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Factors influencing income inequality across urban Argentina (1998-2003)

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**Factors influencing income inequality
across urban Argentina (1998-2003)**

María Emma Santos

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ABSTRACT

This paper tries to disentangle the most relevant determinants of spatial inequality in the urban areas of Argentina. The analysis is restricted to the period 1998-2003. The study is performed with a Panel Data approach using a random effects model. Results suggest that human capital, measured by rates of education completion, is an important contributor to spatial inequality. High rates of primary education appear to reduce inequality while higher rates of secondary education appear to increase it. Labor market characteristics also play a role: urban areas with higher unemployment rates, higher returns to education and a lower percentage of people employed in the secondary sector tend to have higher levels of inequality. Also, dependency and the percentage of people with unsatisfied basic needs have increasing-inequality effects. Finally, there seems to be a relationship between inequality and the level of development, though not with a clear inverted-U pattern as hypothesized by Kuznets. Results are robust to different measures of inequality and different income specifications.

1. Introduction

Over the last four decades, and with considerable research, economists concluded that the distribution of income plays an important role in social welfare. Atkinson's theorem (1970) and extensions by Dasgupta, Sen and Starret (1973) and Shorrocks (1983) showed a direct link between Lorenz rankings and welfare rankings.¹ Because of these strong links with welfare, inequality is one of the most interesting topics in economic development.

Within any country, inequality exists between and within regions. Inequality between regions is called *spatial inequality*. Although the *between-regions* component tends to be small, this does not mean that it is an unimportant explanation of inequality. "*Spatial location is often not of interest itself but rather because of its association with many other important influences (...) Current*

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procedures assign all of these factors to location without trying to disentangle the associated influences.”
(Shorrocks and Wan (2005), p.10)

Latin America is one of the regions in the world with the highest level of inequality. However, until the mid-1970's, Argentina was the exception to the rule, with most people belonging to the middle-income class with a few rich and poor. Since 1974, the country has experienced persistent deterioration in the distribution of income. While many papers have studied the determinants of the overall level of inequality in Argentina in recent decades, they have rarely analyzed the factors that contribute to spatial inequality.² This paper focuses on spatial inequality and identifies some of those factors.

The paper provides evidence that education plays a very important role in the determination of spatial income inequality. Urban agglomerations with a high percentage of people who have completed primary education appear to have lower inequality, while urban areas with a high percentage of people who have completed secondary education show higher inequality. Urban areas with higher unemployment rates, higher returns to education and a lower percentage of people employed in the secondary sector tend to have higher levels of inequality. Areas with a higher percentage of people with unsatisfied basic needs and a higher percentage of households with indigenous members also show higher levels of inequality, although the effect of ethnicity is small. We also find association between spatial inequality and dependency and the level of development.

Section 2 presents a review of the literature on inequality determinants. Section 3 describes the data sources. Section 4 explains the measurement of inequality. Section 5 presents the basic features of inequality in Argentina. Sections 6 and 7 present the analytical model and the empirical approach. Section 8 presents the results. Finally, Section 9 provides policy implications and concluding remarks.

2. Literature Review

Bourguignon, Ferreira and Lustig (2005, p.10) distinguish two broad approaches to the study of inequality: the *macroeconomic* and the *microeconomic approach*. The first one uses aggregated data and regression analysis. The second one relies on microeconomic data, probit regressions and decomposition analysis.

The *macroeconomic approach* is usually applied to the study of international inequality determinants. The pioneer paper in this literature was Kuznets (1955) who hypothesized that in the process of development, inequality first rises and then declines. The original explanation for this theory argued that the process of economic development produces migration of the population from the agricultural sector to the industrial one. The initial shifts in population to the industrial sector lead to higher earnings among that small group of people, which increases the level of inequality. As more and more people move to the industrial-urban sector and the agriculture sector gets smaller, the ratio of the industrial wage to the agricultural wage decreases, decreasing the level of inequality.

Several papers tested the Kuznets' hypothesis. Some of the cross-country studies found support for the Kuznets' curve (Paukert (1973), Ahluwalia (1976) and Fields (1980)), but others found that by adding control variables to the model such as education (Bourguignon and Morrison, 1990) or regional dummy variables (Deininger and Squire (1998)), there is no support for the Kuznets' hypothesis. Using country-specific parameters, Deininger and Squire (1998) found that most countries under study show no U or inverted U-shaped relationship. In summary, there is no consensus on whether there is an inverted-U empirical regularity between inequality and income across countries or within countries over time. Moreover, even when empirical support is found for the Kuznets hypothesis, the low

R^2 usually obtained makes it clear that there are many other factors that are associated with inequality.

The study of the determinants of spatial income inequality within countries also belongs to the *macroeconomic approach*. The starting point of most of these studies is again the Kuznets hypothesis but many other variables have been suggested as potential determinants of spatial income inequality. These include industrial structure (Levernier *et al.*, 1995), city size (Long *et al.* 1977, Nord 1980), demographic characteristics (Nord 1982, Levernier *et al.*, 1995), education (Al-Samarrie and Miller 1967) and labor market variables (Dunford, 1996).

The papers by Trendle (2005) and Morrill (2000) are worth mentioning for their similarities with our study. Trendle (2005) evaluates the sources of cross-sectional variation in income inequality between local government areas, within the region of Queensland, Australia, with data from the 2001 Census. Using the Gini Coefficient as the inequality measure, he finds that the average regional income, the share of women in the workforce, the proportion of the population with post-school qualifications and unemployment are positively associated with inequality. Higher shares of employment in the construction industry tend to reduce inequality, while higher shares of employment in the mining industry tend to increase it. Morrill (2000) uses Census data to examine income inequality across states in the United States from 1970 to 1990 and also uses the Gini Coefficient as the inequality measure. He runs separate regressions for each year and one regression for the change in inequality in the period. He finds that high rates of labor force participation, manufacturing wages, unions, welfare support levels, urbanization and home ownership lowered inequality while higher rates of female-headed households, racial minorities, property income, dependence on military expenditures, service employment and farm activities increased inequality.

