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The Spatial Implications of Housing Policy in Chile

by
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In many countries throughout the world, housing and land markets are significantly influenced by government policy. Chile has a long history of government involvement in housing policy, having passed its first housing law in 1906, and today there continues to be extensive intervention in the housing market by the national government. While virtually all residential construction is done by the private sector, in the 1980s and early 1990s, over 40% of residential construction had direct public subsidy. If mortgage subsidies and housing vouchers[1] are considered as well, the government is involved in a much larger portion of the housing market.

Government intervention in housing and land markets can have profound implications on the spatial distribution of economic activity by influencing the location decisions of both households and firms. In this paper, we consider two levels of spatial distortions: interregional and intraregional. In the interregional case, we examine the extent to which government policy influences the location decisions of households among the 13 regions of the country. We measure this regional influence on household location in four ways: we compare 1) the regional distribution of government subsidized housing units and vouchers to regional shares of the population; 2) the regional distribution of subsidy dollars to shares of the population; 3) the distribution of subsidies relative to poverty levels; and 4) the regional distribution of subsidized units to government estimates of the housing need in each region. For the distribution of publicly-subsidized units and expenditures on these units, we find that there are some disparities across regions; resources tend to be reallocated towards the more remote areas of the country to the north and south and to Region Metropolitana (R.M.), one of Chile's 13 regions and the one which includes Santiago. Regional disparities are more apparent in the distribution of vouchers and voucher expenditures. In particular, R.M. receives a notably higher share of both vouchers and voucher expenditures, and Regions V (Valparaiso) and VIII (Bio-Bio with Concepcion) significantly lower shares, than expected from their shares of the country's population, households, poor households, and the housing deficit.

Chile is highly urbanized; in 1992 over 62% of the country's population lived in one of its three main cities. As in many large cities throughout the world, publicly subsidized housing in Greater Santiago tends to be located at the fringe of the city. Housing policy makers generally consider only land and construction costs in siting public housing. Given that many residents of this housing commute to the center of Santiago for work, there can be substantial additional costs to siting housing at the fringe in terms of time, congestion, and pollution. We attempt to quantify these non-land, non-construction costs associated with locating subsidized housing at the fringe of the city. We present crude estimates of what the magnitude of these other costs must be in order to justify the higher land costs associated with more central locations for subsidized units. We find that in many cases inclusion of these other costs makes

[1] Throughout this paper, we translate subsidios habitacionales as "vouchers," to differentiate from subsidies provided by the government through mortgage assistance programs or the Basic, Progressive and Special unit production programs of the Ministry of Housing and Urban Affairs (MINVU).

more central locations attractive. While we only provide analysis of Santiago in this paper, similar analyses could be done for Chile's two other major urban centers, Valparaiso and Concepcion.

In the next section of this paper we highlight some of the salient characteristics of Chile's housing market and put them into an international context. Next, we briefly describe Chile's recent housing programs, emphasizing the goals and strategies of the government's housing policies. Throughout, our focus is on potential impacts on locational choice and mobility. Then we present an analysis of interregional distortions based on the current distribution of economic activity. In the following section, we examine the spatial distribution of population and jobs in Greater Santiago, followed by our estimates of the non-housing costs of locating the poor at the fringe. We conclude with some policy recommendations.

THE CHILEAN HOUSING MARKET: INTERNATIONAL CONTEXT

Few countries have as high a homeownership rate as Chile. The World Bank has assembled cross-national data on homeownership rates, based on the homeownership rate in the main city (usually the largest) in each country. As shown in Table 1, Chile's homeownership rate is 80%. Only Singapore (90%), Mexico (83%) and Pakistan (83%) have higher rates than Chile (World Bank 1993).

As also shown in Table 1, the house price-to-income ratio for Chile is quite low at 2.10 compared to other countries, which means that buying a house in Chile is relatively affordable. The average for Latin American countries in this study is 3.92. The rent-to-income ratio for Chile is quite high at 0.28. Only Korea (0.35), Mexico (0.36) and Singapore (0.38) have higher rent-to-income ratios. In fact, Chile's ratio is high even compared to Latin American countries, which the World Bank averages at 0.20. This high rent-to-income ratio may be related to the fact that Chile has a very small rental market. As we discuss below, this small rental market may be due to problems with clearly defining property rights. There seems to be evidence that while the formal rental market is small there is a larger informal market.

In Table 2, we present simple correlations between cross-country homeownership rates and several other variables. The correlations between homeownership and both the national GNP and the average household income of the country's main city are positive but weak. The homeownership rate is positively correlated with the level of urbanization, although in many countries (e.g., U.S.), homeownership rates tend to be higher in rural than in urban areas. Latin American countries generally tend to have high homeownership rates. Finally, the house price-to-income ratio is negatively correlated with homeownership while there is a strong positive correlation between the rent-to-income ratio and homeownership.[2]

[2] Identifying a causal relationship between homeownership and rents and prices is difficult since homeownership rates, rents and house prices are all market outcomes. As a result, we do not include

Results from an attempt to explain cross-country differences in homeownership rates are presented in Table 3. The results in Regression 1 are somewhat surprising. Per capita GNP has a negative and statistically significant impact on homeownership in the main city, while the extent of urbanization in the country has a positive and significant impact. Both of these results are quite robust to changes in specification. While an increase in GNP would be expected to increase homeownership, in this model GNP may be working as a proxy for property rights. If so, an increase in the development of property rights will decrease homeownership rates. Property rights must be well-developed to have an active rental housing market so that in poorer countries, homeownership may be the dominant form of tenure because of the lack of well-established property rights. The positive impact of a country's level of urbanization may also be due to differences in property rights across countries. We have not been able to find a cross-country index of property rights in order to test this explanation. In Regression 2, the dummy variable for Latin American countries has a positive impact on homeownership, although not statistically significant.

Households in Chile do not move very often. Although the World Bank has no official figure on Chilean household mobility, a World Bank working paper on the Chilean housing market commented on Chile's very low housing mobility rate (Renaud 1988, 28). In 1982, only 8.6% of people 5 years and older that year had changed the provincia (a geographical subcategory of Chile's 13 Regions) in which they lived sometime during the previous five years. By comparison, in the U.S. in 1990, 17.6% of people 5 years and older changed the county they lived in. Our interviews suggest, though, that there may be more mobility than these data suggest. Across Chile, many families are "allegados"--often translated as "drop-ins"--people living with friends or relatives in extra rooms or makeshift additions in the yard. In 1990, the government estimated that of the 3.2 million households in the country, 42% were living in *allegado* situations (Mideplan CASEN 1992, 124).[3]

From discussions with officials and a review of newspaper classified advertisements, it is clear that the formal rental housing market in Chile is small and, in Santiago, is focused on the upper end of the income distribution. The widespread existence of *allegados* may mask an informal rental market (a market which may be more rentals of rooms than of independent units), higher actual mobility rates, and homelessness.

Lack of a significant rental housing market for low income households can have important implications. In the U.S. experience, homeowners tend to move far less often than renters. A strong rental market in the U.S. for low income households allows

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rent-to-income and price-to-income ratios as explanatory variables in the regression models examining the determinants of cross-country homeownership rates in Table 3.

[3] This does not imply that 42% of households are *allegados* without homes of their own. Rather, the 42% represents those families directly affected by doubling or tripling up--both the homeowner and the drop-ins. Over 80% of the *allegado*-affected households are in urban areas.

individuals and families greater opportunity to move to where the jobs are and to exercise their tastes and preferences in the market because the transaction costs of a move for renters are less than they are for homeowners. The dominance of homeownership for the poor in Chile may substantially reduce the mobility of these households, limiting economic opportunities. As a result, poorer families, as well as younger people who are compelled to live with their parents until they can purchase a home of their own, may be considerably underconsuming housing.

CHILEAN HOUSING POLICY: COPING WITH NEEDS

With varying degrees of dedication, the Chilean governments of the 20th century have assumed a role in meeting the housing needs of the country. The focus of their housing policy has been almost exclusively devoted to promoting homeownership. Current forms of government intervention in the housing market include vouchers to households for the purchase of a house, subsidized housing developments, and mortgage programs offered by the State Bank.

The 1992 Census records 3,101,356 occupied units in the housing stock, compared with a population of 13,231,803 and 3,293,779 households. The Chilean government frames its housing policy goals, for better or for worse, as the need to address the housing shortage, called the "housing deficit." Their approach to measuring housing need in the country is to divide it into two components: 1) the number of units required to provide each household a home of their own, and 2) the replacement of units deemed inadequate.

The Chilean government tracks three different housing-related measures: homes (viviendas), households (hogares), and families. There are more households than housing units. Homes often have more than one household; a household, in turn, can have more than one family. In 1988, Chile had 1.10 families for every household. Some portion of these households and families may be deemed *allegados*, or drop-ins. Traditionally, the Chilean government measures the housing deficit as the difference between the number of households and the number of adequate units. Their goal is to replace the worst quality shelter and to alleviate the significant overcrowding across the country.

Table 4 shows calculations of the 1988 housing deficit, taken from a Chilean housing department working paper (MINVU Antecedentes 1989). Countrywide, estimates of the magnitude of the deficit ranged from 850,000 to 1.1 million units. The first columns show the distribution of the housing stock by geographical region, and the share of each region's stock that has been determined inadequate. In 1988, the government identified 330,000 inadequate units. The middle section of the table, the "conservative" estimate, shows the housing deficit by region as traditionally calculated by the government: adding to the inadequate units the difference between the total number of households and the existing stock. By this estimate, the 1988 housing deficit was over 800,000 units, representing 35% of the existing stock at the time.

Government officials, however, argued that using household totals as an estimate for housing need undercounts the real deficit. A more appropriate measure, they suggest, would be the difference between families and units. Using this approach, they calculate the 1988 housing deficit at over 1,100,000, as shown in the last panel, or 47% of the existing stock.

The exact definition of each of these components changes over time and is difficult to measure precisely. Determining actual households and families in a country with a large number of *allegados*, or doubling-up, situations is difficult. The definition of inadequate units is also hard to pin down. The census housing stock figures include unauthorized housing, which are units that did not meet building codes. According to the Chilean housing agency, across the nation in 1988, 13.6% of the housing stock was considered "inadequate." (MINVU 1989). In 1980, that figure was less than 12% (Mideplan CASEN 1992, 94-95). For the 1992 census, 12% of occupied units were classified as tenement houses, one-room shacks with lean-tos, shacks with no floors and slums (*callampas*).

Measuring the number of inadequate units is just one example of the challenges of accessing housing data in Chile. In some cases, information was simply not available. In most cases, we collected data from a wide variety of sources. Often, different sources did not provide the same information even when it seemed that they addressed the same question. As a result, there are places in this chapter where data on a question diverge due to different sources. Throughout, we attempt to use the best data available and always identify the source.

Modern Housing Policy: MINVU Programs

In 1964 the modern agency charged with housing policy, the Ministry of Housing and Urban Affairs (MINVU), was created with the specific goals of 1) diminishing the housing deficit (which at the time was estimated at 420,000 countrywide), and 2) increasing production through direct construction and stimulation of the private sector (Kusnetzoff 1993). MINVU also has responsibility for much of the country's infrastructure. MINVU's creation began a ten-year era emphasizing the state as a housing provider. From 1964 to 1973, 400,000 units were added to the stock, 62.5% of which were built by the public sector (Kusnetzoff 1993), compared to less than 120,000 units built in the period from 1906-1960 (Trivelli 1987, 23).

In 1973, with the incoming military government, public sector housing policy shifted to a focus on the marketplace with a relaxation of regulations and a deemphasis on public sector construction (Kusnetzoff 1993). By the mid-1980s, the government stepped up its efforts to address the housing deficit and began expanding the state role with production programs similar to those from earlier governments (Kusnetzoff 1993).

Table 5 gives a summary of the subsidy programs administered through MINVU in the early 1990s. Between 1988 and 1992, MINVU's subsidy programs generated

direct production of 173,719 units and provided an additional 156,667 subsidy vouchers for units. This compares to the government's conservative estimate of a housing need of 856,817 in 1988, as in Table 4.

In 1991, MINVU had a total budget of over US$390 million[4] (MINVU 1992). Of that, about 75% was directly invested in housing, infrastructure and other projects. In 1991, 80% of MINVU's direct investments was devoted to housing programs.[5] These housing programs fell into two types of activity: 1) the provision of housing subsidies or vouchers which the recipient could apply to the purchase of existing homes or the construction or alteration of new ones, and 2) direct involvement in housing production. These programs were exclusively for homeownership. As of 1994, there were no rental assistance subsidy programs.[6]

Vouchers. Roughly 35% of MINVU's direct investment in housing programs was used for the voucher programs. The specifics of the subsidy programs were continually altered by legislation, but generally fell into two groups: "unified" and rural. The unified program was a broad one, covering primarily urban but also some rural areas and serving a wide income range including middle income families. Between 1978 and 1992, 273,853 vouchers were distributed. Since their inception in 1988, the unified subsidies accounted for the bulk of vouchers--over 80%, measured in both units and value.

In 1991, MINVU paid out over 22,000 unified subsidies. The average house value for 1991 was just over US$10,000, and the average subsidy covered 30% of that value; the maximum house value under the program was 2,000UF (or about US$45,000) for subsidized housing in the extreme north and extreme south where construction costs are high.[7] These certificates were only valid for 18 months, and could be applied to existing housing only in the last 6 months. As a result, in 1991, 86% of the unified subsidies were applied to new units. In 1991, MINVU administered three rural programs which paid out nearly 5,000 rural subsidies, worth about US$2,200 and applied to new houses valued at about US$3,850--therefore covering over 50% of the house price.

Units. Restarted in 1988, directly administered production programs (as contrasted with indirect voucher subsidies) used about 65% of MINVU's expenditures

[4] Throughout this paper, all U.S. currency figures are in 1992 dollars.

[5] MINVU's 1990 budget shows a similar breakdown. (MINVU 1991).

[6] The government launched a leasing program in 1994. However, this was not a rental program, it was a lease-to-own program, focused on increasing access to homeownership.

[7] The unified subsidy program was modified in 1993. Changes included lowering the maximum value of the houses from 2,000 UF to 1,500 UF, and reducing the value of the subsidy in order to increase the number of subsidies available for unit production programs directed at low income groups. (Interview with Sergio Leon.)

on direct housing investment. The three production programs were Progressive Housing, for the very poorest, Basic Housing, and the Special Program for Workers (PET). Together, these programs provided 172,719 units from 1988 to 1992.

All construction was done by the private sector through a bidding process. Private developers chose the site. MINVU defined basic standards for each program and the contracts were awarded to the developers with the lowest costs. For the Progressive and Basic Housing programs, MINVU and/or SERVIU (an arm of MINVU) administered the contracts directly; the PET program was administered through workers cooperatives or other political/social organizations.

MINVU explicitly sought to build as many units as possible while minimizing direct costs. As a result, these programs produced relatively cheap housing units, which generated some concern that units were not sufficiently durable. However, these units were certainly of higher quality than many of the units that they replaced and the additions that residents constructed themselves.

In awarding contracts, the primary considerations were land and construction costs. The production programs did not consider transportation or congestion costs, nor the provision of significant infrastructure. For many projects, the developer had to provide some minimal project infrastructure such as roads and pavement, but the costs of connections between the projects and local urbanized areas were largely left out of the cost calculations.[8] As a result, the work often went undone. In practice, subsidized housing units in Chile were built as large projects on a single large tract of land rather than on smaller in-fill sites.

The Progressive Housing program, targeted at the very poor in both urban and rural areas, had two phases: the first was for construction of the basic unit, and accounted for roughly 70% of the program's expenditures; the second phase was for additions to the unit.[9] In 1992, MINVU produced 8,053 units through the first phase. The units produced were very basic: they averaged around 120 square feet, provided the minimal structure and sanitary installation, and had a maximum value of about US$3,100. Virtually all of the cost of the home was subsidized; the recipient needed to provide a minimum of 3% of house value from savings, representing US$120, as shown in Table 5.

[8] In 1994, many projects still were without improved infrastructure systems. The national government, through MINVU and through its social service agency, budgeted funds to provide road paving and some sanitary service connections. The provision of these services were not programmed until after construction was complete and the area's needs were assessed. The agencies then attempted to secure funds and put these projects in a pipeline for infrastructure construction and hook-up. In addition, MINVU issued grants to income-eligible families to help them pay their utilities.

[9] Interview with Jaime Silva, Seremi de la Region Metropolitana, MINVU, 1994.

The Basic Housing program produced the most units and spent almost eight times as much as the Progressive Housing program (not including administrative and personnel costs). Over 22,000 Basic units were completed in 1992. The Basic units averaged close to 400 square feet; the average house value was close to US$4,700 with a maximum of about US$7,300 occurring only in remote areas where construction was more difficult and therefore more expensive. The subsidy covered up to 75% of the house value.

