**Master Thesis**

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**Regional Economic Growth and Income Inequality:**

**Evidence from Chilean Regions**

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**Abstract**

Recently, the relationship between income inequality and economic development or growth has regained interest from economists. Theories have pointed to positive, negative and causally reverse (the inverted-U or Kuznets curve) connections between the two and empirical work on the subject has given ambiguous results. These inconclusive results have been mainly attributed to inconsistent measurement of inequality indicators due to the use of multiple sources, the neglect of changes in parts of the income distribution due to the focus on a single inequality measure and to omitted variables related to institutional differences between countries. This thesis analyzes the association between economic growth and inequality on a subnational level in Chile between 1990 and 2009, a period with high economic growth in a country with large spatial differences in growth and inequality patterns. Inequality measures are compiled from a single regionally representative household survey, thereby minimizing measurement errors and allowing for the analysis of parts of the income distribution. Results show weak signs of a U-curve relationship instead of an inverted-U between regional inequality and regional development. In addition, no clear overall relationship between income inequality measures and economic growth for Chilean regions emerges in the relevant period for both the short and long run.

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1. **Introduction**

Chile experienced high economic growth in the last two decades, with GDP per capita almost doubling at an average annual growth rate of 5.2% from 1990-2010[[1]](#footnote-1). The OECD welcomed Chile as its newest member in 2010, but it also became the most unequal member: not only topographically (as the country’s length exceeds its average width by a factor of more than 20) but also on an economic level. Income inequality as measured by the Gini-coefficient remains notoriously high at 0.50, although it has declined from a peak of 0.55 in 1996[[2]](#footnote-2). Chile also has large disparities on a subnational level. The country is divided in 13 regions, with regional GDP per capita in 2009 varying from US$ 5.351 to US$ 23.470 and regional Gini-coefficients ranging from 0.38 to 0.54 (OECD, 2010). The country’s large metropolitan region of its capital Santiago encompasses 35 *comunas* or sub-regions, in which average income in its richest comuna is eight times as high as in its poorest. These income differences have led to riots and demonstrations in Santiago, in which public anger was mainly focused on differing educational opportunities within the population, a problem related to the high level of income inequality and government policies regarding the subject.

Theoretical and empirical work linking income inequality and economic growth has received growing interest from economists over the years, because it is important for policy makers to understand how economic growth is shared among individuals in an economy and how this distribution of income impacts future growth rates. Do the poor also reap the fruits of economic growth or is it distributed unevenly among society? Do more equal economies grow faster than more unequal ones? Does fast growth drive incomes apart? Despite these interesting questions, the possible link between inequality and economic growth is also surrounded by controversy, which stems from the inconclusiveness of empirical work. Also, there have been problems attributing empirical results to the wide range of (contradictory) theories in the field.

Regarding these theories, Kuznets (1955) was among the first to posit a relationship between economic development and income inequality. He hypothesized that due to the industrial revolution and the resulting labor shifts from the low-pay, egalitarian rural areas to the higher pay, less equal urban areas, income inequality must have risen at the end of the 19th century. During this economic development, he noticed that inequality levels flattened and eventually fell as the economy grew. In a graphical representation with economic development on the horizontal axis and income inequality on the vertical axis, this pattern resembled an inverted-U shape or a ‘Kuznets curve’ as it is since known. Economists further elaborated on his theoretical work and with an increasing availability of reliable data compared to the 1950’s, several empirical tests of the relationship followed, to date with ambiguous results (Kanbur, 2000; Barro, 2000).

In the 1970’s and 1980’s, the East-Asian egalitarian growth miracles suggested that the Kuznets curve is not a necessary component of economic development. Combined with the subsequent rise of both income inequality levels in western economies like the US and the UK in the 1990’s and of endogenous growth theories, a new strand of theoretical and empirical research followed, positing the opposite relationship. That is, from income inequality to economic growth. There are four main transmission channels through which inequality could influence economic growth, resulting in an unclear expected sign of the overall relationship (Barro, 2000). The first channel, based on the work of Keynes (1920) and Kaldor (1956a), postulates that inequality is beneficial to economic growth due to its positive effect on aggregate savings, investment and incentives. Redistribution then hampers economic growth through its adverse effect on incentives to save and work (Aghion *et al*., 1999). The second channel argues that greater inequality will increase public support for more redistribution, resulting in higher tax rates on capital accumulation and subsequently lower growth rates. The third one suggests that due to credit market imperfections, growth suffers from income inequality because the poor forgo their investment opportunities in education and innovation. The last channel entails the view that income inequality can cause social and political instability resulting in a more uncertain future return on investment which lowers investment and thus growth rates. Clearly, the sign of the overall relationship due to all these different channels remains ambiguous (Voitchovsky, 2009).

Empirical results have also not reached a consensus on the sign of the possible effect of income inequality and economic growth. Most studies from the 1990’s based on cross-country growth-regressions suggested a negative relationship between inequality and growth, while more recent studies, exploiting the time series property of new datasets, found a positive relationship between the two (De Dominicis *et al*., 2008). Knowles (2005) attributed these differing results to country- or regional measurement errors. Forbes (2000) suggested that the ambiguity in results could reflect the difference between a positive short run effect and a negative long run effect. Voitchovsky (2005) pointed out that the differing results could be caused by the inequality measure used, since the widely used Gini-coefficient does not reveal if changes in the income distribution are located in the bottom, middle or upper end of the distribution, while theories do point to different effects related to specific parts of the income distribution. By constructing human capital inequality measures instead of income inequality measures, Castello-Climent and Domenech (2002) found that human capital inequality measures provide more robust results than income inequality measures in growth estimations. De Dominicis *et al*. (2008) performed a meta-analysis of the empirical work and argued that data on a regional level within a single country are more appropriate for analysis than cross-country regressions.

The objective of my thesis is to analyze the relationship between both the level of development and income inequality and between income inequality and economic growth on a sub-national level in a high-growth but unequal country, Chile. By using income data from one, high-quality source, comparability between data over time is expected to be more consistent than cross-country data from different sources. I have compiled different inequality indicators based on data from a regionally representative Chilean household survey from 1990-2009 to account for changes in parts of the distribution over time. This research therefore focuses on two directions: is the level of development of Chilean regions during 1990-2009 related to income inequality or has inequality had an effect on economic growth? For policy makers the question whether these two factors are related is important, because policies aimed at economic development or aimed at reducing income inequality are usually at the forefront of political decision making. The within-country focus this thesis provides has received little attention in both strands of research and has to my knowledge not yet been applied to a high-inequality country like Chile.

To see if economic development in Chilean regions follows a pattern as described by Kuznets (1955), my first hypothesis is:

*H0: Regional economic development and regional income inequality within Chile during 1990-2009 can be characterized as part of an inverted-U-shaped pattern.*

*Ha: Regional economic development and regional income inequality within Chile during1990-2009 cannot be characterized as part of an inverted-U shaped pattern.*

The possible relationship between growth and inequality leads to my second hypothesis, which is:

*H0: Regional income inequality in Chile has had a negative effect on regional economic growth during 1990-2009.*

*Ha: Regional income inequality in Chile has had a non-negative effect on regional economic growth during 1990-2009.*

Since inequality measures based on human capital are found to provide more robust results as stated before, my third and final hypothesis states that:

*H0: Regional educational inequality in Chile has had a negative effect on regional economic growth during 1990-2009.  
Ha: Regional educational inequality in Chile has had a non- negative effect on regional economic growth during 1990-2009.*

The structure of my thesis is as follows. In the next chapter I give an overview of the relevant theories and empirical work regarding inequality and growth, which include the Kuznets relationship and inequality-growth relationships. In chapter three I describe the main features of the data employed from the CASEN household survey and other sources and I elaborate how the different variables used for my empirical analysis have been constructed. Chapter four contains a preliminary analysis of Chile in the period relevant for my analysis (1990-2009), describing its main economic characteristics including economic growth and the income distribution, also on a regional level. Chapter five contains the methodology used for my empirical study and chapter six follows with a discussion of the results obtained. In the last chapter I conclude and share possibilities for future research on the subject.

1. **Literature Review**

The possible relationship between income inequality and economic growth and vice versa has been a heavily debated subject in the fields of economics, sociology and philosophy. Adam Smith argued in his seminal work ‘The Wealth of Nations’ that “No society can surely be flourishing and happy, of which the greater part of the members are poor and miserable. It is but equity, besides, that they who feed, clothe and lodge the whole body of the people, should have such a share of the produce of their own labour as to be themselves tolerably well fed, clothed and lodged” (Adam Smith, 1776, p. 110-111). David Ricardo (1817) also mentions that the distribution “of the whole produce of the earth” is the principal problem in political economics.

For economists, the question is not what an ethical or moral optimal level of inequality in a society is, but if inequality leads to a more efficient economy, thereby creating conditions for higher economic growth. For most of the last century, Keynes’s view that inequality was beneficial to economic growth has been the dominant view. Keynes argued that because the rich have a higher savings rate than the poor, accumulation of wealth by the rich was necessary for the economy as a whole to grow (Keynes, 1920). Kaldor formalized this argument by mentioning the propensity of the wealthy to save more, creating higher aggregate savings which lead to higher growth rates (Kaldor, 1956a). This view is especially relevant for developing countries that are in the early industrializing phase due to their economy’s dependence on physical capital for economic growth. In a paper he prepared as a consultant for the United Nations regarding Chile’s fiscal policy (Kaldor, 1956b), Kaldor advised the government of Chile in line with this argument to tax the wealthy more, because they consumed too much (foreign produced) luxury goods. Therefore, he states that aggregate savings were low and the Chilean economy suffered from underinvestment.

* 1. **Kuznets and the Growth-Inequality Relationship**

In the second half of the last century, the subject of inequality and economic growth has been approached from different perspectives. A reverse causal relationship (between economic growth or development and income inequality) was proposed by Simon Kuznets when he presented his seminal paper on the subject at the 1954 Presidential Address to the American Economic Association (Kuznets, 1955). Based on time series data from the US, UK and Germany, Kuznets hypothesized that when industrial development in an economy takes off, labor shifts from the low-productivity, egalitarian rural sector to the high productivity, less equal urban areas, and income inequality rises. Eventually income inequality levels and in advanced stages of development, income is distributed more equally, as was the trend in advanced economies he observed using the scarcely available data at the time. When graphically depicted, the development-equity relationship in this form is characterized as an inverted U. This has since been known as the inverted U-hypothesis or Kuznets-curve. Note that there are two processes at work that change the overall inequality in the economy. One the hand, inequality results from the shift from the low-paid, traditional, rural sector to the higher-paid, modern, urban sector (intersectoral wage inequality). On the other hand, inequality increases because labor shifts to the more unequal modern sector (intrasectoral wage inequality). To more formally show how a Kuznets-curve can be the result from intersectoral wage inequality, assume that and are the wages in the traditional and modern sector respectively, and that . Income inequality is depicted by the variance of income , with representing the proportion of labor in the modern sector and the average income in the economy. Development of the economy consists of shifting q from 0 to 1 with inequality maximizing at (Anand and Kanbur, 1993). See figure 2.1 for a graphical representation.

Figure 2.1. *Kuznets-curve*

Lewis (1954) described a similar mechanism and a more elaborate mathematical background for the theory was later provided by Fei and Ranis (1964). Their model of intersectoral migration has later been further refined by Robinson (1976), who also provided a formal analysis of the intrasectoral income inequality as described above. Anand and Kanbur (1993) emphasized the role of surplus labor in the model and showed that the assumption that laborers do not save is critical for the relationship to hold. This assumption was one of the main thoughts in development economics in the 1960’s and 1970’s, implying a tradeoff between growth and equity. Anand and Kanbur (1993) also found that the existence of a Kuznets-curve depends on the chosen inequality parameter and on the weight of inter- and intrasectoral income inequality in measuring total inequality. To illustrate the latter result, we follow the same definitions as above and assume that inter- and intrasectoral inequality are independent of each other. Therefore, total inequality in the economy becomes , where intersectoral inequality is and average income and intrasector inequality is measured for each sector separately (). The sign of the derivative then depends on and on . The development process then only shows a Kuznets-curve if . With , income inequality will only be growing during the development process instead of leveling and then falling (Hellier and Lambrecht, 2012).

A clear shortcoming of the simple model described above and also of the more elaborate ones by Robinson (1976) and Anand and Kanbur (1993) is that the levels of productivity in the modern and traditional sectors are exogenous and that the model assumes a closed economy with just two sectors. This setup also implies that growth itself is exogenous. There is also no human capital accumulation to result in rising wages (Deininger and Squire, 1998). Recently, Glomm and Ravikumar (1998) constructed a model capable of generating the Kuznets curve that does include human capital accumulation. Glomm (1997) and Chusseau and Hellier (2012) have also constructed new micro-founded models which show that in a general equilibrium analysis, one can generate either a Kuznets-curve in the development process, or just an increase or decrease in inequality levels, depending on the model parameters.

* 1. **Empirical Results**

Kuznets’ paper and subsequent theoretical work as described in chapter 2.1 has resulted in a vast empirical literature trying to capture the suggested inverted U in the available data. Most work was motivated by the fear that the poor might not benefit from economic growth (Deininger and Squire, 1998). So far, empirical work on the Kuznets curve has found mixed results. The most common specification to check for the existence of a Kuznets curve relationship in the early years was limited to a cross-section of countries due to the lack of observations over time. This entailed estimation of roughly the following equation for each country:

(2.1) ,

where is an inequality measure (usually the Gini-coefficient) and is an income measure (usually GDP per capita or its natural log).   *u*sually stands for a matrix of several control variables that are also assumed to be determinants of , such as educational attainment and population growth. Recently, new datasets have become available, allowing the combination of the cross-section of countries with multiple observations over time (panel data). For a panel of countries *c* at time *t* , equation 2.1 then becomes:

(2.2) .

