The role of federal transfers in regional convergence
in human development indicators in Argentina

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Abstract

In this paper we analyse regional convergence between Argentine provinces
in well-being indicators for the period 1970-2001. More specifically, we examine
the role of regional public policy in reducing the development gap between the
provinces. We find strong evidence of conditional convergence in well-being
indicators. However, we find no evidence that redistributive transfers from the
federal government to the provinces have had a positive effect on convergence
in these indicators. In fact, we find that for some schooling, health and housing
measures, the effect of federal transfers on improvement rates has been negative.

Keywords: Regional Convergence; Fiscal Transfers; Distributional Dynamics

JEL Codes: H77

Abstract

Este trabajo analiza el fenómeno de convergencia en variables de desarrollo
humano y bienestar entre las provincias argentinas para el período 1970-2001.
Se estudia la hipótesis de convergencia condicional medida en términos de las
transferencias fiscales a las provincias. Los resultados sugieren que ha existido
convergencia condicional entre las provincias argentinas en la gran mayoría de
los indicadores de desarrollo. Sin embargo, no existe evidencia significativa de
que las transferencias del gobierno central a las provincias hayan promovido
la convergencia; por el contrario, para algunos indicadores de escolarización,
salud y condiciones de vivienda, se encuentra un efecto negativo de las trans-
ferencias federales sobre las tasas de crecimiento de los indicadores.

Palabras Claves: Convergencia; Transferencias fiscales; Dinámica distributiva

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1 Background and motivation

One of the central goals of a federal form of government is to help easing the regional disparities in social and economic outcomes between the provinces. To this end, most federal countries have specific financial arrangements between the different tiers of government aimed at ensuring homogeneous levels of public goods provision across the regions. In most cases, these arrangements involve some form of tax-sharing and vertical transfers according to different criteria, but usually along both devolutive and redistributive bases.

Several federal countries have designed alternative schemes for implementing these tax-sharing agreements. In Brazil, both regional states and municipalities receive transfers from the federal government1. In Australia, federal transfers are critical to state budgets representing as much as 50% of total revenues. The largest transfer is that corresponding to the proceeds of the goods and services tax (GST) followed by other specific transfers2. Similarly, the unconditional Equalization Transfer in Canada accounts for more than 80% of total federal transfers to the provinces. In Argentina, most intergovernmental fiscal relations take place under the Régimen de Coparticipación Impositiva which introduces criteria for vertical and horizontal distribution of funds3. Even non-federal countries often have some form of financial arrangements between the central and local governments. One recent example is the significant changes in intergovernmental relations in China introduced in 1994 when the Chinese government engineered the Tax-Sharing System (TSS) reform aimed at improving the efficiency of sub-national spending and reducing horizontal inequalities4

While this topic has often attracted the attention of scholars, it has only in recent years become more actively researched due to several reasons. Firstly, the fact that several countries have moved towards more federal forms of government in the last 30 years has prompted scholars to analyze these and other related topics in more de-

1There are several different programmes but the most relevant are the Fundo de Participação dos Estados e do Distrito Federal (FPE) a scheme through which the federal government allocates money to the Brazilian Estados in a clear redistributive fashion whereby the poorer northern and northeastern States receive nearly 85% of the total fund while the rest goes out to the richer, southern States. Additionally, there is also the Fundo de Participação dos Municipios (FPM) which accounts for as much as 40% of total municipal revenues, and it is also structured on redistributive criteria.

2There are two central types of transfers to the states and territories; the General Purpose Payments (GPP), which consist of automatic untied transfers and the Specific Purpose Payments (SPP), which consist of earmarked funds for specific areas such as health, education, transport and housing.

3Although the current implementation of the Régimen de Coparticipación Impositiva was agreed in 1988, the tax-sharing agreements and transfers between the federal government and the provinces have existed for almost 80 years.

4After the 1994 reform, taxes are classified in three categories: central, local and shared taxes between the central and local governments. Alongside with two separate tax administration systems, the government created a third scheme by establishing the tax rebate system and the equalization transfer system based on the relation between fiscal capability and expenditure needs of local governments. The Chinese TSS reform is explained in more detail in (Zhang and Martinez-Vazquez, 2003).
tail. Additionally, the growing importance of regions as clusters of economic activity has also highlighted the relevance of inter-governmental financial relations. Finally, although only a small number of countries are federally organized by law, they use up around half of the earth’s surface area and their citizens make up more than 40% of the world’s population. Furthermore, a large part of the literature is focused on studying the economic and political determinants of federal transfers while the strand that focuses on the economic and social effects of transfers has been given less attention. Our paper contributes to this latter literature by means of investigating the role of federal transfers in regional convergence across a wide range of social and wellbeing indicators.