Finally, the *Special Program for Workers (PET)*, begun in a new form in 1990, was organized primarily around worker cooperatives or "syndicates." In 1992, this program completed 13,300 units. As with the Progressive and Basic Housing programs, MINVU set the building codes and maximum costs, but the syndicates administered the design, construction and disbursement. The PET program had a maximum house value of roughly US$8,900; the subsidy could cover up to a maximum of 20% of the house value.

Mortgages. Each MINVU housing program also came with an option of a mortgage. These mortgages had very favorable terms--12 to 20 year terms at 8% real interest rate.[10] Except for the small amount of savings required by each program, the homeowner could easily secure a mortgage to cover all remaining costs after the subsidies. In addition, the government made attractive loans available to many households outside of the unit subsidy programs.

While a few private banks provided mortgages, most banks found that the mortgages were too small to be the basis of a viable business. The State Bank of Chile held the vast majority of the mortgages. Significantly, people both within and outside of the government were quick to say that repayment of State Bank mortgages was easily ignored. In interviews with various government officials, quoted default rates ranged from 30% to 60%. Melo (1993) reports that in December 1989, 66% of the SERVIU borrowers were behind four or more payments. By 1991 that number had decreased to 38%, but rose to 62% by October 1992. The high default rates are of concern to government officials and are drawing increased attention from Chile's financial markets.

Common Elements of the Programs. Although they differed significantly, MINVU's two basic programs also shared some common elements:

- Each program required some savings contributions by the recipient. Both the amount of the savings and the length of time the recipient had been saving were important. MINVU was explicitly looking for evidence of a commitment to owning a home.

[10] These terms are for the Basic and Special Workers programs. The Progressive program offered 8% loans at 5-8 year terms.

- MINVU's stated policy was to help the poorest of the poor. For all the programs, selection was largely based on a points system awarded for a long list of family characteristics, including family size and income.

- A long waiting list existed for the programs. For the largest program (the Basic Housing Program), MINVU got 6-7 applicants per unit and had a 4-5 year waiting list.

- Most of Chile's housing assistance programs applied primarily to newly-constructed units rather than to existing units. Specifically, the government's major program for housing assistance subsidized the production of housing units to be purchased by eligible households. The government's other major programs provided housing subsidies ("vouchers") for the purchase of a home; the recipient could purchase existing housing only in the last 6 months of the life of the subsidy (18 months total). As a result, in the early 1990s, less than 12% of the subsidies were used for existing housing. It appears that these programs, with their deep subsidies, were essentially one-time opportunities for homeownership granted by the government.

- While the government programs assisted homeowners in providing additions to their homes, these additions did not significantly add value to the home. Most recipients did the work on their homes themselves. While the quality of the interior construction often seemed sound, the quality of exterior additions seemed quite poor. (Interview with Jaime Silva, MINVU).

SPATIAL IMPLICATIONS OF MINVU'S HOUSING PROGRAMS

There are two ways in which MINVU programs could potentially lead to spatial distortions. First, they could alter the location decision of households since some of the subsidies were location-specific. Second, they might limit the mobility of households. While there is nothing inherently wrong with households choosing to stay in their home for a long time, housing programs that limit households' abilities to move may restrict them from pursuing economic opportunities. The potential impacts on household location are:

1. The unit-based programs required the households to move to the location of the unit. The units were often built on undeveloped, remote land, so households were virtually always relocated from their previous neighborhood.

2. The criteria for selecting the private contractor for building the units only considered land and construction costs, and encouraged very large scale development. If the total cost of the location were considered, would different locations have been chosen?

3. The programs encouraged the purchase of new units, which in cities often meant limiting choice to distant locations.

Although beneficiaries of the housing programs were technically required to live in their homes for only five years, MINVU programs may further limit mobility. The potential impacts on mobility are:

1. The nearly exclusive focus on homeownership can decrease mobility since the transaction costs of moving are higher for homeowners than for renters.

2. The programs generally provided a one-time deep subsidy for the purchase of the home. This subsidy structure implies a permanent location for the household.

3. The focus on providing very low cost units for homeownership can result in low quality units that over time may have limited resale value, decreasing household mobility.

4. The priority given to the purchase of new vs. existing units may significantly limit the resale market, which again decreases household mobility. Interviews with housing officials and research in newspaper real estate pages support the notion that there is virtually no viable market for existing homes at middle to lower values.

5. The high mortgage default rate means that it is difficult for many households to sell their homes because the outstanding mortgage is a lien against the home.

Housing Subsidies: Are There Spatial Distortions?

While we do not have the data to analyze the spatial distribution of mortgage assistance, we can measure the regional distribution of vouchers and subsidized new construction. We can compare the distribution of these vouchers and new units to the regional shares of population, the housing deficit, and regional poverty rates. Specifically, possible spatial distortions at the regional level might be revealed through four comparisons:[11]

1) Regional shares of population and households to units constructed and vouchers distributed;

[11] In comparing regional shares of population with units constructed and vouchers received, it is important to keep in mind that we are not saying anything about the direction of causality. Are people following subsidies or are subsidies following people? From the information we have, we cannot tell. For our purposes, we are simply using this comparison as a static indicator of whether or not the spatial distribution of subsidies matches the spatial distribution of need.

2) Regional shares of population and households to housing subsidy funds spent by the government;

3) Regional shares of households and regional poverty rates to housing subsidy units, vouchers, and funds spent by the government; and

4) Regional shares of publicly subsidized units constructed to the shares of the housing deficit, and regional shares of the number of vouchers paid to the shares of the housing deficit.

Population and Units. Since the government contracts with the private sector for the construction of subsidized units, virtually all housing construction in Chile is done by the private sector. Chart A tracks private residential construction for the country and the R.M. for 1980-1992. In 1992, over 105,000 housing units were built countrywide; over the thirteen-year period, an average of more than 60,000 housing units were built each year.

As expected, the faster growing regions in the country saw a good deal of construction as a percentage of their stock, although these regions are quite small and the absolute numbers of new units are modest. In the early 1990s, R.M. was the site of almost one-half of private construction. Despite that, though, the region's share of 1992 housing
stock at 37% still fell short of its 1992 share of population.

Table 6 adds to this picture by comparing the distribution across regions of several indicators. The first section shows the regional shares of population, households, housing stock and construction. In addition, it lists the homeownership rates from the 1992 census; the census reports rates ranging from 60.3% to 72.2%. In 1990, 1,282,679 or 40.1% of the country's households were in R.M.

Table 6 also shows regional shares of publicly subsidized units, a subset of total private housing construction. These figures measure the units completed each year for the Progressive, Basic and PET programs. Until 1990, MINVU allocated its housing subsidies through a centralized program without consideration of the differences among regions. Beginning in 1990, however, each region's share of units was based on population.[12] The MINVU housing production column in Table 6 indicates that over the five-year period the shares did not reflect population shares. While R.M. received 40.1% of the publicly-subsidized new units over the period, its share steadily declined over the period from 50.6% in 1989 to 36.5% in 1992. Over the 1988 to 1992 period, Regions V and VIII received a smaller share of public units than their shares of population or households would indicate. Their shares of public units have not been

[12] Interview with Jaime Silva, MINVU.

growing much over time: in 1992, Region V received 8% of the public units and Region VIII had 11.5%, well below their population shares. The faster-growing, more remote regions to the far north, on the other hand, received a larger share of the units than their share of population.

A somewhat similar story emerges from the regional distribution of vouchers presented in Table 6. R.M. received 47.2% of the vouchers over the 1988 to 1992 period compared to its 40.1% share of the households in 1990, but R.M. dropped from 50% of total vouchers in 1988 to 39.9% in 1992. Both Regions V and VIII received a smaller share of vouchers than their shares of the population. However, the regions to the extreme north and south also received relatively small shares of the vouchers. As with the distribution of units, though, there has been some correction. For example, in 1992 Regions V and VIII received 8.4% and 10.2%, respectively, of the country's vouchers, up from previous levels.

Population and Subsidy Dollars. The story is quite similar when expenditures on subsidies are considered, as also illustrated in Table 6.[13] The three exceptions are in Regions I, XI, and XII, where the share of subsidy dollars significantly exceeded the share of subsidized units. In 1991, the average subsidy per unit in these regions ranged from US$5,000 to US$8,000, while the average construction subsidy per unit nationally was US$4,730. While we have no data on regional variations in housing costs, the larger per unit subsidies in these regions may reflect higher construction costs in these areas due to their climate, terrain and remoteness. In addition, several government officials point to a national defense strategy to create a solid population presence in the extreme north and south regions.

For expenditures on vouchers, regional disparities are more apparent. From 1988 to 1991, over 53% of the voucher expenditures went to R.M. with a gradual increase throughout the period. In 1989, R.M. received 50.5% of voucher subsidy dollars but by 1991 the share was 53.9%. The average voucher per unit in R.M. in 1991 was US$5,929, more than twice the national average of US$2,890. Part of this discrepancy was due to the fact that virtually all (97%) of the vouchers going to R.M. were under the unified program, which generally provides larger subsidies than the rural program. In addition, the higher voucher values in R.M. may reflect higher construction costs and land costs in the city of Santiago.

Housing Subsidies and Poverty Rates. Although MINVU has primarily based the availability of subsidies across regions on regional shares of population, it is instructive to look at the levels of poor households in each region. The last section of Table 6 gives the census poverty rates for each region.[14] The figures are quite high.

[13] The budget figures cover only 1988 through 1991.

[14] The poverty level is defined as per capita income twice the value of the basic nutritional basket, as defined by the United Nations at a 1990 Regional Conference on Poverty in Latin America and the Caribbean (Mideplan CASEN 1992, 368-372).

Nationally, 40.1% of the population and 34.5% of households live in poverty. The household poverty rate ranges from 25% in Region XII to 42.7% in Region VII. The column displaying the distribution of poor households across regions compares relatively proportionately to the distribution of population and households in general. With the exception of R.M., the regions in the middle section of the country, particularly the other urban Regions V and VIII (with Valparaiso and Concepcion), have higher shares of poor households relative to their shares of households and population.

In comparing the poverty distribution across regions to the regional shares of MINVU's subsidies, as shown in the middle section of the table, it is clear that as of 1992 the extreme north and south regions and R.M. had received a higher share of subsidies than their poverty levels might suggest: R.M. had 34.8% of the poor households, but received 41.8% of the total subsidies. Much of the middle section of the country, notably Regions V and VIII, received significantly less of the share of subsidies given their high poverty shares. Region V, for example, has 11.9% of the poor households but from 1988-1992 received only 7.0% of MINVU's units and 6.9% of the expenditures on vouchers. These facts seem to support the comments we heard repeatedly in interviews that households in R.M. could get subsidies more easily.

Using data in the 1990 Casen study, we were also able to examine the allocation of MINVU subsidies across income quintiles.[15] For the nation as a whole, 43% of housing subsidies were for the poorest households in the first and second quintiles; another 23.5% went to households in the third quintile; the fifth quintile received 13% of the subsidies. Of total households in the poorest quintile, 8.7% received a subsidy. For the second, third, fourth and fifth quintile, 9.7%, 10.6%, 8.7% and 5.7%, respectively, of households received housing subsidies. This pattern of distribution across quintiles was similar across all of the regions: the second and third quintiles tended to have the highest levels of access to subsidies, with the lowest share represented by the fifth quintile.

How is it that such significant portions of MINVU's subsidies were distributed to the 4th and 5th income quintiles? First, even the programs targeted at the very poor require a downpayment and a steady income stream and so are out of reach of the poorest households. Second, although we cannot distinguish the individual MINVU programs in these figures, the unified voucher program was specifically targeted at the middle income, and the PET production program was for working low-and middle-income families. In addition, the census statistics show that there are a lot of very poor people in Chile. With a national household poverty rate of 34.5%, that means that all the households in the 1st and most of the 2nd quintile are poor by census definitions. Households in the third quintile are still quite poor, just over the poverty line.

[15] In these figures, MINVU subsidies included all subsidies *used* by households during the 1989-90 survey period, not those issued 1988-1992.

Publicly-Subsidized Units and the Housing Deficit. Chart B compares the regional share of directly subsidized units (from the Progressive, Basic and PET programs) to the share of the 1988 housing deficit, as calculated conservatively by MINVU (using household figures rather than families). Regions V, VI and VII were somewhat underserved and R.M. had somewhat more than its share of subsidized units over the five-year period. The extreme regions to the north and south also received considerable attention from MINVU relative to their shares of the housing deficit, although the absolute numbers are small.

Comparing the regional shares of vouchers distributed with regional shares of the housing deficit generates conclusions similar to the comparisons of the distribution of vouchers with regional population and poverty shares. Overall, though, the spatial distortions due to the regional distribution of subsidized units seem relatively modest. From 1988 to 1992, R.M. and the regions in the extreme north and south did get somewhat more than would be predicted based on population or the government's estimate of the housing deficit, while the more central regions (other than R.M.) got somewhat less. R.M.'s portion of subsidized units in 1993 and 1994 is more in line with its population share. Similarly, the spatial distortions due to the regional distribution of subsidy expenditures seem small.

The voucher programs seem somewhat more distorted. What is most striking is what is happening in the middle section of the country. R.M. is clearly receiving a larger share of vouchers and a considerably larger share of voucher subsidy expenditures than its population share or its share of poor households and the national housing deficit would suggest. At the same time, Regions V and VIII are underserved, clearly receiving fewer vouchers and lower value per voucher than expected given their population shares and shares of the poor and the housing deficit.

It seems clear that the population and housing deficit data do not explain the interregional distribution of vouchers and voucher expenditures. Perhaps vouchers are a more appropriate form of subsidy in some regional markets than in others. For example, there may be more opportunities to use a voucher in the Greater Santiago housing market than in some of the smaller markets in other regions of the country.

If the goal of housing subsidy programs is to increase supply, government unit production programs do produce units, although the standard question raised by government production programs is to what extent they simply replace private sector activity. Although we do not know the specifics of how the Chilean vouchers operate, in general they are demand-side subsidies that are expected to stimulate supply. We would need detailed information on the operation of individual markets in order to assess the appropriateness of voucher subsidies versus construction subsidies. It would be useful to have more detailed information on who is being served by each of the housing programs in order to assess to what extent each of the programs is reaching their target populations.

INTRAREGIONAL DISTRIBUTION OF HOUSING SUBSIDIES: THE CASE OF GREATER SANTIAGO

In 1992, about 39% of Chile's population, or 4.7 million people lived in Greater Santiago. Because of this significant concentration in the capital, typical for Latin American countries, it seems useful to evaluate possible spatial distortions at the intraregional level. We begin with an overview of the metropolitan area.

Greater Santiago had 1.1 million housing units in 1992, representing on average 4.3 people per unit (compared to a countrywide "household size" of 4.1 in 1990). (Mideplan CASEN 1992, 24 and 94). Map A shows the distribution of the city's 1992 population over the 34 comunas that make up Greater Santiago.[16] (See Appendix B for population figures for each comuna.) The downtown Santiago comuna is among the largest, accounting for 4.3% of Greater Santiago population or 202,010 people. However, three comunas at the outskirts of the city are larger--together, Puente Alto and La Florida to the south and Maipu to the southwest are the home of 18% of the total population. Other comunas on the northern fringe, despite their large land area, have the smallest share of total inhabitants: Quilicura, Huechuraba, and Lo Barnechea, each have about 1% of the population. Finally, a few areas have small portions of the population despite their central location and good access to downtown, notably Independencia, Vitacura, San Miguel and Cerrillos (each housing below 1.9% of the city's population).

Population Distribution and Dispersion

The population of Santiago has become more dispersed over time. Map B shows the population density by comuna for 1992. (See Appendix B for detail.) The relationship between population density and distance from the center of the city can be analyzed by estimating a standard density gradient (see Table 7).[17] For 1992, the

[16] In the maps used here, the outside borders of the fringe comunas are rough estimates. Typically, borders for agricultural land at the fringe are not exact and often change. To give the reader a sense of scale, the distance from the center of Maipu to the center of Las Condes is about 26 kilometers. The distance from roughly the center of Puente Alto to the center of the Santiago comuna is about 19 kilometers. One centimeter on the maps represents roughly 0.32 kilometers.

[17] To estimate the simple population density gradient, we use the standard negative exponential form:

$$D(u) = Ae^{-bu}$$

In order to transform this equation into a linear expression which can be estimated statistically, we take the natural log of both sides, which yields:

$$\text{Log } D(u) = \log(A) - bu$$

where the dependent variable D(u) is the log of gross population density by comuna, and the independent variable is distance u from the center of each comuna to the center of the Santiago comuna; A and b are parameters to be estimated from the data.

coefficient on density is -0.07, which suggests that population density decreases 7% with each kilometer increase in distance from Santiago.

