient of Variation

Year	RSD-District	RSD-Sector
1990	35.17%	27.04%
1992	37.21%	30.61%
1994	39.49%	30.46%
1996	41.28%	33.56%
1998	36.18%	30.52%
2000	34.76%	28.66%
2003	35.93%	23.97%
2006	35.88%	22.56%
2009	39.08%	24.55%
2011	44.18%	32.79%
2013	44.97%	31.60%
2015	46.44%	29.97%

C. Variances Ratio

Year	Sv/Dv
1990	59.10%
1992	67.65%
1994	59.51%
1996	66.08%
1998	71.15%
2000	67.95%
2003	44.49%
2006	39.54%
2009	39.45%
2011	55.07%
2013	49.40%
2015	41.65%

D. Dissimilarity Index

Year	D
1990	20.57%
1992	20.58%
1994	22.26%
1996	22.83%
1998	18.00%
2000	15.06%
2003	17.83%
2006	15.45%
2009	14.95%
2011	22.97%
2013	20.71%
2015	20.14%

E. Sector Comparison at 2015

Sector	Mean
chacabuco	14.96%
cordillera	10.69%
maipo	14.08%
melipilla	9.38%
talagante	8.57%
stgo_c	12.15%
stgo_e	3.89%
stgo_n	14.64%
stgo_s	16.28%
stgo_se	10.29%
stgo_w	10.04%
AVG	11.36%

F. Sector Change

Sector	Change
chacabuco	-29.95%
cordillera	-21.27%
maipo	-27.23%
melipilla	-31.94%
talagante	-34.42%
stgo_c	-19.71%
stgo_e	-3.19%
stgo_n	-24.96%
stgo_s	-22.06%
stgo_se	-26.33%
stgo_w	-25.07%
AVG	-24.19%

Interpretation / Observations:

General:
(1) From "A": The percentage of units facing overcrowding has decreased significantly since 1990 (from 36.5% to 15%)
(2) From "F": The most important diminution is in peripheral provinces.
    This may reflect the beneficial impact of new subsidized stock in those areas.
(3) From "E": Still, by 2013 peripheral provinces and poorest sectors in santiago, have important disparities with wealthy areas.

Large scale dispersion
(4) The RSD by sector its been decreasing, altough by district it has been increasing. So, while sectors' variability in relation to their mean has been reduced, the total variability between districts has increased.
    That may explain then, that in general terms D shows a tendency towards diminution.

Small scale dispersion
(5) Districts have tended to become more homogeneous (less dispersion, variability), which can be consequence of the indexes obtained from the income, poverty, and subsidized stock analysis.

Conclusions:
The conventional explanation for overcrowding is that there is a shortage of affordable housing. The logical policy direction to ameliorate the problem is thus to increase the availability of housing that is affordable to these groups.

Avg. Stock presenting overcrowding

RSD - Districts (black) Sectors (yellow)

Dissimilarity Index

Overcrowding Stgo-East (black) - Cordillera (blue)
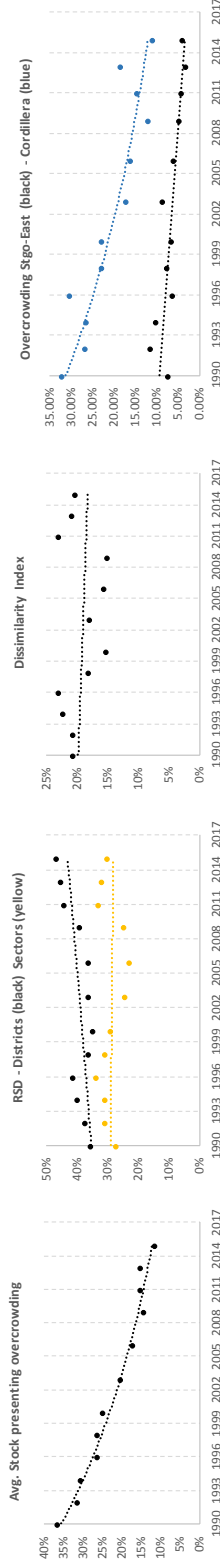
4b. Overcrowding - Dispersion within sectors