The pattern in the data of an inverted-U shaped relationship in both equations is then confirmed if both and . The quadratic specification also makes it possible to calculate the turning point of the imposed inverted-U shape. If at the income measure equals , it can be shown that the turning point occurs at time such that . Anand and Kanbur (1993) argued, as mentioned in the previous section, that the choice of inequality measure should influence the specific functional form to be estimated. For the Gini-coefficient, they found[[3]](#footnote-3) that the quadratic term should be replaced by the inverse of income, such that

(2.3)

Using a similar specification as equation 2.1, multiple studies in the 1970’s and 1980’s confirmed the presence of a Kuznets curve in the development process. These studies were later criticized because they suffered from poor data quality, as they often had only one observation per country and inequality indicators were based on differing income measures, with some being derived from household surveys based on individual income or household income or some being derived from mere quantile income data, resulting in substantially lower inequality measures which are not likely to represent the true income distribution (Deininger and Squire, 1998). Also, the development process as described in section 2.1 by Kuznets describes the development of a single country and its effect on income inequality over time, not on a multi-country setup at one point in time. A common cited example of this literature is the paper by Ahluwalia (1976). Ahluwalia included different percentile shares of income as indicators of inequality in regressions similar to equation 2.1 as well as a ratio of agricultural output to total GDP and a measure of urbanization to account for the processes Kuznets described as being important for the implied relationship. He confirmed the presence of a Kuznets-type relationship based on one or two observations per country as did many studies in that period (Kanbur, 2000).

From the 1980’s onward, both new theoretical work and supporting empirical evidence suggested that the Kuznets curve is not a necessary part of development. Although Ahluwalia (1976) concluded that there was strong empirical evidence for a Kuznets curve relationship between economic growth and inequality and Adelman and Robinson (1989) even regarded it a ‘stylized fact’, the East-Asian growth miracle suggested otherwise. Fei *et al*. (1979) conducted a study where they showed that increasing inequality is not necessary for economic growth. Their case-study of Taiwan indicated that agricultural wages also benefitted from the industrial urban rise. Furthermore, most industrialized countries such as the US and UK also suffer from an increase in inequality in the last three decades which also contradicts the existence of a Kuznets curve in recent years.

More recent empirical studies, using different datasets and econometric setups similar to equation 2.1, 2.2 and 2.3, have found contradicting results. Ravallion (1995) used two observations per country to test for the first-difference estimation of equation 2.1 He found no evidence for an inverted-U in the process of development. Deininger and Squire compiled a new inequality dataset with multiple observations over time for a large set of countries (Deininger and Squire 1996), enabling the use of panel data techniques. They used the functional form of equation 2.3 and found a cross-country Kuznets curve when using decadal averages but these findings were not robust after controlling for country-specific effects (Deininger and Squire, 1998). They also tested for country-individual Kuznets curves but could only confirm this for 10% of their sample. Barro (2000) detected a stable Kuznets type relationship between economic growth and inequality based on a modified version of the same dataset (Deiniger and Squire, 1996), but found that much of the variation in time and across countries remains unexplained[[4]](#footnote-4). Barro (2008) does find partial confirmation of a Kuznets curve with a newer dataset, as does Chambers (2007) for long-run growth. Since the research mentioned is just a summary of the main results obtained, it is clear that the Kuznets curve remains an ambiguously tested theory, but is has not yet completely lost its appeal.

* 1. **Inequality and Growth**

Besides the relationship between economic development or growth and income inequality, more recent work has dominantly focused on a reversed causality, that of income inequality on economic growth. In the 1970’s and ‘80s, the representative agent paradigm dominated the field of macroeconomics, rejecting the relevance of heterogeneity on determining economic growth. This also implicitly implied that the (heterogeneous) distribution of income was not relevant for macroeconomic analysis (Galor, 2011). With the rise of the endogenous growth models of Romer (1986) and Lucas (1988), a re-assessment of the variables affecting growth started, recognizing income and wealth distribution as significant variables through physical and human capital accumulation (Leoni and Pollan, 2003). The 1990’s and the last decade have brought various new views on the possible relationship between income inequality and economic growth by proposed new theories and empirical work. These point to either a positive, negative or ambiguous relationship. Without attempting to be exhaustive, I will provide a summary of the main transmission channels through which income inequality could affect economic growth[[5]](#footnote-5). First I will discuss the more ‘traditional’ theories that predict a positive relationship between inequality and economic growth based on saving rates, investment indivisibilities and incentives. Next I will discuss the more recent theories mainly predicting a negative relationship, ending with a brief review of the empirical results based on these theories.

* + 1. **Positive Relationship**

The first theory that I’ll discuss is the one based on the arguments of Keynes (1920) and Kaldor (1956a). As mentioned in the introduction to this chapter, the wealthy are assumed to have a higher propensity to save relative to the poor, leading to larger capital accumulation if there is more inequality present in the economy. Since, in Kaldor’s model, economic growth is driven by capital accumulation which in turn depends on the savings rate, inequality is growth enhancing. Stiglitz (1969) reached similar conclusions, and Bourguignon (1981) showed in a dynamic model, based on Stiglitz (1969), that equilibria based on unequal distributions of wealth among individuals are Pareto superior to the equilibrium based on an equal distribution. Key assumption in these frameworks is that savings increase with income. This has also been assumed in many influential articles, such as the permanent income hypothesis of Friedman (1957) and the life-cycle hypothesis of Ando and Modigliani (1963). Also, more general, raising an economy to a higher growth path requires substantial investment (Sachs, 2004), which is influenced by the income distribution.

A second theory supporting a positive relationship between inequality and growth comes from investment indivisibilities and sunk costs. Large investment projects in new economic activities, like the setting up of new industries or the use of technological innovations, often involve large sunk costs. If capital markets are not functioning well, wealth needs to be concentrated if these investments are ever to take place (Aghion *et al*., 1999).

A third argument is based on incentives and the possible trade-off between equity and efficiency. A more unequal society can generate incentives for workers to make an additional effort. Since output depends on the effort of workers, less effort results in a less efficient economy, lowering growth rates (Mirrlees, 1971). Voitchovsky similarly states that:’ In an economic structure where ability is rewarded, effort, productivity and risk taking will also be encouraged, generating higher growth rates as well as income inequality as a result’ (Voitchovsky, 2005, p. 276). Not only has this line of argument been applied on a macro-economic level, but also on a micro-economic level. For exmaple Mahy *et al*. (2011) have found that within firms, productivity is enhanced by wider wage dispersion.

* + 1. **Credit Market Imperfections**

As stated before, endogenous growth models brought new determinants of economic growth as for example human capital and its externalities (e.g. Lucas, 1988). Galor and Zeira (1993) were the first to posit a relationship between income inequality, subsequent unequal investment in human capital and its effect on economic growth by assuming imperfect credit markets and indivisibilities in investments in human capital. Imperfect credit markets result in a higher interest rate for borrowers than for lenders. In an overlapping-generations model they showed that imperfect credit markets and indivisibilities in investment in human capital lead to an underinvestment in human capital. This not only harms economic growth in the short run but also in the long run because of bequests or intergenerational transfers. Investment in human capital is only possible for individuals who inherit sufficient capital. In their paper, Galor and Zeira emphasize the importance of a large middle-income class to ensure high economic growth.

Banerjee and Newman (1993) use similar assumptions but relate them to sub-optimal investment in entrepreneurial activity, also resulting in lower economic growth. In their model, instead of choosing to be a skilled or unskilled worker as in the Galor and Zeira setup, individuals choose between becoming a worker or an entrepreneur. Similarly, because of fixed costs involved with entrepreneurship and imperfect credit markets, there will be underinvestment in entrepreneurial activity and hence lower economic growth.

Aghion and Bolton (1997) developed a ‘trickle-down’ model where capital accumulation of wealthier individuals can trickle down to the poor via the capital market. They endogenized the interest rate so that when capital accumulates through savings by the wealthier, interest rates drop so the less wealthy individuals are also able to benefit from credit. The outcome of their model is ambiguous as it depends on which effect dominates: accumulation of savings by the rich (more inequality) or the trickle-down process.

A recent model by Foellmi and Oechslin (2008) showed an adverse result. That is, if inequality is decreased by redistribution from the wealthier to the middle-class, the demand for capital will increase as will the interest rate. Poor individuals, confronted with higher interest rates, will not be able to invest as much as would be optimal given their higher marginal return, which will have a negative effect on economic growth. Assumptions in this model include an increasing but concave investment function in the initial endowment, causing the raised demand for capital.

* + 1. **Political Instability**

Alesina and Perotti (1996) have linked inequality to economic growth via political instability. They used a neo-classical growth model in which investment is a determinant of economic growth. In their model, inequality increases political instability, thereby decreasing the investment rate of the economy and hampering economic growth. Political instability then refers to their argument that with public discontent regarding the unequal society, the probability of social unrest through coups, mass violence etc. will increase policy uncertainty and will threaten property rights, which will have a negative effect on the investment rate. In their paper they acknowledged that political instability will be a variable that is “hard to define in a way which can be used for empirical work” (Alesina and Perotti, 1996, p. 1205). The political instability approach looks more relevant for Latin-American and African countries than for more advanced economies (Barro, 2008), although e.g. Rodriquez (2000) used US state-data in a two-stage analysis to show that there is a strong relationship between inequality and violent crimes and subsequently between this proxy for instability and economic growth. Easterly (2001) related a larger middle class (a more equal society) to less political instability. Furthermore, Collier and Hoeffler (2002) argued that if there is a minimum wage, the full cost of instability will be borne by capital with a negative impact on capital accumulation and economic growth.

* + 1. **Median Voter Theorem**

Using the median voter theorem, Persson and Tabellini (1994) hypothesized that inequality, measured as the difference between the median and mean income, will cause people in democratic countries to vote for more redistributive policies. This results in progressive tax-regimes which cause distortions in production and investment. Redistribution therefore causes lower entrepreneurial activity. Their model considers infinitely lived agents. Alesina and Rodrik (1994) used similar reasoning but in an overlapping (two-period) generations model: the median voter has a relatively small endowment of capital in an unequal society, therefore he will vote for higher taxes on capital which constrain the economy’s ability to invest and innovate.

* + 1. **Recent Theories**

Besides the main arguments as described in 2.3.1-2.3.4, other theories have also been published on the relationship between inequality and growth. As mentioned earlier, investments in education can benefit economic growth. High fertility rates are often associated with lower economic growth rates (De Dominicis *et al.,* 2008). Galor and Zang (1997) were the first to relate these two with income inequality. When the income distribution in a society is given, higher fertility rates cause a family to invest less per child in education. This can cause growth to contract. Therefore, less equal societies have higher fertility differentials and lower investment in human capital which consequently weakens their economic growth (de la Croix and Doepke, 2003; Moav, 2005).

Castello-Climent and Domenech (2008) developed a model where a similar trade off occurs. In their model, it is not the differences in fertility that cause underinvestment in human capital, but the differences in life expectancy. As in their earlier article (Castello-Climent and Domenech, 2002), they posited that human capital inequality could be a better proxy for wealth inequality than the typically used income inequality measures. In their model, inequality affects economic growth (per capita income) through their investment in human capital accumulation. This investment partially depends on their life expectancy, which in turn depends on the human capital of their parents.

In an attempt to capture multiple theories on the subject in one framework, Galor and Moav (2004) and Galor (2011) provided a so-called unified theory. They contended that the effect of the income distribution on economic growth depends on the development level of a country. In the earlier stages, economic growth is mostly based on physical capital accumulation whereas in later stages of development, human capital accumulation is the main driver of economic growth. Since inequality fosters physical capital accumulation for reasons discussed earlier, inequality is beneficial to economic growth in the early stages of development. Subsequently, when growth is driven relatively more by human capital accumulation, equality is beneficial to economic growth because of the credit market imperfections argument. Note that this theory is based on the evolution of long-term growth. For LDC’s, the import of skill-biased technologies increases the return of human capital. Therefore, in this framework it could be that current LDC’s benefit more from equal societies than currently developed countries did in their early stages of development, when growth was mainly driven by physical capital accumulation.

* + 1. **Empirical Results**

As is clear from the previous discussion of just a sample of the relevant mechanisms working together, often in opposite directions, no clear-cut overall sign of the relationship between inequality and growth has emerged from these theories (Barro, 2000). Therefore, much empirical work has been done the last decades to test for these theories. Early studies on the relationship between inequality and growth in the 1990’s usually used some form of reduced form growth regression and included an inequality measure to see if it impacts economic growth[[6]](#footnote-6). Most of these studies, similar to those estimating a Kuznets curve in the early years, used a cross-section of countries because of a lack of data covering timespans. Using cross-sectional OLS-estimation, most authors until the late 1990’s found a negative relationship between inequality and growth[[7]](#footnote-7). Examples of these early works include Persson and Tabellini (1994), Alesina and Rodrik (1994), Clarke (1995) and Deininger and Squire (1998). These studies usually used a growth regression of the following form:

(2.3) ( .

Similar to the estimation of the Kuznets curve, stands for some measure of economic growth, usually GDP per capita which is also used as a dependent variable to account for convergence[[8]](#footnote-8), for a measure of inequality, for a set of control variables and for a white noise error term, all in country *i* at time *t*. The relationship is commonly estimated using a 3, 5, 10 or even 20 year lag (defined as *τ* in(2.3)). The explanatory variables are usually levels at the beginning of the period as in equation 2.3 or average values of the time span considered. Most of these studies found evidence of a trade-off between the two variables, where inequality has a negative effect on economic growth. Main critique on this kind of estimation is the problem of bias due to possible omitted variables (a problem facing most growth regressions, see e.g. Caselli (1996)) and the quality of the datasets employed (de Dominicis *et al*., 2008). Technology, institutions, redistribution policies and other country-specific variables that are difficult to quantify are likely to have an influence on growth rates and could be correlated with the explanatory variables. To alleviate the data quality and quantity problem suffered by early studies, Deininger and Squire (1996) released an improved inequality dataset (henceforth D&S dataset), allowing for panel data estimations. This allowed for estimating with Fixed effects to capture the time-invariant country specific effects such as institutions etc. The resulting empirical literature using the D&S dataset usually found a positive relationship (Banerjee and Duflo, 2003). Examples of this literature are Forbes (2000) and Deininger and Squire (1998). The D&S dataset allowed for panel data estimation of the relationship and controlling for the omitted variable bias with fixed or random effects, therefore alleviating most of the critique on cross-sectional OLS-estimation. Most of these estimations of the relationship were of the form

(2.4) ,

where is a fixed effect for time, is a constant-assumed country characteristic and catches the remaining error in the model. Problem of this type of estimation is the inclusion of lagged dependent variables and the possibly still present omitted variable bias (de Dominicis *et al*., 2008; Voitchovsky, 2005). The usual econometric solution for this problem is the use of a System GMM estimator where first-differencing the model removes the unobserved time-invariant effects as specified above () and where the use of appropriate instruments can control for endogeneity and measurement error (Voitchovsky, 2005; Castello-Climent, 2004).