For Argentina, Gasparini *et al.* (2000) tested the Kuznets' hypothesis with a panel of 22 provinces' capital cities for the years 1990, 1992, 1994, 1996 and 1998. They used the Gini coefficient for per capita family income as the inequality measure and per capita electricity consumption of each province as a proxy for GDP per capita. They estimated both fixed and random effects models. Adding additional time-invariant variables such as education, the school dropout rate and the percentage of people with unsatisfied basic needs to the random effects model, they find support for the Kuznets' hypothesis.

The *microeconomic approach* is usually applied to the study of the determination of inequality within a specific country over time. For Argentina there are several recent papers that employ the microeconomic decomposition technique of Bourguignon, Ferreira and Lustig (1998). This methodology evaluates the impact of specific factors on the change in the income distribution between periods t and t' by simulating what the income distribution would have been in t' if the parameters of the earnings equation in t had been those of t' .

Using this methodology, Altimir *et al.* (2002) studied the Greater Buenos Aires region (GBA) for the period 1972-2000. They find that decreases in the labor force participation among households in the upper deciles of the distribution and increases in participation among households in the lower deciles lowered inequality. The increase in unemployment had an inequality-increasing effect of large importance in the subperiods 1980-1986 and 1990-1994. The change in educational structure had an equalizing effect while the increase in the dispersion in relative earnings by educational level contributed to an increase in inequality. In a similar study, Gasparini, *et al.* (2005) find that during the 1990's increases in returns to education and dispersion in the endowments or returns to unobservable factors and the fall in hours of work of less-skilled, low-income people were the dominating forces that increased inequality. The reduction in the gender wage gap, the increase in

unemployment and in average education of the population only had mild effects on the change in inequality.

Our paper follows the *macroeconomic approach*. The model is based on the paper by Gasparini *et al.* (2000) although the purpose of our paper is different. We do not focus on the empirical test of the Kuznets' hypothesis in Argentina but on the identification of a much broader set of spatial inequality determinants across urban agglomerations.

3. The Data

Inequality studies for other countries apply cross-sectional regression analysis with Census data. However, in Argentina, the data that allow this type of study are micro level data of the Encuesta Permanente de Hogares (Permanent Household Survey, EPH from now on)³, a survey that was conducted twice a year in Argentina by the National Institute of Statistics and Census (INDEC) in the months of May and October until May 2003.⁴ The survey was carried out in all the urban agglomerations of more than 100,000 people according to the 1991 census⁵, 28 cities in total. The use of these data imposes two limitations. First, the study is restricted to urban areas.⁶ Second, 28 urban agglomerations is a small number of observations over which to run cross-section regressions that allow one to identify spatial inequality determinants. We, therefore, develop and use a panel data set of the 28 cities over the period 1998-2003.

The urban agglomerations covered by the survey contain 71% of the total urban population in Argentina and 62% of the country's population. About 20,000 households and more than 61,000 individuals were randomly sampled. The urban agglomerations of the survey belong to six statistical regions: Greater Buenos Aires, Northeast, Northwest, Cuyo, Pampeana and Patagonica. We generated four inequality measures, the returns to education,

the rates of primary, secondary and superior education, the dependency index and the share of employed people in the secondary sector. The data on unemployment were provided by INDEC and were also calculated with the EPH data.

The data on the percentage of people with unsatisfied basic needs and per capita electricity consumption correspond to the department to which each urban agglomeration belongs.⁷ The percentage of people living in households with unsatisfied basic needs was obtained from the 2001 Census, and data on the total electricity consumption (Mega Watts Hour) were obtained from the Secretary of Energy of the Ministry of Economy in Argentina.

4. Measurement of Inequality

4.1 Inequality Measures

Based on conventional use in the empirical literature and on the properties of inequality measures, we chose the Gini Coefficient, the Theil 1 and Theil 2 Indices and the Coefficient of Variation (CV from now on) as our inequality measures. The Gini coefficient can be expressed as:

$$G = \frac{1}{2N^2\mu} \sum_{i=1}^N \sum_{j=1}^N |Y_i - Y_j|$$

where Y_i is the income of individual i , N is the total population size and μ is the mean income of the income distribution. The values of the coefficient range from 0 to 1; the higher the value, the higher the level of inequality.

Following the same notation, the Theil 1 measure is defined as:

$$T_1 = \frac{1}{N} \sum_{i=1}^N \frac{Y_i}{\mu} \ln\left(\frac{Y_i}{\mu}\right)$$

This measure ranges from 0 (for perfect equality) to $\ln(N)$ (for perfect inequality).

The Theil 2 measure -the mean logarithmic deviation measure- is defined as:

$$T_2 = \frac{1}{N} \sum_{i=1}^N \ln\left(\frac{\mu}{Y_i}\right)$$

This index is zero for the case of perfect equality and approaches infinity in the case of perfect inequality.

The CV is the square root of the variance divided by the mean:

$$C = \frac{1}{\mu} \sqrt{\sum_{i=1}^N (\mu - Y_i)^2 / N}$$

It ranges from 0 in the case of perfect equality to $\sqrt{(N-1)}$ in the case of perfect inequality.

These four inequality measures satisfy four basic axioms stated in the inequality measurement literature: (1) **symmetry** (the measure is unchanged if there is a permutation of incomes between two persons; this principle is also called the *anonymity* principle); (2) **replication invariance** (the measure is unchanged if the population is doubled, tripled, and so forth), (3) **mean independence** (the measure is unchanged if all incomes in the distribution are multiplied by a scalar); and (4) **Pigou-Dalton Principle** (the inequality measure increases with any regressive transfer). Because they satisfy these four principles, these measures belong to the class of measures of relative inequality which are Lorenz consistent (Anand, 1983). This means that whenever one distribution x Lorenz-dominates another distribution y , each of these measures will show a lower inequality value for x than for y . However, whenever the Lorenz criterion is not decisive over a pair of distributions, these inequality measures may differ in the assessment of inequality (Foster, 1985).