Internal RSD	Avg.	1990	1992	1994	1996	1998	2000	2003	2006	2009	2011	2013	2015	Change
chacabuco	13.33%	7.73%	16.43%	2.18%	0.00%	6.30%	11.53%	4.39%	19.98%	10.97%	48.52%	10.68%	21.20%	13.5%
cordillera	21.79%	12.29%	18.42%	19.21%	0.00%	21.06%	27.44%	19.59%	25.41%	13.84%	20.18%	12.94%	71.06%	58.8%
maipo	14.49%	na	24.38%	5.50%	9.39%	16.00%	4.23%	16.94%	21.39%	9.25%	23.21%	10.91%	9.49%	-14.9%
melipilla	22.89%	19.58%	9.82%	23.23%	11.61%	9.21%	5.16%	13.63%	16.53%	20.64%	34.37%	50.35%	48.23%	28.6%
talagante	26.11%	11.28%	25.82%	8.87%	20.50%	15.21%	17.89%	29.81%	17.35%	13.98%	33.04%	70.45%	49.13%	37.8%
stgo_c	na	na	na	na	na	na	na	na	na	na	na	na	na	na
stgo_e	88.90%	63.29%	101.76%	120.28%	66.39%	87.21%	67.47%	50.51%	85.93%	157.15%	106.57%	72.48%	87.73%	24.4%
stgo_n	20.51%	27.06%	20.71%	24.14%	20.29%	27.36%	27.36%	24.10%	14.34%	17.99%	15.71%	15.72%	16.82%	-10.2%
stgo_s	28.28%	18.07%	18.65%	19.91%	30.77%	31.87%	22.61%	35.23%	31.24%	44.40%	14.22%	32.50%	39.93%	21.9%
stgo_se	28.72%	39.17%	25.31%	32.88%	28.56%	21.84%	15.88%	32.51%	27.35%	33.32%	55.34%	15.91%	16.54%	-22.6%
stgo_w	24.52%	19.81%	21.89%	49.93%	26.21%	18.09%	5.57%	23.45%	32.01%	28.76%	26.17%	21.08%	21.25%	1.4%

4c. Selected sub-units detailed

G. Max. / Min. Comparative evolution

		1990	1992	1994	1996	1998	2000	2003	2006	2009	2011	2013	2015	Change
stgo_e	la_reina	13.73%	12.14%	7.26%	7.70%	10.07%	11.80%	5.50%	3.63%	7.58%	8.67%	1.11%	4.57%	-9.16%
stgo_e	las_condes	3.03%	4.14%	0.57%	5.48%	2.78%	2.45%	1.55%	0.00%	6.89%	1.08%	2.32%	2.52%	-0.51%
stgo_e	lo_barnechea	na	31.02%	30.95%	12.50%	17.15%	6.64%	13.26%	16.62%	15.25%	14.43%	7.89%	13.23%	-17.79%
stgo_e	nunoa	6.46%	10.81%	13.50%	4.91%	2.78%	4.99%	5.42%	2.33%	4.16%	1.59%	3.44%	5.52%	-0.93%
stgo_e	providencia	3.65%	1.25%	0.00%	0.00%	3.23%	7.79%	3.76%	0.00%	3.30%	3.10%	3.29%	2.44%	-1.21%
stgo_e	vitacura	na	1.25%	1.89%	na	2.08%	0.00%	0.00%	0.00%	9.58%	0.00%	1.03%	0.17%	-1.08%
cordillera	pirque	28.64%	31.68%	33.38%	na	17.73%	18.31%	18.05%	12.46%	12.45%	11.42%	16.26%	2.33%	-26.30%
cordillera	puente_alto	30.21%	20.00%	21.60%	30.30%	21.54%	18.71%	16.45%	14.48%	17.99%	14.52%	18.32%	11.41%	-18.80%
cordillera	san_jose_de_maipo	37.70%	28.36%	24.12%	na	29.30%	31.87%	12.83%	7.53%	20.36%	18.75%	22.17%	3.38%	-34.33%
Weighted Avg.	stgo_e	7.09%	11.31%	10.04%	6.06%	7.49%	6.33%	5.79%	4.47%	8.51%	3.95%	3.11%	3.89%	-3.19%
Weighted Avg.	cordillera	31.96%	26.44%	26.39%	30.30%	22.72%	22.58%	16.00%	11.85%	16.98%	14.31%	18.39%	10.69%	-21.27%

A. IRS

Year	Pop. Mean	IRS-District	IRS-Sector
1990	42.47%	na	na
1992	37.03%	na	na
1994	31.72%	na	na
1996	24.72%	na	na
1998	25.81%	na	na
2000	25.47%	na	na
2003	25.94%	na	na
2006	29.50%	na	na
2009	37.92%	na	na
2011	25.71%	na	na
2013	25.39%	na	na
2015	27.62%	na	na

