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SPATIAL INEQUALITY, MIGRATION, AND ECONOMIC GROWTH IN CHILE[*]

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1. INTRODUCTION

In the past twenty years Chile's has pursued an aggressive strategy of market liberalization, trade opening, and other structural transformations. Two decades after the reforms, there is a consensus that the subsequent period of high and sustained growth was the direct outcome of those policies (Gallego and Loayza, 2002; Morandé and Vergara, 1997). At the same time, there is consensus that growth has not benefitted regions –and their populations– equally: although poverty levels diminished in all regions, regional income inequality did not decline and welfare differentials show high persistence.

In this paper we explore the reasons for this uneven regional pace and its impact on the spatial dimensions of income inequality. We document that per-capita income and productivity levels either do not seem to be converging towards a common long-run level or the speed of convergence is too slow to become a significant force in equalizing regional income. The main hypothesis of this paper is that lack of convergence in Chile seems to be largely associated with low levels of regional migration and that this phenomenon may be the result, to a large extent, of some government social policies. In particular, when policies are effectively targeted –as is the case of the housing policies that we study–, they can tie families to their geographical location, inhibiting migration.

This paper first explores whether regions would converge, in the long run, to a common level of per-capita income, what is the rate of convergence, and if there are initial conditions that could influence the steady-state income level. The second part of the paper focuses on the fact that lack of convergence of regional income in the Chilean economy is largely associated with low levels of interregional migration. We document that migration has become increasingly less significant as an equalizing force for regional disparities. We provide evidence that this is not a market-driven result. This observation leads us to focus on the role that policies may play in slowing convergence in income levels between regions. We concentrate on public housing subsidies that have sufficient power to affect in a systematic way interregional migration, per capita income growth, and the speed of convergence.

2. ECONOMIC GROWTH AND SPATIAL INEQUALITY

The last decades have certainly been the most successful period of economic growth in Chile since the Big Depression of the 1930s. Between 1975 and 2000, the economy grew at an average rate of 5.2% and real per-capita GDP increased by 125%, reaching US$ 4,500. This vigorous expansion in production was accompanied by declining levels of unemployment, rising real wages, decreasing inflation, and a progressively buoyant external situation.[1]

The engine of this spectacular transformation of the Chilean economy has undoubtedly been the reform program initiated in the mid 1970s.[2] The main reasons for the radical transformation brought about by the reforms was the clear failure of the import-substitution, state-led strategy in providing the basis for sustained growth and, in particular, for improving welfare. The abandonment of the most conservative import-substitution regime in Latin America transformed Chile into a dynamic, export-oriented economy and a leading example of the widespread benefits of market deregulation and competition.

Although the benefits of reforms were substantial, they had a disparate impact on the regions and, more importantly, on different segments of the population. First, growth was not a smooth process. While on average per capita GDP grew at 5.2% between 1975 and 2000, the growth rate of the second half of the period was much higher and less volatile than in the first half. Second, economic sectors contributed in different proportion to overall growth. While fishing, transportation, and telecommunications expanded significantly (11.7% and 6.6% per year on average), industry and the agricultural sector have been less dynamic (both sectors grew less than

[1] Concomitant demographic changes in this period include a marked reduction in the rate of growth of the population (from 2.0% to 1.2% per year), an increase in life expectancy (to 76 years), and widespread improvements in the standard of living (Anríquez et al., 1998).

[2] The Chilean economic transformation has been extensively documented (see for example Edwards and Cox-Edwards, 1987 and Bosworth, Dornbusch, and Labán, 1994). Initial reforms included market deregulation, trade liberalization and exchange rate unification, the elimination of most non-tariff barriers, and fiscal balance. A second round of reforms included the privatization of public enterprises, deregulation of labor markets, social security reform, and partial transferring of health and public education responsibilities from the ministries to the county levels or the private sector.

4.5% per year). The asymmetrical expansion in sectoral activity, in turn, had a contrasting impact on regional GDP growth since there is substantial heterogeneity in regional economic structures: in some regions[3] –as in the north of the country (regions I to IV)– expansion in mining activities contributed between one third and two thirds of total regional GDP growth in the 1975-2000 period, while in the south (regions VI, VII and X) agriculture was the leading economic activity. The Metropolitan Region of Santiago (RM) concentrates around 50% of total GDP and its sectoral composition is largely dominated by industry and services.

This uneven path of regional development also had important effects on regional inequality and poverty. As shown in Table 1, between 1987 and 2000, total poverty reduced from 38% to around 20%, while indigence declined from 13% to 6%.[4] This substantial reduction in poverty levels, however, has not been accompanied by a similar decline in inequality as indicated by stagnant Gini indices at the country level.

Among regions, nevertheless, poverty and income inequality evolved in dissimilar ways. As expected, in all regions poverty levels declined markedly (except in region XI), but some regions benefitted the most (e.g., II, VI, VIII and the Metropolitan Region of Santiago), while others improved less substantially (e.g., X and XII). Within-region income inequality (measured by Gini indices) remained virtually stagnant in several regions (e.g., I II and XII), improved notoriously in regions III, VI and X, while it worsened clearly in regions IX and XI.

The decline in poverty has been clearly associated with the period of sustained economic growth observed in the 1990s by several authors (e.g., Beyer, 1997 and World Bank, 2002). However, social policies were also instrumental in reducing poverty by an efficient targeting of transfers in the form of housing, education, and health, as well as by direct monetary support for indigent families.

[3] For a map of Chilean regions see Appendix Figure 1.
[4] Consistent poverty measures are available only since 1987. Income inequality is measured using the total labor income at the household level, i.e., excluding income from non-labor sources and government transfers.