There are three other properties that a measure of inequality may satisfy: The first is **transfer sensitivity**, an idea introduced by Atkinson (1970) and formalized by Shorrocks and Foster (1987); this is based on the concept of a '*favourable composite transfer*', which consists of a progressive transfer at one part of the distribution and a regressive transfer of

equal size higher up. They define a measure of inequality as being transfer sensitive when a *favorable composite transfer* produces a reduction in inequality.

A second property is **additive decomposability**. This property is satisfied whenever the total income distribution is divided into subgroups and the weighted sum of the inequality measures *within* each group plus the value of the inequality measure *between* each group equals the value of the inequality measure of the whole distribution.⁸ This property allows identification of how much of total inequality is explained by a certain characteristic.

Finally, as decomposability is a strong requirement that only a reduced group of inequality measures satisfy, a less restrictive but related property can be required, which is **subgroup consistency**. This property just requires that if inequality rises in one subgroup and remains unchanged in the other subgroups, overall inequality must increase. If a measure is additively decomposable, it is subgroup consistent, but the converse does not hold.

The Gini coefficient is widely used in the empirical literature. It is a very direct measure of income differences, taking account of differences between every pair of incomes. It has a very easy graphical representation which is two times the area between the Lorenz curve and the line of absolute equality. However, the Gini coefficient is transfer-sensitive on the number of people between income levels and not on the size of the income levels; that is, a regressive transfer between two people has increasing impact on the Gini the greater the number of people apart the two individuals are. Also, the Gini coefficient is not additively decomposable,⁹ and it does not satisfy subgroup-consistency. (Sen and Foster, 1997).

Both Theil measures satisfy transfer sensitivity, subgroup consistency and additive decomposability. In particular, the weights needed for the within-inequality term for Theil 1 are the group income shares, $w_k = (n_k/n) (\mu_k/\mu)$, where k refers to the subgroup. The weights for the Theil 2 measure are the population shares, $w_k = (n_k/n)$ which is more intuitive because

the sum of the shares equals one. Finally, the CV gives exactly the same weight to transfers produced at different parts of the distribution, so it is not transfer-sensitive. However, the square of this measure is additively decomposable.

4.2 Empirical Measurement Issues

We calculate the four measures of inequality over per capita family income. Per capita family income is obtained by dividing total family income (which is the sum of all individual incomes in the household except for the income earned by domestic service) by the number of household members including domestic servants. Because the income (often in-kind) from domestic service is not measured, per capita income is downward biased.

All people belonging to a household where someone gave an invalid answer were excluded from the calculations.¹⁰ Valid zero incomes were not included in the calculations either, though including them does not change the coefficients significantly.

Misreporting of income is a well-known problem in household surveys. For the case of Argentina, Gasparini (1999) proposed a set of coefficients to adjust the different sources of income, but they were calculated with information from 1993 and have not been updated because more recent information on disposable income is unavailable. Therefore, we decided not to make this adjustment. Finally, inequality measures can be calculated with the equivalent household income which is obtained by dividing total family income by the number of equivalent adults in the household raised to 0.8 to adjust for economies of scale. When this adjustment is made, all inequality measures are reduced, since poorer families tend to be bigger, but the pattern of inequality does not change.

5. Inequality in Argentina

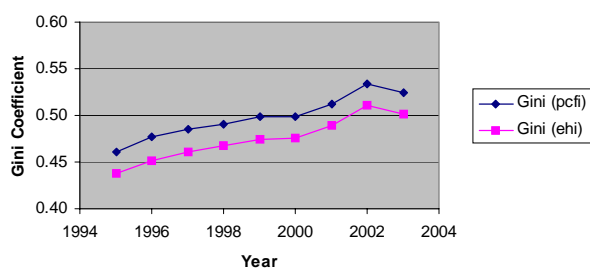
5.1 Inequality over time

The period 1998-2003 is part of a longer period over which inequality increased in Argentina. This longer period starts in 1974 when the first (independent) estimations of the Gini coefficient for per capita family income became available, but only for the GBA area. Over the 1980's, the Gini fluctuated, but there was an evident overall increase in inequality from the beginning of 1980 until the end of the decade. During the 1990s an increasing number of cities were progressively incorporated into the EPH. This allowed researchers to perform inequality estimation for a bigger number of urban agglomerations. This research showed an increase in inequality independent of the measures used.¹¹

Graph 1 presents the evolution of the Gini Coefficient calculated with two different income definitions: per capita family income (pcfi) and equivalized family income (efi). The patten over time for the other three measures used in this paper is the same. The graph starts in 1995. There is steady increase in inequality over time with a peak in 2002 after the December 2001 crisis and a decline after 2002. However, the overall increase in inequality between 1998 and 2003, which is the period under study, is relatively small.

As expected, the plot of the Gini calculated over household equivalized income is found below the plot using per capita family income. This is because equivalized household income considers the number of equivalent adults and not just the total number of family members. Because poorer families tend to be bigger, they count less. Also, this income measure corrects for economies of scale. However, the trends are the same.

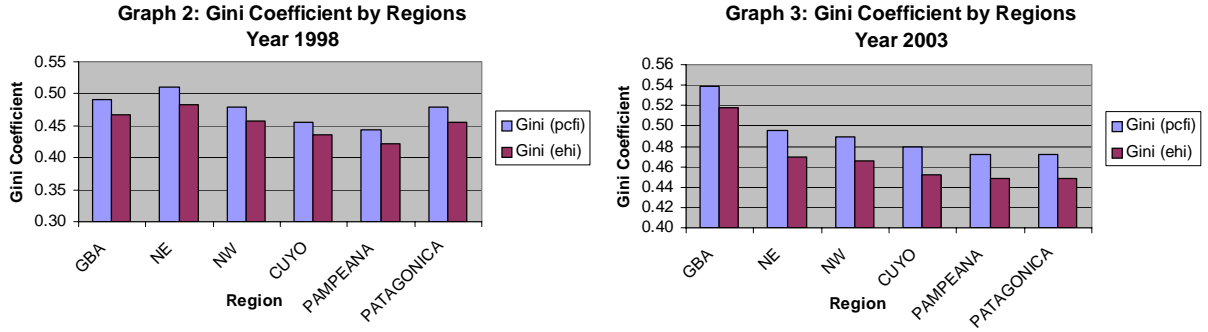
Graph 1: Evolution of the Gini Coefficient



Source: Own calculations based on EPH, May wave of each year.