B. RSD | Coefficient of Variation

Year	RSD-District	RSD-Sector
1990	27.69%	40.74%
1992	33.34%	44.45%
1994	37.14%	46.53%
1996	39.50%	48.24%
1998	29.76%	46.00%
2000	33.07%	47.53%
2003	32.44%	39.78%
2006	21.04%	32.48%
2009	21.84%	31.36%
2011	31.60%	52.82%
2013	30.83%	46.82%
2015	27.87%	41.45%

C. Variances Ratio

Year	Sv/Dv
1990	46.21%
1992	56.25%
1994	63.70%
1996	67.04%
1998	41.85%
2000	48.41%
2003	66.50%
2006	41.98%
2009	48.47%
2011	35.78%
2013	43.34%
2015	45.20%

D. Dissimilarity Index

Year	D
1990	28.01%
1992	27.82%
1994	26.38%
1996	23.15%
1998	21.64%
2000	22.63%
2003	21.16%
2006	17.46%
2009	17.08%
2011	29.17%
2013	25.77%
2015	21.58%

E. Sector Comparison at 2015

Sector	Mean
chacabuco	31.50%
cordillera	25.17%
maipo	25.29%
melipilla	40.42%
talagante	40.37%
stgo_c	32.28%
stgo_e	11.90%
stgo_n	32.32%
stgo_s	34.36%
stgo_se	24.54%
stgo_w	31.05%
AVG	29.93%

F. Sector Change

Sector	Change
chacabuco	-23.06%
cordillera	-12.93%
maipo	-16.52%
melipilla	-14.76%
talagante	-6.53%
stgo_c	-13.80%
stgo_e	2.39%
stgo_n	-11.82%
stgo_s	-11.47%
stgo_se	-21.46%
stgo_w	-4.36%
AVG	-12.21%

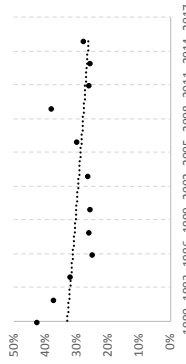**Interpretation / Observations:**

General:

Large scale segregation:

Small scale segregation:

Conclusions:

Charts:

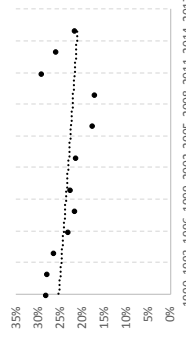Avg. Stock presenting deficiencies (years 1990–2017)

RSD - Districts (black) Sectors (yellow) (years 1990–2017)

Dissimilarity Index (years 1990–2017)
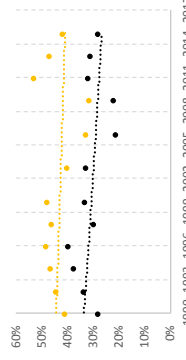
Ph. deficiencies Stgo-East (black) - Talagante (blue) (years 1990–2017)
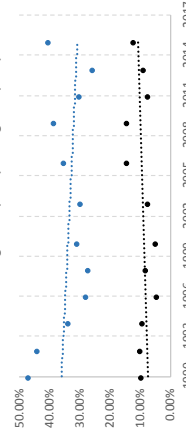
5b. Materiality Index - Dispersion within sectors