TABLE 1
INCOME, POVERTY, AND INEQUALITY IN THE REGIONS OF CHILE

	1987			2000		
Regions	Per capita GDP (mill $1986)	Poverty (%)	Income Inequality (Gini index)	Per capita GDP (mill $1986)	Poverty (%)	Income Inequality (Gini index)
I	369	36.1	55	691	20.9	49
II	555	34.1	53	1225	10.9	48
III	262	34.7	55	611	23.6	44
IV	172	44.2	54	370	25.2	50
V	238	35.9	55	384	19.2	48
RM	291	33.8	57	517	14.3	55
VI	294	40.7	52	429	10.9	56
VII	171	41.6	61	335	16.1	48
VIII	218	51.9	58	299	20.6	54
IX	109	51.3	60	195	25.3	57
X	149	47.5	61	286	27.1	58
XI	242	23.1	52	379	32.7	49
XII	777	21.4	54	884	24.7	52
Country Average	257	38.0	58	451	20.6	55

Note: Poverty is measured as the percentage of families below the poverty line.
Source: Own elaboration on the basis of CASEN surveys and data from Central Bank of Chile.

The high heterogeneity in regional income inequality, to some extent could be the result of uneven GDP growth at the sectoral level. For example, in regions I, II and IV mining expanded at an impressive rate in the 1990s and, given its share in regional GDP, this most likely led to generalized welfare gains for workers. This claim is, nevertheless, incapable of explaining why inequality declined markedly in other regions where mining is non existent (e.g., regions VII, or V). Simplistic explanations tend to overlook important aspects such labor market conditions or government policies, which we discuss below.

One has to be careful, nevertheless, not to equate the evolution and dispersion of per-capita GDP and that of household income. While the former corresponds to created value added, the latter refers only to the portion accrued to workers. Both are certainly related in the long run, but they may differ notoriously in the short run. Hence, the connection between growth and income inequality requires the more elaborated treatment we provide next.

3. SPATIAL INEQUALITY AND CONVERGENCE IN REGIONAL INCOME

The dynamic evolution of regional GDP in Chile calls for an analysis of the eventual convergence of per-capita GDP levels to long run (or steady state) levels. Economic theory provides a wealth of models suggesting that average labor-productivity levels among different countries –usually proxied by per-capita GDP in empirical studies– should tend to converge in the long run. From the pioneering work of Solow (1956) and Swan (1956) on exogenous growth to the more elaborate models of endogenous growth of Lucas (1988) and Romer (1986), economists predict that, absent rigidities, rational agents would arbitrage out disparities and, consequently, economies should tend to converge. Regions further apart from their steady-state should grow faster than the rest. If, as assumed in exogenous growth models, all regions share the underlying factors determining individuals' and firms' optimal choices (such as technology, preferences, and institutional set-up) and only differ in terms of their initial capital stock per unit of labor, then the prediction is even stronger: steady state per capita GDP will be the same for every region and then poorer regions will grow faster to catch-up with rich ones. This is called "absolute convergence".

New classical models, on the other hand, predict "conditional convergence", that is the convergence of each region to its own steady-state in terms of per capita GDP and product (Romer, 1986; Lucas, 1988). Each region's steady-state will then depend on initial conditions and other idiosyncratic variables (e.g., endowment of natural resources or location). Applied work suggests that convergence among different countries cannot be dismissed as an explanation of long-run growth rates, but also indicates that numerous elements condition actual growth and the speed of convergence. These include idiosyncratic elements (e.g., institutions) as well as government policies.[5]

At the regional level, arbitrage of business opportunities and income differentials should operate faster and more efficiently that among countries, as one expects within-country rigidities to be less stringent than international barriers to capital flows, technology transfer and migration. In such case, the rate of convergence in regional income and productivity levels should also be higher. Perhaps due to lack of data, however, the study of regional income convergence tends to be displaced by the

[5] See Loayza and Soto (2002) for a summary of the main empirical findings in the literature.

analysis of labor market flows and migration (see Greenwood (1997) for developed economies and Lucas (1997) for developing economies). This suggests that, ex ante, economists expect migration to be an important force in the convergence of per-capita income levels. The evidence, however, does not necessarily support that notion; in particular, Aroca and Hewings (2002) provide evidence that migration flows in Chile may not be a significant equating force as they tend to cluster around the capital, Santiago. Only recently, the spacial location of economic activity became to be seen as an important determinant of economic activity and productivity although mainly at the city or global, but not regional, level (Fujita et al., 1999 and Lucas, 2001).

We explore the path of growth and convergence of Chilean regions under the plausible assumption that they share similar preferences, social and political institutions and technological parameters. As mentioned, per-capita GDP is the variable commonly used in growth studies, but since our goal is to study the relationship between economic growth and inequality, it seems reasonable to include also a variable more closely related to the incomes of the working force and labor market conditions, such as average labor productivity.[6] On average, labor productivity expanded at around 2.1% per year in Chile in the 1975-2000 period, but in several regions the increase was much higher (e.g., over 4% in region II, III, VII and X), while in others productivity expanded very little (e.g., 1.8% in region XII). Consequently, labor productivity also shows an important degree of heterogeneity at the regional level.[7]

3.1 Long run regional convergence

A first look at the evidence for Chile, as reflected in Figure 1, indicates that the stronger hypothesis of absolute convergence has little chance to be supported by the data in 1976-2000 period. The association between the average rate of growth of per capita GDP and productivity levels for the thirteen administrative regions and their initial levels seems to be fuzzy.

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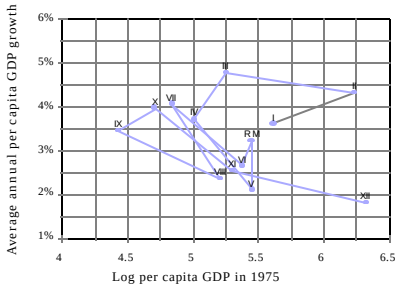
[6] Household income cannot be used for long run growth analysis, since it is only available since 1987 and for selected years.