There are several studies that examine the relationship between federal transfers and economic convergence between the sub-national units. (Coulombe and Lee, 1995), (Coulombe and Lee, 1998), (Kaufman et al., 2003) find a positive effect of transfers on convergence for Canadian provinces while (Rodríguez, 2006) finds no significant effect. The evidence is also mixed for the Australian case. While (Ramakrishnan and Cerisola, 2004) concludes that there is no significant impact of transfers on convergence during the 90’s decade, (Rangarajan and Srivastava, 2004) find a positive relationship. There are only a few other studies based on other federal countries. In a recent study, (Martinez-Vazquez and Timofeev, 2010) find a negative effect of federal transfers on regional economic convergence in the Russian federation. Similarly, (Bagchi, 2003) finds that regional disparities have increased in India during the last 50 years despite the persistence of federal transfers to the regions. Some recent studies [(Maciel et al., 2008), (de Oliveira, 2008)] suggest that transfers to states and municipalities have had a positive effect on the process of regional convergence in Brazil.

Similarly, some recent studies have examined the role of transfers from the central government on regional convergence in non-federal countries and other spatial units resembling a federal arrangement. Recent contributions include work on China by (Shuanyou and Hongxia, 2003), (Heng, 2008), and (Candelaria et al., 2009) which find that inter-governmental transfers have not been beneficial towards easing regional inequalities in recent decades. (Ferreira Dias and Silva, 2004) use transfers from the central government in Portugal and finds no significant association with regional convergence. Finally, there is a growing literature on the effects of vertical transfers from the European Union to member countries; these transfers are usually channelled through the Structural and Cohesion Funds and are found to be positively correlated with convergence [(Cappelen et al., 2003)]7.

Despite the existence of a long-standing mechanism of inter-governmental transfers in Argentina, there has been little work on the effect of government transfers on

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5 This recent interest on the effect of inter-governmental transfers has also been fueled by the experiences of some of the most heavily populated countries which, are either federal by law (India and the Russian Federation) or share some trademark federalist traits.

6 It should be noted, however, that while convergence across Brazilian regions seems to have taken place at different subperiods in recent decades there is no evidence of long-term trend towards regional convergence.

7 More recent papers have found that this positive effect is cancelled out when other control variables are included [(Checherita et al., 2009), (Dall’erba and Gallo, 2008)].
economic and social outcomes from a convergence perspective. This is surprising considering the amount of work devoted to studying the convergence phenomenon [(Elías, 1995), (Elías and Fuentes, 1998), (Willington, 1998), (Utrera, 1998) (Utrera and Koroch, 2000), (Garrido et al., 2002), (Marina, 2001), (Ramón-Berjano, 2002), (Figueras et al., 2003), and (Figueras et al., 2004)]. Most of these studies, however, tend to reject the hypothesis of absolute convergence across Argentine provinces. In contrast, most of these papers suggest that Argentine provinces tend to converge to their own stationary state supporting the hypothesis of conditional convergence. In other words, once one accounts for control variables that reflect differences between the regions other than the level of the variable of interest in the convergence equation, the coefficient for the GDP variable becomes significant –this variable is the literacy rate in (Utrera and Koroch, 2000) but often the investment-to-GDP ratio and the population growth rate are also used.

While these studies are concerned with convergence in income levels, a growing number of studies have focused on convergence in indicators of well-being and human development [(Easterly, 1999), (Easterlin, 2000), (Kenny, 2005), and (Branisa and Cardozo, 2009)]. In this work, our main goal is to evaluate the extent to which public policy from the central government has contributed to alleviating regional disparities in human development in Argentina. We are only aware of one previous study that analyses convergence in this type of indicators, namely (Porto, 1994). (Porto, 1994) finds evidence of absolute convergence in human development indicators but no evidence of absolute convergence in income. Interestingly, the author finds a positive effect of redistribute fiscal policy on convergence in human development measures. Our contribution in this paper is twofold: firstly, we analyze regional convergence in measures of well-being and human development using both approaches to convergence and secondly, we analyse the role of federal fiscal policy for convergence across regions in human development.

The paper is organised as follows. The next section provides some theoretical insights that motivate the choice of our approach. In section 3 we describe the data and analyze the distributional dynamics of the selected indicators. Section 4 lays out the econometric specification and proceeds to estimation of the baseline models. Section 5 concludes.