Internal RSD	Avg.	1990	1992	1994	1996	1998	2000	2003	2006	2009	2011	2013	2015	Change
chacabuco	22.64%	34.44%	20.70%	17.81%	0.00%	20.09%	30.12%	13.06%	22.04%	21.50%	48.96%	25.78%	17.21%	-17.2%
cordillera	31.06%	26.53%	31.72%	35.89%	0.00%	33.57%	55.91%	30.74%	12.70%	21.74%	28.35%	28.00%	67.52%	41.0%
maipo	20.77%	34.14%	12.96%	8.17%	40.73%	17.42%	34.95%	3.00%	22.73%	2.70%	26.72%	22.33%	23.38%	-10.8%
melipilla	25.15%	29.27%	47.17%	27.51%	13.11%	34.15%	41.55%	17.20%	8.36%	20.22%	11.92%	23.40%	27.93%	-1.3%
talagante	25.41%	15.30%	15.24%	22.89%	53.43%	29.28%	12.66%	19.47%	17.62%	17.26%	41.05%	37.78%	22.99%	7.7%
stgo_c	na	na	na	na	na	na	na	na	na	na	na	na	na	na
stgo_e	67.80%	12.77%	79.84%	99.17%	64.19%	70.48%	88.94%	67.07%	62.00%	57.30%	64.06%	86.94%	60.87%	48.1%
stgo_n	27.35%	26.35%	19.69%	23.37%	25.46%	44.60%	34.48%	17.46%	22.63%	25.85%	30.33%	35.86%	22.15%	-4.2%
stgo_s	24.81%	25.18%	21.46%	30.50%	27.72%	24.35%	16.69%	17.08%	25.82%	29.80%	33.24%	24.49%	21.38%	-3.8%
stgo_se	23.00%	30.96%	16.67%	25.79%	46.90%	13.63%	46.35%	8.31%	25.40%	11.68%	15.18%	20.08%	15.07%	-15.9%
stgo_w	30.36%	32.38%	37.50%	20.09%	32.62%	23.85%	27.77%	34.50%	20.07%	16.80%	49.74%	42.07%	26.93%	-5.4%

5c. Selected sub-units detailed

G. Max. / Min. Comparative evolution

Sector	District	1990	1992	1994	1996	1998	2000	2003	2006	2009	2011	2013	2015	%Change
stgo_e	la_reina	8.56%	7.02%	5.57%		5.13%	12.44%	7.04%	24.49%	19.33%	12.05%	18.61%	14.18%	5.62%
stgo_e	las_condes	8.25%	3.04%	1.58%		4.40%	10.63%	1.56%	7.45%	4.41%	1.72%	4.99%	8.78%	0.53%
stgo_e	lo_barnechea	na	24.28%	24.83%		10.00%	12.02%	11.50%	19.89%	26.22%	14.82%	28.36%	27.43%	3.15%
stgo_e	nunoa	10.76%	11.49%	12.17%		2.99%	6.20%	5.50%	7.27%	14.31%	15.51%	4.20%	17.40%	6.64%
stgo_e	providencia	10.95%	5.63%	3.61%		0.94%	0.17%	0.65%	20.13%	4.91%	6.81%	7.06%	7.33%	-3.62%
stgo_e	vitacura	na	3.48%	1.89%		na	1.10%	0.61%	3.70%	7.96%	2.03%	2.06%	3.07%	-0.41%
talagante	el_monte	58.34%	34.04%	40.30%		45.55%	20.24%	30.59%	45.54%	38.98%	28.94%	45.78%	25.42%	-32.92%
talagante	isla_de_maipo	46.13%	41.99%	41.74%		na	39.03%	28.61%	33.95%	41.31%	19.00%	24.37%	29.21%	-16.92%
talagante	padre_hurtado	na	47.14%	27.63%		na	23.82%	37.70%	34.68%	48.06%	32.00%	29.92%	43.79%	-3.35%
talagante	peñaflor	38.34%	52.08%	22.07%		9.28%	18.60%	26.16%	31.19%	27.16%	52.01%	26.54%	45.67%	7.33%
talagante	talagante	45.36%	na	38.67%		28.35%	33.53%	29.76%	27.76%	37.07%	17.90%	13.10%	45.14%	-0.22%
Weighted Avg.	stgo_e	9.51%	9.82%	8.90%		4.31%	7.97%	4.80%	13.98%	14.04%	7.09%	8.78%	11.90%	-0.73%
Weighted Avg.	talagante	46.89%	43.84%	33.65%		27.76%	27.10%	30.64%	35.01%	38.53%	30.10%	25.62%	40.37%	-21.27%

8.8. Appendix 8: Labor engagement

A. IRS

Year	Pop. Mean	IRS-District	IRS-Sector
1990	36.47%	na	na
1992	38.47%	na	na
1994	38.67%	na	na
1996	na	na	na
1998	38.56%	na	na
2000	38.08%	na	na
2003	40.38%	na	na
2006	42.37%	na	na
2009	40.78%	na	na
2011	43.86%	na	na
2013	45.32%	na	na
2015	46.85%	na	na

B. RSD | Coefficient of Variation

Year	RSD-District	RSD-Sector
1990	8.91%	6.81%
1992	8.29%	7.25%
1994	8.35%	7.37%
1996	na	na
1998	9.34%	9.35%
2000	9.76%	8.54%
2003	9.31%	10.78%
2006	8.68%	8.89%
2009	8.97%	6.93%
2011	10.24%	9.41%
2013	9.63%	12.25%
2015	9.44%	9.78%