5.2 Inequality across regions

Inequality across the six statistical regions changed over the period under analysis. Graphs 2 and 3 plot the Gini Coefficient of each region calculated with the two income specifications (per capita family income and equivalized household income) in the years 1998 and 2003. It is interesting to observe that the two income specifications do not significantly change the ranking of the regions. Second, inequality ordering between regions changed over the period. Although the rankings obtained with the other measures are not presented here, they show that in 1998, all inequality measures except for the CV ranked the NE as the region with the highest inequality. The second and third places were alternatively occupied by the GBA and the Patagonia region. The CV placed Patagonia first, followed by the NE and GBA. In the case of the Gini, the NW shared third place with Patagonia. For the two Theil measures and the CV, NW was always in fourth place. Finally, all measures agreed that the Pampeana region was the least unequal. In 2003, the ranking picture had changed. All inequality measures ranked GBA as the most unequal region, followed by the NE and NW regions. Cuyo was always in the middle, and Pampeana and Patagonia had the lowest inequality. The Patagonia region had the lowest level of inequality and NW climbed to a higher rank.



Source: Own calculations based on EPH, May wave of each year.

5.3 Inequality between and within cities and regions

The overall level of inequality in Argentina can be decomposed to see what percentage of inequality can be attributed to within-city inequality and between-city inequality. The same procedure can be done for regions (the six statistical regions defined in Section 3). This decomposition can be conveniently done with the Theil 2 Index since the weights for the within-inequality component sum to one. Specifically, the decomposition is defined as follows:

$$T_2 = T_2[W] + T_2[B] = \sum_{k=1}^K \left(\frac{n_k}{n} \right) \left[\left(\frac{1}{n_k} \right) \sum_{i=1}^{n_k} \ln \left(\frac{\mu_k}{Y_{ik}} \right) \right] + \left(\frac{1}{n} \right) \sum_{k=1}^K n_k \ln \left(\frac{\mu}{\mu_k} \right)$$

where k represents the subgroup (in this case a city or a region) from 1 to K , Y_{ik} is the income of individual i belonging to subgroup k , n_k is the total number of people in subgroup k and n is the total population size. Finally, μ is the total mean income and μ_k is the subgroup k mean income. The value of the between index over the value of the total index indicates the percentage of total inequality that can be attributed to between-group inequality. A similar index measures the within part. Table 5.1 shows this decomposition for cities and region for the years 1998 and 2003.

TABLE 1: SPATIAL DECOMPOSITION OF INEQUALITY IN URBAN ARGENTINA

Year	Category	No Groups	Total Inequality (Theil 2 pcf)	Between %	Within %
1998	Urban Agglomeration	28	0.43	6.4	93.6
	Region	6		6	94
2003	Urban Agglomeration	27*	0.51	5.6	94.4
	Region	6		5	95

Source: Own calculations based on EPH, May wave of each year.

*In May 2003 EPH could not be done one of the urban agglomerations (Santa Fe) due to severe floods.

From the table, it can be seen that, over the period 1998-2003, the between-city component represents around 6% of total inequality. This is consistent with empirical evidence found for other countries. Shorrocks and Wan (2005) examine empirical evidence from different countries and conclude that the between-group component in spatial decompositions averages 12%, with a minimum of 0% and a maximum of 51%. Only in the case of the urban-rural divide does the between component tend to be bigger. The between-city inequality does contribute to total inequality in Argentina, and its causes have not yet been explored.

6. Analytical Model

Considering empirical findings for other countries and the characteristics of the Argentinean economy during the period under analysis, we hypothesize that spatial income inequality is determined by four major sets of characteristics of cities. First, we include variables that capture the characteristics of the *labor market* and determine earnings, the most important income source for most families. Second, we include variables that measure *human capital assets*. Third, we include the *demographic characteristics* of the population. Finally, the level of inequality of a specific community might also be conditioned by the overall *level of development*

in that community; we can use this variable to test the Kuznets' hypothesis. All together: $I_{it} = (L_{it}, A_{it}, D_{it}, Z_{it})$ (1) where I_{it} is the level of inequality of the urban agglomeration i in period t , L_{it} and Z_{it} are vectors of characteristics of the labor market (such as unemployment and returns to education) and level of development, A_{it} is the vector of human capital assets and D_{it} the vector of demographic characteristics for each urban area.

7. Empirical Approach

7.1 Selected Variables

The dependent variable –inequality– is measured with the Gini Coefficient, the Theil 1 and Theil 2 Indices and the CV. Models with each of the four measures are compared.

Labor Market Characteristics

The variables representing the labor market characteristics of each urban agglomeration in each year (L_{it}) are the unemployment rate, the returns to education and the share of the employed in the secondary sector. The unemployment rate is the percentage of unemployed people over the total active population (employed plus unemployed). It is likely to be negatively related to inequality since the income of most households at the lower end of the distribution in urban areas is comprised of labor earnings. Argentinean cities show wide variation in unemployment.

Variability in returns to years of education across urban agglomerations may also influence spatial inequality since they are positively related to human capital investment and future earnings. During the 1990s returns to education in Argentina increased, especially for the group with university education.¹² Returns to education were estimated from the traditional Mincer earnings function, corrected for sample selection bias. For workers in each city and year, the log of hourly earnings was regressed on years of education, age (proxy for

experience), age squared and a dummy variable for gender. The selection equation also included the number of children younger than 6 years and the number of children between 6 and 18 years old and dummy variables for marital status and for the presence of non-labor income.¹³ The coefficient on years of schooling in the separate city-year regression was the rate of return in city k in year t .