Most studies utilizing cross-country regressions in the 1990’s find evidence for a negative relationship between initial income inequality and economic growth, while those using panel data find a positive relationship. Most authors explain the differing results[[9]](#footnote-9) on the topic by stating that most research setups suffer from issues regarding the estimation technique, the quality and comparability of inequality measures between countries and the samples used in the regressions (De Dominicis *et al*, 2008).

Voitchovsky (2009) argued that the different results obtained between cross-sectional and panel data work could be caused by a problem of omitted-variables, by the impact of measurement error due to the persistent nature of income inequality, by a misspecification of the assumed linear relationship (Banerjee and Duflo, 2003) and by the different time span considered between the studies (Knowles, 2005; Forbes, 2000).

Sample selection is also seen as a reason for the different results obtained. Barro (2000) for example finds a positive effect of inequality in rich countries and a negative effect in poor countries. It could also be the case that measurement error could be higher in poor states overall due to corrupt data, or a systematic under/over estimation of inequality indices (Voitchovsky, 2009; Durlauf *et al*., 2005).

Voitchovsky (2005) has argued that the chosen measure of inequality greatly influences the results. She claimed that theories predict different effects for different parts of the income distribution. That is, a single inequality index such as the Gini-coefficient will not yield reliable results because some theories predict that top-end inequality or a large middle class are at the root of the inequality-growth relationship. She therefore argued to also consider the ratios of the 90/75 and 50/10 percentiles of the income distribution to capture these effects separately. She argues that top-end inequality, as measured by the 90/75 ratio enhances growth while lower-end inequality, measured by the 50/10 ratio, is harmful for growth. Empirical support was provided for both hypotheses. Also, due to the use of secondary datasets, most studies only use a pre-calculated Gini-coefficient instead of compiling their own inequality index, with all possible compatibility problems across countries (Atkinson and Brandolini, 2001).

Castello-Climent (2010) empirically investigated whether human capital inequality could lower growth and investment. He found that greater human capital inequality increases fertility rates and lowers life expectancy which then hampers economic growth through the accumulation of human capital. He proposed the use of human capital inequality instead of income inequality as it better reflects wealth inequality, which is the type of inequality most theories in the field describe. His results show that using human capital inequality yields more robust results than only focusing on income inequality measures.

* 1. **Regional[[10]](#footnote-10) Analysis**

Analysis of the relationship between inequality and economic growth on a subnational level has not attracted much attention yet. Partridge (1997, 2005) and Panizza (2002) argued that most theories relating inequality to economic growth should also be present on a lower aggregate level than countries, as they are small open economies with individual histories and institutions. Kanbur (2000) summarized research on the relationship between economic growth and inequality and vice versa. He suggested that more country-specific empirical work or case studies should be done to clarify the relationship. De Dominicis *et al*. (2008), describing a meta-analysis of the available empirical work on the relationship, reached similar conclusions. Fallah and Partridge (2007) concluded that factor flows should be higher within countries than between because there are relatively few barriers to capital and labor mobility. Another argument to use data on a sub-national level is that comparability problems between inequality indicators are much less severe than in cross-country datasets. This is due to the fact that most of these variables stem from the same source and the definition of variables or for example the phrasing of survey questions used is generally more uniform in a sub-national dataset.

Empirical studies of the relationship between economic growth and inequality at the regional, within-country level has to my knowledge been limited to the US and European countries. For the United States, Partridge (1997, 2005) analyzed data on a state level from the US Census bureau between 1960-1990 and 1960-2000 respectively. He found a positive impact on economic growth using spatial econometric techniques from both the Gini-coeffient and the income from the third quintile (Q3) of state population. The alternative inequality measure had been chosen to reflect either the impact of the median voter, a large middle class or both. Another paper using US state data finds some evidence supporting a negative relationship on the US state level (Panizza, 2002). Panizza uses fixed effects OLS and GMM estimations and postulates that the differences in the results between Partridge (1997) and Panizza (2002) come from the use of different estimations techniques, a larger dataset (1940-1980), a different source (IRS data vs census data) and the use of the level of initial income per capita instead of the log. Contrary to Panizza’s results, Frank (2009) found a positive relationship. He conducted research on a large state-level sample from 1945-2004 also based on IRS income data. It was found that the long run relationship between inequality and economic growth had a positive sign and that it was driven by the concentration of income in the upper end of the distribution. Fallah and Partridge (2007) analyzed the relationship on an even lower aggregate level. They argue that there are not only regional differences on a state level between the effects of inequality on economic growth, but also between urban and rural areas. They used a sample of 3028 counties and found a positive link in metropolitan areas and a negative link in non-metropolitan areas, suggesting urbanization is also a relevant determinant of the relationship.

For European countries, Ezcurra (2007) studied the inequality-growth relationship based on a sample of 63 regions in 8 European countries during the period 1993-2002. He found a negative correlation between the two using spatial econometric methods. Rodriguez-Pose and Tselios (2010) explored data on 102 regions in 13 European countries from the European Community Household Panel. Based on cross-section and panel data analysis, they reported that existing levels of both income and educational inequality are growth-enhancing. Rooth and Stenberg (2012), in their study of Swedish regions, contended that the regional setup allows for diminishing the omitted variables problem which has plagued other studies because regions in Sweden share similar redistribution policies and institutions. They found, using OLS, Fixed-effects panel estimation and System GMM-estimation that income inequality in Swedish regions increased economic growth by stimulating commuting patterns.

1. **Data**

For my thesis I use various sources to compile variables measuring inequality and economic growth. I’ll first discuss my main data source from which the inequality and educational variables are compiled, the CASEN household survey, in section 3.1. Then I’ll explain how the income inequality indicators for my analysis are constructed from the household survey in section 3.2 and in section 3.3 I will briefly cover the sources and construction of other variables used.

* 1. **CASEN Household Survey**

The dataset employed in my thesis for the construction of income and educational variables is the Chilean National Socio-Economic Characterization Survey (CASEN), a household survey. It is conducted by the Chilean Ministry of Planning (Mideplan) with cooperation of the Micro-Data Institute of the Department of Economics at the Universidad de Chile, located in Santiago. The surveys used were held in November or December of 1990, 1992, 1994, 1996, 1998, 2000, 2003, 2006, and 2009[[11]](#footnote-11). The survey’s goal is to monitor the socio-economic impact of policies implemented by the government to alleviate poverty. This entails the collection of economic, demographic, educational and health data. Collection of data is done by fieldwork with questionnaires handed out in November and December of the respective years. The household survey is constructed to be both nationally as well as regionally representative by the use of expansion factors. Sampling can be described as multi-stage random sampling with geographical stratification and clustering. The country is divided in rural and urban sectors for each of Chile’s 13 regions. Rural sectors were final level strata and urban sectors were again split in three categories according to population size. From these three, the largest urban sectors were again final level strata, while medium and small towns were clustered. First stage sampling occurred with probabilities proportional to population on primary units. A second stage sampling involved households within these primary units (World Bank ,2002). Table 3.1 shows the resulting sample sizes and populations of the surveys.

Once a survey is completed, the data is sent to ECLAC, the United Nation’s Economic Commission for Latin America and the Caribbean, which adjusts the data in two ways. They correct the data for non-response and errors (for example, people declaring themselves formally employed but report no income) and adjust it for under- and over reporting of different income levels, by using national account data provided by the Central Bank of Chile[[12]](#footnote-12).

*Table 3.1.* *Observations and actual population size*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1990** | **1992** | **1994** | **1996** | **1998** | **2000** | **2003** | **2006** | **2009** |
| **Individuals** |  |  |  |  |  |  |  |  |  |
| Sample | 105.189 | 143.459 | 178.057 | 134.262 | 188.360 | 252.748 | 257.077 | 268.873 | 246.924 |
| Population | 12.957.503 | 13.458.623 | 13.894.631 | 14.386.031 | 14.765.419 | 15.003.753 | 15.639.785 | 16.152.353 | 16.607.007 |
| **Households** |  |  |  |  |  |  |  |  |  |
| Sample | 25.793 | 35.948 | 45.379 | 33.636 | 48.107 | 65.036 | 68.153 | 73.720 | 71.460 |
| Population | 3.180.536 | 3.387.757 | 3.556.009 | 3.623.448 | 3.777.023 | 3.871.863 | 4.130.404 | 4.337.066 | 4.685.490 |

Source: CASEN survey for respective years

**3.2 Income and Income Inequality**

To be able to accurately quantify the income distribution in a region, all income sources should be taken into account. I use the total household income variable labeled ‘YTOTHAJ’ in the CASEN dataset. Income at the household level is preferred over individual income because this better reflects the welfare level of individuals within the household compared to individual income measures (Deaton, 1997). For example, in a household consisting of two adults with only one adult receiving income, individual income would yield zero income for the non-income receiving adult, while this individual most likely does not have the same welfare level as an individual in a zero-income household. Total household income consists of all income accrued by all household members in the preceding month including wages, self-employment, government subsidies of all kind, pensions and imputed rent, after adjustment by ECLAC. This reveals one important limitation of the CASEN household survey: rent from capital (bonds, shares or other investments with possible future benefits) is not included. Comparing income as registered in the household surveys with national accounts also reveals that the household surveys do not capture all income (Contreras and Ffrench-Davis, 2012). This potentially influences my estimation of inequality of the income distribution as this is most likely to be underestimated. Assuming this underreporting occurs in every year at approximately the same level and knowing that every adjustment made after the ECLAC adjustments would be arbitrary, I do not adjust the dataset in any way.

I subsequently do adjust the household income in various ways to account for price levels and economies of scale within the household. First, for the sake of comparability between different survey years, I de- or inflate all income data to November 2003 prices by using the headline consumer price index (CPI) provided by Chile’s Central Bank (Banco Central, 2012)[[13]](#footnote-13). Second, since Chile extends 4270 km from north to south, transporting costs can be assumed to influence prices within the country. Therefore, only correcting for a national price index is not sufficient, especially since I consider regional income differences[[14]](#footnote-14). Unfortunately, there are no pricing levels available for each region (and also no data for rural pricing), only for each region’s capital relative to the price level of Santiago. Since this price index is very volatile in the relevant period and because the scarcely available regional pricing levels do not cover all survey years, I use an average regional price index based on a World Bank review of the Chilean economy and impose that on all income data (World Bank, 2002). The regional price index and the CPI are given in respectively table 3.2 and table 3.3.

*Table 3.2. Regional price index1*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Region | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII | R.M. |
| Price Index | 1.27 | 1.17 | 1.11 | 1.09 | 1.03 | 1.04 | 1.01 | 1.04 | 1.05 | 1.04 | 1.09 | 1.22 | 1.00 |

Source: World Bank 2002. Note: (1) Regional price index is composed of the price levels of the regions’ capitals relative to the national capital Santiago (R.M.). Regions are characterized by Latin numbers, except for Santiago which is denoted by an abbreviation for Region Metropolitana.

*Table 3.3. CPI*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year¹ | 1990 | 1992 | 1994 | 1996 | 1998 | 2000 | 2003 | 2006 | 2009 |
| CPI² | 41,52 | 55,77 | 68,05 | 78,44 | 86,94 | 93,34 | 100,00 | 108,45 | 124,00 |

Source: Banco Central de Chile. Notes: (1) Values of November of the respective years are used to match the survey dates, with November 2003 as a base year; (2) Headline Consumer Price Index consisting of a basket of 483 consumer goods, as defined by the Chilean Central Bank

.

After adjusting the income variables for pricing levels, I use an equivalization scale to create an income variable per equivalized adult. Equivalization of income variables is preferable if income is measured at the household level to account for economies of scale within a household. It can be done in many ways and the choice of equivalization scale is always an arbitrary process (Atkinson and Brandolini, 2001). Although one can argue that equivalization scales which give different weights to adults and children and that are based on the average household size in a population are preferable, the format and size of the dataset make this an unfeasible operation. I have chosen to use the root of the household members as equivalence scale. That is, if a household consists of *h* members and total household income is *y*, the equivalized adult income attributed to all *h* members is .

As the Kuznets hypothesis assumes that both inequality and income are lower in rural areas than in urban areas, I have also aggregated the data accordingly. That is, variables are aggregated and used on a regional level, but I also distinguish between rural income and urban income within the regions with their subsequent income distribution. The CASEN survey marks an observation as urban when the household interviewed lives in a dwelling of more than 2000 inhabitants and rural if it resides in a smaller dwelling. Although clearly an arbitrarily set border between urban and rural, it could provide some indication of differences between the country-side and urban environments.

With the income variable defined, the income distribution can be analyzed. The simplest way to depict the income distribution graphically is to use a frequency distribution or histogram. Figure 3.1 shows the income distribution for the scarcely populated Aysén region (Region XI) of Chile in 1990 and 2009 as a histogram. The horizontal axis represents income p/month and the vertical axis shows the percentage of the population with this income. At first sight, the graph indicates that the income distribution as a whole shifted to the right and has flattened, indicating that the average income has increased and that income has been more evenly distributed. But since the maximum income has also shifted from CLP$3.407.184,- to CLP$12.168.404,- and the mean and median have of course also shifted, no definitive conclusions regarding improvements or deteriorations of the income distribution as a whole are to be concluded from this graph. The fact that the maximum income is capped at CLP$500.000,- hides the highest incomes.