Map C shows population growth by comuna between 1982 and 1992. (See Appendix B.) During that time, the population of Greater Santiago grew 18.8%, more than the country as a whole, but somewhat less than the growth rate for the Region Metropolitana. At the same time the population of the Santiago comuna in the center of the metropolitan area decreased by 13.2%. The density gradient has flattened over the ten year period from 1982 to 1992, indicating the location of more of the population at more distant locations.[18] It is immediately apparent from the map that, along with Santiago, several comunas near the center of the city experienced negative growth, while the comunas at the fringe grew dramatically. In fact, La Pintana, Lo Barnechea, Maipu and Puente Alto each more than doubled in population.

These density calculations may actually be underestimating the extent to which the population is moving further away from the center of Santiago, since implicit in them is the assumption that the population is uniformly distributed within the comunas. Instead, many of the more remote comunas--such as La Pintana, Puente Alto, Maipu and several others--are characterized by pockets of relatively dense settlement next to vast tracts of vacant undeveloped land (INECON 1993). Therefore, population density measures for the fringe comunas, based on the total population of the comuna compared to the comuna's total land area, will underestimate the actual density of the areas in which people live.

Employment and Commuting Patterns

The 1991 Origin-Destination Study of Greater Santiago provides information on employment distribution across the city (Mideplan O-D Encuesta 1992). Using the study's information on the number of daily work trips to each comuna, we can estimate the portion of city jobs located in each comuna. Map D illustrates the spatial distribution of these jobs.[19]

The northeastern corridor of Santiago, Providencia and Las Condes clearly dominated the employment picture. Santiago comuna had by far the largest share of employment with 31.5% followed by Providencia with over 10% and Las Condes at 6.3%. Together, these comunas employed 882,311 of the Region's total 1.8 million

[18] Estimating similar population density gradients for Boston and Los Angeles for 1990 yields coefficients on distance of -0.08 and -0.04, respectively.

[19] We applied the Origin-Destination Study distribution of A.M. peak hour work trip destinations across comunas for the entire region to the October-December 1991 INE employment figures for the R.M. to estimate the distribution of actual jobs. Unfortunately, we do not have the data to examine changes over time in spatial distribution of employment because the comuna boundaries were substantially redefined since the previous Origin-Destination Study in 1977.

employees. Nunoa, on the eastern border of Santiago and the southern border of Providencia, was the fourth largest employer in the Greater Santiago area, with just over 5% of the area's jobs.

As shown in Table 7, estimating an employment density gradient by comuna yields a distance coefficient of -0.11--a one kilometer increase in distance from Santiago decreases employment density by 11%.[20] Distance explains 64% of the variance in employment densities across comunas. Map E presents employment density by comuna and again shows the dominance of Santiago and Providencia. Again, these density figures can be somewhat misleading because the more distant comunas have very large land areas, some of which are not urbanized.

A closer look at the Origin-Destination Study reinforces important work-related commuting patterns. For residents in 32 of the 34 comunas, Santiago was the most common workplace (for Quilicura and Lo Barnechea to the north, the dominant workplace was their home comuna). For these 32 comunas, the portion of employees traveling to Santiago for work ranged from 18% in Penalolen to 42% in Nunoa. The home comuna was the second largest employer for residents. For those comunas identified as having the fastest growing population in the 1980s--Maipu, Lo Barnechea, La Pintana, and Puente Alto--27% commuted to Santiago, 5% commuted within their own comuna, and 17% commuted to Providencia and Las Condes.

Income and Poverty

Despite the strong economic growth in Chile in the late 1980s, much of the population lived in poverty. Map F shows the 1990 poverty rates for select comunas as reported in the CASEN survey, using the previously reported poverty definitions. (See also Appendix B.) The average poverty rate for the 25 reported comunas was 34%.[21] As is the case in urban areas in many developing countries, the poor in Greater Santiago tended to be concentrated at the fringe of the city. There are significant concentrations of poor households in the south and east of the city. Five comunas--Cerro Navia, La Pintana, Penalolen, Quilicura and Renca--have poverty rates near or above 50%.

While data on income by comuna is scarce, the 1991 Origin-Destination Study reported distribution of households by income level. They divided income levels into eight categories, so there is not much detail. Map G shows the median income category for each comuna (Appendix B). Even with these somewhat crude data, it is clear that households are segregated by income level in Santiago. Particularly noticeable is the high income northeast corridor of the city. Not apparent from the map

[20] Estimating an employment density gradient for Boston for 1990 results in a very similar distance coefficient of -0.09.

[21] Poverty rates are not available for all comunas.

is the fact that in nearly all of the comunas, well over 50% of each comuna's population is clustered within two or three adjoining income categories.

The Housing Market in Greater Santiago

As noted, one of the distinguishing features of the Chilean housing market is the primacy of homeownership. As can be seen in Map H, there is considerable variation in homeownership across comunas, ranging from a high of 90.3% in La Pintana to a low of 56.3% in the Santiago comuna (see Appendix B.)[22] Contrary to experience in the U.S. (where the national homeownership rate is 64%), homeownership seems inversely related to income. In fact, across comunas the simple correlation between the homeownership rate and the poverty rate is positive and quite high at 0.47.[23] The homeownership rate is lowest in relatively high income comunas such as Santiago and Providencia.

The evidence on homeownership rates by comunas supports the notion that the formal rental market is concentrated in the middle to high income end of the market. As discussed in the Housing Programs section above, the rental market for poor households is an informal market, taking the form of *allegados*--the practice of doubling and tripling up of families in a single unit. To the extent that a low income informal market does operate, it is understood by Chilean housing officials to revolve primarily around rentals of rooms rather than entire units.

Location of Publicly Subsidized Units. From 1988 to 1992, 203,000 housing units were constructed in the Region Metropolitana. Of these units, 70,000, or 40%, were publicly subsidized, virtually all of which were in Greater Santiago. As shown in Map I and detailed in Appendix C, most of the publicly subsidized units were located at the fringe of the metropolitan area with very large concentrations of this housing in comunas to the far south. La Pintana, Puente Alto, and La Florida contained over 40% of the publicly subsidized units produced in the city from 1988 to 1992. Many of these subsidized units were built in very large developments consisting of 350 or more units. As a result, the housing programs developed large concentrations of poor people at the fringe of the city.

This concentration of subsidized housing at the fringe seems largely due to the lower land prices there. MINVU contracts for the construction of these units went to the lowest bid per unit. It seems reasonable to assume that construction costs were

[22] In these data, the overall homeownership rate is 76.6%. The discrepancy between this homeownership rate and the figure in Table 1 may be in part due to a difference in geographic definitions.

[23] The homeownership rates are based on national surveys which include inadequate units, such as shacks and lean-tos, though undoubtedly not all of this housing is captured. The rates are probably also clouded somewhat by unreported doubling up, although significant levels of *allegados* are included in census results.

roughly constant across comunas in Greater Santiago. As a result, land costs would be the major determinant of location.

As illustrated in Map J, land prices were substantially lower to the south and west of Santiago where most of the subsidized units have been constructed. (See Appendix B for details.) While there are some anomalies such as the high land prices in Vitacura, which is on the northeast fringe of the metropolitan area, land prices in Greater Santiago generally declined with distance from the center (the Santiago comuna), following the land price gradient predicted by the classic monocentric model of an urban area. Our estimate of land price gradients indicates that land prices fell 8.2% with a one kilometer increase in distance from the center.[24]

Are There Spatial Distortions? Potentially, there are significant spatial distortions resulting from locating subsidized units on large, inexpensive tracts of land. For many households, these locations were far away from employment opportunities. For example, for La Pintana and San Bernardo residents, Santiago was the dominant work destination; the average commuting time per trip to Santiago was 62.1 and 54.2 minutes, respectively, by public transportation, mostly buses (See Table 8). In addition to the time costs of commuting, these trips increase congestion and pollution. Other substantial costs may have been incurred because families were forced to move far from relatives and friends to get their unit.

Although the poverty rates and income data of Maps F and G show greater numbers of poor people living at the comunas farther away from the center of Santiago, locating the subsidized housing at the fringe of the city often did result in recipients being forced to leave their communities. The implementation of MINVU's programs overwhelmingly resulted in very large projects, often built on entirely undeveloped land. By definition, this meant moving to the farthest edge of existing development. In addition, MINVU's projects do not include razing existing housing. These modern programs, unlike some Chilean programs earlier in the century, revolved entirely around newly-built developments, not the redevelopment of existing settlements.[25]

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[24] The estimated land price gradient is:

$$\log(\text{Price}) = \underset{(0.84)}{4.63} - \underset{(0.03)}{0.082}u$$

$R^2 = 0.16$ N = 34

[25] As early as 1906, the Chilean government began demolishing units because of poor quality and sanitation problems (9000 units in Santiago between 1906 and 1925) (Trivelli 1987, 12). Until 1980 the dominant mechanism for establishing low income housing was through political seizures of land by the poor. On this land, all on the periphery of the city, grew unregulated makeshift campgrounds and shacks, tacitly accepted by the government. Literally hundreds of thousands of unregulated units were set up between 1930 and 1980 (Trivelli 1987, Kusnetzoff 1993). Beginning in 1980, government housing policy began explicitly addressing these *campamentos*, and the dominant activity in public lower-income housing was the regularization and relocation of these squatter towns (Trivelli 1987, 13-14 and 161; Kusnetzoff 1993).

Finally, considerable anecdotal and documented evidence suggests that MINVU's current programs cause significant relocation of the new residents. A 1985 private study of residents in new projects reported that 47.5% of the displaced population at that time said they would immediately return to their previous location and living conditions if allowed to do so, even given the poorer conditions they previously lived in.[26] Among the reasons cited were removal from the city proper and less access to urban opportunities; smaller size units; lack of public space, urban amenities and important neighborhood infrastructure such as health and education facilities; higher transportation costs; destruction of previous neighborhoods and social networks; and job loss. In this study, 14.3% claimed that they lost their jobs due to relocation. Still, poor families in Chile who want to consume higher quality housing often rely on the units provided by MINVU's programs. The choice of unit under these programs is very limited since the waiting lists for units are long (often many years) and if a household does not take the first unit offered it moves to the bottom of the list.

Would these fringe locations have been chosen for subsidized units if housing policy makers considered the total costs of these locations rather than just the land and construction costs? In the standard monocentric urban models of Alonso (1964), Muth (1969) and Mills (1972), consumers trade off land costs against commuting costs. Land prices are in equilibrium when any benefits from moving farther from the center which take the form of lower land prices are exactly offset by the increase in commuting costs. No household is better off by changing location. In other words, land prices are lower at more distant locations precisely because of increases in commuting costs. It is clear that the presence of location specific subsidies alters the household's tradeoff between land costs and commuting costs. In addition, the standard monocentric model does not consider externalities such as congestion and pollution.

Estimating the Magnitudes of Spatial Distortion. The question we try to answer is: where would subsidized housing for the poor in Santiago be located if the total costs of that location were considered rather than just construction and land cost? Measuring the total cost of locating subsidized housing at a particular site is a difficult task. A wide variety of costs beyond land and construction costs should be considered in any such calculation. These costs include commuting costs (including out-of-pocket, time and congestion costs), pollution costs from traveling greater distances, lost opportunities due to locations far from employment prospects, and the costs associated with moving far from family, friends and services.[27] In addition, there may also be costs

[26] From "Estudio de Evaluacion el Programa de Erraicacion de Campamentos en la Region Metropolitana," Santiago, CEPA Consultores, 1985 (Trivelli 1987, 161).

[27] Other costs of such policies arise from the social problems resulting from large concentrations of poor. In the U.S., there has been extensive experience with large scale housing projects that tend to isolate the poor in marginal neighborhoods. See William Julius Wilson's (1987, pp. 25-39, 56-62) discussion of social isolation and concentration effects in ghetto and inner city public housing projects in the U.S. In addition, evidence suggests that the quality of neighborhoods has significant impacts on education as well as on future success in the labor market for young people.

imposed on the surrounding community when publicly subsidized units are built nearby. To the extent that wealthier households prefer not to live near poor households, the existence of subsidized units may decrease property values in the area. If increases in the number of low income households are correlated with crime, the community may be viewed as more dangerous with more subsidized units. Clearly, the measurement of some of these costs is straightforward while the measurement of others is virtually impossible.

For the purposes of this paper, we sought to obtain some estimate of the magnitude of the costs and benefits of more central locations, closer to the employment center of Santiago and more accessible to important services and infrastructure than the more remote areas where the majority of subsidized housing is being built. Current subsidized housing programs in Chile tend to generate very big sites with a large number of units. The priority given to large developments may limit the opportunities to build subsidized housing projects in more central locations. While very large tracts of vacant land may be hard to find in more central comunas, there is vacant land available, providing opportunities for building subsidized units. In Santiago, for example, 18% of the central comuna's land was undeveloped, according to a recent study by Catholic University. (Pontificia Universidad Catolica de Chile 1988).

Our calculations are done on a per unit basis ignoring the possible costs and benefits of large scale development. While there may be efficiency gains associated with large scale developments, there may also be substantial increases in infrastructure costs if large scale development requires more remote sites.[28] Unfortunately, we cannot measure these benefits and costs. Assuming that the cost of constructing a subsidized housing unit is roughly the same throughout the metropolitan area, the increase in land cost is the major extra cost of constructing a unit in a more central comuna.

Therefore, we begin by estimating the additional land costs that would arise from building a publicly-subsidized unit in more centrally-located comunas. We then compare those costs to some of the benefits of moving the household to these closer comunas. As with costs, many of the benefits of more central locations are difficult to quantify. If the subsidized housing unit were located in the more central comuna, the household would realize a decrease in commuting time which would decrease commuting costs. In addition, if the commuter were traveling by bus and fares were based on distance there would be an out-of-pocket savings as well. If the commuter were traveling by car there would be out-of-pocket savings in terms of operating expenses due to the shorter commute. A shorter commute should also have an impact on air quality in Greater Santiago.[29] The benefits of being closer to employment

[28] We expect that infrastructure costs may vary across locations as well. While we do not have any explicit measures of these costs, we expect that access to roads and water and sanitation systems may well be less expensive in more developed comunas than at fringe locations.

[29] We should also note that the Chilean government made a very large investment in a subway system with plans for expansion. Even with the expansion, the system will only go as far south as La Granja.

opportunities as well as family and friends are clearly important but far more difficult to measure. In our calculations, we use a rather crude measurement of some of the benefits of a shorter commute as a way to begin thinking about the benefits to be weighed against the increased land costs of moving units in from the fringe. We find that simply by including estimates of benefits from shorter commutes and decreased pollution impacts, it is immediately apparent that there are several locations closer to the center of the city where the increased benefits outweigh the additional land costs.

We evaluated moving subsidized units from three comunas--La Pintana, Puente Alto, and San Bernardo, all in the south--which house 37% of the publicly-subsidized units constructed between 1988 and 1992 to target comunas that are closer to Santiago. La Pintana and Puente Alto have consistently been popular sites for significant numbers of publicly-subsidized units. San Bernardo, while accounting for a smaller portion of units, seems to have attracted more subsidized units in recent years: while San Bernardo attracted 3% of 1990's units and 4% of 1991's units, it doubled to 8% of the units in 1992.

The target comunas considered are Cerrillos, Cerro Navia, Lo Espejo, Pedro Aguirre Cerda and Renca, all closer to the center of the city. Table 8 shows the average 1992 land costs per square meter in the fringe comunas and the target comunas. The land values are the average across all lots sold in the comuna across four quarters of 1992 (Mercado 1993). Even these crude average land costs vary considerably across these comunas, from $8.03/square meter in La Pintana to $39.17 in Renca. If we were to consider more central comunas such as Santiago and Providencia where land prices are considerably higher, the variation would be much greater.[30]

When examining the land cost differentials, it should be remembered that the land prices are based on average land prices for all lot sizes by comuna. There may be considerable variation in land prices within a comuna and price will vary with the size of the lot (e.g., some parcels in San Bernardo may be less expensive than some parcels in the target comunas, while other parcels may be more expensive). However, average land prices do still provide a useful starting point for illustrating the impact of choosing different locations. It should also be noted that while average land prices by comuna generally fall with distance from Santiago, this is not always the case. In Table 8, the average land price in San Bernardo is higher than those in the target comunas of Cerrillos and Cerro Navia.

The system is currently underutilized. While we leave the analysis of the wisdom of building the system to others, it exists, and there may be considerable benefits to locating subsidized housing units near this system in terms of reducing congestion and pollution from commuting.

[30] The average 1992 land value across the 34 comunas was $74. The lowest value was $8.03 per square meter in La Pintana, and Providencia had the highest at $442.38. The central comuna, Santiago, had an average value of $190.35.

Current regulations suggest that the minimum lot size for a house in Greater Santiago is 100 square meters. However, subsidized units are often constructed with considerably less land per unit. In this analysis, we consider lot sizes of 60 and 100 square meters. As can be derived from Table 8, a 100 SM lot in Renca, on average, is $3,114 more than a 100 SM lot in La Pintana; moving a unit from San Bernardo to Cerro Navia, however, could result in a $395 savings in land costs. These changes in land costs are substantial given that house prices are typically between $5,000 and $10,000.