C. Variances Ratio

Year	Sv/Dv
1990	58.39%
1992	76.40%
1994	77.79%
1996	na
1998	100.00%
2000	76.63%
2003	100.00%
2006	100.00%
2009	59.74%
2011	84.57%
2013	100.00%
2015	100.00%

D. Dissimilarity Index

Year	D
1990	4.71%
1992	5.35%
1994	5.05%
1996	0.00%
1998	4.91%
2000	4.63%
2003	4.76%
2006	5.34%
2009	4.91%
2011	6.31%
2013	5.97%
2015	6.64%

E. Sector Comparison at 2015

Sector	Mean
chacabuco	45.44%
cordillera	48.42%
maipo	43.30%
melipilla	42.03%
talagante	40.62%
stgo_c	57.71%
stgo_e	51.76%
stgo_n	46.05%
stgo_s	44.15%
stgo_se	45.37%
stgo_w	45.33%
AVG	46.38%

F. Sector Change

Sector	Change
chacabuco	8.69%
cordillera	12.67%
maipo	6.33%
melipilla	8.91%
talagante	5.17%
stgo_c	18.79%
stgo_e	8.34%
stgo_n	10.62%
stgo_s	7.68%
stgo_se	8.88%
stgo_w	9.45%
AVG	9.59%

Interpretation / Observations:

General:

Large scale segregation:

Small scale segregation:

Conclusions:

Population active in labour market

RSD - Districts (black) Sectors (yellow)

Dissimilarity Index

Market engagement Stgo-East (black) - Melipilla (blue)

6b. Labour engagement - Dispersion within sectors

Internal RSD	Avg.	1990	1992	1994	1996	1998	2000	2003	2006	2009	2011	2013	2015	Change
chacabuco	5.09%	6.32%	5.40%	7.34%	na	4.42%	7.41%	5.53%	2.63%	5.12%	3.64%	0.92%	7.27%	0.9%
cordillera	3.47%	1.82%	4.67%	2.36%	na	3.38%	2.44%	6.79%	2.09%	1.57%	4.66%	3.56%	4.88%	3.1%
maipo	4.15%	4.08%	2.47%	4.30%	na	4.25%	4.04%	1.15%	4.38%	5.03%	5.96%	4.53%	5.49%	1.4%
melipilla	6.21%	7.32%	5.12%	4.09%	na	9.52%	4.16%	4.74%	6.32%	5.47%	6.58%	8.06%	6.93%	-0.4%
talagante	4.60%	4.90%	1.88%	3.01%	na	3.18%	4.58%	4.69%	4.88%	3.99%	6.46%	6.56%	6.43%	1.5%
stgo_c	na	na	na	na	na	na	na	na	na	na	na	na	na	na
stgo_e	7.38%	6.92%	4.72%	6.81%	na	5.65%	6.66%	7.90%	7.59%	8.19%	11.29%	8.72%	6.72%	-0.2%
stgo_n	5.47%	5.90%	3.64%	4.61%	na	8.58%	5.36%	4.97%	3.37%	5.22%	6.40%	6.60%	5.50%	-0.4%
stgo_s	4.92%	4.74%	3.74%	3.71%	na	3.77%	5.83%	6.75%	6.08%	5.51%	2.86%	5.69%	5.40%	0.7%
stgo_se	2.72%	2.43%	2.48%	5.33%	na	1.10%	2.14%	1.45%	4.41%	4.17%	2.80%	2.61%	1.01%	-1.4%
stgo_w	4.86%	3.20%	7.20%	3.89%	na	3.92%	2.68%	2.06%	5.82%	6.13%	4.66%	5.31%	8.64%	5.4%