The third labor market variable is the share of workers employed in the secondary sector, which is calculated as the number of people employed in the secondary sector¹⁴ over the total number of employed people. Most people in urban areas are employed either in the secondary or tertiary sector. However, given that Argentina is a developing country, the tertiary or ‘services’ sector typically includes a broad range of activities, including those in the informal sector. Therefore, a higher share of people employed in the secondary sector indicates a higher degree of formality and a higher proportion of better-paid jobs.

Assets

The distribution of assets clearly affects the distribution of income. The more diversified the income sources are, the lower the impact of a crisis from a specific source of wealth. A complete model should consider all types of assets when analyzing income inequality. However, data availability imposes a restriction on the kind of assets that can be considered for the estimation of equation (1). Specifically, the assets A_{it} vector is restricted to only one type of asset: education. Three measures of education were constructed: the proportion of people who completed primary school, the proportion of people who completed secondary school and the proportion of people who completed university or tertiary education (grouped in ‘superior education’). The first rate was calculated over the population older than 12 years, the second, over the population older than 18 years and the third was calculated

over the population older than 22 years. The lower bound ages are the minimum possible ages at which a person can complete the corresponding level of education.

We expected the rate of complete primary education to have a reducing-inequality effect. However, we did not have a clear prediction on how the rate of secondary education impacts inequality because this rate is much lower than the rate of complete primary education in all cities, never exceeding 53%. This suggests that at most half of the population is able to get the higher returns that secondary education generates. Finally, we expected tertiary and university education to have a positive impact on inequality, since it is the most selective level of education and the one that provides the highest returns.

Demographic Characteristics

Several demographic features determine spatial income inequality. However, not all of them are equally relevant in Argentina. The Argentinean population is quite homogeneous in terms of race and ethnicity. Among native Argentines only descendants from indigenous groups can be considered to have a different ethnicity, and they represent a very small fraction of the population; only 2.8% of total Argentinean households have one or more indigenous or indigenous-descendant members. However, as there are certain regions of the country where the presence of indigenous groups is more important, a variable defined as the percentage of households with at least one indigenous member was included as one of the elements in vector D_{it} . The values used correspond to the departments where each city belongs and are provided by the 2001 Census; they do not change over time.

Gender is another potential source of spatial income inequality, though perhaps not very significant for the period under analysis. Considering that labor earnings constitute the

main income source, it is worth noting that in Argentina, the hourly wage gender gap decreased over the 1990s and stabilized close to equality at the end of the decade.¹⁵

Finally, the other included variable in vector D_{it} was the Dependency Index which is related to the age-distribution of the population. It was calculated for each city in each year as the number of people younger than 15 years old and older than 65 years old over the total population. With a weak system of social welfare and pensions, the higher the number of people of non-working age per working-age person, the lower the per capita family income tends to be. Combined with the fact that families at the lower end of the income distribution tend to be bigger, dependency may contribute to inequality.

Level of Development Characteristics

By including a measure of the level of development of each city in the model we can test the Kuznets' hypothesis. Following Gasparini *et al.* (2000), electricity per capita was taken as a proxy for GDP per capita. There are no reliable estimates of GDP for each of the provinces or urban agglomerations. In each year, the per capita electricity consumption (MWh) of each department is calculated as the total electricity consumption of the department divided by the estimated population. The population values were estimated assuming a constant annual population growth rate which was calculated from the population values for each department in the 1991 and 2001 Censuses. There were eight cases in which the total provincial electricity consumption was not disaggregated by departments, so the value was estimated in the following way. First the ratio of the electricity consumption of the department to the total provincial consumption was calculated for each of the years for which this information was available. Then the average of these ratios was taken, and this

average was multiplied by the total provincial consumption. The approach gives us a close estimate of the electricity consumption in that department in that year.

Vector Z_{it} is composed of per capita electricity consumption, its square and a dummy variable that controls for the cases where electricity consumption was estimated. Two other variables were included in this vector: a poverty measure defined as the percentage of people with unsatisfied basic needs and the politics of the city. The poverty measure is calculated by INDEC with every Census since 1980. A person is considered poor if she lives in a household that satisfies one or more of the following characteristics: (1) more than three people per room, (2) substandard housing, (3) without any type of water closet, (4) children of school age who do not go to school, (5) household with four or more people per employed member and whose family head has a low level of education (second grade of primary school at the maximum). The higher the percentage of people with unsatisfied basic needs the lower the level of development. The values for this variable correspond to the department level and are provided by the 2001 Census. This is a time-invariant variable.

The second is a dummy variable equal to one if the last two elections of governors in the province were won by the Peronista Party, which is supposed to be more concerned about people at the lower end of the income distribution. We expect that provinces that have elected leaders from this party would support economic and social policies designed to reduce inequality, and inequality would therefore tend to be lower. Because the party in power influences the development policies in each urban area, this political variable belongs to the group of *level of development*. Table A.1 in the Appendix presents the summary statistics for all the variables.

7.2 Estimation Technique

Using the variables discussed above, the baseline estimating equation is written in a double log form as:

$$\text{Log}(I_{it}) = \alpha_{it} + x'_{it} \beta + e_{it}, \text{ with } i = 1, \dots, 28 \text{ and } t = 1998, \dots, 2003 \quad (2)$$

where $\text{Log}(I_{it})$ is the log of each of the four inequality measures (Gini Coefficient, Theil 1 Index, Theil 2 Index and CV). The vector of explanatory variables includes the log of all of the following variables: unemployment rate, returns to education, share of employed people in the secondary sector, rates of primary, secondary and superior education, dependency index, percentage of households with indigenous members, per capita electricity consumption and its square, percentage of people with unsatisfied basic needs and a set of dummy variables that control for: the cases where the electricity consumption was predicted; the urban agglomerations belonging to provinces with Peronista governors; and region with GBA as the base category. One dummy variable groups the two northern regions (Northeast and Northwest) together, one groups the two center regions (Pampeana and Cuyo) together and one includes the South region (Patagonia). These variables capture all the fixed regional characteristics that could not be addressed by the other explanatory variables.