*Figure 3.1. Frequency distribution of the Aysén region for 1990 and 2009*

Source: Own Calculations based on CASEN 1990 and 2009. Note: Income range used is CLP$10.000,- and is capped at CLP$500000,-. Mean Income rose from CLP$168721,- in 1990 to CLP$377279,- in 2009.

Figure 3.2 shows a histogram based on logarithmic income, which gives a better picture of how income is distributed in Aisén. Again, the distribution apparently shifted in the 19 year period, but comparing the two distributions is difficult, because it is not possible to get a good picture of the differences between all the individuals. Also, the income ranges on which the percentages are based are chosen arbitrarily, just as in figure 3.1, and the maximum is still capped at CLP$500.000,-, which does not permit to draw conclusions on the income distribution as a whole.

A more appropriate way to analyze the equality of an income distribution is to use cumulative frequencies of both income and population, as in the Lorenz curve. In the Lorenz curve of figure 3.3, the cumulative percentage of population ranked according to their income is on the horizontal axis and the cumulative percentage of the corresponding income on the horizontal axis. For an income distribution to be perfectly equal, it must equal the dotted diagonal line. The larger the area is between the Lorenz curve and the diagonal line, the more unequal the income distribution is.

*Figure 3.2. Histogram with logarithmic income, Aysén Region 1990 and 2009*

Source: Own Calculations based on CASEN 1990 and 2009.

In figure 3.3, the Lorenz curves of both the 1990 and 2009 income distribution of the Aysén Region are depicted. In contrast with figures 3.1 and 3.2, the Lorenz curves show that the equality of the income distribution has hardly changed over the years, that is, both lines are almost as close to the diagonal line, suggesting that although the distribution has shifted to the right and has flattened out during the years, the income of the higher class has also increased substantially, almost evening out the effect of the flattening of the income distribution.

So how to quantify these differences for quantitative analysis? The most widely used inequality measure is the Gini-coefficient. Since this is also the predominant measure used in most relevant empirical work, this measure will also be used in my research for comparability reasons. It is the ratio

*Figure 3.3. Lorenz curve, Aysen region in 1990 and 2009*

Source: Own calculations based on CASEN 1990 and 2009.

to the mean of half the average income over all the pairs of absolute deviations between the income of the population and can be expressed as:

(3.1) ,

where *N* is the population size, is the mean income and and is the income of any two individuals of the population (Deaton, 1997). Equation (3.1) shows that if all incomes are equal (, the resulting Gini-coefficient is zero, while when one individual has all income , all pairs will have zero income difference except *N*-1 times when individuals are paired with the individual with income, yielding the difference of and a Gini-coefficient of one. Hence, the Gini-coefficient ranges from 0 to 1 and the lower the Gini-coefficient is, the more equal a distribution is.

An alternative way of constructing the Gini-coefficient is by using the Lorenz-curve[[15]](#footnote-15). It equals the ratio of the area between the Lorenz curve and the perfect equality line (the dotted diagonal line in figure 3.3) and the total area under the diagonal. Since (3.1) involves computing income differences between *N*(*N*-1)/2 pairs and the data for the whole of Chile cover 12.957.503 individuals in 1990 and 16.607.007 in 2011 (when the expansion factors are used), I have chosen to use this indirect method by using trapezoids for the calculation of the Gini-coefficient of the different regions in Chile. If is a cumulated proportion variable for ranked by income such that with , and is the cumulated proportion of income for with , , the Gini-coefficient equals:

(3.2) .

The Gini-coefficients for the Aysén Region equals 0.4762 in 1990 and 0.4693in 2009, quantifying the minimal differences graphically depicted in the two Lorenz Curves in figure 3.3. But as is apparent from figure 3.2 and figure 3.3, these Gini-coefficients don’t tell the whole story, as shifts in parts of the income distribution are not depicted in this single measure. Therefore, besides using the Gini-coefficent as inequality measure, I will also use the ratio of the 90th to the 75th percentile of the income distribution (P90/75) as a measure of top-end inequality and the ratio of the 50th to the 10th (P50/10) as a measure of bottom end inequality as suggested by Voitchovsky (2005). For the Aysén Region, these variables have changed in opposite directions over time. The P90/75 ratio declined from 1.90 to 1.75, while the P50/P10 ratio increased from 2.45 to 2.77. This could possibly explain why the Gini-coefficient has hardly changed from 1990-2009: absolute income differences in the upper part of the income distribution have decreased and those in the lower middle part of the income distribution have increased, possibly cancelling out in the Gini-coefficient.

**3.3. Other Variables**

As a measure of the human capital stock in a region, the average years of schooling of the working age regional population (aged 15-65), also extracted from the CASEN surveys, is used[[16]](#footnote-16). As discussed in section 2.3.6, Castello-Climent and Domenech (2002; 2008) found that human capital inequality could be a better proxy for wealth inequality than income inequality. In order to estimate an inequality measure for human capital they compiled an inequality measure based on the Gini-coefficient. Their ‘human capital Gini-coefficient’ can be expressed as:

(3.4)

where is the share of the population with either education level *i* or *j* and is the average schooling years per education level. The fact that I use the raw data of the CASEN surveys also allows me to compile this educational or human capital inequality measure directly. I follow Castello-Climent and Domenech (2002) and compute a Gini-coefficient based on the average schooling years and four both mutually exclusive and collectively inclusive educational levels of the working age population (15-65 years). This was done by recoding the education level variable (EDUC) to (0) for no formal education, (1) for complete and incomplete primary schooling, (2) for incomplete and complete secondary schooling and (3) for higher education. The average years of schooling per level were formed by using the average years of education variable (ESC). Since an individual who has finished secondary school has also finished primary school, it can be stated that

(3.5) .

Combining (3.4) and (3.5) and rewriting gives the final expression used:

(3.6) ,

As a measure of economic development, both the mean income per region computed from the CASEN survey as the regional GDP per capita is used (all in 2003 CLP$). Unfortunately, no data for the investment ratio or total private investment on a regional level is available for all the years. Therefore I combine the data available on regional public investment and regional FDI to proxy for total regional investment. The data on public regional investment come from the Chilean Secretariat of Regional Development (Subsecretaria de Desarrollo Regional y Administrativo), as do the data on Regional GDP p/capita. The Foreign Investment Committee of the Chilean government (Comité de Inversiones Extranjeras) is the source for data on FDI, and all GDP and investment variables are measured in 2003 Chilean pesos. Unemployment data come from the Chilean Central Bank. Urbanisation rates are computed by using the share of population stated as living in urban areas according to the CASEN survey.

1. **Preliminary Analysis of the Data**

To analyze economic growth and the income distribution in Chilean regions in the relevant period (1990-2009), I will start with an overall view of Chile’s economic performance in the last two decades, focusing on the national trends during the relevant period in section 4.1. Section 4.2 continues with an analysis at the regional level.

**4.1. Chile: High Growth and Persistent Inequality**

Chile has experienced high economic growth during the last two decades, with GDP per capita almost doubling from US2005 $6937 in 1990 to US2005 $13.832 in 2009, outperforming any other Latin-American country in this period (PPP GDP per capita, World Bank, 2012). The foundation for this economic success has been an extensive reform program initiated in the mid 1970’s by the military government led by Augusto Pinochet. These reforms included market deregulation, fiscal balance, exchange rate unification and trade liberalization. The fall of the Pinochet regime and the subsequent installment of a democratic government in 1990 did not put a halt on reforms. Public enterprises were privatized, labor markets deregulated and extensive social security reform has since taken place (Soto and Torche, 2004). Over the last three decades, Chile has signed 59 bilateral or regional trade-agreements with all major economies of the world. Chile’s focus on trade liberalization has had a big impact on the country’s economy: almost one third of its GDP comes from exports.

In the period 1991-1998, GDP per capita growth averaged at 6.4% annually, but the Asian financial crisis hit the open economy hard, causing negative GDP per capita growth in 1999 and slow growth afterwards, as depicted in figure 4.1. From 2004-2008, GDP growth averaged almost at around 4%, fuelled by the commodity price boom.

Poverty reduction in Chile has been immense in the 1990’s. Moderate poverty decreased from 38.6 to 20.6 percent while extreme poverty fell from 12.9 to 5.7 (Pizzolito, 2005), but levels of inequality have stayed roughly the same, causing social unrest and massive demonstrations in its capital Santiago in 2006, 2009, 2011 and earlier this year. Its colonial past has given it relatively high income-

*Figure 4.1. The Chilean economy during 1990-2009*

Source: Banco Central de Chile, CASEN 1990-2009 household surveys. Note: Real GDP per capita growth rate, constant 2003 prices; Gini-coeffecient, calculated for available years in CASEN survey, interpolated for other years.

inequality levels as it has done with the whole region: 10 out of the 15 most unequal countries in the world are situated in Latin-America (UNDP, 2010). But as other Latin-American economies grew, their inequality levels declined, while Chile’s remained relatively stable, showing only a drop after 2004 in figure 4.1. Possible explanations for this prolonged inequality lie in the low level of migration, uneven returns to education, foreign competition in labor-intensive goods, an increase in labor-participation by women and increasing reliance on seasonal contract labor (Agostini and Brown, 2010). Policies implemented by the Chilean government to reduce poverty have been quite successful but have also had negative effects. For example, housing subsidies have effectively reduced poverty, but have also caused citizens to stick to their place of origin instead of moving to more productive areas with higher wages (Soto and Torche, 2004). Studies conducted by Contreras (2001, 2003) show that poverty reduction has been evident in Chile, but that income inequality failed to decline, suggesting a larger middle-income class and a larger high-income class.

When we take a first look on our data at the national level, a number of trends are clear. Table 4.1 show the levels of different variables at the national level for selected years. The slow growth surrounding the millennium, visible from figure 4.1 is also clear from both GDP p/capita data as the mean income (comparing 1998 and 2003 levels), as is the surge in unemployment resulting afterwards and the permanent decline in investment rate. In contrast with the assumptions of the Kuznets model, mean income levels lie higher in rural areas than in urban areas[[17]](#footnote-17). The income on the countryside does seem to be more evenly divided across the population, with Gini levels lower in rural areas than in urban areas for all years except 1990. At the aggregated national level, inequality levels show a persistently high character with a drop after 2003 with a similar pattern when only comparing the rural or urban income distribution. The P90/75 and P50/10 ratios lead to similar conclusions.

*Table 4.1. Summary of national variables*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variable, National level** | **1990** | **1994** | **1998** | **2003** | **2009** |
| GDP p/cap (2003 CLP$)1 | 1,940,376 | 2,476,980 | 3,043,892 | 3,270,916 | 3,844,655 |
| Unemployment (%) | 7.57 | 7.52 | 6.42 | 9.53 | 9.69 |
| Investment rate (%) | 24 | 24 | 26 | 20 | 22 |
| Mean Income2 | 199,502 | 245,981 | 289,627 | 300,154 | 336,103 |
| Mean Income rural | 210,325 | 266,884 | 313,854 | 319,712 | 354,772 |
| Mean Income urban | 146,553 | 132,473 | 142,971 | 170,078 | 208,392 |
| Gini | 0.54 | 0.54 | 0.55 | 0.55 | 0.51 |
| Gini (urban) | 0.53 | 0.54 | 0.54 | 0.54 | 0.51 |
| Gini (rural) | 0.57 | 0.48 | 0.48 | 0.50 | 0.45 |
| Median Income | 111,132 | 137,481 | 160,015 | 166,473 | 202,914 |
| P90/75 | 1.98 | 1.93 | 1.96 | 1.87 | 1.83 |
| P50/10 | 2.78 | 2.79 | 2.84 | 2.72 | 2.55 |
| Urbanisation (%) | 83.03 | 84.45 | 85.82 | 86.93 | 87.25 |
| Average education. years | 9.03 | 9.20 | 9.69 | 10.16 | 10.39 |
| Human capital Gini | 0.35 | 0.34 | 0.32 | 0.31 | 0.31 |

Source: Own calculations based on the CASEN Household Survey for the respective years. Notes: (1) Source:

Central Bank of Chile; (2) Mean income measures are income per month in CLP$, other definitions as specified

in the text,

The human capital stock as measured by the average level of education of the working age population climbs steadily as is to be expected and the human capital Gini-levels drop over the years. Since 1965 the compulsory amount of years of education has been 8 years, which has been lifted to 12 years in 2003, an unprecedented high for Latin-America (Mattear, 2007). Average education levels in rural areas (not shown in the table) range from 6.23 to 7.94 years while urban levels lie approximately 3 years higher for all years measured, showing an education gap between rural and urban areas which is globally a common phenomenon. The human capital Gini-coefficient lies higher in rural than in urban areas, probably reflecting the smaller portion of individuals attending secondary or tertiary education, causing more inequality.

* 1. **Regional Growth and Inequality**

In his research on inequality levels in Chile, Contreras (2001) shows that inequality is regionally dependent since that there are large differences in regional inequality and economic growth present in Chile. Chile is divided in 13 regions[[18]](#footnote-18) with regional populations ranging from a mere 90,000 in the southern Aysen region (Region 11) to over 6 million in the capital’s region of Santiago (Region 13). Regional GDP p/cap levels also differ greatly from the poor Araucanía region (Region 9) to the wealthy region of Magallanes (Region 12) as did each regions performance in the time period considered. Figure 4.2 captures the initial regional GDP p/cap in 1990 and the regional growth rates of the whole period considered (1990-2009) relative to the national level and growth rate over the same period.

*Figure 4.2. Regional GDP and growth in a national context*

Source: Own calculations based on data from Banco Central de Chile. Notes: (1) Regional average annual GDP per capita growth rate in 1990-2009 for all 13 regions minus national average annual GDP per capita growth rate in 1990-2009 (5.2%) ; (2) LN regional GDP per capita 1990 for all 13 regions minus LN national GDP per capita 1990.