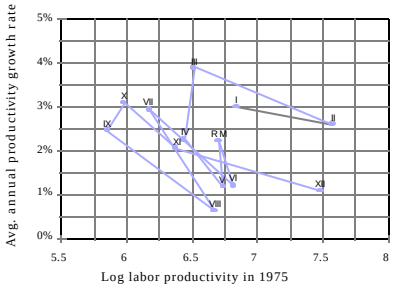
[7] Navarro and Soto (2002) obtain plant-level evidence that productivity growth in Chile was largely due to resource relocation in the 1979-86 period, while in the 1987-1998 period it mostly reflected technology advances. In the former period, it would be reasonable to observe increasing value added without substantial increases in average productivity, as the economy relocates

FIGURE 1

Average per capita GDP growth 1975-2000 and initial per capita GDP level



Average labor productivity growth 1975-2000 and initial labor productivity level



A formal econometric test of absolute convergence –in the spirit of Barro and Sala-i-Martin, 1995– is bound to be uninformative since the sample is too small (13 regions) to provide robust results. Simple correlations, nevertheless, suggest that there is no evidence of absolute convergence in per capita GDP at regional or in average productivity levels. When excluding mining from GDP, correlations for both per-capita GDP and average labor productivity levels are much higher. The main reason to subtract value-added in mining from GDP is that most of the investment was made either by the central government or by foreign firms, so that the rent of natural resources is not clearly allocated to local factors. Although the correlation is statistically significant, its magnitud is is very small, equivalent to non-convergence for all practical purposes.

Cross section analysis is limited by the small number of regions in Chile. In addition, important information is eliminated when working with time averages. In particular, the within-period variation of growth and its determinants. A useful alternative is to study conditional convergence using a panel conformed by creating five non-overlapping sub-samples of 5-year each, covering the entire period 1975 to 2000. Moreover, other papers have documented that conditional convergence models may be a better representation of the regional growth data in Chile (Morandé et al., 1997; Fuentes,

resources from inefficient uses to more efficient applications. Once relocation is completed, value added increases are largely associated with higher labor productivity.

1997; and Aroca and Bosch, 2000). Initial conditions reflect what the neoclassical theory calls "tastes, environmental, and institutional set-up", which can be proxied by measurable welfare and policy indicators. In this context it is important to control for transient shocks that may affect growth rates. Following Loayza and Soto (2002) we include unemployment as a proxy for the business cycle. We control for two space-related variables: the distance between each region and the capital of the country (Santiago) and their geographical area.[8] These variables operate, in practice, as fixed effects. In addition to standard per capita GDP and productivity, we compute similar measures excluding value added in mining.

We use the following generic econometric model:

$$(1) \qquad y_t^i - y_{t-1}^i = \alpha y_{t-1}^i + \beta Z_t^i + \lambda_t + \mu^i + \nu_t^i$$

where y_t^i is the log of per-capita GDP in region i at time t (thus the left hand side of equation (1) is the growth rate), z_t^i is the set of conditioning variables, 8 and μ are time and space fixed effects, and $<_t$ is a white noise innovation. Evidence of convergence obtains whenever parameter ∀ is negative.

We present the results in Table 3. It can be seen that these estimates show the expected negative sign for conditional convergence and that speed of convergence ranges between 3.3% and 4.8% on an annual basis (except for the last column which is insignificant). These estimates indicate a half life of around 20 years while a 1% to 2% rate –as usually obtained in cross-section analysis– suggests a half-life of around 70 years. Obtaining faster adjustment in panel-data models is customary –as discussed in Loayza and Soto (2002)– and these estimates are consistent with those of Aroca and Bosch (2000). The higher rates of convergence are explained by the ability of dynamic models to incorporate in the convergence process toward steady state, the actual changes in the steady states themselves. In this sense, the convergence parameters measure changes in output growth more than speed of convergence properly considered. A second interesting result is the role of unemployment as a control for cyclical shocks: a negative parameter indicates that regions in the lower part of their activity cycle

[8] Chile lends itself nicely to the use of distance as a proxy of transportation costs, since it is long and very narrow, so that regions are located alongside from north to south. Santiago, in the RM

(recession) tend to grow faster than those in booms. Third, the results on the two geographical variables (size and distance to the center, Santiago) are interesting. Distance to the center is not significant, suggesting that transportation costs and connectivity may be unimportant (adding a quadratic term does not imprve the results). Area, on the other hand, is not significant when GDP and productivity measures exclude mining, indicating that most likely the significance observed in other studies is spurious. This would result because the share of mining in GDP is substantial higher in the biggest regions (II, III and XII). Finally, initial human capital levels seem to play also an important role.

TABLE 2
TESTS OF CONDITIONAL CONVERGENCE IN CHILE, 1975-2000
(PANEL DATA: 5-YEAR AVERAGES OF 13 REGIONS)

	Including Mining in GDP		Excluding Mining from GDP	
	Per capita GDP	Labor Productivity	Per capita GDP	Labor Productivity
Constant	-0.56	-0.52	-0.13	-0.35
	(-4.36)	(-5.18)	(-0.87)	(2.20)
Initial per capita GDP	-0.033	-	-0.048	-
	(-5.82)		(-6.99)	
Initial productivity	-	-0.033	-	-0.007
per worker		(-4.84)		(-0.88)
Unemployment	-0.23	-0.17	-0.38	-0.24
Rate	(-3.18)	(-1.87)	(-4.79)	(2.65)
School Achievement	0.32	0.28	0.27	0.12
	(7.69)	(5.51)	(5.94)	(2.61)
Geographical area	0.03	0.03	0.001	0.02
	(2.71)	(2.54)	(0.03)	(1.91)
Distance to center	-0.019	-0.022	0.0001	-0.002
	(-1.68)	(-1.14)	(0.44)	(-1.38)
R^2	0.68	0.56	0.64	0.42

Source: Own calculations using data from Central Bank of Chile and INE.
Note: t-statistics in parenthesis

In summary, convergence if it exists is quite slow. Moreover, when discussing growth regressions we ought to separate between the analysis of the time needed to reduce differences in per-capita GDP between regions (that is better represented by cross-section analysis) from the dynamics of per capita GDP growth more properly, which are better described by the dynamic model.

region, is approximately at the geographical center of the country.