Given that households in Santiago tend not to move very often, we assume that households stay in their units for 10 or 20 years. We calculate the annual cost of the increase in land prices by assuming a 12% discount rate for both a 10 year and 20 year tenure for the two lot sizes.[31] The last four columns of the Land Costs section in Table 8 show these annual costs. The largest annual land cost differential occurs when moving from La Pintana to Renca at $551 for each of 10 years for a 100 SM lot, and $331 a year for a 60 SM lot. Relocating a unit on a 100 SM lot from Puente Alto to Cerrillos or Cerro Navia would only cost $101 and $59 per year, respectively (based on a 10 year term).

To calculate commuter savings, we assume, for simplicity's sake, that each household has one commuter, who works in the Santiago comuna and uses public buses.[32] Although we simplify here, we do not believe we risk overstating commuter savings. First, although not everyone works in the Santiago comuna, Map D and Appendix B illustrate the dominance of Santiago as a work destination. Providencia, Las Condes, Vitacura, and Recoleta comunas are also major employment centers for workers living in our three fringe comunas (La Pintana, Puente Alto and San Bernardo), and they are further north (that is, farther away than these southern fringe comunas). In addition, on average Greater Santiago had 1.4 outside-of-the-home workers per household in 1991. By assuming one worker, we err on the side of underestimating commuter savings. In Table 8, commuting times to Santiago for each comuna are shown. The time saved by moving from each fringe comuna to the target comunas ranges from 32 minutes by moving from Puente Alto to Renca to 7.6 minutes by moving from San Bernardo to Cerrillos. To convert to annual time saved, we assume two work trips a day and 250 work days a year.

The value of time is estimated by taking one half the hourly wage times the hours saved per year (which is a standard calculation in the transportation literature).

[31] The Chilean government used a 12% discount rate to evaluate transportation investments (Kain and Liu, Chapter 7).

[32] The 1991 Origin-Destination Study reported that 85% of morning rush hour trips from our three fringe comunas to downtown Santiago were by bus.

We use the average wage according to the AFP, Chile's private pension system.[33] In effect, this exercise represents taking a household with a single wage earner working in the Santiago comuna who earns the average AFP wage and examining the costs and benefits of moving that household to different locations.

Estimates of the annual value of time savings associated with moving from the fringe comunas to each of the target comunas are presented in the Time Savings rows of Table 9. The annual household benefits from commuting time savings range from $66.70 by moving from San Bernardo to Cerrillos, to $280 by moving from Puente Alto to Renca. Clearly, these savings estimates are dependent on our assumptions about household wages. Lower income households have a lower value of time and therefore would realize less savings from the move. On the other hand, the time savings calculations could increase substantially with more than one worker per household.

In Santiago, bus fares do not vary with distance so we do not consider a change in out of pocket travel costs in these calculations. This implies, though, that if bus fares were restructured to better match costs, the additional out-of-pocket savings from moving the commuter closer to the center of the city would be added to the benefit calculations in Table 9, improving the attractiveness of moving households from fringe to target comunas.

Comparing the values of time savings to the land premiums provides little evidence that land cost differentials simply reflect the costs of longer commutes, as suggested by the simple monocentric model. In some cases, the value of time savings are considerably higher than the price differentials while in other cases the opposite in true. For example, the time savings from moving from a 100 square meter lot in Puente Alto to a similar lot in three of the five target comunas are considerably higher than the land costs differentials.

Longer commuting trips also contribute to the pollution problem in Greater Santiago. In their paper on pollution (Chapter 4), Kahn and Kerr estimate pollution costs per bus trip minute per person per year at approximately $0.35. This estimate is conservative in that it only measures the health effects of particulates and ozone damage from buses. It does not include damage from other pollutants, agricultural damage, or decreases in visibility. Using this conservative estimate, we calculate the value of the pollution savings per year for each move. These savings are presented in Table 9.

In Table 9, the land price differentials are compared with the value of the benefits from reduced commuting time and pollution savings. The results clearly show that there are more central comunas that are feasible for subsidized construction in

[33] All employees must make contributions to the AFP pension system. The Superintendencia de AFP records wage rates and publishes average wages on a monthly basis. The average wage for March 1993 was $136,926 Chilean pesos, which converts to $4,212 annually in 1992 U.S. dollars.

most cases. The shaded parts in Table 9 show moves in which measured benefits exceed measured costs. Moving households, for example, from 100 SM lots in San Bernardo to Cerrillos could save nearly $100 annually. (Calculations in Table 9 assume a 10-year term; assumption of a 20-year term would further increase the attractiveness of moving from fringe to central comunas because the annual land premium would drop.) Moving households from Puente Alto to Cerrillos, Cerro Navia, or Pedro Aguirre Cerda would result in significant savings. If the lots of land were 60 SM, moves from fringe to target comunas become even more attractive. In most of the cases, the time and pollution savings far exceed the increased land costs. Even moving from a 60 SM lot in La Pintana to one in Cerrillos would only cost $3.18; moving from San Bernardo to Lo Espejo would cost $21.52. It may well be that the benefits not measured here from the more central location would be larger than this cost, making the move worthwhile. The calculations for San Bernardo are less clear. In our data, San Bernardo has higher average land costs than Cerrillos and Cerro Navia.

These calculations are crude. Many of the costs and benefits listed in the beginning of this section are not included in the calculations. In addition, the data used must be viewed as at best rough approximations. The calculations provided here, however, are likely conservative estimates given that they tend to understate the apparent benefits.

Even with these crude calculations it is clear that consideration of costs beyond land could result in a different location pattern for subsidized units. Given the extraordinary concentration of subsidized housing construction on the fringe of Santiago and the crude calculations that we present in this section, more attention should be given to measuring accurately the total costs and benefits of alternative locations.

POLICY RECOMMENDATIONS

Current housing policy in Chile contributes to spatial distortions, either by limiting household mobility or by explicitly altering household location by the provision of housing units. The evidence also suggests that the formal rental housing market is limited to the upper end of the income distribution. It is virtually impossible to measure the extent of the informal market. However, the focus of government programs on homeownership results in relatively large subsidies being provided to some households with others receiving no subsidies. More households could be served through rental subsidies. In addition, the focus of government programs on homeownership may limit household mobility since the moving costs are considerably higher for owners than for renters. The subsidy structure, which encourages the purchase of new rather than existing structures, may limit the future marketability of these subsidized units.

In our work, the spatial distortions in the provision of units across regions were found to be relatively modest, with the extreme south and north regions and R.M.

somewhat favored. The distribution of vouchers has favored R.M., which has received a higher share of both vouchers and voucher expenditures than would be indicated by its share of the country's population or housing deficit.

The regional distribution of vouchers and voucher expenditures is difficult to explain on the basis of the population and housing deficit data provided in this paper. While it may be that vouchers are a more appropriate form of housing subsidies in some regional housing markets than in others, we have no basis from which to make an assessment for Chile's regional markets. In fact, we need to understand how the various markets respond to vouchers versus construction subsidies.

The largest spatial distortions resulting from government subsidized housing construction identified in this paper were in Greater Santiago. The location of these units in areas far from the center of the region imposes significant costs on residents of these units, as well as on all residents of the region. Locating units on the basis of only construction and land costs ignores significant costs such as pollution, congestion and social isolation. While our calculations are crude and include only the costs and benefits that we could easily estimate, this work clearly suggests that a different spatial distribution of these units could result if total costs of locations were considered. While we did not examine the spatial distortions in other cities in Chile, it is clear that in the building of any subsidized housing units, the total costs and benefits should be considered, regardless of the region of the country.

In order to consider the total costs and benefits of different locations, there is a need to have more information. Our crude calculations are based on available data on the costs associated with land, transport and pollution. It would be useful to have better information on house prices and rents by geographic unit (i.e., by comuna in Greater Santiago and by the appropriate geographic unit in other major cities and regions in the rest of the country). The pollution costs in our calculations are also very rough estimates focused on only the health effects of particulates and ozone damage from buses. A different approach to estimating the costs of pollution from the buses would be to estimate hedonic regressions of house values where the direct impact of pollution on house values is estimated. This approach would require data on house values, housing and neighborhood characteristics and measures of the spatial variation in air quality.

In general, government should consider moving away from very large projects to smaller, scattered sites for publicly subsidized construction. The large scale projects may limit opportunities for more central locations. In addition, there may be substantial social costs to isolating the poor in very large developments at the fringe of the city.

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TABLE 1
CROSS-COUNTRY COMPARISONS: 1990

COUNTRY	Major City	GNP per Capita	Population (millions)	Urban Population (% of Total)	Homeowner-ship Rate (Main City)	Annual Income (US$s)	House Price to Income Ratio	Rent to Income Ratio
ALGERIA	Algiers	2,060	25.1	0.52	0.45	7,335	11.70	0.05
AUSTRALIA	Melbourne	17,000	17.1	0.86	0.73	26,080	3.90	0.16
AUSTRIA	Vienna	19,060	7.7	0.58	0.17	22,537	4.70	0.13
BANGLADESH	Dhaka	210	106.7	0.16	0.30	1,352	6.30	0.12
BRAZIL	Rio de Janeiro	2,680	150.4	0.75	0.62	5,204	2.30	0.14
CANADA	Toronto	20,470	26.5	0.77	0.60	44,702	4.20	0.18
CHILE	Santiago	1,940	13.2	0.86	0.80	3,433	2.10	0.28
CHINA	Beijing	370	1133.7	0.56	0.08	1,079	14.8	0.06
COLOMBIA	Bogota	1,260	32.3	0.70	0.62	3,252	6.50	0.20
CZECHOSLOVAKIA	Bratislava	3,140	15.7	0.78	0.14	3,677	6.5	0.03
ECUADOR	Quito	980	10.3	0.56	0.79	2,843	2.40	0.19
EGYPT	Cairo	600	52.1	0.47	0.32	1,345	6.70	0.06
FINLAND	Helsinki	26,040	5.0	0.60	0.63	35,770	3.70	0.19
FRANCE	Paris	19,490	56.4	0.74	0.43	32,319	4.20	0.21
GERMANY	Munich	22,320	79.5	0.84	0.17	35,764	9.60	0.18
GHANA	Accra	390	14.9	0.33	0.28	1,241	2.50	0.06
GREECE	Athens	5,990	10.1	0.63	0.55	14,229	3.80	0.15
HONG KONG	Hong Kong	11,490	5.8	0.94	0.43	15,077	7.40	0.08
HUNGARY	Budapest	2,780	10.6	0.61	0.45	5,173	6.6	0.06
INDIA	New Delhi	350	849.5	0.27	0.48	1,084	7.70	0.25
INDONESIA	Jakarta	570	178.2	0.31	0.56	1,975	3.50	0.15
ISRAEL	Tel Aviv	10,920	4.7	0.92	0.80	16,680	5.00	0.23
IVORY COAST	Abidjan	750	11.9	0.40	0.21	3,418	1.40	0.13
JAMAICA	Kingston	1,500	2.4	0.52	0.41	3,696	4.90	0.16
JAPAN	Tokyo	25,430	123.5	0.77	0.40	38,229	11.60	0.16
JORDAN	Amman	1,240	3.2	0.61	0.75	4,511	3.40	0.16
KENYA	Nairobi	370	24.2	0.24	0.29	1,500	1.00	0.10
KOREA	Seoul	5,400	42.8	0.72	0.40	19,400	9.30	0.35
MADAGASCAR	Antananarivo	230	11.7	0.25	0.36	747	3.30	0.21
MALAWI	Lilongwe	200	8.5	0.12	0.33	692	0.70	0.10
MALAYSIA	Kuala Lumpur	2,320	17.9	0.43	0.59	6,539	5.00	0.26
MEXICO	Monterrey	2,490	86.2	0.73	0.83	4,810	3.70	0.36
MOROCCO	Rabat	950	25.1	0.48	0.46	4,158	6.70	
NETHERLANDS	Amsterdam	17,320	14.9	0.89	0.09	14,494	4.80	0.18
NIGERIA	Ibadan	290	115.5	0.35	0.62	1,331	3.60	0.07
NORWAY	Oslo	23,120	4.2	0.75	0.74	34,375	5.50	0.09
PAKISTAN	Karachi	380	112.4	0.32	0.83	1,622	1.90	0.19
PHILLIPINES	Manila	730	61.5	0.43	0.48	3,058	2.60	0.14
POLAND	Warsaw	1,690	38.2	0.62	0.35	2,265	10.8	0.06
SENEGAL	Dakar	710	7.4	0.38	0.57	2,714	3.00	0.19
SINGAPORE	Singapore	11,160	3.0	1.00	0.90	12,860	2.80	0.38
SOUTH AFRICA	Johannesburg	2,530	35.9	0.60	0.64	9,201	1.70	0.05
SPAIN	Madrid	11,020	39.0	0.78	0.74	23,118	3.70	0.10
SWEDEN	Stockholm	23,660	8.6	0.84	0.45	41,000	4.60	0.11
TANZANIA	Dar es Salaam	110	24.5	0.33	0.27	763	1.90	0.03
THAILAND	Bangkok	1,420	55.8	0.23	0.68	4,132	4.10	0.20
TUNISIA	Tunis	1,440	8.1	0.54	0.67	3,327	6.10	0.21
TURKEY	Istanbul	1,630	56.1	0.61	0.60	3,576	5.00	0.25
UNITED KINGDOM	London	16,100	57.4	0.89	0.58	18,764	7.20	0.25
UNITED STATES	Washington, D.C.	21,790	250.0	0.75	0.61	49,667	3.90	0.25
VENEZUELA	Caracas	2,560	19.7	0.84	0.65	5,123	2.00	0.24
ZIMBABWE	Harare	640	9.8	0.28	0.45	2,538	2.80	0.14
MEAN		6,717	78.6	0.59	0.51	11,611	4.91	0.16

SOURCE: (World Bank 1992, 1993).

TABLE 2
CROSS-COUNTRY CORRELATIONS

able	Homeowner-ship	GNP	Popu-lation	Urbani-zation	Price to Income	Latin America	Income
Homeownership	1.000						
1990 GNP	0.016	1.000					
1990 Population	-0.216	-0.121	1.000				
1990 Urbanization	0.251	0.613	-0.143	1.000			
House Price to Income Ratio	-0.360	0.171	0.464	0.225	1.000		
Latin American Dummy	0.321	-0.225	-0.069	0.213	-0.201	1.000	
1990 Income	0.079	0.948	-0.101	0.568	0.155	-0.222	1.000
(observations=52)							
Rent to Income Ratio*	0.499	0.130	-0.023	0.294	-0.118	0.297	0.149

* Rent to Income ratio was only available for 51 countries.

TABLE 3
CROSS-COUNTRY HOMEOWNERSHIP REGRESSIONS

Dependent Variable: 1990 Homeownership Rate

	Coefficients (St. Error)	
Independent Variables	Regression #1 Adjusted R-square: 0.11	Regression #2 Adjusted R-square: 0.14
Constant	0.3457 (0.0833)	0.3729 (0.08375)
1990 GNP	-0.000023 ** (0.000011)	-0.000019 * (0.00001)
1990 Urbanization	0.3444 ** (0.1522)	0.225 (0.1678)
1990 Population	-0.000217 (0.00014)	-0.0002 (0.00014)
1990 Income	0.000011 * (0.0000064)	0.000011 * (0.000006)
Latin America Dummy		0.14326 (0.0906)

Number of Observations: 52

* Statistically significant at the 10% level.
** Statistically significant at the 5% level.

TABLE 4
HOUSING DEFICIT, 1988

Region	Housing Stock	% Inadeq.	HOUSING DEFICIT *Conservate Estimate* Households	Quantity (Households - Stock)	Quality (Inadeq. Units)	Total	HOUSING DEFICIT *Revised Estimate* Families	Quantity (Families - Stock)	Quality (Inadeq. Units)	Total
I	61,253	12.9%	78,692	17,439	7,877	25,316	86,168	24,915	7,877	32,792
II	75,221	7.3%	91,601	16,380	5,454	21,834	100,303	25,082	5,454	30,536
III	40,675	9.1%	48,671	7,996	3,693	11,689	53,295	12,620	3,693	16,313
IV	88,966	25.7%	105,260	16,294	22,820	39,114	115,260	26,294	22,820	49,114
V	268,027	10.0%	333,773	65,746	26,749	92,495	365,481	97,454	26,749	124,203
VI	99,347	15.3%	145,584	46,237	15,210	61,447	159,414	60,067	15,210	75,277
VII	137,832	23.8%	173,891	36,059	32,763	68,822	190,411	52,579	32,763	85,342
VIII	306,918	16.9%	362,290	55,372	51,992	107,364	396,708	89,790	51,992	141,782
IX	141,097	21.1%	163,984	22,887	29,757	52,644	179,562	38,465	29,757	68,222
X	167,715	11.9%	200,725	33,010	19,891	52,901	219,794	52,079	19,891	71,970
XI	15,205	10.9%	17,914	2,709	1,653	4,362	19,616	4,411	1,653	6,064
XX	32,243	2.5%	36,240	3,997	819	4,816	39,683	7,440	819	8,259
RM	991,646	11.2%	1,194,381	202,735	111,263	313,998	1,307,847	316,201	111,263	427,464
Total	2,426,145	13.6%	2,953,006	526,861	329,956	856,817	3,233,542	807,397	329,956	1,137,353

Source: "Antecedentes Regionales de la Situacion Habitacional en Chile," Documentos de Trabajo, MINVU, September 1989.