The regression was estimated assuming that the individual specific constant terms are randomly distributed across the urban agglomerations, so that $\alpha_{it} = \alpha$ and $e_{it} = \mu_i + v_{it}$, where μ_i is the random disturbance characterizing the i -th urban agglomeration and is constant over time. In theory, the *random-effects* specification should only be used when the cross-sectional units are randomly drawn from a large population, which is not the way the 28 cities of the survey are chosen. However, other reasons justify this specification.

The main reason is that the purpose of this paper is to study inequality between the different urban agglomerations of Argentina. Given that the survey is available only for 28

cities, estimating equation (2) with a cross section specification would leave too few degrees of freedom. On the other hand, estimating it with a *fixed-effects* model, which assumes that differences across urban agglomerations are fixed and can be captured through differences in the intercept ($\alpha_{it} = \alpha_i$), would eliminate all the variation between urban agglomerations, which is precisely the interest of this paper. Also, it would mean a loss of 28 degrees of freedom, which is not a minor loss. The panel is composed of a relatively large number of cross-section units (28 cities) over a relatively short time span (6 years). Therefore, most of the variation is between units and not over time-within each unit. This makes the random-effects model a better specification, since its estimator is a weighted average of the within and between-units estimators (Greene, 1993). Also, although cities are not randomly chosen, they belong to a much bigger population of cities in the country. Finally, the households included in the survey in each city are randomly selected.

8. Results: Determinants of spatial inequality

Table 2 presents the estimation results of equation (2) using the inequality measures calculated with per capita family income. Results with the inequality measures calculated with the equivalized family income are not reported because they are very similar. Given that the model was specified in double log terms, all coefficients can be interpreted as the elasticities of each specific inequality measure with respect to each of the explanatory variables. The overall goodness of fit of the model is quite good in most of the cases; the R^2 is 0.64 in the case of the Gini, 0.55 with the Theil 1, 0.61 for the Theil 2. The lowest R^2 (0.33) is obtained with the CV. The R^2 Between in each case is high, ranging from 0.91 for the Gini to 0.80 for the CV.

The three variables that capture labor market characteristics are very significant in most cases and have the expected signs. The unemployment rate has a significant positive coefficient. The unemployment elasticity of each inequality measure ranges from 0.117 (with the Theil 2) to 0.037 (with the Gini). Returns to education are also significant and positive in all cases. The returns elasticity of each inequality measure was in all cases higher than the unemployment elasticity, ranging from 0.183 (with the Theil1) to 0.078 (with the Gini). As expected, the higher the share of employed people in the secondary sector, the lower the level of inequality. Only in the CV regression was this variable not significant. The elasticity ranges from -0.197 (with the Theil 1) to -0.116 (with the Gini).

Among the group of variables accounting for human capital assets, the rate of primary education has a strong decreasing-inequality impact, with an elasticity going from -2.432 (with the CV) to -0.756 (with the Gini). However, the rate of secondary education appears to have an increasing-inequality impact; the coefficient ranges from 0.535 with the Theil 1 Index to 0.206 with the Gini Coefficient. The reducing-inequality effect of the rate of primary education agrees with the intuition that the higher the percentage of people who finish primary school, the higher the percentage of people who can earn a reasonable income for living. The positive effect of secondary education is expected for two reasons. First, while the rate of primary education ranges from 77% to 94% with a mean of 87%, the rate of secondary education never exceeds 53% and has a mean of 42%. Secondary education is more selective with respect to ability and access. Second, the secondary education has a higher marginal return than the primary education.¹⁶ Finally, the proportion of people with tertiary or university degrees was significant only for the case of the Theil 2, and its effect was negative. This result was not expected because tertiary education is even more selective than secondary education.

Regarding the demographic characteristics, the dependency index had the expected positive coefficient and was significant in all regressions, except for the CV. In the models with equalized family income, the income measure took family structure into account, and dependency had no additional impact on inequality. It is interesting to note that the percentage of households with indigenous members was significant and positive in all cases except for the Theil 2 Index. This is a city-level, time-invariant variable, and the effect is small in magnitude; the elasticity ranges from 0.023 with the CV to 0.006 with the Gini.

The log of per capita electricity consumption, our proxy for GDP per capita, was significant and positive in all cases, ranging from 0.262 (the Theil 1 Index) to 0.096 (the Gini). The square of electricity consumption had a negative coefficient in all cases, as the Kuznets' inverted-U hypothesis predicts. However, the variable was not significant in any model. This suggests that the higher the level of electricity consumption, the higher the level of inequality, which agrees with evidence found for other countries such as Australia (Trendle, 2005). The overall level of development of an urban area does play a role in the determination of inequality.¹⁷

The percentage of people with unsatisfied basic needs was significant and positive for all inequality measures except for the CV. The endogeneity problem that can be argued in this case (inequality can cause poverty) is weakened by the fact that this poverty measure is mostly related to characteristics of the shelter, which tend to be stable over time. Income inequality immediately affects income poverty, but the effect over 'structural' poverty, as captured in this measure, is not immediate.

The political development variable is not an important determinant of spatial inequality. The negative coefficient suggests that urban areas where the Peronista Party was elected for two consecutive periods experienced a reduction in inequality. However, the

variable was significant in only two cases (with the Gini Coefficient and the Theil 1 Index), and only at the 10% significance level. This can be understood from political economy theory: a democratic society with a two-party system converges in the type of politics offered by each party, which tends to satisfy median-voter demands in the long run.¹⁸

Finally, the regional dummies were significant in all regressions except for the CV model. The South region systematically had lower inequality compared to the Greater Buenos Aires area. The urban agglomerations belonging to the Center region also had lower inequality than the GBA, but the regional impact was smaller than for the South. The North region was significantly different from GBA only in two of the four regressions, again with a negative coefficient. The lower level of significance of this regional dummy was expected since the levels of inequality in northern cities are quite similar to those observed in the GBA.