3.2. The role of migration in regional growth

Historically, economists have given an important role to migration when discussing the determinants of economic growth or when estimating convergence models in integrated geographical areas such as the US or Europe. Labor mobility acts in a similar way as capital, speeding up convergence in regional incomes toward their steady-state position. Workers tend to move from regions of low wages or other unfavorable conditions to those with higher wages or more favorable economic conditions. Since higher wages in the recipient region are the result of higher per capita capital, labor mobility implies that the speed of capital accumulation in the recipient region declines and that of the origin region increases, bringing about convergence. Empirical evidence that migration affects convergence is documented for the 50 states of the US by Barro and Sala-i-Martin (1991) and, to a lesser extent, for 118 European regions by Canova and Marcet (1995). We extend the previous analysis to include migration.

Regional migration in Chile is rather low for international standards, in particular when one considers that the country is small, population is very homogeneous, and urbanization levels quite high (by 2,000, urbanization was around 85%, comparable to European countries). On average, in the 1965-2000 period around 0.6 percent of the population moved between regions every year. Because the benchmark for assessing relative mobility is difficult to establish, we provide estimates of regional migration for several developed and developing countries in Table 3. These figures should be taken with caution as they are negatively affected by the size (and positively affected by the number) of regions. We can see that migration rates in Chile –as in other Latin American economies– are substantially lower than those in developed economies, with the only exception of Spain.

TABLE 3
INTER-REGIONAL ANNUAL MIGRATION RATES
AND OTHER DEMOGRAPHIC INDICATORS

Country	Urbanization levels (%)	Number of regions	Average regional population (thousands)	Annual migration rate (%)
USA (1990s)	75.0	48	5,000	6.6
Australia (1986-91)	86.0	8	1,100	2.5
UK (1981-91)	89.0	12	5,000	3.1
Spain (1988-98)	79.0	17	2,300	1.6
Argentina (1975-80)	85.0	24	1,100	1.2
Uruguay (1991-96)	89.2	19	145	1.3
Costa Rica (1979-84)	45.0	6	350	1.0
Chile (1965-70)	75.0	13	680	0.7
Chile (1977-82)	81.1	13	850	0.6
Chile (1987-92)	82.8	13	1,000	0.8
Chile (1997-02)	85.0	13	1,170	0.6

Source: CELADE for Latin American Economies, Cameron and Muellbauer (1998) for the UK, Greenwood (1997) for the US, Australia Industry Commission (1993) for Australia and Lindley et al. (2002) for Spain.

In the Chilean case, only one paper by Aroca and Hewings (2002) has discussed the effect of migration on regional growth, finding that the evidence of very slow convergence maintains and that migration is an important deteminant of regional growth.[9] That paper, however, has data limitations and do not test policies. We undertake an econometric test of this effect by extending the convergence model to include net migration flows (Mt), defined as the net inflow or outflow of population as share of the total population in each region. The model is

$$(2) \qquad y_t^i - y_{t-1}^i = \alpha y_{t-1}^i + \beta z_t^i + \gamma M_t^i + \lambda_t + \mu^i + \nu_t^i$$

[9] A previous paper by Coeymans (1982) discusses rural-urban migration based on the 1970 Census. The results are invalid due pre-test biases arising from censoring the sample of regions.

TABLE 4
TESTS OF CONDITIONAL CONVERGENCE IN CHILE
1977-1997

	Per capita GDP	Per capita GDP Excluding mining
Constant	-0.018	-0.06
	(-0.71)	(-3.28)
Initial per capita GDP	-0.013	-0.018
	(3.91)	(6.80)
Unemployment	-0.036	0.043
Rate	(-1.10)	(1.66)
School Achievement	-0.008	-0.005
	(-1.74)	(-1.84)
Net migration rate	0.011	-0.09
	(1.06)	(-1.34)
R^2	0.024	0.085

Source: Own calculations using data from Central Bank of Chile and INE.
Note: t-statistics in parenthesis

The model was estimated using two non-overlapping samples (1977-87 and 1987-1997) as data availability on migration precludes us from using a longer period. Migration rates were calculated for the periods 1977-1982 and 1987-1992 and then extrapolated to cover each decade. While this alternative might bias somewaht the results, the alternative of running two 5-year samples to infer the convergence properties of per capita GDP or productivity proved to be inferior. We instrument the initial condition since there is evidence of high colinearity with net migration rates (as one should expect).

When comparing these results to those in Table 2, two significant elements appear. First, the size of the coefficients reduce significantly, being closer to those found for other economies by Barro and Sala-i-Martín (1995). Second, it can be seen that net migration flows are not significant in affecting growth rates. This result is consistent with the abovementioned feature of low migration as well as with our observation that migration has not been an equalizing force in the economy of Chilean regions in the last two decades.