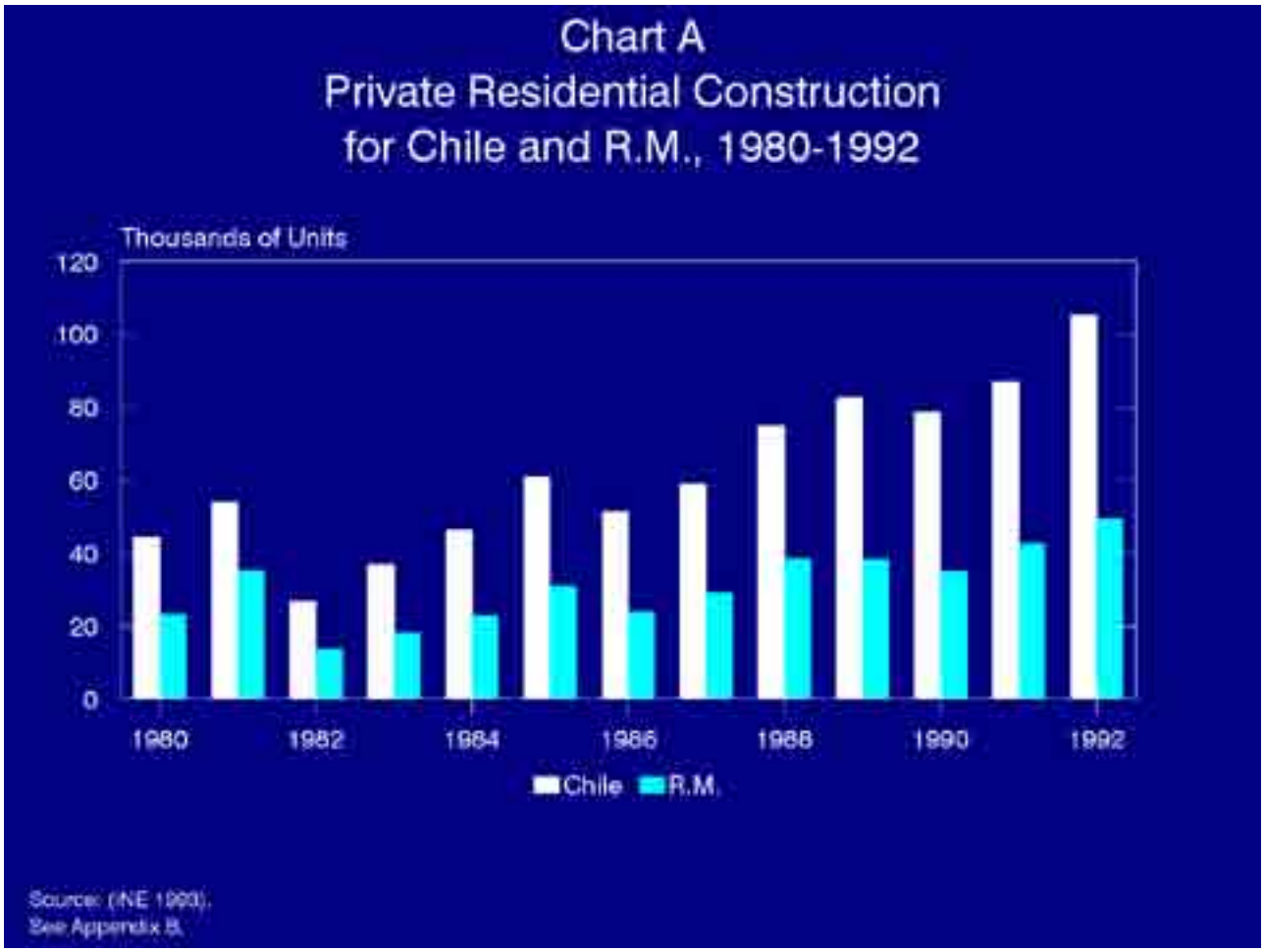


Chart A
Private Residential Construction
for Chile and R.M., 1980-1992
Thousands of Units
120
100
80
60
40
20
0
1980
1982
1984
1986
1988
1990
1992
Chile
R.M.
Source: (INE 1993).
See Appendix B.

TABLE 6
REGIONAL SHARES OF POPULATION, HOUSING STOCK, CONSTRUCTION, VOUCHERS AND REGIONAL POVERTY RATES

	POPULATION AND HOUSEHOLDS			**UNITS** ------TOTAL------		MINVU PRODUCTION PROGRAMS		**VOUCHERS**		**POVERTY RATE** (Households)	
Region	1992 Population	1990 Households	1992 Homeownership Rate	1992 Housing Stock	Housing Construction 1988-92	Construction 1988-92	Value of Construction (MINVU Costs) 1988-91	Number of Vouchers Paid 1988-1992	Value of Vouchers Paid 1988-1991	1990 Poverty Rate	Distribution of Poverty
I	2.6%	2.6%	63.9%	2.6%	2.5%	4.9%	5.8%	1.3%	1.4%	26.3%	2.0%
II	3.1%	2.9%	60.3%	3.0%	2.5%	4.4%	4.1%	2.4%	1.8%	28.0%	2.4%
III	1.7%	1.4%	63.4%	1.9%	1.8%	3.3%	3.5%	0.4%	0.4%	30.8%	1.3%
IV	3.8%	3.6%	69.2%	4.0%	4.5%	5.2%	4.5%	4.5%	3.8%	41.0%	4.3%
V	10.4%	11.1%	64.7%	12.3%	9.2%	7.0%	7.4%	7.2%	6.9%	36.8%	11.9%
VI	5.2%	4.9%	65.2%	5.2%	5.9%	4.9%	4.7%	8.7%	7.8%	36.9%	5.2%
VII	6.3%	6.5%	64.3%	6.4%	5.3%	4.5%	3.9%	8.9%	8.3%	42.7%	8.1%
VIII	13.1%	12.2%	68.2%	12.5%	9.4%	11.8%	11.7%	7.9%	7.3%	41.2%	14.6%
IX	5.9%	5.9%	72.2%	5.8%	5.5%	5.1%	5.0%	7.4%	5.5%	40.3%	6.9%
X	7.2%	6.8%	70.0%	7.1%	4.5%	6.0%	6.0%	3.7%	3.4%	37.6%	7.4%
XI	0.6%	0.6%	63.9%	0.7%	0.6%	1.1%	1.8%	0.2%	0.1%	27.2%	0.5%
XII	1.1%	1.2%	66.6%	1.3%	0.9%	1.6%	2.5%	0.1%	0.1%	25.0%	0.9%
R.M.	39.1%	40.1%	70.7%	37.3%	47.5%	40.1%	39.1%	47.2%	53.3%	29.9%	34.8%
TOTAL	13,231,803	3,197,429	68.3%	3,260,674	428,277	172,719	593,129,193	156,667	351,745,747	34.5%	100.0%

Notes: Shading highlights Region V with Valparaiso, Region VIII with Concepcion, and R.M. with Santiago.
UNITS: Housing Stock and Housing Construction include private and public sectors.
MINVU production programs represent Progressive, Basic and PET programs.
VOUCHERS: Represent unified and rural subsidies paid.

Sources: Census 1992; INECON 1993; MINVU 1992, 1993a, 1993b; Mideplan CASEN 1992.

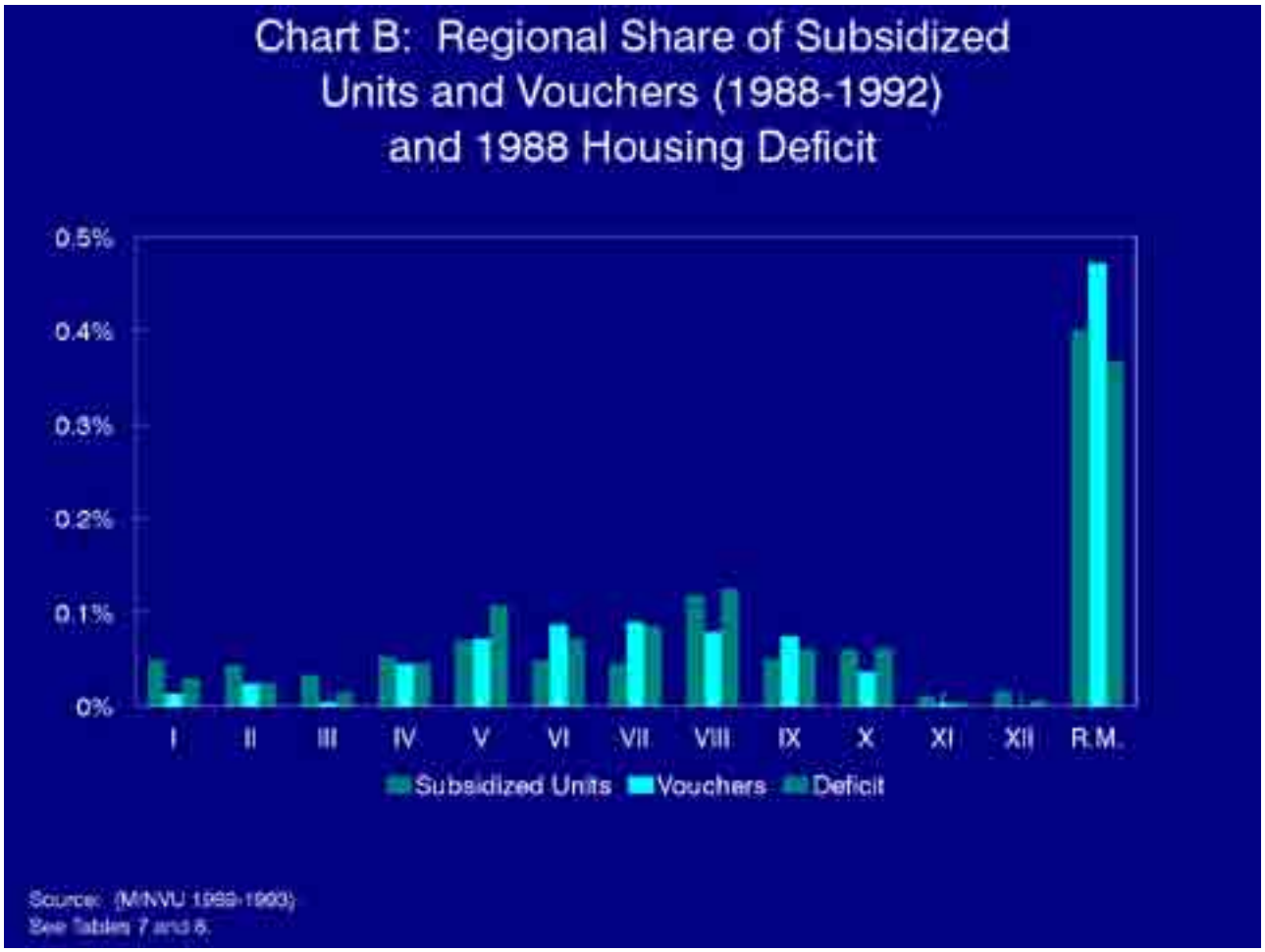
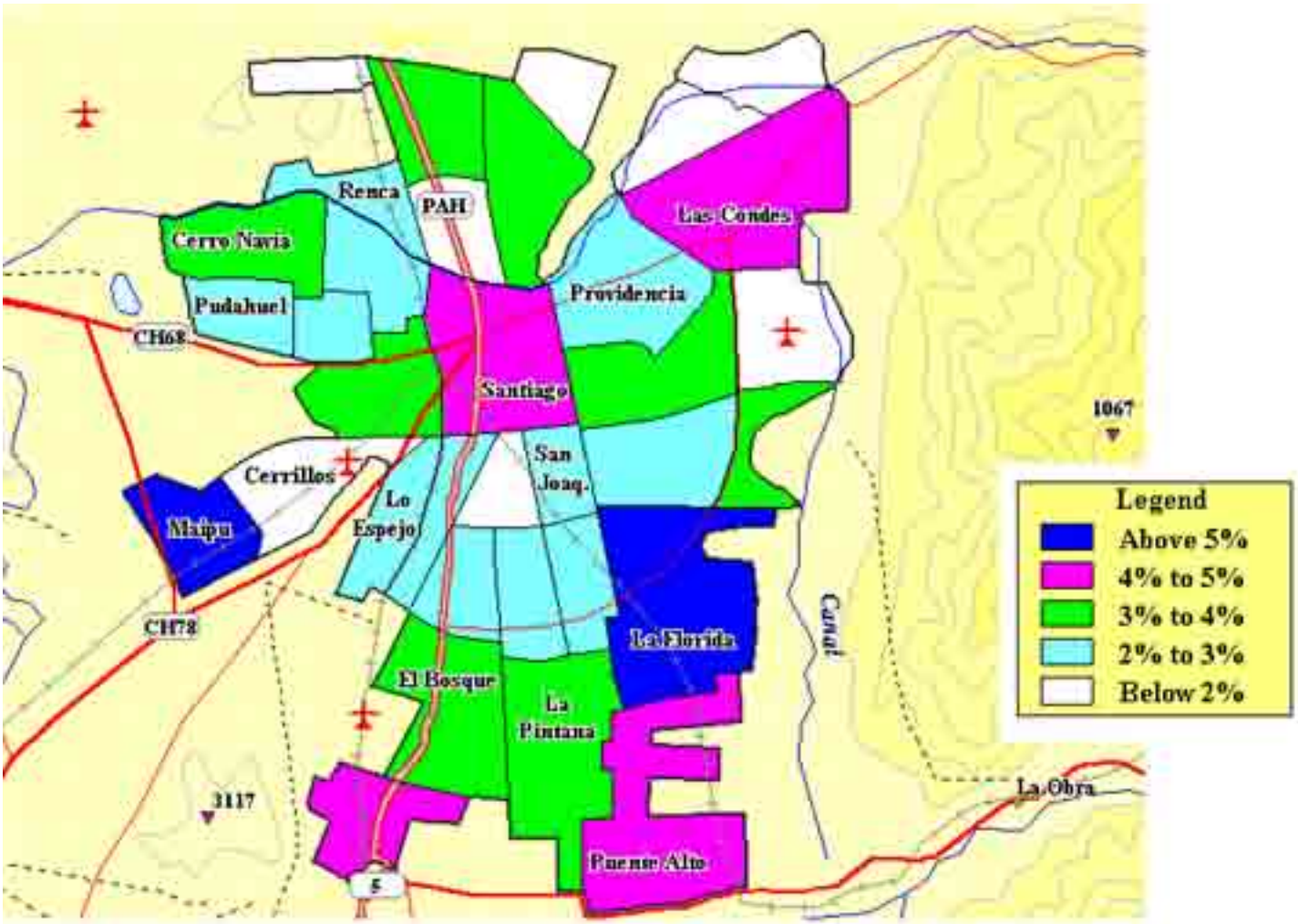
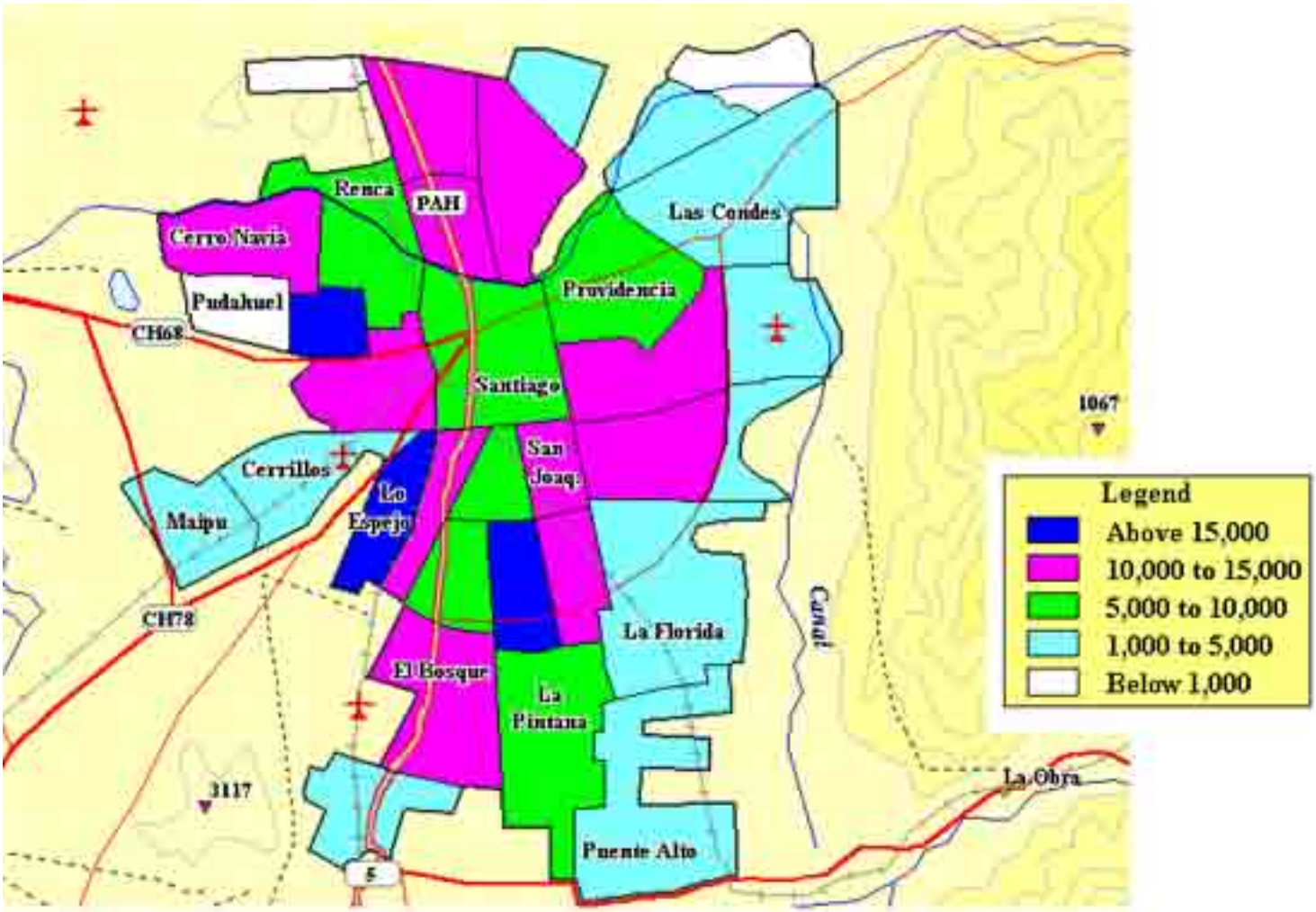