This shows that the wealthy region 12 is falling behind rapidly while most regions tend to show similar average growth rates to the national level. This process of catching up or convergence can also be seen in figure 4.3 which plots the initial log of regional GDP per capita in 1990 and the annual regional growth rate over the whole period. Although one should be cautious interpreting these basic results, the regression results depicted in the graph shows that there is a process of absolute cross-

*Figure 4.3. Beta-convergence in Chilean regions*

Source: Own calculations based on data from Banco Central de Chile. F-Test value 2.874 (p=0.118)

regional convergence in the period at approximately 1 % per year. The low explanatory power suggests that besides lagged income level, additional structural variables can influence the growth performance of regions.

To get a first impression of regional inequality levels, figure 4.4 depicts the average Gini coefficients in the period 1990-2009 for the regional population as a whole and for the urban and rural population separately. The Gini-coefficients show considerate variability with region 13 (the metropolitan region of Santiago) standing out as by far the most unequal when compared to the other regions. The figure also shows that most inequality levels lie in the range of 0.44 to 0.48 while the national Gini-coefficients persistently lie above 0.50. Besides the fact that region 13 inhibits almost half of the Chilean population so its higher Gini-coefficient causes the national levels to rise, this also reflects the

*Figure 4.4. Average regional inequality levels*

Source: Own calculations based on the CASEN Household Survey, 1990-2009. Gini levels depicted are average values over 1990-2009.

fact that the national Gini-coefficient comprises of both within-group levels (intra-regional Gini-coefficients) and the between-group levels (inter-regional inequality levels), suggesting that a substantial portion of the national Gini-levels is due to interregional income inequality, as also found by e.g. Contreras (1996; 2003)[[19]](#footnote-19). These interregional differences are also apparent from table 4.2, which shows levels of several relevant variables for the year 2000 measured at the regional level. The differences in mean income per region are very clear. Also, the high level of GDP per capita of region 2 compared to its mean income stands out, which is explained by the fact that region 2 receives high investments for the extraction of copper and other minerals. The table also shows the small

*Tabel 4.2. Regional variables, measured in 2000.*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Region** | **Population** | **GDP P/C** | **Mean Income** | **Median Income** | **Gini** | **P90/75** | **P50/10** | **Aver. Educ.** | **HC Gini** |
| 1 | 420.899 | 3.989.072 | 235.657 | 150.001 | 0.48 | 1.86 | 2.47 | 10.36 | 0,27 |
| 2 | 479.040 | 6.406.778 | 307.568 | 205.542 | 0.48 | 1.68 | 2.84 | 10.93 | 0,26 |
| 3 | 250.731 | 3.606.495 | 189.967 | 131.343 | 0.44 | 1.67 | 2.62 | 9.76 | 0,30 |
| 4 | 606.337 | 1.871.034 | 218.870 | 138.363 | 0.50 | 1.84 | 2.63 | 9.34 | 0,34 |
| 5 | 1.542.975 | 2.503.019 | 250.691 | 168.063 | 0.47 | 1.72 | 2.75 | 10.17 | 0,29 |
| 6 | 785.763 | 2.216.439 | 213.785 | 141.734 | 0.46 | 1.69 | 2.45 | 8.8 | 0,35 |
| 7 | 909.984 | 1.809.041 | 232.666 | 131.462 | 0.54 | 1.86 | 2.57 | 8.63 | 0,37 |
| 8 | 1.854.838 | 2.302.799 | 241.001 | 128.897 | 0.56 | 1.76 | 2.65 | 9.39 | 0,34 |
| 9 | 857.665 | 1.365.373 | 209.407 | 111.955 | 0.57 | 2.03 | 2.91 | 8.78 | 0,37 |
| 10 | 1.063.589 | 2.006.782 | 197.943 | 124.314 | 0.49 | 1.94 | 2.44 | 8.5 | 0,36 |
| 11 | 87.277 | 2.954.764 | 267.826 | 174.533 | 0.49 | 1.78 | 2.71 | 8.81 | 0,36 |
| 12 | 138.520 | 5.605.267 | 371.056 | 191.848 | 0.54 | 2.59 | 2.73 | 10.43 | 0,28 |
| R.M. | 6.115.041 | 3.278.067 | 389.686 | 203.568 | 0.56 | 2.08 | 2.62 | 10.7 | 0,28 |
| National | 15.112.659 | 3.083.852 | 296.986 | 164.775 | 0.55 | 2.28 | 1.58 | 9.91 | 0.32 |

Source: Own calculations based on the CASEN Household Survey, 2000, and Central Bank of Chile.

population size of regions 11 and 12 in the southern part of the country, which casts doubt about the inference possibilities of these values as explained before. Levels of inequality that stand out are similar to those in figure 4.4: regions 9, 8 and 13 are the most unequal regions in Chile. The human capital Gini in the last column correlates reasonably well with the income Gini coefficients: the above mentioned three regions also score relatively bad on human capital inequality, except for region 13, which is the region of Santiago. As can be seen in column 9, the average education level is also reasonably high in the capital. If we look at the relationship between the human capital Gini and the human capital stock in more detail as in the scatterplot in figure 4.6, the negative relationship between the two variables is apparent. The figure contains all possible values in the sample (1990-2009) and shows a negative relationship, which is also found by Castillo-Clement and Domenech (2002, 2008).

*Figure 4.6. Human capital: inequality vs stock¹*

Source: own calculations based on CASEN 1990-2009. Note: (1) Scatterplot includes all 13 regions of Chile with 9 observations from 1990-2009.

They however find a larger variance per average education level, which could be due to the fact that they consider multiple countries in their sample with differing educational government policies.

1. **Methodology**

To empirically asses my hypotheses formulated in the introduction, several crossection- and panel data regressions are conducted using the data described in section 3. First, I will discuss the empirical setup used to test for the presence of an inverted-U curve in the development process of Chilean regions. Secondly, the one chosen to shed light on the inequality- growth relationship will be introduced.

* 1. **Estimating the Kuznets Curve**

As discussed in section 2.2, most estimations of a Kuznets type relationship between the level of development and the inequality of the income distribution are performed by regressing an inequality measure as the dependent variable on a measure of economic development and on its squared or inverse value, to account for the shape of the assumed curve. Since my dataset covers Chilean regions from 1990 to 2009, I do not expect to detect the whole Kuznets curve in my data for all regions. That is, the turning point of economic development which results in lower inequality in the income distribution could also lie in the past, resulting in a negative relationship between the level of development and an inequality measure. It could also be the fact that regions are still experiencing increasing inequality while they develop, positing them on the upward slope of the Kuznets curve as depicted in figure 2.1. To first check if all countries follow the same Kuznets curve, I will perform a panel least squares regression which is common in the literature using the following specification:

(5.1) .

An inequality indicator (*INEQ*) is regressed on an income measure (*Y*) and on this income measure squared, where *b* is expected to have a positive sign and *c* a negative sign. represents time-dummies and the remaining error term is . Due to the inclusion of time-dummies, equation 5.1 only focusses on the cross-regional variation. As income measure, I will use both the GDP per capita levels and the mean monthly income levels. The income level corresponding to the turning point in equation 5.1 equals *–c/2b.* Besides using this specification, I will also use the functional form proposed by Anand and Kanbur (1993), which takes the inverse of the income variable instead:

(5.2) .

Note that now the Kuznets curve is found if bothand have a negative sign and that the turning point of this specification is at *√(c/b).* Equations 5.1 and 5.2 allows me to test for different possibilities using either least squares or fixed effects in a panel setup (Deininger and Squire, 1998): do all regions conform to a Kuznets curve with the same coefficients () or are there region-specific intercepts ()?

* 1. **The Inequality-Growth Relationship**

The inequality-growth literature as discussed in section 2.3.6 has shown that there are various issues to take in consideration when estimating a growth regression with an inequality indicator as one of the dependent variables. Results are thought to be influenced by the time span considered (short versus long), the quality and consistency of the data, the different effects of bottom and top-end inequality, different relationships of inequality and growth between rich and poor countries and the possible impact of urbanization levels when estimating on a subnational level.

To estimate the effect of inequality on economic growth, I will first discard the time series property of my dataset and only use the cross-sectional framework by running an OLS-regression on the average growth rate from 1990-2009. This captures the long-run effect at the cost of having only one observation per region. The setup is a typical growth-regression setup common in the literature with the growth rate of GDP per capita over the sample period 1990-2009 () explained by income inequality in the initial year 1990 (), the logarithm of GDP per capita in 1990 () to account for the possibility of convergence and several control variables measured in the initial year () as in equation 5.4:

(5.4) .

Various measures of inequality will be used to check for the stability of the results. As mentioned in section 2.3.6, the upper-end inequality measure P90/75 is expected to enhance growth (e.g. by increasing investment) while lower-end inequality is expected to harm growth due to channels related to restrictions on investment in human capital, crime rates and suboptimal work effort (Voitchovsky, 2005). When combining p9075 and Gini, the Gini coefficient can be thought of as picking up the lower end inequality. Furthermore, these OLS results can be seen as picking up the long-term effect of inequality on growth (Partridge, 2005).

One common issue with growth regressions as stressed in section 2.3.6 is that of omitted variables in a cross-sectional setup. There is a possibility that a variable, not captured in the cross-section above, is both correlated to economic growth and initial inequality. A method to capture these omitted regional effects is to exploit the panel data setup and estimate the following equation using fixed effects:

(5.5) .

I will use all observations available (entailing will represent a 3 and 2 year interval, since the CASEN survey was held every 2 years in the 90’s and every 3 years since 2000) which totals to 104 observations, since one cross-section is lost when estimating the growth rates. Two or 3 year intervals are considered relatively small in the literature, where 5, 10 or even larger timespans are standard for empirical work. Therefore, business cycles could therefore influence my results using these small intervalls. Therefore, I also use = 2 and = 3 and estimate four, five or six year intervals (1990-1994-1994-1998, 1998-2003, 2003-2009) and six or seven year intervals (1990-1996, 1996-2003 and 2003-2009). Variable definitions are similar to equation 5.4 and stands for time-fixed effects and for region specific effects. Inclusion of time-fixed effects is done to correct for unobservable national effects such as fiscal or monetary policy, business cycles etc.

The equation (5.5) can be tested in different forms, depending on which assumption is made regarding the relationship between the error term and the explanatory variables. The first option is to estimate a panel least squares with time dummies or time fixed effects, where the composite error term is assumed not to correlate with the explanatory variables. If most of the variation in the income variables is cross-sectional, the panel least squares regression coefficients will probably reflect long-run effects (Partridge, 2005). The second option is to use a fixed effects (FE) approach. This will eliminate the omitted variable bias which could be caused by unobserved regional effects that correlate with the dependent variables.[[20]](#footnote-20)

1. **Results**

In this chapter I will discuss and analyze the results obtained. Similar to the previous chapter, results are divided in those dealing with a possible Kuznets relationship in the next section and those dealing with the effect of inequality on economic growth in the last section.

**6.1 The Regional Kuznets-curve**

Figure 6.1 shows the spread of both the regional income Gini-levels and the logarithm of regional GDP p/capita over time. Contrary to most literature on the subject (e.g. Rooth and Stenberg, 2012),

*Figure 6.1*. *Spread of regional Gini and regional GDP*

Source: Own calculations.

the variation in income inequality levels is mostly cross-sectional instead of temporal, as the variation increases during the years and the inequality levels also drop considerably during the 19 year period.

To quantify the possible existence of a Kuznets curve in the development of Chilean regions, I start by first estimating equation 5.1 as discussed in the previous chapter. Estimation of the first model entails pooling all observations and estimating a panel least squares with time dummies. There are 9 observations for all 13 regions during the considered time period, which gives 117 observations. All income variables are reported in 1000 CLP$ and regional income and regional human capital Gini-coefficients are all in percentages. The results are shown in table 6.1. Columns 1 and 2 show the results for respectively the regional GDP per capita and the regional mean income with its squared values. The results using regional GDP per capita and its squared value are not significant, while those using the regional mean income only yield a significant coefficient for the squared value. The signs of both variables in columns 1 and 2 are not as expected: instead of pointing to an inverted-U curve, they point to a normal U-curve, indicating that inequality has initially decreased during the period and subsequently increased as the regional economies developed.

Adding control variables (not reported) or changing the specification to the Anand and Kanbur variant as in equation 5.2 does not yield stronger results for the GDP specification (column 3). Instead, using the mean income and its inverse does yield significant coefficients for both the explanatory variables at the 10% level (column 4), but both coefficients do not carry the expected sign. Again, they show a real U rather than an inverted-U pattern. The minimum and thus the turning point is reached at CLP$ 186,036. This mean income level is exceeded by most regions before 1996 in my sample. To check for the robustness of this last result, both the human capital stock as measured by the average amount of schooling in years (HC Stock) and the regional population (Population) are added in column 5. Addition of these (highly significant) variables just renders the coefficient on mean income insignificant, while the inverse remains significant at the 10% level, but also switches sign. The human capital stock has a strong positive relationship with equality while population size impacts equality negatively. The above results thus do not support the existence of a Kuznets curve in the development process of Chilean regions in the last two decades. If any, they point to a drop and subsequent rise of

*Table 6.1. Panel least squares with time fixed effects, estimation of the Kuznets curve*

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Panel with time fixed effects** | | | | | | | | | |
|  | **1** | | **2** | | **3** | | **4** | | **5** | |
|  | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** |
| Constant | 52.366 | 0.000 | 54.390 | 0.000 | 50.164 | 0.000 | 27.419 | 0.002 | 60.337 | 0.000 |
| GDPpc | -0.001 | 0.474 |  |  | -0.000 | 0.134 |  |  |  |  |
| GDPpc^2 | 0.000 | 0.936 |  |  |  |  |  |  |  |  |
| 1/RGDPpc |  |  |  |  | 2,676.59 | 0.590 |  |  |  |  |
| Mean Income |  |  | -0.063 | 0.237 |  |  | 0.055 | 0.001 | 0.024 | 0.136 |
| Mean Income^2 |  |  | 0.000 | 0.047 |  |  |  |  |  |  |
| 1/Mean Income |  |  |  |  |  |  | 1,903.52 | 0.077 | -1,762.94 | 0.054 |
| HC Stock |  |  |  |  |  |  |  |  | -3.262 | 0.000 |
| Population |  |  |  |  |  |  |  |  | 1.600 | 0.000 |
| Observations | 117 | | 117 | | 117 | | 117 | | 117 | |
| R2 Adjusted | 0.336 | | 0.337 | | 0.340 | | 0.322 | | 0.632 | |
| F-Test | 0.000 | | 0.000 | | 0.000 | | 0.000 | | 0.000 | |
| Schwartz | 5.826 | | 5.824 | | 5.821 | | 5.846 | | 5.299 | |
| Log-likelihood | -314.615 | | -314.510 | | -314.307 | | -315.813 | | -279.055 | |

Notes: Panel Least Squares with time fixed effects (not reported). Standard errors are robust. Dependent variable: income Gini coefficient in percentage-points. F-Test values are probability values.

inequality levels.