4. SPATIAL INEQUITY, MIGRATION, AND THE ROLE OF HOUSING POLICIES

The main hypothesis of this paper is that lack of convergence in Chile seems to be largely associated with low levels of regional migration and that this phenomenon may be the result to a large extent of housing policies. In section 4.1 we present a stylized model of migration as the result of potential migrants comparing their actual living standards in one region with expected levels in other regions. In section 4.2 we document that migration has become increasingly less significant as an equalizing force for regional disparities. We also provide evidence that this is not a market-driven result. This observation leads us in section 4.3 to concentrate on the role that policies might have played in slowing convergence between regions in income and poverty levels. Certainly, idiosyncratic elements may affect the speed of convergence. Nevertheless, we think that public housing policies have sufficient power to affect in a systematic way interregional migration, per capita income growth, poverty, and the speed of convergence towards long run equilibrium.

4.1. A model of migration

Following Borjas (2001) and Aroca and Hewings (2002), we set up a simple model to analyze the decision of families to migrate. Assume that an individual ranks preferences according to the generic utility function:

(3) $$Max_{X_j, T_j} U\left(X_j, T_j, Z_j, H_j\right)$$

subject to the budget constraint $I_j + P_H H_j \geq P_X X_j + P_T T_j$, where X is a composite good other than transportation, T is the transportation cost, Z is the set of other characteristics of the region that are taken into account by the worker and H are the services provided by housing. Ij is the income of the worker and P_X and P_T are the prices of goods and transportation respectively. On the other hand, P_H is the rental price of housing which is positive for the owner and negative for the leasee.

The indirect utility function of a worker considering to migrate from region i to j is:

$$(4) \qquad V_{ij} = V\left(P_X, P_T, I_j, Z_j, H_j\right) + \varepsilon_{ij}$$

Assuming that prices of goods are the same everywhere, this will not be a variable that affects the worker's migration decision.[10] Therefore, the worker compares the utility that he/she can derive from each possible destination region (including the origin region) and chooses the region that yields the highest utility. This utility maximizing selection can be cast as a random utility process subject to a stochastic error which, if assumed to have a generalized extreme value distribution[11], results in the following specification, with the probability of a worker moves from region i to region j as:

$$(5) \qquad P_{i,j} = \frac{e^{V_{ij}}}{\sum_{j=1}^{K} e^{V_{ij}}}$$

where K is the number of regions in the country (including the origin).

Unfortunately, only aggregate data is available. Thus, some additional assumptions will be necessary to derive an estimable equation with aggregate data. Following Berkson's method (see Berkson 1944; Ben-Akiva and Lerman 1985; Gourieroux 2000 for a generalization), imposing the constrain that $\Sigma\ P_{ij} = 1$ and normalizing by the probability of staying in the current region P_{ii}, expression (5) can be modified to the following form:

$$(6) \qquad \ln\left(\frac{P_{ij}}{P_{ii}}\right) = V_{ij} - V_{ii} = \alpha_0 + \alpha_1\left(I_j - I_i\right) + \alpha_2\left(Z_j - Z_i\right) + \alpha_3\left(H_j - H_i\right) + \nu_{ij}$$

Equation (6) indicates that migration from region i to region j –expressed as the probability of observing workers to migrate– is the result of income differentials between origin and destination (I_j - I_i), differentials between the characteristics of regions, and differences between housing costs among regions. Since income is only

[10] Unfortunately, there is no systematic data on price differentials at the regional level for the 1987-2002 period.

[11] When modelling migration in Germany, Bierens and Kontuly (2002) uses the Poisson distribution. Our small sample (13 regions) precludes us from replicating their methodology.

achieved if employed, we use expected income (I^e) computed as the actual income level (I) adjusted by effective employment levels a la Todaro (1969). That is, $I^e_j = (1-\mu_j)I_j$ where μ_j is the unemployment rate in region j. In addition, Aroca and Hewings (2002) document that distance operates in a quadratic form, so we extend P_T to include a quadratic term.[12]

4.2. Migration patterns in Chile

In addition to displaying low levels of internal migration, a striking feature of Chilean demographics is the observed change in the direction of migratory flows. In the 1965-1982 period, migration was predominantly from low income regions towards high income regions. In the last twenty years, however, population in low income or low growth regions does not seem to migrate any longer to higher income or higher growth regions. In figure 2, we plot net migration rates at the regional level conditional on initial per capita income levels (data come from the 1970, 1982, 1992 and 2002 censuses)[13].

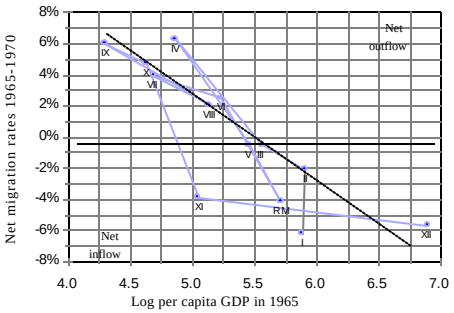
If migration is a significant equalizing force for per capita income levels, one should expect negative, significant correlations. That is precisely what is observed in Panel A: low income regions in 1965 displayed clearly higher outflows of population in the following five years, while higher income regions were net recipients of migrants. We have estimated this correlation at -0.82. When we replicate this exercise for the 1977-1982 period, the correlation becomes less strong (-0.69) but remains still very significant. However, when this exercise is undertaken in the 1987-1992 period, one observes zero correlation (0.08) and no clearly discernable relocation patterns. Likewise, for the 1997-2002 period, correlation is actually positive (0.35). The same exercise performed with data post 1976 for average labor productivity levels, expected labor income, and GDP excluding mining produce a qualitatively similar result .

[12] Aroca and Hewings (2002) suggest using the following variable to pick up "connectivity effects": use the principal component of the (kxk) matrix that has 1 if two regions are contiguous and 0 otherwise. We found this variable to be uninformative as in Chile regions are located along a straight line (see map) and, thus, few have more than two neighbors. In addition, there is high colinearity with housing subsidies.