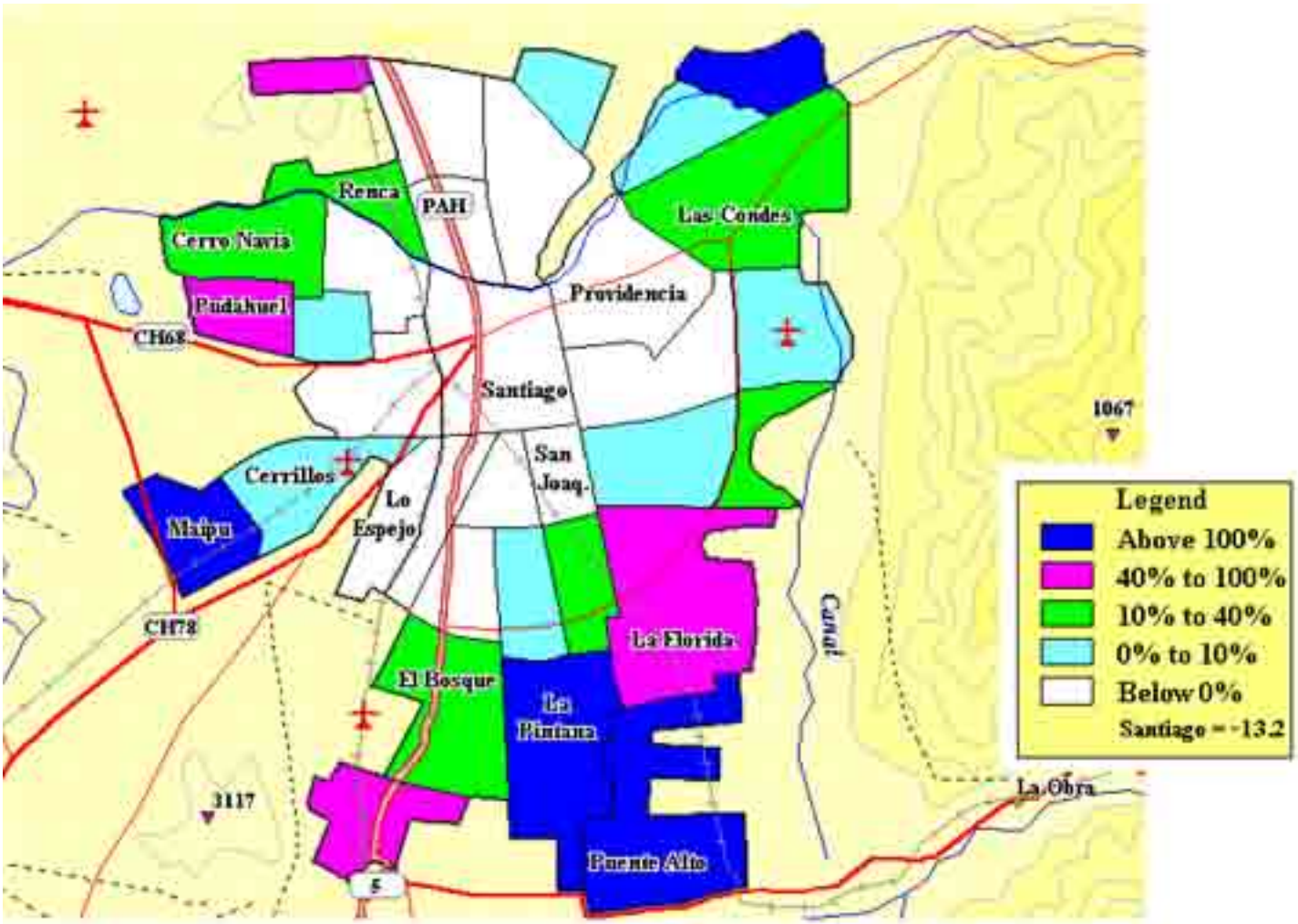
Chart B: Regional Share of Subsidized Units and Vouchers (1988-1992) and 1988 Housing Deficit
0.5%
0.4%
0.3%
0.2%
0.1%
0%
I
II
III
IV
V
VI
VII
VIII
IX
X
XI
XII
R.M.
Subsidized Units
Vouchers
Deficit
Source: (MINVU 1988-1993)
See Tables 7 and 8.



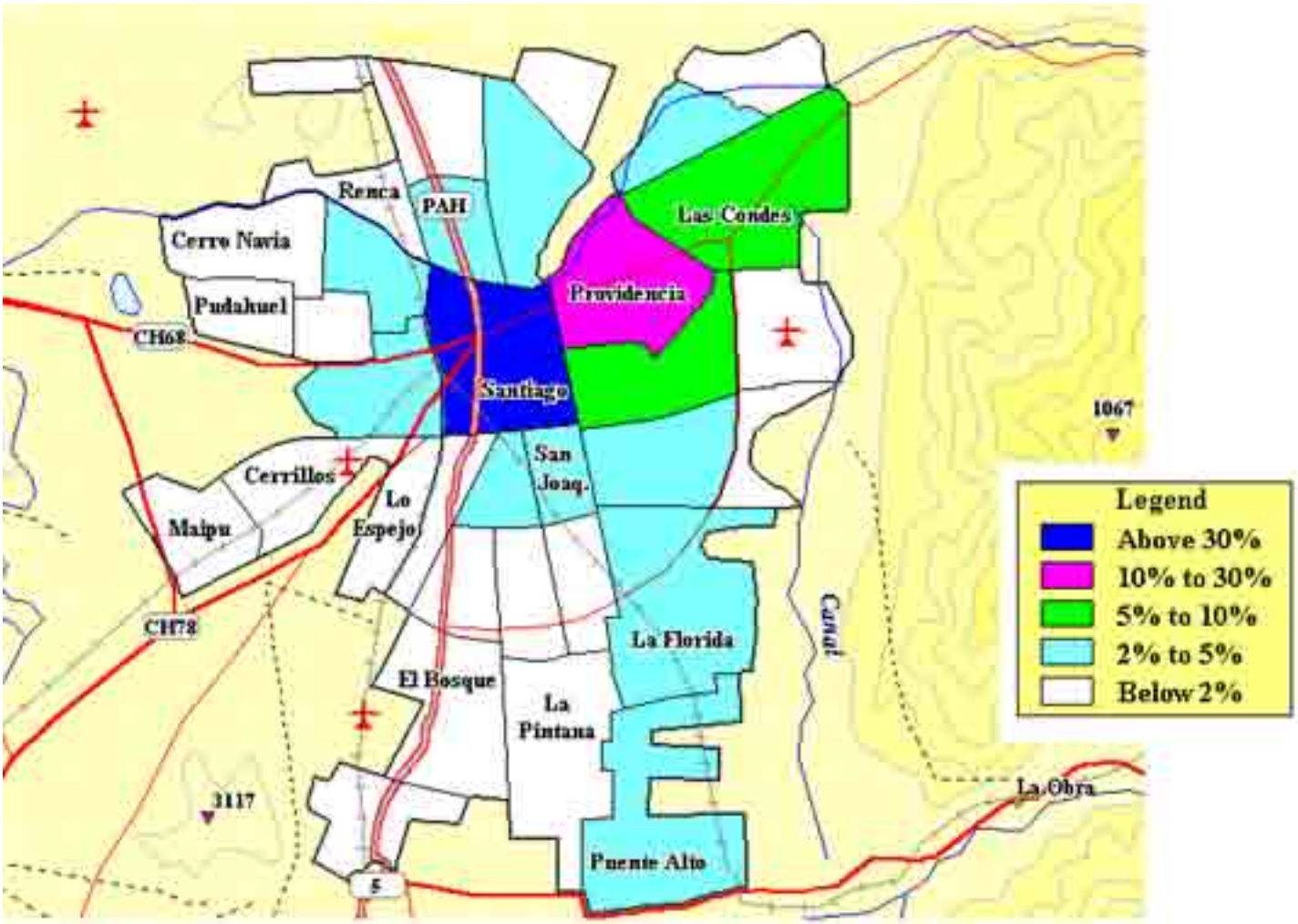
Map A: 1992 Population Distribution by Comuna in Percent



Map B: Population Density (per square kilometer) for 1992



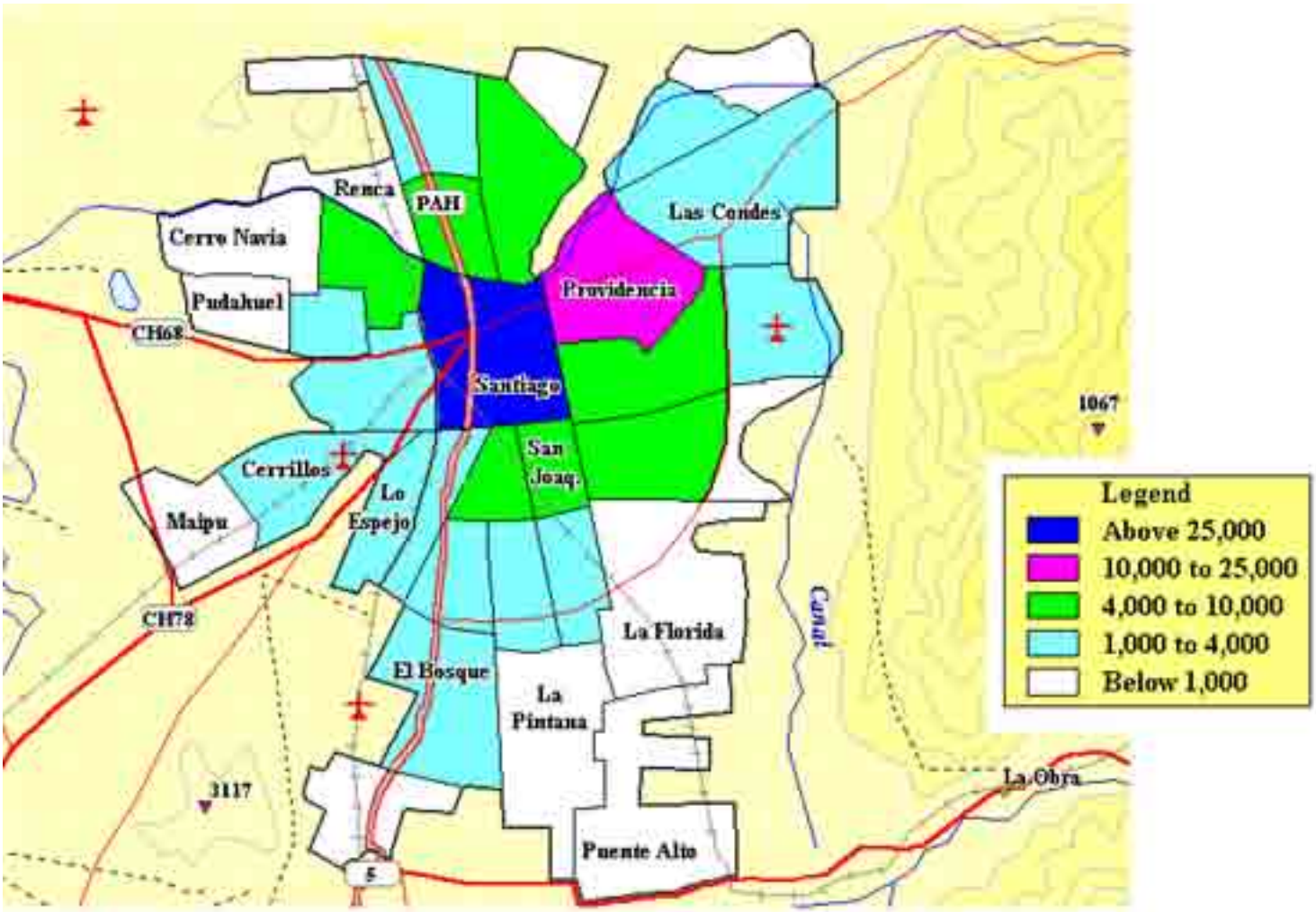
Map C: Population Growth from 1982 to 1992 by Comuna