As Deininger and Squire (1998) note, this could be caused by omitted variables that affect inequality levels and are correlated with the income levels. A possible solution to this problem is the estimation of the model using regional fixed effects. This could overcome the possible bias of omitted variables as mentioned above. A disadvantage of the fixed effects model is that it removes all cross-sectional variation in the data and possibly interferes with the estimated parameters (Pindyck and Rubinfield, 1998). Regional fixed effects allow the intercept to vary per region which seems more realistic since there are sizable differences in inequality, GDP and income levels as noted in chapter 4. As also mentioned by Deininger and Squire (1998), it is unlikely that all regions are on the ‘same’ Kuznets curve. Table 6.2 shows the results of estimating the models using regional fixed effects[[21]](#footnote-21). As is clear from column 6 and 7, both estimates again do not show the expected sign, that is, they show a U-curve instead of an inverted-U pattern. Adding the two control variables used before does not change the sign, nor does using the specification with the inverse instead of the square income variable (not reported). Combining both the time and region fixed effects yields the results as shown in column 8 and 9. Now both GDP and its squared show a highly insignificant coefficient. The mean income variable and its squared do yield significant coefficients and have the appropriate sign for an inverted-U, with both coefficients significant at the 1% level. Column 10 tests for the robustness of this result by adding the average education level and the population. HC stock enters the model significant at the 10% level and has a positive effect on equality while population does not enter the equation in a significant way. To further check for this specification, equation 5.2 is estimated as shown in column 11. Changing the specification as proposed by Anand and Kanbur (1993) makes the variables switch sign, showing that the model is not robust to a different functional form.

Overall, results point to a U-curved relationship between development and inequality instead of an inverted-U, with most of these results not robust to different specifications or the addition of control variables. The mean income seems to pick up this pattern better than regional GDP, which could be caused by the higher volatility of GDP compared to income. This could be related to the fact that regional GDP in my sample depicts levels every 2 or 3 years, while most literature on the subject (including Kuznets’s 1955 paper) deals with much larger time spans. Unfortunately, the limited amount of regional inequality data does not support this kind of analysis.

**6.2 Inequality as a Determinant of Economic Growth**

As outlined in section 5.2, I will use several lengths of growth spells to determine if inequality has an influence on regional economic growth in Chile during the 1990-2009 period. Each growth regression is estimated using 8 different model specifications, where the difference between these specifications consists of the differing inequality estimators which are included. Note that both the income and human capital Gini enter in coefficients instead of percentages.

My first approach is to use cross-sectional estimations, using only one observation per region to a total of 13 observations. Although this severely limits the amount of observations, given the data it is the only way to allow for a regression on long term growth rates. The dependent variable is the average

*Table 6.2. Panel Least Squares with fixed effects, estimation of the Kuznets curve*

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Panel regional fixed effects** | | | | **Panel regional and time fixed effects** | | | | | | | |
|  | **6** | | **7** | | **8** | | **9** | | **10** | | **11** | |
|  | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** |
| Constant | 59.136 | 0.000 | 52.977 | 0.000 | 53.013 | 0.000 | 22.636 | 0.000 | 29.244 | 0.749 | 92.235 | 0.290 |
| GDPpc | -0.004 | 0.001 |  |  | -0.002 | 0.456 |  |  |  |  |  |  |
| GDPpc^2 | 0.000 | 0.014 |  |  | 0.000 | 0.746 |  |  |  |  |  |  |
| 1/GDPpc |  |  |  |  |  |  |  |  |  |  |  |  |
| Mean Income |  |  | -0.034 | 0.548 |  |  | 0.141 | 0.000 | 0.159 | 0.000 | 0.045 | 0.001 |
| Mean Income^2 |  |  | 0.000 | 0.451 |  |  | -0.000 | 0.008 | -0.000 | 0.004 |  |  |
| 1/Mean Income |  |  |  |  |  |  |  |  |  |  | -2884.426 | 0.001 |
| HC Stock |  |  |  |  |  |  |  |  | -2.528 | 0.084 | -3.007 | 0.041 |
| Population |  |  |  |  |  |  |  |  | 1.028 | 0.871 | -0.945 | 0.876 |
| Observations | 117 | | 117 | | 117 | | 117 | | 117 | | 117 | |
| R2 Adjusted | 0.464 | | 0.325 | | 0.602 | | 0.806 | | 0.8103 | | 0.823 | |
| F-Test | 0.000 | | 0.000 | | 0.000 | | 0.000 | | 0.0000 | | 0.000 | |
| Schwartz | 5.735 | | 5.967 | | 5.682 | | 4.966 | | 5.001158 | | 4.932 | |
| Log-likelihood | -299.801 | | -313.333 | | -277.650 | | -235.728 | | -233.0406 | | -228.987 | |

Notes: Panel least squares with regional specific effects. Model 8, 9, 10 and 11 are estimated using both regional and time fixed effects. Standard errors are robust. Dependent variable: income Gini coefficient in percentage-points.

annual growth rate of the whole period of 19 years. Table 6.3 shows the results. As is directly evident, almost all specifications have low statistical power as all models cannot refute the F-Test convincingly that all coefficients are actually equal to zero. Nevertheless, several results are notable. First, although its effect is not significant in all specifications, the log of initial regional GDP is negatively related to regional economic growth, indicating a process of convergence. The investment rate is positively related to regional economic growth, as is the human capital stock, except when the human capital Gini-coefficient is included as in model 7, which turns the sign of the human capital stock. Population and unemployment levels do not seem to have significant impact on the long term regional growth rate, with both switching signs when including different inequality indicators. Of the three regional income inequality indicators, the Gini-coefficient of income shows the weakest results, with changing signs when adding the top income inequality indicator (p9075) or the bottom inequality indicator (p5010) as in models 2,3 and 4. Bottom income inequality shows a negative relationship with long term growth, where top income inequality shows a positive relationship. These results are in line with those of Voitchovsky (2005), who states that this could be attributed to restrictions on investment in human capital, crime rates and suboptimal work effort resulting from the large disparities in the bottom of the income distribution, or by channels related to investment for the inequality in the top of the income distribution. Model 5, with only the bottom end inequality indicator included, seems to yield the strongest results, which could be an indication of the importance of bottom-end inequality in long-term Chilean regional economic growth.

Unfortunately, the results shown in table 6.3 are only estimated using 13 observations. Therefore, by shortening the growth periods, the number of observations can be increased and the effects of inequality on more short-term growth can be analyzed. With multiple observations per period the panel structure of the dataset can be utilized and the models can be estimated using time-invariant cross-section (in this case regional) fixed effects to control for the differences between regions not captured by variables included. It also allows for the inclusion of time fixed effects, which take into consideration trends which are common to all regions at certain points in time. As mentioned before, the only other three available growth spell lengths are 6, 4 or 2 year periods[[22]](#footnote-22). Table 6.4 represents the results when using the 6 year growth period which allows for 3 observations per region and includes regional and time fixed effects.[[23]](#footnote-23) The results again show strong support for convergence as initial regional GDP has a negative effect on regional growth in all 8 models. Top income inequality has an overall negative impact on growth, while inequality in the lower part of the income distribution shows a positive relationship with regional growth, contrary to the results obtained using the 19-year period.

*Table 6.3. Ordinary Least Squares, cross-sectional estimation of long run growth*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **OLS** | | | | | | | | | | | | | | | | |
|  | **1** | | | **2** |  | **3** |  | **4** |  | **5** | | **6** | | **7** | | **8** | |
|  | **b** | **p-value** | | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** |
| Constant | 0.232 | | 0.291 | 0.305 | 0.068 | 0.273 | 0.063 | 0.197 | 0.253 | 0.279 | 0.046 | 0.186 | 0.194 | 0.390 | 0.234 | 0.237 | 0.061 |
| LnGDPpc | -0.017 | | 0.192 | -0.018 | 0.059 | -0.017 | 0.052 | -0.016 | 0.156 | -0.017 | 0.042 | -0.016 | 0.130 | -0.018 | 0.119 | -0.015 | 0.050 |
| Gini | 0.007 | | 0.938 | -0.034 | 0.530 | -0.051 | 0.238 | -0.016 | 0.837 |  |  |  |  |  |  |  |  |
| HC Gini |  | |  |  |  |  |  |  |  |  |  |  |  | -0.002 | 0.502 |  |  |
| P5010 |  | |  | -0.051 | 0.007 | -0.049 | 0.010 |  |  | -0.050 | 0.004 |  |  |  |  | -0.048 | 0.005 |
| P9075 |  | |  |  |  | 0.021 | 0.038 | 0.025 | 0.077 |  |  | 0.025 | 0.045 |  |  | 0.020 | 0.031 |
| HCStock | 0.009 | | 0.193 | 0.021 | 0.008 | 0.022 | 0.009 | 0.010 | 0.133 | 0.021 | 0.006 | 0.010 | 0.110 | -0.001 | 0.936 | 0.022 | 0.006 |
| Investment | 0.050 | | 0.031 | 0.080 | 0.005 | 0.075 | 0.012 | 0.045 | 0.048 | 0.079 | 0.003 | 0.045 | 0.040 | 0.060 | 0.034 | 0.073 | 0.007 |
| Population | -0.001 | | 0.477 | 0.001 | 0.482 | -0.001 | 0.691 | -0.003 | 0.231 | 0.000 | 0.766 | -0.003 | 0.239 | 0.000 | 0.968 | -0.001 | 0.460 |
| Unemployment | -0.001 | | 0.607 | -0.002 | 0.085 | -0.001 | 0.222 | 0.000 | 0.961 | -0.002 | 0.067 | 0.000 | 0.954 | 0.000 | 0.698 | -0.001 | 0.198 |
| Urbanisation | -0.018 | | 0.707 | -0.072 | 0.080 | -0.083 | 0.048 | -0.033 | 0.372 | -0.072 | 0.073 | -0.033 | 0.367 | -0.017 | 0.706 | -0.082 | 0.050 |
| Observations | 13 | | | 13 | | 13 | | 13 | | 13 | | 13 | | 13 | | 13 | |
| R2 Adjusted | 0.190 | | | 0.642 | | 0.677 | | 0.156 | | 0.705 | | 0.323 | | 0.239 | | 0.732 | |
| F-Test | 0.367 | | | 0.111 | | 0.150 | | 0.433 | | 0.046 | | 0.265 | | 0.328 | | 0.066 | |
| Schwartz | -5.794 | | | -6.636 | | -6.829 | | -5.779 | | -6.803 | | -5.973 | | -5.857 | | -6.927 | |
| Log-likelihood | 47.924 | | | 54.678 | | 57.213 | | 49.104 | | 54.477 | | 49.084 | | 48.328 | | 56.566 | |

Notes: Standard errors are robust. Dependent variable: Average annual regional GDP growth from 1990-2009. Independent variables are all measured in 1990.

*Table 6.4. Panel least squares with fixed effects, estimation of 6 year growth*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Panel regional and time fixed effects** | | | | | | | | | | | | | | | |
|  | **1** | | **2** | | **3** | | **4** | | **5** | | **6** | | **7** | | **8** | |
|  | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** |
| Constant | 1.905 | 0.022 | 2.568 | 0.002 | 2.047 | 0.002 | 1.503 | 0.013 | 3.029 | 0.001 | 1.511 | 0.008 | 2.223 | 0.014 | 2.065 | 0.001 |
| LnGDPpc | -0.099 | 0.000 | -0.132 | 0.000 | -0.155 | 0.000 | -0.133 | 0.000 | -0.123 | 0.000 | -0.133 | 0.000 | -0.093 | 0.002 | -0.155 | 0.000 |
| Gini | -0.117 | 0.013 | -0.111 | 0.037 | -0.010 | 0.803 | -0.004 | 0.929 |  |  |  |  |  |  |  |  |
| HC Gini |  |  |  |  |  |  |  |  |  |  |  |  | -0.001 | 0.702 |  |  |
| P5010 |  |  | 0.040 | 0.003 | 0.030 | 0.001 |  |  | 0.041 | 0.002 |  |  |  |  | 0.030 | 0.001 |
| P9075 |  |  |  |  | -0.035 | 0.000 | -0.039 | 0.000 |  |  | -0.039 | 0.000 |  |  | -0.036 | 0.000 |
| HCStock | -0.018 | 0.089 | -0.043 | 0.003 | -0.028 | 0.005 | -0.008 | 0.250 | -0.056 | 0.001 | -0.008 | 0.189 | -0.033 | 0.023 | -0.029 | 0.002 |
| Investment | 0.067 | 0.002 | 0.033 | 0.073 | 0.012 | 0.368 | 0.034 | 0.036 | 0.043 | 0.021 | 0.034 | 0.035 | 0.076 | 0.002 | 0.012 | 0.359 |
| Population | -0.029 | 0.652 | -0.035 | 0.539 | 0.022 | 0.582 | 0.032 | 0.480 | -0.073 | 0.217 | 0.032 | 0.467 | -0.052 | 0.475 | 0.020 | 0.584 |
| Unemployment | 0.000 | 0.591 | 0.000 | 0.521 | -0.001 | 0.332 | -0.001 | 0.387 | 0.000 | 0.696 | -0.001 | 0.387 | 0.000 | 0.884 | -0.001 | 0.336 |
| Urbanisation | 0.222 | 0.009 | 0.256 | 0.005 | 0.272 | 0.000 | 0.248 | 0.000 | 0.229 | 0.004 | 0.248 | 0.000 | 0.236 | 0.039 | 0.270 | 0.000 |
| Observations | 39 | | 39 | | 39 | | 39 | | 39 | | 39 | | 39 | | 39 | |
| R2 Adjusted | 0.874 | | 0.895 | | 0.938 | | 0.926 | | 0.883 | | 0.930 | | 0.854 | | 0.942 | |
| F-Test | 0.000 | | 0.000 | | 0.000 | | 0.000 | | 0.000 | | 0.000 | | 0.000 | | 0.000 | |
| Schwartz | -5.515 | | -5.665 | | -6.167 | | -6.013 | | -5.591 | | -6.107 | | -5.372 | | -6.259 | |
| Log-likelihood | 147.850 | | 152.605 | | 164.215 | | 159.393 | | 149.316 | | 159.388 | | 145.058 | | 164.174 | |

Notes: Standard errors are robust. Dependent variable: average annual regional GDP growth from 1996-1990, 2003-1996, 2009-2003. Independent variables are all measured in the initial growth year. Estimation with both cross-sectional and time fixed effects.