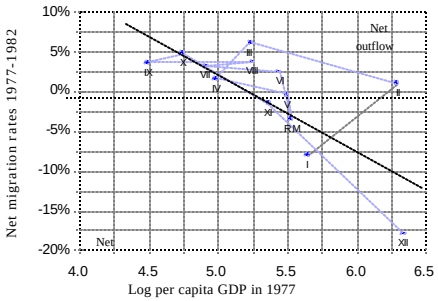
[13] In each of the last 4 censuses, the following question was surveyed: where were you living 5 years ago? which we use for computing migration. Hence, we cannot tell whether migrants have migrated more than once in the last five years, or whether non-migrants migrated and returned within the past 5 years.

FIGURE 2
NET INTER REGIONAL MIGRATION RATES AND INITIAL PER CAPITA GDP[14]

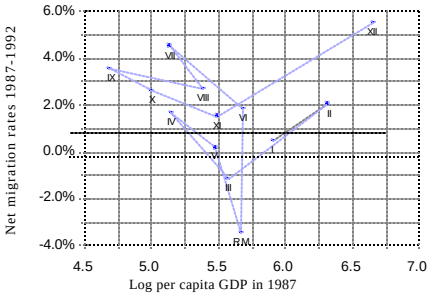
Panel A



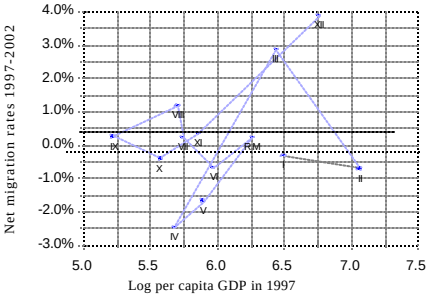
Panel B



Panel C



Panel D



Evidently, something changed in the migrating patterns of the population in the 1980s. Migration became less significantly correlated to income differentials, productivity levels, and expected wages. Since migration in Chile has not been a powerful equalizing force in the last two decades, one should focus on those market factors and policies that may have inhibited the movements of workers towards regions with higher per-capita GDP. Before turning towards policies, we check market factors that might have inhibited mobility.

[14] Net inflows and outflows correspond to changes in residence between that of the census (1970, 1982, 1992 and 2002) and five years before (1965, 1977, 1987, and 1997)..

One obvious alternative is that migration stopped because income differentials became less important on time. As documented in Table 1, this is not the case. When comparing per-capita income levels, the evidence shows little tendency towards a reduction in the dispersion of per capita income levels in the 1960-1998 period. In particular, the standard deviation in per capita GDP among regions increased by 20% in the 1980s and 1990s when compared to the previous two decades. These results and the rest in this chapter are not sensitive to excluding mining from GDP or using households –as opposed to per capita– income.

A more promising venue is to focus on labor market conditions that may affect migration. One alternative is that high-income regions were not able to create jobs at a similar pace than low-income regions and, thus, they did not become powerful attractors to induce migration. This should be apparent in relatively lower rates of job creation and/or higher unemployment rates in high income regions. These hypotheses, however, are not consistent with the data. As shown in Table 3 there is a positive correlation between job creation and initial per capita regional GDP in the 1977-1982 period. In the next two periods, on the contrary, these correlation are statistically zero. Again, note the important change in conditional migration patterns in the 1980s. Second, we do not observe the positive correlation between average unemployment rates and initial per capita GDP that is necessary to support the notion that market forces inhibited migration. Lower unemployment rates in high-income regions should have induced larger migrating flows but that did not happen.

TABLE 3
REGIONAL JOB CREATION, UNEMPLOYMENT, AND MIGRATION

Correlations	1977-1982	1987-1992	1997-2002
Initial GDP p.c.and Job Creation	0.462*	-0.029	-0.264
Initial GDP p.c.and Unemployment	-0.011	-0.095	0.096

Note (*) significant at 95%.

In summary, if migration is to a large extent determinated by the arbitrage of expected income differentials, as suggested by theory and international evidence, the observation that Chilean workers did not migrate significantly in the last decades is an important puzzle for our understanding of spatial inequality. Workers in low income

regions in the mid 1970s or 1980s would have preferred to migrate to high income regions as their expected income levels were markedly higher.[15] One should expect labor mobility to be much more important within a country than between countries. After all, in a political and cultural homogenous country like Chile there should not be significant barriers to the movement of capital, labor, and technology between regions.

4.3 The role of housing subsidies

In this section we provide econometric evidence that insufficient movement of workers could be the result of housing policies that tie families and workers to their original location. Housing policies in the 1960s in Chile rested on the principle that each family was entitled to own a house and that it was the government's duty to satisfy such right. Until 1970, the main instruments to accomplish such goal were market subsidies to the supply of housing. Benefits to target groups included subsidized mortgage rates, periodic bail outs for debtors, direct subsidies to dividends, less-than-perfect indexation of dividends to inflation, and tax exemptions. These policies were not successful in reducing the housing deficit, estimated at 600 thousand units in 1965, mostly because of lack of targeting and poorly designed operating procedures.[16] In the 1970s, the failure of previous housing policies led to replace market mechanisms by massive –and overly inefficient– state-led housing policies. The government froze dividends, reduced minimum saving requirements for borrowers, enacted progressive tax reductions, kept mortgages at negative real interest rates, and opened bank credit at subsidized rates for small size housing projects. These policies were also quite inefficient and less than 100 thousand houses were initiated –mostly never finished– in the 1970-74 period.

Reforms in the housing sector initiated in Chile in 1975 were based on two guidelines. First, the government abandoned the principle that housing was the right of each family but the result of systematic saving and, second, subsidies were to be allocated to demand using market mechanisms. These policies provided ample space to private-sector initiative and confined the government only to subsidizing the access of low-income families to housing. In the 1975-79 period, however, policies were mostly

[15] Expected labor productivity (i.e., labor productivity weighed by the probability of finding a job) is very heterogenous, even if mining is excluded, with low productivity regions (e.g., region X) exhibiting one fifth of the productivity of regions II or RM.