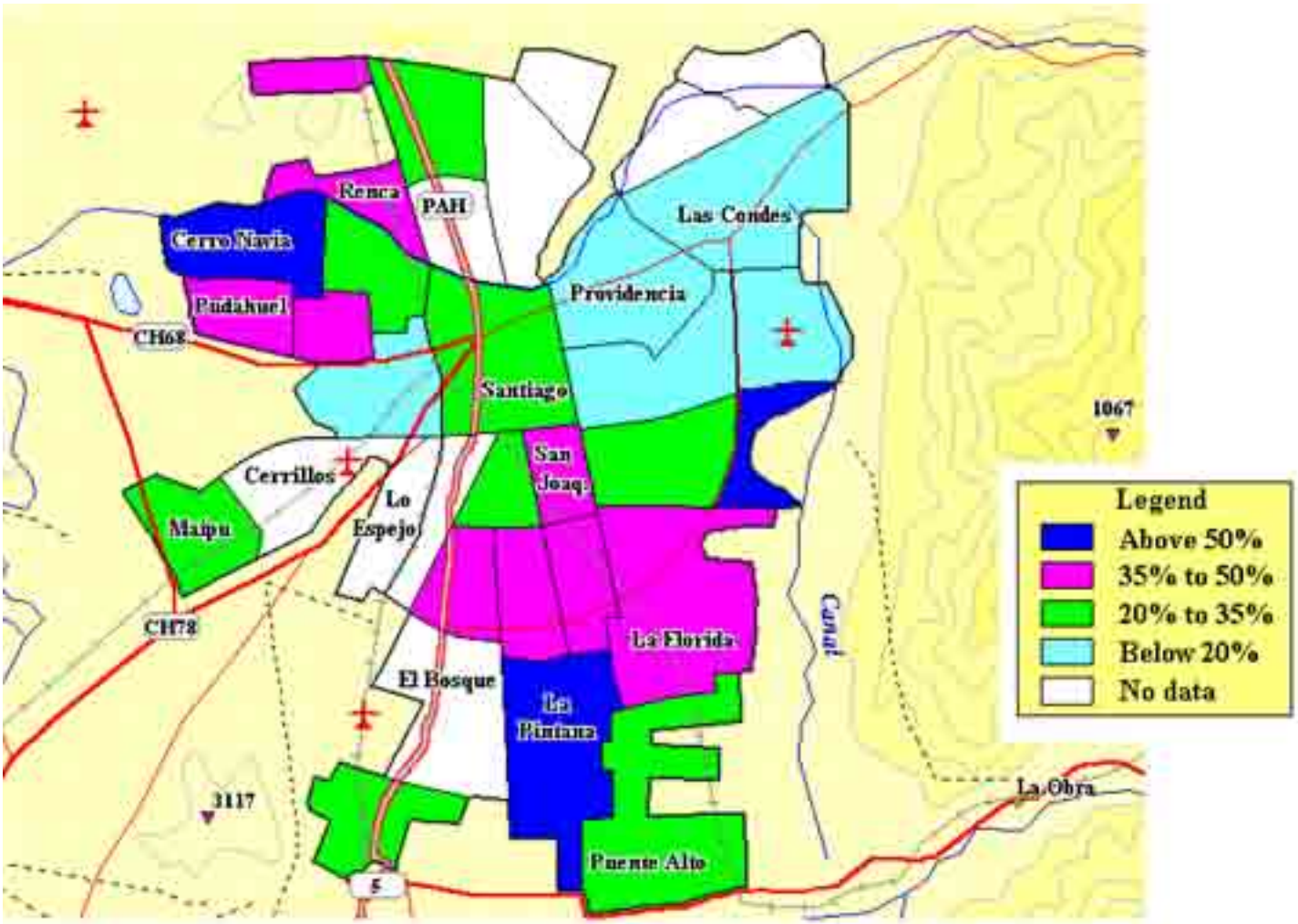
Map D: Comuna Share of Employment

TABLE 7
POPULATION AND EMPLOYMENT DENSITY GRADIENTS

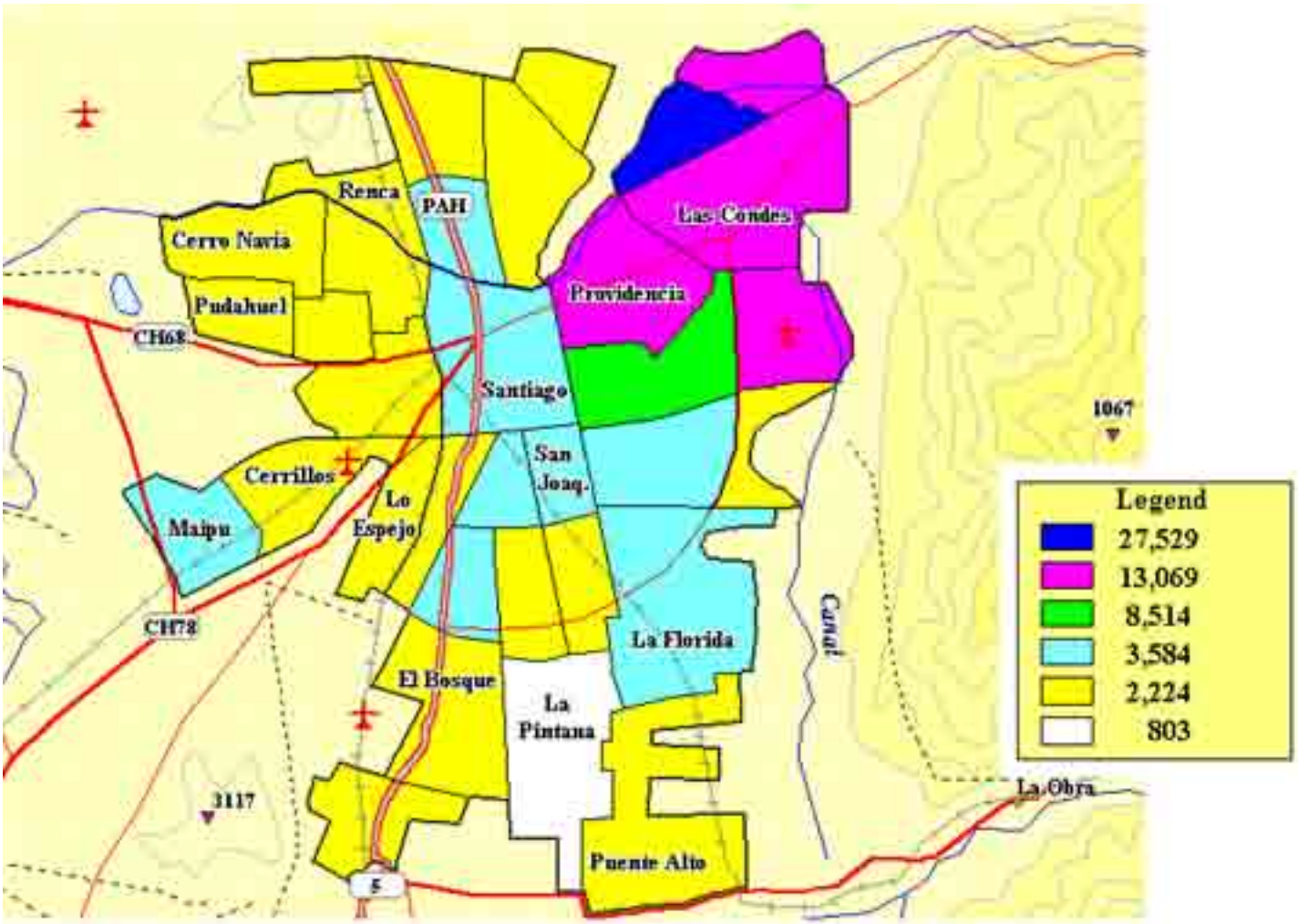
	Population		Employment
	1992	1982	1991
Constant	5.7 (0.39)	6.04 (0.41)	9.91 (0.98)
Distance	-0.07 (0.014)	-0.09 (0.015)	-0.111 (0.015)
Adjusted R Squared	0.42	0.52	0.64
Observations	34	34	34



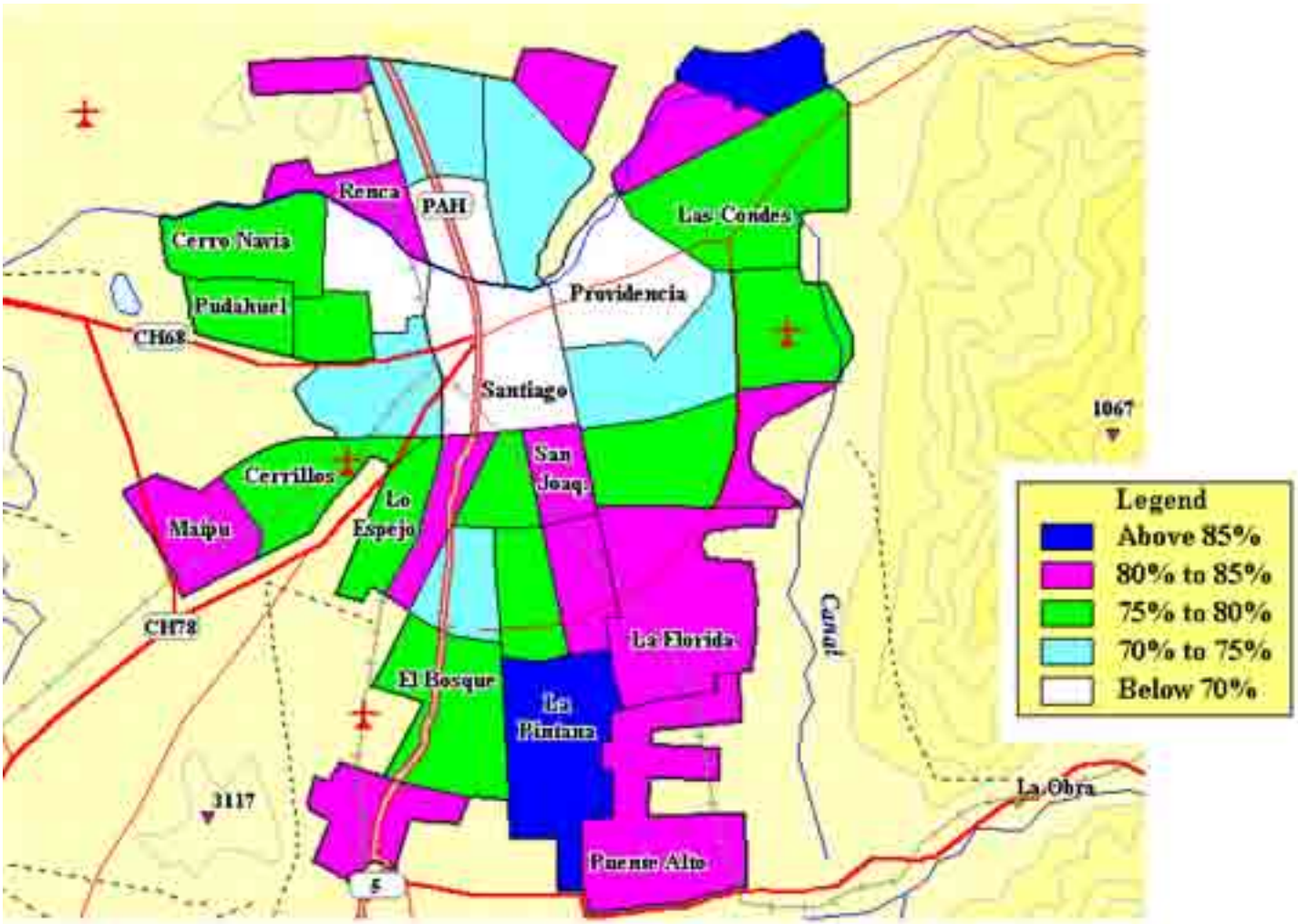
Map E: Employment Density (per square km) for 1991



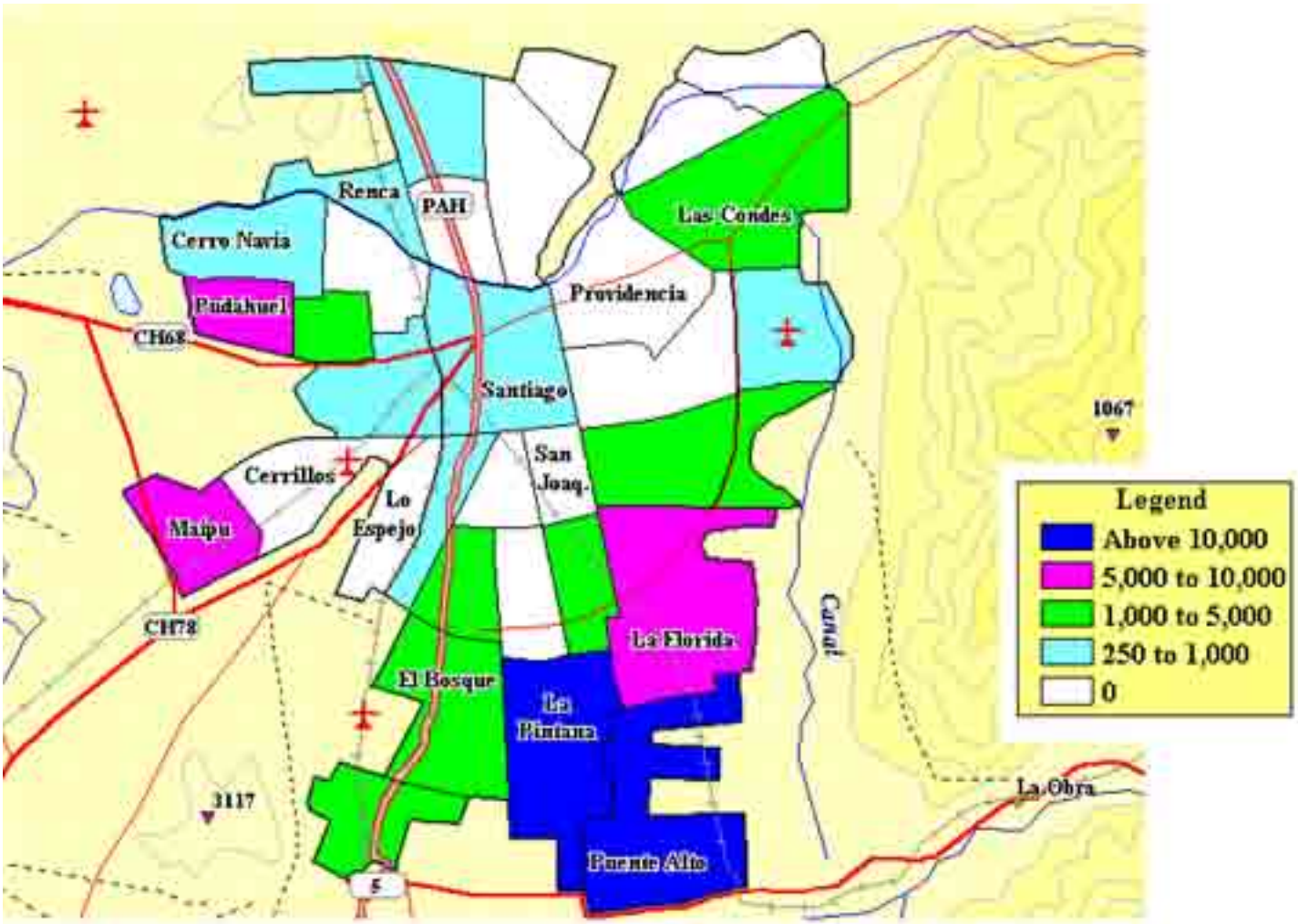
Map F: 1990 Casen Poverty Rates



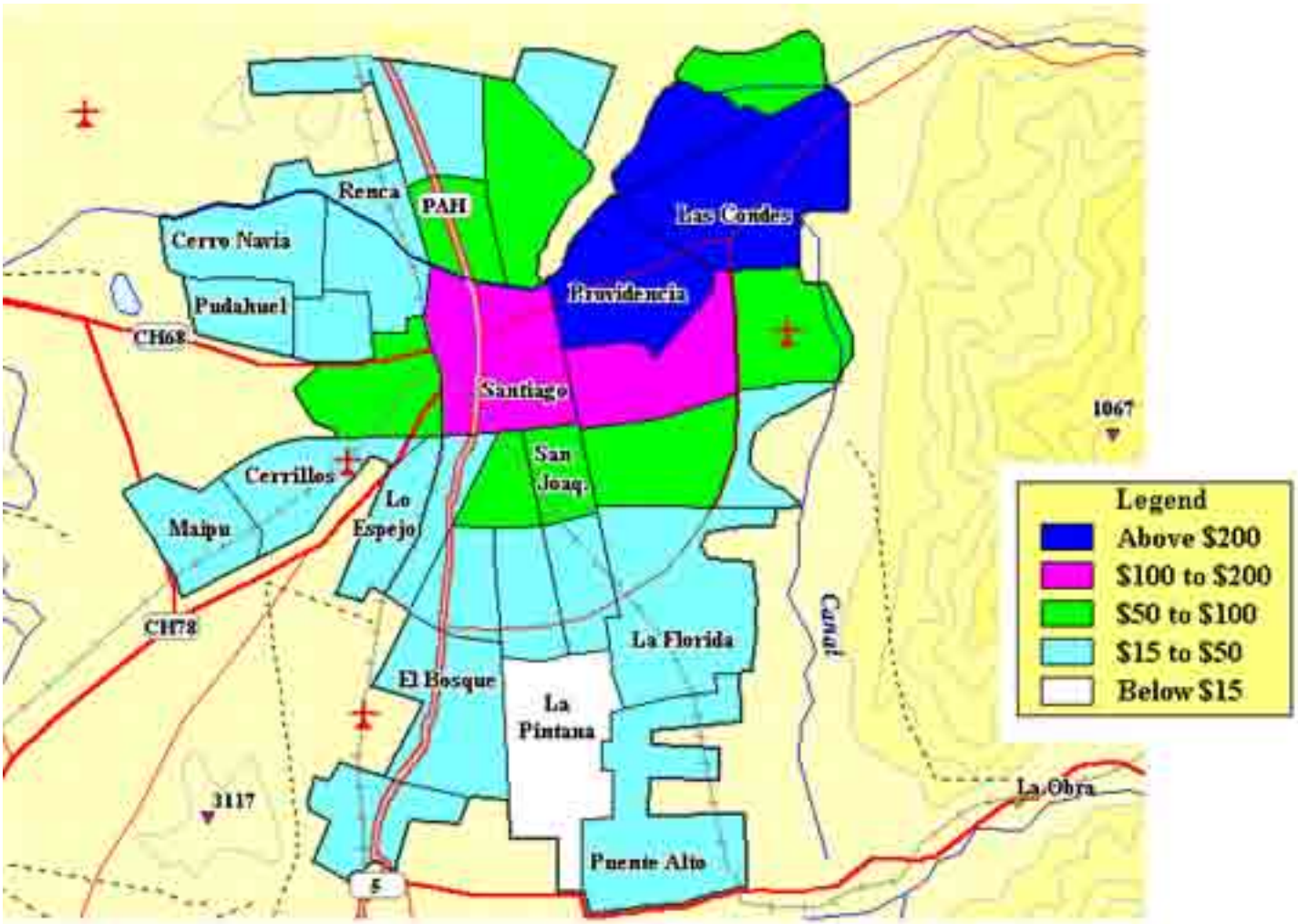
Map G: 1991 Median Annual Income (1992 US$s)



Map H: 1991 Homeownership Rates



Map I: Total Number of Subsidized Housing Units Added from 1988 to 1992



Map J: 1992 Land Prices per Square Meter (1992 US$s)

TABLE 8
LAND COSTS AND COMMUTING DATA

	LAND COSTS							WORK TRIPS*				
	1992 Average Cost (US$/SM)	Total Lot Cost		Annual Cost at 12%				% to Santiago	% in home comuna	Total Work Trips	Work Trips to Santiago	Time to Santiago (minutes)
		100 SM	60 SM	10 years 100 SM	10 years 60 SM	20 years 100 SM	20 years 60 SM					
FRINGE COMUNAS												
La Pintana	8.03	803	482	142	85	108	65	30.8%	7.0%	70,775	21,799	62.1
Puente Alto	15.96	1,596	958	282	169	214	128	23.4%	22.3%	90,787	21,244	71.0
San Bernardo	23.20	2,320	1,392	411	246	311	186	26.3%	23.9%	52,764	13,877	54.2
TARGET COMUNAS												
Cerrillos	21.65	2,165	1,299	383	230	290	174	32.4%	19.6%	31,450	10,190	46.6
Cerro Navia	19.25	1,925	1,155	341	204	258	155	25.3%	8.4%	58,332	14,758	44.4
Lo Espejo	33.39	3,339	2,003	591	355	447	268	27.2%	10.5%	44,583	12,127	44.7
Pedro Aguirre Cerda	23.77	2,377	1,426	421	252	318	191	37.4%	2.8%	62,511	23,379	42.2
Renca	39.17	3,917	2,350	693	416	524	315	27.3%	17.6%	51,701	14,114	39.1
AVERAGE FOR 34 COMUNAS	73.92	7,392	4,435	1,308	785	990	594	30.6%	14.6%	1,836,600	562,000	NA

Sources: Land costs: Mercado 1993.
Work trips and travel time: Mideplan Origin-Destination Study 1992.
Employment data: INE 1993.