TABLE 2: INEQUALITY REGRESSIONS WITH PER CAPITA FAMILY INCOME

Dependent Variable (in Log)	GINI COEFFICIENT		THEIL 1 INDEX		THEIL 2 INDEX		COEFFICIENT OF VARIATION	
<i>Independent Variables (in Logs)^a</i>	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error
Intercept	-1.455***	0.375	-2.828***	1.026	-2.188***	0.828	-1.634	1.288
<i>Labor Market Characteristics</i>								
Unemployment	0.037***	0.012	0.084***	0.032	0.117***	0.026	0.071*	0.041
Returns to Education	0.078***	0.018	0.183***	0.048	0.157***	0.039	0.149**	0.060
Share of Secondary Sector	-0.116***	0.033	-0.197**	0.090	-0.270***	0.073	-0.047	0.113
<i>Assets</i>								
Rate of Primary Education	-0.756***	0.199	-2.204***	0.544	-1.763***	0.439	-2.432***	0.683
Rate of Secondary Education	0.206***	0.071	0.535***	0.195	0.522***	0.157	0.519**	0.245
Rate of Superior Education	-0.041	0.036	-0.110	0.098	-0.156**	0.079	-0.126	0.122
<i>Demographic Characteristics</i>								
Dependency Index	0.267**	0.105	0.625**	0.288	0.488**	0.232	0.450	0.361
Households with Indigenous Members	0.006**	0.002	0.020***	0.007	0.007	0.006	0.023***	0.009
<i>Level of Development Characteristics</i>								
Electricity	0.096***	0.029	0.262***	0.080	0.164**	0.064	0.231**	0.100
(Electricity) ²	-0.039	0.029	-0.134*	0.081	-0.035	0.065	-0.139	0.101
Dummy Electricity	-0.038**	0.017	-0.081*	0.047	-0.088**	0.038	-0.055	0.058
Poverty	0.095***	0.024	0.205***	0.065	0.190***	0.052	0.125	0.081
Peronista Party	-0.019*	0.010	-0.052*	0.027	-0.025	0.022	-0.054	0.034
<i>Regional Dummies</i>								
North	-0.052*	0.029	-0.116	0.079	-0.140**	0.064	-0.103	0.099
Center	-0.059**	0.027	-0.127*	0.074	-0.135**	0.059	-0.086	0.092
South	-0.110***	0.032	-0.236***	0.087	-0.208***	0.070	-0.145	0.109
N obs	167		167		167		167	
N groups	28		28		28		28	
R ² Within	0.213		0.121		0.279		0.041	
R ² Between	0.908		0.899		0.900		0.796	
R ² Overall	0.640		0.555		0.615		0.330	

***=significant at the 1% level, **=significant at 5% level and *=significant at 10% level.

9. Policy Implications and Concluding Remarks

In the last three decades, inequality has become a problem in Argentina, and, although there has been considerable research on the factors that led to the increase in inequality, there has been little evaluation of the extent to which inequality differs across regions. Although there is a general belief that the northern regions and the Greater Buenos Aires area have higher levels of inequality, the causes and consequences of this spatial inequality have not been

isolated. In this paper we try to measure the importance of spatial inequality and to determine the causes of regional disparities.

To address these questions, we constructed a panel data set of 28 cities in Argentina for the period 1998-2003. The performance of the economy during this period was poor. 1998 was a recession year and the situation worsened over the following years ending in an economic breakdown in December 2001. The Convertibility Plan¹⁹ was eliminated at the beginning of 2002 and by the end of that year the economy started to show signs of recovery. These facts make this period suitable for the study of spatial inequality because inequality was high and rising before and after the economic shocks.

We found that from 1998-2003, inequality between urban agglomerations explains about 6% of total inequality in household income, which is in line with findings for other countries. We hypothesized that the inequality between urban areas is determined by labor market characteristics, human capital assets, demographic characteristics and the level of economic development. We expected unemployment, return to education, poverty and dependency index to have positive impacts on inequality, while the rate of primary school completion and the share employed in the secondary sector to have negative impacts. We did not have a clear prediction on the impact of secondary and tertiary education and per capita electricity consumption, which proxied for GDP per capita. We expected a positive effect of the indigenous population and a negative effect for the influence of the Peronista party in local politics.

We found that the four sets of city characteristics did play a role in the determination of spatial inequality. Unemployment and returns to education are indeed positively associated with inequality, but it is the composition of employment in the city (share of employed people in the secondary sector) that has the greatest (negative) impact on

inequality. Primary school completion seems to reduce inequality, but secondary school completion increases it; tertiary education plays a small role between cities inequality. Education is a strong determinant of spatial inequality. The level of development and poverty are of lesser importance than education and sectoral employment. The demographic characteristics have a small impact on inequality, but we do find that cities with a larger indigenous population have higher income inequality than other cities.

These results are important because they suggest that an urban agglomeration is more unequal not just because it is located in the North for example, but because, compared to other cities, it is likely to have a lower proportion of the population with primary education, a less developed industrial sector, and higher unemployment. It may also have a high level of structural poverty and dependency and is affected by the presence of indigenous groups in the local population. These findings are relevant from a policy perspective because they provide the policy maker with information on regional conditions that contribute to inequality and can be affected by regional policies strategies.