[16] See Silva (1997) for a description of housing policies in the 20th century in Chile..

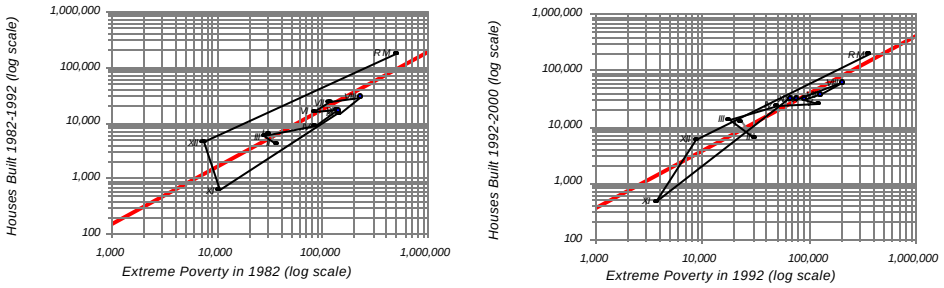
directed toward improving the efficiency of public agencies, concluding housing developments left unfinished by previous administrations and eliminating restrictions in the use of land (zoning). In 1980 the government improved targeting significantly by introducing a standardized form (called CAS) that identified poor families and inhibited the access of middle and higher income families to subsidies.[17] In addition, the government implemented specific subsidies for rural housing projects and streamlined procedures to process applications and grant subsidies. The new mechanism became the main instrument to allocate public housing and, with minor modifications, has remained in place since. Between 1990 and 2000, the government expanded substantially the resources devoted to public housing (10% on average in real terms) and enacted additional subsidies on sewerage and electricity for poor neighborhoods and rural areas.

Figure 4 shows that public housing has been effectively targeted toward regions with higher shares of population in extreme poverty. Those regions that concentrated the largest number of people in extreme poverty in either 1982 or 1992, obtained larger shares of housing subsidies in the subsequent decade. Since other public policies (e.g., transfers) were also allocated using the CAS form, those policies became complimentary to housing policies as they were also allocated to areas with higher levels of extreme poverty.

[17] The CAS form is largely based on housing criteria (quality, crowding, access to potable water, etc.) and as such provides an adequate benchmark for targeting housing policies, but its efficiency for other social programs is less clear (see World Bank, 2002).

FIGURE 4
REGIONAL SUBSIDIZED HOUSING AND INITIAL POVERTY

Panel A: 1982-1992 Panel B: 1992-2002



In addition to improving the allocation of subsidies, the new targeting policies implemented since 1980 also considered important limitations to beneficiaries to avoid the leakage of subsidies to non-targeted groups (i.e., high income quintiles). The most important limitation was the outright prohibition to sell or rent subsidized houses (until late 2002) and the rigid norms to determine the location of subsidized housing.

Our hypothesis is that after reforms the combination of improved targeting and the prohibition to sell or rent subsidized houses effectively tied families to their original location and, thus, inhibited migration. Since their original location was in poor areas where unemployment was high and labor productivity was low, workers could not arbitrage out income differentials in an effective way.[18] In addition to housing subsidies, we control for distance (as a proxy for transportation costs), population in the origin and at destination (as a proxy for size and economic density), the expected income differential (i.e., actual wages adjusted by effective employment) and public housing subsidies given to the origin region. Based on our model we expect a positive correlation between migration and expected wage differentials and population at destiny, while a negative sign is expected for all other variables. If our hypothesis is correct, a negative correlation should be observed between migration and housing policies after 1982 and a non-significant coefficient before.[19] We also include the contiguitiy matrix (Sij)

[18] In addition, the government purchased the cheapest land plots to build subsidy housing, i.e., those in areas away typically far from production centers and employment opportunities.
[19] Andrienko and Guriev (2002) obtain a similar specification derived from a gravity model and test this model against Russian data in the 1990s.

proposed by Aroca and Hewings (2002) to check if proximity is of importance and, following the literature, we include Net_j, an indicator of the network connections of potential migrants which is defined as the stock of immigrants from region i in region jk at the beginning of each sample. The model can be synthesized as:

$$M_{i,j} = \beta_0 + \beta_1 \left(I_j^e - I_i^e \right) + \beta_2 HS_i + \beta_3 Pop_j + \beta_4 Pop_i + \beta_5 Dist_i + \beta_6 Dist_i^2 + \beta_7 Net_i + \beta_8 S_{ij} + \varepsilon_{ij}$$

In Table 6 we provide an econometric test of this model and our main hypothesis using separately data for the periods 1977-1982, 1987-1992 and 1997-2002. The dependent variable in these models is the net migration rate for each of the 13 regions in Chile to each of the other 12 regions. In total, there are 156 observations in each sample. A positive migration rate implies that the region was a net recipient of migrants.

The results support our hypothesis as the estimated parameter for housing subsidies is significant in both samples after 1982 but is not significant in the 1977-1982 period. The size of the parameters suggests that the elasticities are of increasing importance when explaining the low migration rates: -0.15 for 1977-82 (and non-significant), -0.26 for 1987-1992, and -0.89 for 1997-2002. Using the actual means in each period, we compute the impact over the average migration rate of the observed increase in the stock of subsidized houses. For the 1987-92 period, the increase in subsidies of about eight percentage points would have reduced the migration rate by about 4% in five years (or 0.8% per year). A slightly smaller effect is observed when comparing the 1997-2002 period with the 1987-1992 period: the increase in the stock of housing subsidies would have reduced migration rates by about 2% (or 0.4% per year). These are very large values, comparable to actual migration rates as presented in Table 3.