* Work trips were calculated by using total number of trips by comuna for all transportation modes, for the purpose of work, for morning rush hour (7:00-8:30 a.m.). These data gave the percentages of work trips to Santiago and within each comuna. Distribution of total morning rush hour trips was then applied to total employment figures for Greater Santiago, taken from the 1993 INE, to estimate total daily work trips.

TABLE 9
COMPARING MEASURED COSTS AND BENEFITS OF DIFFERENT LOCATIONS
(in 1992 $s)

Assuming 100 Square Meters per Unit

Fringe Comuna	Target Comuna: Cerrillos	Cerro Navia	Lo Espejo	Pedro Aguirre Cerda	Renca
La Pintana					
Land Premium*	241.05	198.58	448.83	278.57	551.13
- Time Savings	136.03	155.34	152.70	174.64	201.85
- Pollution Savings	5.43	6.20	6.09	6.97	8.05
= Total Cost	99.60	37.05	290.04	96.97	341.23
Puente Alto					
Land Premium	100.70	58.23	308.48	138.22	410.78
- Time Savings	214.14	233.44	230.81	252.75	279.96
- Pollution Savings	8.54	9.31	9.21	10.08	11.17
= Total Cost	-121.98	-184.52	68.47	-124.61	119.66
San Bernardo					
Land Premium	-27.43	-69.91	180.35	10.09	282.64
- Time Savings	66.70	86.01	83.37	105.31	132.52
- Pollution Savings	2.66	3.43	3.33	4.20	5.29
= Total Cost	-96.79	-159.35	93.66	-99.42	144.84

Assuming 60 Square Meters per Unit

Fringe Comuna	Target Comuna: Cerrillos	Cerro Navia	Lo Espejo	Pedro Aguirre Cerda	Renca
La Pintana					
Land Premium	144.63	119.15	269.30	167.14	330.68
- Time Savings	136.03	155.34	152.70	174.64	201.85
- Pollution Savings	5.43	6.20	6.09	6.97	8.05
= Total Cost	3.17	-42.39	110.51	-14.47	120.78
Puente Alto					
Land Premium	60.42	34.94	185.09	82.93	246.47
- Time Savings	214.14	233.44	230.81	252.75	279.96
- Pollution Savings	8.54	9.31	9.21	10.08	11.17
= Total Cost	-162.26	-207.81	-54.93	-179.90	-44.66
San Bernardo					
Land Premium	-16.46	-41.95	108.21	6.05	169.59
- Time Savings	66.70	86.01	83.37	105.31	132.52
- Pollution Savings	2.66	3.43	3.33	4.20	5.29
= Total Cost	-85.82	-131.39	21.52	-103.46	31.79

* Land Premium is annual differential cost of land assuming a 10-year term at 12%.

Appendix A
Private Residential Construction
for Chile and R.M., 1980-1992
(See Chart B)

	Chile	R.M.
1980	44,438	23,125
1981	53,961	35,176
1982	26,900	13,652
1983	36,860	18,218
1984	46,493	23,002
1985	60,884	30,908
1986	51,404	23,952
1987	58,924	29,255
1988	74,880	38,477
1989	82,520	38,106
1990	78,621	34,927
1991	86,990	42,595
1992	105,266	49,437

Source: INE 1993.

Appendix B
Greater Santiago Comunas

(1992 US$s)	POPULATION						EMPLOYMENT					INCOME		LAND COSTS	OTHER	
Comuna	Estimated Distance to Center (kms)	1982 Population	1992 Population (Map A)	Population Growth 1982-92 (Map C)	1982 Density	1992 Density (Map B)	1991 A.M. Rush Hour Work Trips To Comuna	Redistributed Employment	1991 Share of Employment (Map D)	Employ Density (Map E)	1990 Unemployment Rate	1990 Poverty Rate (Map F)	1991 Median Annual Income (US$s) (Map G)	1992 Average Cost (All lot sizes) (US$s/SM) (Map J)	1991 Homeowner-ship Rate (Map H)	Public Transit Time to Santiago (minutes)
CERRILLOS	7.98	67,013	72,137	7.65%	3,221.8	3,468.1	14,937	32,655	1.8%	1551.33			2,224	21.65	79.8%	46.6
CERRO NAVIA	9.12	137,777	154,973	12.48%	12,525.2	14,088.5	4,808	10,511	0.6%	952.97574	14.2%	58.6%	2,224	19.25	78.6%	44.4
CONCHALI	8.36	157,884	153,089	-3.04%	14,894.7	14,442.4	10,161	22,214	1.2%	2032.4	6.5%	32.0%	2,224	27.70	74.5%	39.5
EL BOSQUE	13.49	143,717	172,338	19.91%	10,339.4	12,398.4	9,080	19,851	1.1%	1390.1144			2,224	25.00	79.8%	52.2
ESTACION CENTRAL	4.75	147,918	142,099	-3.93%	10,718.7	10,297.0	23,970	52,404	2.9%	3579.4793	7.0%	12.5%	2,224	62.26	73.7%	34.2
HUECHURABA	10.64	56,313	61,341	8.93%	1,271.2	1,384.7	1,785	3,902	0.2%	86.069564			2,224	36.87	82.9%	50.1
INDEPENDENCIA	4.56	86,724	77,539	-10.59%	11,719.5	10,478.2	24,415	53,376	2.9%	7203.2987			3,584	92.83	67.7%	30.9
LA CISTERNA	9.5	95,863	94,732	-1.18%	9,586.3	9,473.2	13,801	30,172	1.6%	3017.1955	13.4%	40.0%	3,584	45.52	71.2%	41.8
LA FLORIDA	12.54	191,883	334,366	74.26%	2,733.4	4,763.0	26,121	57,106	3.1%	705.0139	10.5%	38.8%	3,584	24.55	81.4%	57.6
LA GRANJA	10.83	109,168	126,038	15.45%	10,916.8	12,603.8	5,708	12,479	0.7%	1247.8916	13.2%	46.1%	2,224	18.75	80.7%	51.6
LA PINTANA	15.96	73,932	153,586	107.74%	2,440.0	5,068.8	6,320	13,817	0.8%	455.10144	14.9%	55.2%	803	8.03	90.3%	62.1
LA REINA	12.54	80,452	88,132	9.55%	3,452.9	3,782.5	11,093	24,252	1.3%	1054.4211	3.2%	13.8%	13,069	84.09	77.6%	48.2
LAS CONDES	12.54	175,735	197,417	12.34%	1,784.1	2,004.2	53,141	116,178	6.3%	1205.6627	3.3%	5.0%	13,069	281.02	77.3%	41.1
LO BARNECHEA	20.9	24,258	48,615	100.41%	23.6	47.2	4,463	9,757	0.5%	9.5129753			13,069	55.15	86.9%	55.1
LO ESPEJO	7.6	124,462	119,899	-3.67%	17,529.9	16,887.2	6,271	13,710	0.7%	1713.7194			2,224	33.39	76.7%	44.7
LO PRADO	6.84	103,575	110,883	7.06%	15,693.2	16,800.5	4,338	9,484	0.5%	1450.1225	10.7%	42.7%	2,224	36.58	79.8%	37.0
MACUL	7.6	113,100	123,535	9.23%	9,195.1	10,043.5	24,451	53,455	2.9%	4205.7551	5.7%	21.4%	3,584	63.31	75.9%	45.9
MAIPU	13.3	114,117	257,426	125.58%	869.8	1,962.1	13,019	28,462	1.5%	216.24628	6.3%	28.2%	3,584	35.72	82.0%	49.7
NUNOA	5.89	168,919	165,536	-2.00%	10,363.1	10,155.6	43,701	95,540	5.2%	5686.8922	3.8%	10.7%	8,514	184.78	71.0%	37.1
PEDRO AGUIRRE CER	6.46	145,207	128,342	-11.61%	14,817.0	13,096.1	4,357	9,525	0.5%	1101.1953			2,224	23.77	80.0%	42.2
PENALOLEN	12.92	137,298	178,728	30.18%	2,500.9	3,255.5	7,107	15,537	0.8%	303.70272	9.1%	50.2%	2,224	36.25	81.5%	50.0
PROVIDENCIA	5.32	115,449	110,954	-3.89%	8,130.2	7,813.7	86,205	188,463	10.3%	13509.869	5.0%	7.9%	13,069	442.38	64.4%	30.8
PUDAHUEL	10.26	97,578	136,642	40.03%	495.8	694.3	5,509	12,044	0.7%	61.127033	9.4%	42.3%	2,224	28.01	79.7%	42.9
PUENTE ALTO	19	113,211	254,534	124.83%	1,289.4	2,899.0	17,117	37,421	2.0%	428.31	5.3%	29.5%	2,224	15.96	82.6%	71.0
QUILICURA	12.54	22,605	40,659	79.87%	399.4	718.4	4,970	10,865	0.6%	200.58131	9.2%	46.5%	2,224	22.81	81.2%	48.6
QUINTA NORMAL	5.32	128,989	115,964	-10.10%	10,486.9	9,428.0	22,217	48,571	2.6%	4067.9348	6.5%	29.2%	2,224	43.05	66.4%	38.0
RECOLETA	5.89	164,292	162,964	-0.81%	10,952.8	10,864.3	29,492	64,476	3.5%	4029.7411			2,224	51.03	71.8%	39.9
RENCA	8.36	93,928	129,173	37.52%	4,119.6	5,665.5	9,570	20,922	1.1%	883.90701	7.9%	46.7%	2,224	39.17	81.5%	39.1
SAN BERNARDO	16.72	129,127	188,580	46.04%	834.2	1,218.2	12,266	26,816	1.5%	179.92562	13.3%	27.1%	2,224	23.20	82.0%	54.2
SAN JOAQUIN	6.27	123,904	112,353	-9.32%	12,515.6	11,348.8	24,822	54,266	3.0%	5448.4169	5.6%	37.0%	3,584	59.15	80.0%	40.2
SAN MIGUEL	5.7	88,764	82,461	-7.10%	9,343.6	8,680.1	27,630	60,405	3.3%	6305.3366	3.4%	31.7%	3,584	73.04	75.2%	36.9
SAN RAMON	10.64	99,410	101,119	1.72%	15,062.1	15,321.1	5,248	11,473	0.6%	1818.2658	7.8%	41.8%	2,224	24.84	79.8%	52.1
SANTIAGO	0	232,667	202,010	-13.18%	10,433.5	9,058.7	264,233	577,670	31.5%	25225.772	5.6%	31.7%	3,584	190.35	56.3%	25.3
VITACURA	12.16	72,038	78,010	8.29%	2,518.8	2,727.6	17,756	38,818	2.1%	1404.938			27,529	283.67	81.9%	45.7
FOR ALL COMUNAS	9.78	3,937,277	4,676,174	18.77%	1,737.5	2,063.5	840,082	1,836,600	100.0%	810.5	NA	33.8%	3,584	73.92	76.6%	NA

Sources and Notes:
Distance to center estimated as straight-line map distance from center of comuna to center of Santiago comuna
Population and density data from 1982 and 1992 Census
Work trip, commuting time, and share of employment (from share of work trips) data from Origin-Destination Study, 1991
"Redistributed Employment" and "Employment Density" calculated using 1993 total employment for Region Metropolitana of 1,836,600, from INE, 199
Unemployment and Poverty rates from Casen 1990
Income and Homeownership data from Origin-Destination Study, 1991
Land prices from Land Bulletin, July 1993

Appendix C
Greater Santiago Comunas
MINVU Housing Production
(Map I)

Comuna	1988 Basic	Special	Total	1989 Basic	Special	Total	1990 Basic	Special	Progressive	Total	1991 Basic	Special	Progressive	Total	1992 Basic	Special	Progressive	Total	1988-92 Total	% of Total
CERRILLOS			0			0				0				0				0	0	0.0%
CERRO NAVIA	796		796			0		140		140				0				0	936	1.3%
CONCHALI		512	512			0				0	285			285	144			144	941	1.4%
EL BOSQUE			0			0				0	1,168			1,168	708			708	1,876	2.7%
ESTACION CENTRAL		512	512			0				0	136			136				0	648	0.9%
HUECHURABA			0			0				0				0				0	0	0.0%
INDEPENDENCIA			0			0				0				0				0	0	0.0%
LA CISTERNA			0	1003		1,003				0	1,080			1,080	360			360	2,443	3.5%
LA FLORIDA		1,508	1,508	3055	226	3,281		110		110		640		640	300	376		676	6,215	8.9%
LA GRANJA			0	1367	102	1,469		795		795	237	1,139		1,376		563		563	4,203	6.0%
LA PINTANA	1662		1,662	4392		4,392	3,129			3,129	1,711	74	689	2,474			488	488	12,145	17.4%
LA REINA		263	263			0		19		19				0				0	282	0.4%
LAS CONDES	420		420	1250		1,250	1,250			1,250				0				0	2,920	4.2%
LO BARNECHEA			0			0				0				0				0	0	0.0%
LO ESPEJO			0			0				0				0				0	0	0.0%
LO PRADO		472	472		890	890		150		150		250		250	114			114	1,876	2.7%
MACUL		495	495		572	572		144		144				0				0	1,211	1.7%
MAIPU	1191		1,191	738	363	1,101	1,915	363		2,278		1,352		1,352	240	957		1,197	7,119	10.2%
NUNOA			0			0				0				0				0	0	0.0%
PEDRO AGUIRRE CERDA			0			0				0	588			588	264			264	852	1.2%
PENALOLEN			0	134		134	350	200		550	1,489			1,489	1,416			1,416	3,589	5.2%
PROVIDENCIA			0			0				0				0				0	0	0.0%
PUDAHUEL			0		740	740				0	1,830	609		2,439	2,918	1,026		3,944	7,123	10.2%
PUENTE ALTO*	1144		1,144	776		776		2,565		2,565	1,881	1,538	203	3,622	741	1,371	296	2,408	10,515	15.1%
QUILICURA			0		155	155		516		516				0				0	671	1.0%
QUINTA NORMAL			0			0				0				0				0	0	0.0%
RECOLETA			0			0				0				0				0	0	0.0%
RENCA			0		550	550				0				0	100			100	650	0.9%
SAN BERNARDO*	686		686		320	320		372		372	682			682	660	431		1,091	3,151	4.5%
SAN JOAQUIN			0			0				0				0				0	0	0.0%
SAN MIGUEL			0			0				0				0				0	0	0.0%
SAN RAMON			0			0				0				0				0	0	0.0%
SANTIAGO			0			0				0				0		256		256	256	0.4%
VITACURA			0			0				0				0				0	0	0.0%
TOTAL	5899	3,762	9,661	12,715	3,918	16,633	6,644	5,374	0	12,018	11,087	5,602	892	17,581	7,965	4,980	784	13,729	69,622	100.0%

Source: MINVU 1989-1993a and 1993b.