In general, we think that policies to reduce spatial inequality between urban areas in Argentina should focus on the promotion of primary education in the cities with the lowest completion rates. However, primary school rates are already quite high and the efficacy of this policy will not have much impact in the long run. On the contrary, there seems to be more room for the development of the secondary sector with a focus on employment creation. This sector contains a great variety of industries and each urban area can promote different industries that fit the geographical constraints. Policies to tackle structural poverty and to integrate the indigenous population into the mainstream labor market would also help to reduce spatial inequality. Finally, although secondary school completion seems to increase inequality, we do not recommend a diminution in efforts to expand education at this level

and higher. Inequality is only one aspect of welfare, and the benefits that accrue from a better educated population far outweigh the cost in terms of inequality.

Notes:

1. Atkinson's Theorem states that if social welfare is the sum of individual utility functions, strictly concave in income, then, given two income distributions x and y , both with the same total income, if x Lorenz dominates y , the value of the welfare function in x is higher than in y . (Atkinson, 1970). Dasgupta, Sen and Starret (1972) proved that the theorem is valid in the less strict case of non-additive social welfare functions, non-individualistic social welfare functions and S-concave individual utility functions. Shorrocks (1983) extended the validity of the theorem to compare income distributions with different mean incomes with the Generalized Lorenz Curve concept.
2. This may be due to the fact that it was not until the 1990s that the official household survey had reasonable National coverage.
3. This is because the Census data does not provide information on incomes.
4. From then on, a new version of this survey, the EPH *Continua*, was administered quarterly.
5. These agglomerations are the Greater Buenos Aires, the capital cities of the 23 provinces with their surrounding urban areas (Gran Catamarca, Gran Tucumán-Tafí Viejo, Jujuy-Palpalá, La Rioja, Salta, Santiago del Estero-La Banda, Corrientes, Formosa, Gran Resistencia, Posadas, Gran Mendoza, Gran San Juan, San Luis-EL Chorrillo, Gran Córdoba, Gran La Plata, Gra Santa Fe, Gran Paraná, Santa Rosa-Toay, Comodoro Rivadavia-Rada Tilly, Neuquén-Plottier, Río Gallegos, Ushuaia-Río Grande), and four other cities belonging to different provinces: Bahía Blanca-Cerri, Mar del Plata-Batán, Concordia and Gran Rosario. In 2003, three other cities were included in the survey, but they were not included in this study.
6. This does not make the results less representative since, according to the 1991 Census, 87% of the Argentinean population lives in urban areas.
7. The country is divided in 23 provinces, each of which is sub-divided in departments.
8. To calculate the *between-group* inequality the income distributions of each subgroup are 'smoothed' replacing the income of the individual in each group by the mean income of that group.
9. As long as there is overlap in the incomes of the subgroups, it is always necessary to add a residual term to the sum of *within* and *between* inequality to compensate in the equation. (Sen and Foster, 1997).
10. An example of an invalid answer is someone who works for pay but reports zero income. This does not introduce bias in the estimation since, as Gasparini (2004) points out, the percentage of observations with non-missing and valid household income stabilized around 90% in the 1990s.
11. For a thorough analysis of the evolution of inequality see Gasparini *et al.* (2000) and Altimir *et al.* (2002), among others.
12. See Gasparini *et al.* (2005) and (2000).
13. The years of education completed by each person were estimated from information on the maximum level of education the person attended and on the last year completed at this level. Other studies using the same survey data measured education through dummy variables for the maximum level of education achieved.
14. The industries in the secondary sector are: textiles and shoes, chemical products, petroleum refining and nuclear power, metal products, machinery and equipment, other manufacturing, utilities, construction, wholesale and retail trade.
15. For statistics on this issue see Gasparini (2005). For the period 1998-2003, the value of this variable for the urban agglomerations ranges from 0.8 to 1.3, and about 50% of the observations are around one. This variable was included in earlier versions of this paper and was not significant. We eliminated it from the current model.
16. Evidence for this is provided in Gasparini (2005).
17. The dummy variable that controls for the cases in which electricity consumption was predicted was significant and negative in most of the cases.
18. Although there are more than two political parties in Argentina, apart from Peronismo and Radicalismo, the others represent minorities of voters.
19. With the Convertibility Plan the exchange rate between Argentinean pesos (A\$) and US dollars (US\$) was fixed at A\$1=US\$1. In January 2002 the Argentinean currency was devaluated and the exchange rate system was changed to a floating one.

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Appendix

TABLE A.1: SUMMARY STATISTICS

Variables	N observations	Mean	Standard Deviation	Minimum	Maximum
<i>Inequality Measures:</i>					
Gini (pcfi)	167	0.477	0.035	0.340	0.549
Gini (efi)	167	0.453	0.034	0.348	0.527
Theil 1 (pcfi)	167	0.424	0.078	0.190	0.708
Theil 1 (efi)	167	0.378	0.071	0.203	0.610
Theil 2 (pcfi)	167	0.419	0.066	0.218	0.588
Theil 2 (efi)	167	0.372	0.060	0.224	0.537
Coefficient of Variation (pcf)	167	1.198	0.267	0.635	2.936
Coefficient of Variation (ehi)	167	1.101	0.234	0.675	2.512
<i>Labor Market Characteristics:</i>					
Unemployment	167	13.919	4.868	1.9	25.5
Returns to Education	167	0.092	0.063	0.037	0.887
Share of Secondary Sector	167	33.828	4.720	21.713	45.691
<i>Assets:</i>					
Rate of Primary Education	167	86.738	3.138	76.569	94.055
Rate of Secondary Education	167	42.274	4.791	29.671	52.890
Rate of Superior Education	167	11.067	1.953	70.721	17.084
<i>Demographic Characteristics:</i>					
Dependency Index	168	39.552	2.012	34.81	44.643
Households with Indigenous Members	168	3.389	2.502	1	10.5
<i>Level of Development Characteristics</i>					
Electricity	168	1.337	0.523	0.658	3.590
Poverty***	168	15.44	5.164	8.3	25.8
Peronista Party	168	0.607	0.49	0	1

Notes: For all the inequality measures pcfi means that the measure was calculated with the per capita family income, while efi means that it was calculated with the equalized family income.