As expected, income differentials are significant determinants of migration. The obtained positive sign for the parameters indicates that there have been economic incentives to migration, yet shrinking magnitude suggests that the effect is ameliorating.[20] The elasticities for 1992 and 2002, nevertheless, are around 1.

[20] Correlation among regressors is very low, not surpassing the 0.3 mark in any sample, so that colinearity is not an issue that may distort the results.

The impact on migration of the increasing cost of transportation for distant regions can also be computed: an extra 1000km from the center of the country would reduce migration by 0.6 percentage point, i.e., a negligible effect for most of the population, since 90% of it concentrates within 600km from the center.

The social network indicator is also significant, suggesting that the more connections a potential immigrant has, the more likely it is for him to migrate. Elasticities are around 0.3 in all periods. On the other hand, and contrary to the results in Aroca and Hewings (2002), the contiguity matrix, S_{ij}, is not significant.

In conclusion, public housing policies have been very important in reducing poverty levels and improving welfare levels. Nevertheless, an unexpected negative outcome of the way in which subsidies were allocated and managed was that they may have inhibited migration from low-income regions towards high-income regions. A direct implication of this observation is that subsidies ought to be more flexible and/or that the allocation mechanism should consider that families migrate in order to improve their quality of living and, consequently, be more forward looking.

TABLE 6
MIGRATION RATE DETERMINANTS
Dependent Variable: Log of Migration Rate from Region i to Region j

	1977-1982	1987-1992	1997-2002
Constant	-7.57*	-6.95*	-6.49*
	(-6.85)	(-9.57)	(-8.92)
Expected income differential	0.04*	0.02*	0.02*
	(3.50)	(2.50)	(3.59)
Subsidized housing	-2.06	-1.84*	-5.48*
(% total dwellings)	(-0.50)	(-1.98)	(-2.54)
Population origin (log)	-0.11	-0.16*	-0.16*
	(-0.83)	(-2.46)	(-2.55)
Population destiny (log)	0.55*	0.51*	0.51*
	(5.57)	(6.60)	(8.43)
Distance	-0.09*	-0.08*	-0.07*
	(-3.68)	(-4.12)	(-3.60)
Distance squared	0.002*	0.001*	0.001*
	(2.77)	(2.64)	(2.10)
Social Network	7.47*	11.76*	11.13*
(% of former i residents in j)	(2.71)	(2.61)	(3.24)
Contiguity matrix	0.06	0.19	0.13
(Sij)	(-0.39)	(1.50)	(1.06)
Adjusted R^2	0.53	0.71	0.75

Note: (*) Significant at 95% confidence. t statistics in parenthesis. Robust standard errors.

5. CONCLUDING REMARKS

In this paper we explore the reasons for the uneven pace in regional growth in Chile and its impact on the spatial dimensions of income inequality. We document that per-capita income and productivity levels either do not seem to be converging towards a common long-run level or the speed of convergence is too slow to become a significant force in equalizing regional income.

The main result of the study is the empirical support for our hypothesis that lack of convergence in Chile in the 1980s and 1990s seems to be associated with low levels of regional migration and that this phenomenon may be the result, to a large extent, of government social policies. To support this hypothesis we first provide evidence that for international standards migration is about one third of that in developed economies and, second and equally important, that there was substantial change in the migration patterns since the early 1980s. We document that migration has become increasingly less significant as an equalizing force for regional disparities and we provide econometric evidence that this is not a labor market-driven result.

Since labor market conditions do not seem to explain these two empirical phenomena, we focus on government policies. We concentrate on public housing subsidies as we think they have sufficient power to affect in a systematic way interregional migration and per capita income growth, and can tie families to their geographical location inhibiting migration. We document that there was a change in the way these subsidies were allocated in the early 1980s, where policies became well targeted towards the poor and efficiently managed. These new subsidies included the prohibition to rent or sell subsidy houses. We found empirical support to our hypothesis that the combination of improved targeting and the prohibition to sell or rent subsidized houses effectively tied families to their original location and, thus, inhibited migration. Since their original location was in poor areas where unemployment was high and labor productivity was low, workers could not arbitrage out income differentials in an effective way.

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APPENDIX TABLE 1
TESTS OF ABSOLUTE CONVERGENCE

	Per capita GDP	Labor productivity	Per capita GDP excluding mining	Labor productivity excluding mining
Constant	6.03	6.62	8.12	9.07
	(2.63)	(3.51)	(2.35)	(3.56)
Initial Level	-0.0052	-0.0067	-0.0097	-0.011
	(0.0049)	(0.0053)	(0.0046)	(0.0056)

Note: standard errors in parenthesis.

APPENDIX TABLE II
VARIABLES USED IN REGRESSIONS AND TABLES

Variable	Definition	Data Source
Regional per capita GDP	Regional GDP in $1986 / Regional population	GDP:Banco Central (2004) and CIEPLAN-SUBDERE (1994). Population: INE (2004).
Regional average labor productivity	Regional GDP in $1986 / Regional employment	GDP: Banco Central (2004) and CIEPLAN-SUBDERE (1994). Employment:Banco Central (1995) and INE (2004).
Regional area	Area in square kilometers	Instituto Geografico Militar de Chile (1999)
Distance	Distance from region capital to Santiago	Instituto Geografico Militar de Chile (1999)
School achievement	Average years of education	INE Census 1970
Poverty	Share of population below each year's poverty line	INE casen surveys 1987, 1990, 1992, 1994, 1996, 1998, and 2000.
Household income		INE casen surveys 1987, 1990, 1992, 1994, 1996, 1998, and 2000.


PERÚ
BOLIVIA
ARGENTINA
OCEANO PACIFICO
OCEANO ATLANTICO