8Other papers analyse convergence by different economic activities [(Figueras et al., 2004), (Figueras et al., 2003)] and also the extent to whether σ-convergence has taken place [(Ceña Delgado and Russo, 2000)].

9It is often argued that the correlation between income measures and development measures is hardly straightforward and linear. Furthermore, some authors observe that while convergence in income has often proved difficult to achieve between developed and developing countries, the gaps in human development and well-being indicators have been gradually decreasing.
2 Fiscal transfers, public expenditure and the Dutch disease

As we mentioned in the previous section, the evidence suggests that Argentina provinces are not converging (in absolute terms) in economic conditions [(Porto, 1994; Porto, 1996), (Elías, 1995), (Utrera, 1998), (Marina, 2001), and (Ramón-Berjano, 2002)]. In fact, not only have most relevant studies failed to find a negative and significant sign for the $\beta$ coefficient, but also this can be quickly, albeit less rigorously, perceived from the trends presented in Figure 1. The upper line shows the evolution of the ratio of the five richest provinces to the five poorest provinces while the bottom line shows the GDP ratio between the richer half and the poorer half. Unsurprisingly, both ratios have increased over time which actually suggests that there has been a worsening in regional income inequalities over the last four decades.

![Figure 1: Evolution of regional GDP ratios between rich and poor provinces. Source: Own elaboration based on selected data](image)

However, it is possible that, while the income gap between the provinces has not been reduced, provinces have come closer in terms of other indicators which may reflect wellbeing and living standards more adequately. This is particularly relevant to us in this paper since we are most interested in studying the role of public policy in helping overcome long-standing differences in development levels. More specifically, since federal public policy, in this paper measured strictly in terms of transfers per capita to the regional governments, is likely to affect public spending by the regional governments it is possible that some development variables –like infant mortality rates, educational levels and child undernourishment- are also affected to some extent.

Automatic transfers can be considered as a form of an unconditional grant to the gov-
ernments in that there are no restrictions on how the money is ultimately allocated. But since they account for a large part of provincial revenues, these are often used to finance public expenditures and other purposes. However, even if these transfers increase public spending, there is no guarantee that they will effectively contribute to higher incomes or better living standards. Furthermore, the fact that these transfers are automatic and unconditional may pose additional problems due a possible weakening of accountability incentives by the provincial governments\textsuperscript{10}. Additionally, because of their nature, these transfers are designed to include some redistributive component in their allocation which is meant to reduce regional inequalities across various dimensions; given that these transfers have been persistently higher for some of the poorer regions, it is desirable to analyse their effectiveness in terms of selected measures.

The theoretical underpinnings of the previous considerations are rooted in the traditional literature of the so-called transfer paradox in a static setting [(Brecher and Bhagwati, 1982), (Bhagwati et al., 1983), (Yano, 1983)] and in a dynamic setting [(Galor and Polemarchakis, 1987), (Haaparanta, 1989) and (Cremers and Sen, 2008) and the more recent political economy of federalism and inter-governamental transfers. A recent literature has also suggested that this phenomenon may be associated with a Dutch-disease-like phenomenon working at the sub-national level [(McMahon, 1996), (Paldam, 1997), (Capello and Figueras, 2007)]. More specifically, we argue that it is possible that unconditional transfers from the central government are used in a way that provides spending capacity for the regional governments but affects the possibilities for long-term growth due to the averse incentives it creates for private investment and production. One application of this phenomenon focusing on its impact on the regional labour markets is (Capello et al., 2009) who find that a higher level of transfers per capita increases the wage premium paid by the public sector relative to the private sector which leaves it facing a stronger pressure in the regional job market.

As can be clearly seen from the scatterplot in Figure 2, high transfers per capita are associated with higher number of public officials per capita which would in principle suggest that, at least partly, these transfers are finding their way into more public spending at the regional level\textsuperscript{11}. Similarly, Figure 3 shows a similar scatterplot considering transfers per capita and the average personnel expenditure, measured as the ratio of total expenditures in personnel to the total number of public officials. Again, the graph shows a positive association between higher transfers per capita and higher average personnel expenditure, although the relationship does not appear as clear as in the previous graph.

\textsuperscript{10}In this sense, other transfers, such as capital or extraordinary transfers, may be associated with greater external control and/or tighter accountability constraints. On the other hand, since these transfers are often discretionary and, in many cases, politically motivated, the implications for accountability may not be that straightforward.