6c. Selected sub-units detailed

G. Max. / Min. Comparative evolution

		1990	1992	1994	1996	1998	2000	2003	2006	2009	2011	2013	2015	%Change
stgo_e	la_reina	41.94%	42.02%	42.62%	na	44.50%	44.72%	44.68%	46.22%	42.91%	51.16%	46.39%	50.24%	8.30%
stgo_e	las_condes	44.29%	45.44%	43.62%	na	44.44%	42.32%	50.93%	50.86%	44.99%	47.48%	48.24%	49.03%	4.73%
stgo_e	lo_barnechea	na	40.11%	38.66%	na	41.75%	44.25%	45.45%	46.95%	42.72%	44.66%	46.48%	53.31%	13.20%
stgo_e	nunoa	40.32%	43.07%	45.17%	na	42.91%	46.55%	46.78%	42.58%	44.54%	49.11%	55.67%	49.75%	9.44%
stgo_e	providencia	48.36%	45.85%	47.92%	na	48.39%	51.95%	54.42%	54.92%	52.81%	62.85%	56.71%	58.40%	10.04%
stgo_e	vitacura	na	44.99%	46.63%	na	48.47%	47.85%	44.78%	46.28%	49.21%	53.81%	47.01%	48.29%	3.31%
melipilla	alhue	28.16%	32.81%	35.05%	na	29.20%	35.48%	36.98%	37.60%	35.99%	43.26%	37.04%	44.59%	16.43%
melipilla	curacavi	34.26%	36.46%	37.59%	na	37.40%	36.09%	42.55%	40.87%	38.17%	41.81%	46.75%	43.70%	9.43%
melipilla	maria_pinto	34.19%	35.24%	33.38%	na	35.18%	37.93%	38.27%	43.79%	34.50%	37.25%	40.44%	43.20%	9.01%
melipilla	melipilla	34.24%	35.07%	36.80%	na	38.05%	36.92%	42.44%	42.02%	39.59%	37.84%	41.62%	41.01%	6.78%
melipilla	san_pedro	34.10%	31.65%	36.06%	na	38.28%	39.88%	37.18%	38.75%	37.53%	43.55%	38.78%	36.51%	2.40%
Weighted Avg.	stgo_e	43.42%	43.35%	43.70%	na	44.65%	44.97%	47.07%	47.78%	45.46%	49.76%	50.90%	51.76%	8.34%
Weighted Avg.	melipilla	33.12%	34.37%	35.84%	#DIV/0!	35.69%	37.29%	39.66%	40.62%	37.19%	39.84%	41.13%	42.03%	8.91%

8.9. *Appendix 9: Environment*

A. Sector Comparison at 2013

Sector	Pollution	Infras.	Social
melipilla	5.46%	32.24%	10.66%
talagante	9.89%	20.99%	15.77%
chacabuco	8.75%	20.79%	19.77%
maipo	13.07%	18.22%	27.10%
cordillera	14.34%	5.24%	27.28%
stgo_w	5.26%	4.67%	20.86%
stgo_n	9.33%	4.14%	22.47%
stgo_se	5.15%	4.06%	19.70%
stgo_c	17.15%	3.82%	21.93%
stgo_s	9.86%	1.98%	31.42%
stgo_e	3.58%	1.07%	4.68%

Interpretation / Observations:

General:

Large scale segregation:

provincia	comuna	total	abs.pol	pol (%)	abs.inf	inf(%)	abs.soc	soc(%)
stgo_e	la_reina	416	16	3.8%	0	0.0%	24	5.8%
stgo_e	las_condes	3337	68	2.0%	28	0.8%	77	2.3%
stgo_e	lo_barnechea	514	33	6.4%	13	2.5%	54	10.5%
stgo_e	nunoa	3459	157	4.5%	63	1.8%	286	8.3%
stgo_e	providencia	2702	120	4.4%	14	0.5%	75	2.8%
stgo_e	vitacura	587	0	0.0%	0	0.0%	na	na
stgo_n	cerro_navia	1104	237	21.5%	16	1.4%	460	41.7%
stgo_n	conchali	4961	374	7.5%	166	3.3%	1278	25.8%
stgo_n	huechuraba	438	67	15.3%	30	6.8%	146	33.3%
stgo_n	independencia	407	27	6.6%	5	1.2%	21	5.2%
stgo_n	quilicura	1780	64	3.6%	32	1.8%	174	9.8%
stgo_n	quinta_normal	1013	65	6.4%	65	6.4%	117	11.5%
stgo_n	recoleta	1231	102	8.3%	90	7.3%	194	15.8%
stgo_n	renca	1043	182	17.4%	92	8.8%	301	28.9%
cordillera	pirque	257	10	3.9%	78	30.4%	4	1.6%
cordillera	puente_alto	5407	836	15.5%	188	3.5%	1595	29.5%
cordillera	san_jose_de_maipo	237	0	0.0%	43	18.1%	11	4.6%

x