Again, the partial income inequality indicators p9075 and p5010 seem to be stronger determinants of economic growth than the income Gini-coefficient. Investment and urbanization levels have an overall significant positive impact on regional growth, while inequality in regional education levels (HC Gini) has no significant impact on regional growth. Inconsistent with generally accepted views regarding economic growth, the regional human capital stock has a negative influence on regional growth. Overall, model 8 seems to perform best at capturing the regional growth process at 6 year intervals, with both top and bottom inequality measures included.

Decreasing the amount of years per growth period to 4 years gives 4 observations per region with the data at hand, which brings the total amount of observations to 52. Similar to the 6-year growth period, estimating the models with only time fixed effects does not produce significant results, so only the results including time and regional fixed effects are reported in table 6.5. The lagged regional GDP variable enters all 8 models with a negative sign, again depicting a process of convergence in Chilean regions. The control variables behave similar to the estimation of 6 year growth, including the negative effect of the level of education on regional growth. All income inequality measures fit the model poorly. Although signs are similar to the 6 year model, none show a significant relationship to regional growth. The human capital inequality measure has a positive relationship with economic growth and model 7, with only the human capital Gini-coefficient as inequality measure included as a determinant, seems to be the model of best fit.

The shortest growth spell considered is that between each survey date which on average was held every two years. Results for my largest sample are shown in table 6.6 for the estimation using both time and regional fixed effects[[24]](#footnote-24). Of the considered inequality measures, the bottom-end inequality measure is the only one that shows a significant influence on short-term growth. Just like the other inequality measures, p5010 shows a positive impact on regional growth, indicating that in the short run a wider income distribution contributes positively to economic growth. Control variables behave in the expected way: the human capital stock, investment and population size all increase regional growth rates. The negative sign of initial regional GDP confirms that the pattern of convergence between Chilean regions is also apparent in the short run. Model 5, including only the bottom inequality measure, is the best performing model.

When overviewing the results of these growth regressions with inequality measures and comparing these with results obtained in the literature, several points can be made. First of all, evaluating all inequality measures, the Gini-coefficient does not seem to be related to economic growth, except for

*Table 6.5. Panel least squares with fixed effects, estimation of 4 year growth*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Panel regional and time fixed Effects** | | | | | | | | | | | | | | | |
|  | **1** | | **2** |  | **3** |  | **4** |  | **5** | | **6** | | **7** | | **8** | |
|  | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** |
| Constant | 0.762 | 0.397 | 0.830 | 0.370 | 0.642 | 0.504 | 0.579 | 0.532 | 0.794 | 0.374 | 0.564 | 0.536 | 1.175 | 0.161 | 0.612 | 0.513 |
| LnGDPpc | -0.145 | 0.000 | -0.146 | 0.000 | -0.158 | 0.000 | -0.158 | 0.000 | -0.149 | 0.000 | -0.161 | 0.000 | -0.138 | 0.000 | -0.161 | 0.000 |
| Gini | 0.020 | 0.758 | 0.027 | 0.668 | 0.054 | 0.386 | 0.048 | 0.443 |  |  |  |  |  |  |  |  |
| HC Gini |  |  |  |  |  |  |  |  |  |  |  |  | 0.004 | 0.002 |  |  |
| P5010 |  |  | 0.010 | 0.567 | 0.008 | 0.648 |  |  | 0.009 | 0.612 |  |  |  |  | 0.007 | 0.723 |
| P9075 |  |  |  |  | -0.026 | 0.222 | -0.027 | 0.198 |  |  | -0.022 | 0.277 |  |  | -0.021 | 0.320 |
| HCStock | -0.023 | 0.093 | -0.024 | 0.085 | -0.023 | 0.085 | -0.023 | 0.092 | -0.025 | 0.076 | -0.024 | 0.076 | -0.015 | 0.264 | -0.025 | 0.067 |
| Investment | 0.046 | 0.085 | 0.045 | 0.081 | 0.036 | 0.173 | 0.036 | 0.177 | 0.045 | 0.084 | 0.036 | 0.181 | 0.048 | 0.063 | 0.036 | 0.180 |
| Population | 0.106 | 0.128 | 0.100 | 0.161 | 0.129 | 0.111 | 0.135 | 0.081 | 0.107 | 0.109 | 0.140 | 0.065 | 0.058 | 0.318 | 0.136 | 0.086 |
| Unemployment | 0.000 | 0.932 | 0.000 | 0.994 | 0.000 | 0.935 | 0.000 | 0.873 | 0.000 | 0.967 | 0.000 | 0.837 | -0.001 | 0.604 | 0.000 | 0.879 |
| Urbananisation | 0.239 | 0.101 | 0.234 | 0.112 | 0.248 | 0.085 | 0.253 | 0.076 | 0.247 | 0.073 | 0.272 | 0.043 | 0.130 | 0.356 | 0.270 | 0.044 |
| Observations | 52 | | 52 | | 52 | | 52 | | 52 | | 52 | | 52 | | 52 | |
| R2 Adjusted | 0.697 | | 0.688 | | 0.686 | | 0.695 | | 0.698 | | 0.703 | | 0.718 | | 0.694 | |
| F-Test | 0.000 | | 0.001 | | 0.000 | | 0.000 | | 0.000 | | 0.000 | | 0.000 | | 0.000 | |
| Schwartz | -4.498 | | -4.430 | | -4.382 | | -4.452 | | -4.503 | | -4.520 | | -4.571 | | -4.447 | |
| Log-likelihood | 162.394 | | 162.583 | | 163.312 | | 163.177 | | 162.506 | | 162.953 | | 164.282 | | 163.037 | |

Notes: Standard errors are robust. Dependent variable: average annual regional GDP growth from 1994-1990, 1998-1994, 2003-1998, 2009-2003. Independent variables are all measured in the initial growth year. Estimation with both cross-sectional and time fixed effects.

*Table 6.6. Panel least squares with fixed effects, estimation of 2 year growth*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Panel regional and time fixed Effects** | | | | | | | | | | | | | | | |
|  | **1** | | **2** |  | **3** |  | **4** |  | **5** | | **6** | | **7** | | **8** | |
|  | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** | **B** | **p-value** | **b** | **p-value** |
| Constant | -0.937 | 0.450 | -0.522 | 0.626 | -0.514 | 0.639 | -0.925 | 0.462 | -0.558 | 0.602 | -0.938 | 0.459 | -0.974 | 0.437 | -0.519 | 0.637 |
| LnGDPpc | -0.180 | 0.000 | -0.195 | 0.000 | -0.195 | 0.000 | -0.180 | 0.000 | -0.198 | 0.000 | -0.181 | 0.000 | -0.181 | 0.000 | -0.195 | 0.000 |
| Gini | 0.040 | 0.461 | 0.023 | 0.687 | 0.020 | 0.782 | 0.036 | 0.634 |  |  |  |  |  |  |  |  |
| HC Gini |  |  |  |  |  |  |  |  |  |  |  |  | 0.001 | 0.653 |  |  |
| P5010 |  |  | 0.049 | 0.007 | 0.049 | 0.007 |  |  | 0.049 | 0.007 |  |  |  |  | 0.049 | 0.007 |
| P9075 |  |  |  |  | 0.001 | 0.947 | 0.002 | 0.935 |  |  | 0.006 | 0.675 |  |  | 0.004 | 0.793 |
| HCStock | 0.019 | 0.085 | 0.006 | 0.583 | 0.006 | 0.608 | 0.019 | 0.108 | 0.007 | 0.523 | 0.019 | 0.105 | 0.024 | 0.045 | 0.006 | 0.598 |
| Investment | 0.076 | 0.080 | 0.066 | 0.115 | 0.066 | 0.116 | 0.076 | 0.078 | 0.065 | 0.124 | 0.076 | 0.079 | 0.072 | 0.096 | 0.066 | 0.117 |
| Population | 0.241 | 0.010 | 0.227 | 0.007 | 0.226 | 0.010 | 0.240 | 0.013 | 0.233 | 0.006 | 0.243 | 0.013 | 0.242 | 0.013 | 0.227 | 0.010 |
| Unemployment | 0.001 | 0.643 | 0.001 | 0.666 | 0.001 | 0.666 | 0.001 | 0.644 | 0.001 | 0.676 | 0.001 | 0.658 | 0.001 | 0.726 | 0.001 | 0.675 |
| Urbanisation | 0.238 | 0.081 | 0.231 | 0.066 | 0.232 | 0.076 | 0.239 | 0.090 | 0.232 | 0.065 | 0.244 | 0.082 | 0.214 | 0.142 | 0.234 | 0.070 |
| Observations | 104 | | 104 | | 104 | | 104 | | 104 | | 104 | | 104 | | 104 | |
| R2 Adjusted | 0.59 | | 0.62 | | 0.61 | | 0.58 | | 0.62 | | 0.59 | | 0.59 | | 0.62 | |
| F-Test | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 | |
| Schwartz | -4.05 | | -4.09 | | -4.05 | | -4.00 | | -4.14 | | -4.04 | | -4.05 | | -4.09 | |
| Log-likelihood | 273.11 | | 277.79 | | 277.79 | | 273.12 | | 277.73 | | 273.02 | | 273.09 | | 277.76 | |

Notes: Standard errors are robust. Dependent variable: average annual regional GDP growth from 1992-1990, 1994-1992, 1996-1994, 1998-1996, 2000-1998, 2003-2000, 2006-2003 and 2009-2006. Independent variables are all measured in 1990. Both cross-sectional and time fixed effects are included

the 6-year period. As suggested by Voitchovsky (2005) and also shown in chapter 3.2 for the Aysen region, this could be due to the fact that a singly inequality index, like the Gini-coefficient, captures the average of the effects of different parts of the income distribution. The human capital Gini-coefficient does not seem to have any stable impact on regional growth in the periods considered, contrary to Castello-Climent and Domenech (2002, 2008). Bottom-end inequality seems to be the most reliable determinant of all considered inequality measures, with the model only including p5010 as inequality variable performing best in the short and long run. Bottom-end inequality shows a positive influence in the short and medium run and a negative in the longest growth period considered, which is opposite to the results found by Voitchovsky (2005). Further evaluation of the time periods considered reveal that most inequality measures point to different effects between short term (2 and 4 years) and long term growth (6 and 19 years). In the short run inequality measures have an overall positive effect on regional growth, while in the long term these switch to negative effects, although this distinction is very sensitive to the different model specifications considered, especially in long run. Since these results are not stable, no claims can be made regarding short and long term effects (also because of the limited amount of observations in the long run). If any, they seem to be in accordance with e.g. Forbes (2000), who also found similar effects for the short run. Finally, there are clear signs of convergence between Chilean regions in all time spans considered, and next to initial GDP levels, investment is found to be the most important determinant of regional growth.

1. **Conclusion**

This research has focused on the possible relationship between the growth of Chilean regions in the period 1990-2009 the regional income distribution. The theories and empirical results discussed regarding this relationship show that economists have not yet agreed on whether this relationship is relevant for either growth or inequality and which econometric techniques should be employed. Chilean regions have exhibited very different growth patterns during the last decades and they also show great variation in inequality levels over time and across regions. There seems to have been a catching-up process of poorer regions in Chile in the period studied as there are clear signs of regional GDP convergence. Also, average income levels have almost doubled in the past 20 year resulting in significant poverty reduction. Most regions exhibit lower Gini-coefficient levels in 2009 than in 1990, but focusing on a single inequality index could be misleading. Therefore, also measures of top and bottom inequality have been analyzed. Since the inequality-growth debate started with Kuznets’s claim that inequality follows an inverted-U pattern and empirical results have not yet been conclusive on whether this pattern can be detected in the data, my first hypothesis as stated below was aimed at detecting if this relationship could be detected in the data at hand for Chile on a regional level.

*H1. Regional economic development and regional income inequality within Chile during 1990- 2009 can be characterized as part of an inverted-U-shaped pattern.*

This first hypothesis cannot be accepted as my estimations of a possible Kuznets curve do not point to the existence of such a curve during the last two decades. If anything, they point to the existence of a U-shaped pattern with inequality rising again in the final years of my sample, something also detected in for example the United States and the United Kingdom during the last decades. Numerous factors could be the cause of this lack of pattern between inequality and development. One reason could be the fact that Kuznets described a process of migration from the countryside to urban regions, while this process seems nearly ‘completed’ in the period considered in Chile, with urbanization rates of over 80%. Another reason could be that my data do not contain enough cross-sectional observations as well as long enough time series to detect this pattern. Possibly, the process described by Kuznets took place earlier in the last century, but this cannot be shown with the regional data available.

This lack of observations also seems to trouble my growth estimates and therefore one has to be cautious in drawing conclusions on possible causal connections from these results. My second hypothesis, regarding the effect of inequality in the income distribution on economic growth, also has to be rejected.

*H2. Regional income inequality in Chile has had a negative effect on regional economic growth during 1990-2009.*

Changing signs or estimations that are sensitive to the functional form used do not result in a clear negative sign of the relationship as hypothesized. The traditional growth variables included, such as investment levels and lagged regional GDP levels, do show the expected signs as common in the literature, both in the short and long term. There seem to be different effects for the long and short term when comparing the effects of the inequality measures on regional growth, with positive effects of inequality in the short term and negative in the long term, although these results are not very stable. As suggested by Voitchovsky (2005), focusing on different inequality indicators for parts of the income distribution seems to provide more stable results, but I find the opposite results for the effect of bottom and top-end inequality levels. Of all the inequality measures considered, the bottom-end inequality measure seems to be the most relevant in determining regional growth in Chile for this period. Overall, my results provide no clear indication that inequality is systematically related to growth or economic development as hypothesized.

As for my third hypothesis, changing the inequality variable to reflect educational inequality does not yield significant results. Therefore, my hypothesis as listed below cannot be confirmed.

*H3. Regional educational inequality in Chile has had a negative effect on regional economic growth during 1990-2009.*

The finding of Castello-Climent and Domenech (2002, 2008), that an inequality measure based on the distribution of education in a society is a more relevant determinant of economic growth than income inequality, does not hold for Chilean regions in the period studied. The four different growth spell lengths considered yield no confirmation of any significant and stable impact of the equality of education levels on regional growth.

Future research on the subject could be directed in many ways. Since my research focused on the subnational level, it can be argued that defining which subnational level should be studied is an arbitrary choice. Analyzing a lower aggregate level such as counties as for example in Rooth and Stenberg (2012), or focusing solely on urban and rural differences in growth patterns such as Fallah and Partridge (2007), could show different and more robust effects of inequality on growth. Furthermore, the effects of inequality in different parts of the income distribution on economic growth could also be used in future research in the field, to see if the findings of Voitchovsky (2005) could be reproduced using other datasets.

Also, the surrounding theories regarding for example credit market imperfections and political instability remain interesting to be explored in more detail. The specification used in my setup as in most setups in theempirical literature is not very informative regarding the different channels through which inequality might affect income. Possibly taking the different channels into more detailed consideration instead of estimating an overall relationship could shed new lights as to how different channels function and under what circumstances these theories depict economic reality.

Comparing subnational regions across nations could also be an interesting avenue for future research, although data comparability issues then do play a role when drawing conclusions regarding possible relationships. Initiatives such as the Luxembourg Income Studies, which tries to compile comparable inequality variables from different sources, could have a similar impact on the study of the relationship between inequality and growth as the Deininger and Squire dataset had in 1996. Other interesting research questions surrounding inequality and growth, such as what the effect of redistributional policies is on growth and inequality and if there are differences between poor and rich countries or regions, also remain to be explored.

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**Appendix 1. Map of Chilean regions**

Map of Chilean regions, numbers are the same as in earlier figures, R.M. stands for Region Metropolitana and is equal to Region 13 in the data.

Source: Wikipedia Online Encyclopedia, accessible at: <http://upload.wikimedia.org/wikipedia/commons/archive/6/61/20071014112837!ChileRegions.png>

I: Tarapacá

II: Antofagasta

III: Atacama

IV: Coquimbo

V: Valparaíso

VI: Libertador General Bernardo O’Higgins

VII: Maule

VIII: Bío-Bío

IX: Araucanía

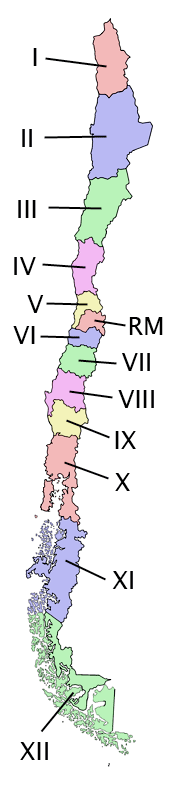
X: Los Lagos

XI: Aysén del General Carlos Ibáñez del Campo

XII: Magallanes y la Antártica Chilena

R.M.: Región Metropolitana

(Since 2007 there is also a Region XIV ‘Los Rios’, comprised of the northern part of Region X ‘Los Lagos’ and a Region XV ‘Arica & Parinacota’, located between the border of Peru and Region I ‘Tarapaca’.)



**Appendix 2. Additional Results**

*Panel least squares with time fixed effects, estimation of 2 year growth*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Panel with time fixed effects** | | | | | | | | | | | | | | | | |
|  | **1** | | **2** |  | **3** |  | **4** |  | | **5** | | **6** | | **7** | | **8** | |
|  | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** | **b** | | **p-value** | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** | **b** | **p-value** |
| Constant | 0.131 | 0.251 | 0.055 | 0.669 | 0.046 | 0.712 | 0.125 | 0.241 | | 0.077 | 0.549 | 0.140 | 0.166 | 0.059 | 0.741 | 0.047 | 0.705 |
| LnGDPpc | -0.014 | 0.093 | -0.012 | 0.140 | -0.012 | 0.148 | -0.014 | 0.092 | | -0.013 | 0.110 | -0.015 | 0.061 | -0.014 | 0.085 | -0.012 | 0.138 |
| Gini | 0.057 | 0.291 | 0.031 | 0.585 | 0.004 | 0.972 | 0.037 | 0.744 | |  |  |  |  |  |  |  |  |
| HC Gini |  |  |  |  |  |  |  |  | |  |  |  |  | 0.001 | 0.439 |  |  |
| P5010 |  |  | 0.034 | 0.053 | 0.035 | 0.052 |  |  | | 0.036 | 0.039 |  |  |  |  | 0.035 | 0.045 |
| P9075 |  |  |  |  | 0.010 | 0.690 | 0.007 | 0.784 | |  |  | 0.013 | 0.294 |  |  | 0.010 | 0.379 |
| HCStock | -0.002 | 0.770 | -0.006 | 0.346 | -0.005 | 0.345 | -0.002 | 0.778 | | -0.006 | 0.287 | -0.002 | 0.742 | 0.004 | 0.639 | -0.006 | 0.338 |
| Investment | 0.191 | 0.000 | 0.181 | 0.000 | 0.183 | 0.000 | 0.192 | 0.000 | | 0.181 | 0.000 | 0.194 | 0.000 | 0.187 | 0.000 | 0.183 | 0.000 |
| Population | 0.004 | 0.119 | 0.005 | 0.110 | 0.005 | 0.115 | 0.004 | 0.119 | | 0.005 | 0.035 | 0.004 | 0.061 | 0.004 | 0.098 | 0.005 | 0.077 |
| Unemployment | 0.000 | 0.706 | 0.000 | 0.752 | 0.000 | 0.698 | 0.000 | 0.667 | | 0.000 | 0.823 | 0.000 | 0.695 | 0.000 | 0.837 | 0.000 | 0.697 |
| Urbanisation | 0.030 | 0.316 | 0.032 | 0.314 | 0.030 | 0.324 | 0.029 | 0.324 | | 0.037 | 0.242 | 0.031 | 0.309 | 0.032 | 0.300 | 0.031 | 0.323 |
| Observations | 104 | | 104 | | 104 | | 104 | | | 104 | | 104 | | 104 | | 104 | |
| R2 Adjusted | 0.471 | | 0.487 | | 0.482 | | 0.466 | | | 0.492 | | 0.471 | | 0.470 | | 0.488 | |
| F-Test | 0.000 | | 0.000 | | 0.000 | | 0.000 | | | 0.000 | | 0.000 | | 0.000 | | 0.000 | |
| Schwartz | -4.191 | | -4.187 | | -4.145 | | -4.147 | | | -4.230 | | -4.190 | | -4.187 | | -4.190 | |
| Log-likelihood | 252.7498 | | 254.892 | | 255.016 | | 252.814 | | | 254.779 | | 252.721 | | 252.577 | | 255.014 | |

Notes: Standard errors are robust. Dependent variable: average annual regional GDP growth from 1992-1990, 1994-1992, 1996-1994, 1998-1996, 2000-1998, 2003-2000, 2006-2003 and 2009-2006. Independent variables are all measured in the initial growth year. Estimation with time fixed effects.

1. The source for all GDP data and related growth rates in my thesis is the Chilean Central Bank’s statistical database (unless stated otherwise), accessible at <http://www.bcentral.cl/bde/index.htm>. [↑](#footnote-ref-1)
2. The source for all Gini-coefficients and other inequality measures related to Chile and its regions are based on own calculations derived from the CASEN household surveys from 1990-2009. See chapter 3 for more on this data source and methods used to derive these inequality measures. [↑](#footnote-ref-2)
3. See Anand and Kanbur (1993) for a detailed derivation of this specification. Their paper also includes functional forms for 5 other inequality measures. Deininger and Squire (1998) utilize the functional form of Anand and Kanbur (1993) but state that utilizing the quadratic specification gives similar results. Note that now an inverted-U emerges if both and . [↑](#footnote-ref-3)
4. Kuznets was very cautious regarding his results, stressing that his dataset was incomplete and causality could be through different channels. “The paper is perhaps 5 per cent empirical information and 95 per cent speculation, some of it possibly tainted by wishful thinking” (Kuznets, 1955, p.23). See Moran (2005) and Kanbur (2000) for more on the subject. [↑](#footnote-ref-4)
5. See for more thorough surveys of the literature Aghion *et al*. (1999), Barro (2000), Bourguignon (2004), Galor (2011), Leoni and Pollan (2003) or Voitchovsky (2009). [↑](#footnote-ref-5)
6. See for example Barro (1991, 2000) for more on growth regressions. [↑](#footnote-ref-6)
7. See Benabou (1996) for a review of this early literature. [↑](#footnote-ref-7)
8. Convergence stands for the process of less wealthy countries (or regions for that matter) catching up with wealthier countries. In growth regressions this usually is tested by including a gdp-level term on the right hand side which is expected to have a negative sign. See for example Barro and Sala-i-Martin (1991) or any textbook on economic growth for more on this subject. [↑](#footnote-ref-8)
9. See for example Voitchovsky (2009) for an overview of the main results, estimation techniques and samples used. [↑](#footnote-ref-9)
10. ‘Regional’ refers to subnational levels, not an aggregation of countries. [↑](#footnote-ref-10)
11. The survey was also held in 1985 and 1987, but these are not strictly comparable with the other surveys, due to different methodological setup (Contreras, 2001; World Bank, 2002; Pizzolito, 2005a). The 2011 results of the survey have just been released, but since other (macro-economic) variables are not yet available for 2011, I will not use these in my thesis. [↑](#footnote-ref-11)
12. For more details regarding the subsequent surveys, sampling procedure, ECLAC’s adjustments and a discussion of the main critiques regarding survey setup and usability, see Worldbank (2002), Pizzolito (2005a) or Contreras (2001). Unfortunately, there is no comparison possible between raw and adjusted data, as raw data are not made available for analysis. [↑](#footnote-ref-12)
13. The specific base year (2003) was dictated by data availability regarding other variables such as GDP. [↑](#footnote-ref-13)
14. The calculation of an (relative) inequality measure at a regional level will of course not be affected by regional price adjustments, but on a national scale (with incomes adjusted per region) they are relevant. [↑](#footnote-ref-14)
15. There are various ways to derive the Gini-coefficient. This method seems the most practical given the data structure. See Yitzhaki (1998) for more on the subject. [↑](#footnote-ref-15)
16. For developing countries, the human-capital stock is usually measured over the population ranging from 15-65 years old, contrary to the measure for developed countries, where the range of 25-65 years old is usually used, see e.g. Castello-Ciment and Domenech (2002). [↑](#footnote-ref-16)
17. This could also be due to the fact that the urbanization rate according to the CASEN Household Survey is above 80% which also results in fewer observations from rural areas. Therefore, a few wealthy households residing in rural areas and participating in the survey could lift the observed mean income in these areas, not giving an adequate representation of the mean income of the whole population. [↑](#footnote-ref-17)
18. As of 2007, the country is divided in 15 regions, 52 provinces and 345 comunas. Since all data from 2007-2009 is available in both the old and new setup, while the data before 2007 do not permit analysis based on the new regional setup, I will ignore this administrative change in my thesis, and utilize the regional structure as it was before 2007. See appendix 2 for a map of the Chilean regions. [↑](#footnote-ref-18)
19. The high level of rural inequality in region 12 stems from the fact that only a few hundred observations are available to make up this Gini-coefficient, because rural dwellings are far apart in this immense southern region. Correcting for this factor would only be arbitrary so no corrections have been made and rural Gini’s will not be used in estimating regressions. [↑](#footnote-ref-19)
20. A System GMM as for example employed by Voitchovsky (2005) is not feasible with the limited amount of observations that are available, so it is not considered here. [↑](#footnote-ref-20)
21. Fixed effects are deemed more appropriate due to the Hausman Test, which, for all models mentioned, rejected H0 that the Random Effects estimator is more efficient. [↑](#footnote-ref-21)
22. Due to the switch in 2000 in the CASEN survey’s frequency from every two to every three years, ‘6 year’ growth spell represents two 6-year periods and one 7-year period, ‘4 year’ spell represents two 4-year, one 5-year and one 6-year period and ‘2 year’ spell represents five 2-year periods and three 3-year periods. See section 5.2 for the exact years used. [↑](#footnote-ref-22)
23. Using only time fixed effects (or time-dummies) does not yield notable results and these results are therefore not reported. [↑](#footnote-ref-23)
24. Results of the 2-year model using only time fixed effects are shown in appendix 2. The bottom-inequality measure P5010 has a positive effect on economic growth in these estimations, while all other considered inequality measures do not enter the model significantly. These results are therefore comparable to those discussed above. [↑](#footnote-ref-24)