\textsuperscript{11}Several observations were excluded from the scatterplot due to their level of transfers per capita being abnormally high, in fact much higher than their mean value over the period. These cases are Formosa and Jujuy in 2002, Catamarca, La Pampa and Tierra del Fuego in 2003 and Rio Negro and San Luis in 2005.
Figure 2: Transfers per capita and public officials per 1000, 1987-2009. Source: Own elaboration from Dirección Nacional de Coordinación Fiscal con las Provincias.

Figure 3: Transfers per capita and average public expenditure in personnel, 1987-2009. Source: Own elaboration from Dirección Nacional de Coordinación Fiscal con las Provincias.
Table 1: Variable coding and definition

| Variable | Description |
|----------|-------------|
| escprim | Primary school enrollment ratio |
| escsec | Secondary school enrollment ratio |
| analfa | Illiteracy rate |
| nbi | Unsatisfied basic needs |
| espvid | Life expectancy at birth |
| mortm | Maternal mortality rate every 10000 live births |
| morti | Infant mortality rate every 1000 live births |
| vivinc | Percentage of deficient dwellings |
| hacina | Ratio of housing overcrowding |
| copa | Automatic transfers per capita. |

3 Methodology and data

There are essentially two different approaches to measuring convergence. The original approach, due to (Barro, 1991), (Barro and i Martin, 1991; Barro and Sala-i Martin, 1992a) and (Sala-i Martin, 1996), is concerned with both $\beta$- and $\sigma$-convergence. This approach, also known as the classical approach to convergence tests for $\beta$-convergence by regressing the average growth rate of the variable of interest on its initial value. A negative and significant coefficient indicates the existence of convergence. On the other hand, $\sigma$-convergence studies how the dispersion of the variable of interest evolves over time. If the coefficient of variation tends to decrease over time, there is evidence of $\sigma$-convergence. The second approach is known as the distributional approach to convergence and it originated with the work of (Quah, 1993; Quah, 1996; Quah, 1997). Rather than exploring measures of position and dispersion, this approach focuses on the distributional dynamics of the data. The specific methodology consists in estimating kernel densities for variables relative to the national average.

Our data come from different sources. The census data for all the human development and well-being indicators are from the Censo Nacional de Población y Vivienda for the years 1970, 1980, 1991 and 2001. The child and maternal mortality annual data are from the Dirección de Estadísticas e Información de Salud, Ministerio de Salud de la Nación. Data on federal transfers to provinces are from the Dirección Nacional de Coordinación Fiscal con las Provincias and complemented with data from (Porto, 2004). Due to data availability, we use data only for automatic transfers. These transfers are channeled through three different regimes: the most important are those comprised in the general regime, or Régimen de Copartipación and then there are two additional sources of automatic transfers corresponding to special regimes. We believe this is justified for two reasons. Firstly, these transfers amount to around 76% (see Table 2 of the total transfers to the provinces and each transfer fund is significantly larger than those corresponding to non-automatic transfers. Secondly, since most of the automatic transfers are not earmarked –also around 76% of total automatic transfers– they are particularly relevant to testing our hypothesis that higher transfers may be harmful to economic and social outcomes since these funds

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12 This approach is used to test for both absolute and conditional convergence.
are not tied to any specific type of spending. The coding and brief description of our variables are given in Table 1. For a full description of variables, coverage and data sources see Table 12 in Appendix 6.

Table 2: Composition of total transfers to provinces, 2010

| Concept                                              | Amount    | %  |
|------------------------------------------------------|-----------|----|
| Unconditional automatic transfers (Coparticipación)  | 67992.52  | 47.6 |
| Unconditional automatic transfers (Specific regimes) | 15023.17  | 10.5 |
| Conditional automatic transfers (Specific regimes)   | 26325.17  | 18.4 |
| Current transfers (National budget)                  | 16801.60  | 11.8 |
| Capital transfers (National budget)                  | 13231.90  | 9.3  |
| Transfers due to regional promotion regimes          | 3538.40   | 2.5  |
| **Total**                                            | **142912.76** | **100** |

Data in millions of Argentine pesos. Source: Ministerio de Economía

Before testing for \( \beta \)-convergence using an econometric model, it is useful to study the evolution of the dynamics of the distribution of the different variables\(^{13}\). There are several methods of looking at the evolution of the convergence in the dispersion of values, but we look at the behaviour of the empirical distributions over time. This is usually done through non-parametric kernel density estimates of the different variables. In order to study the distributional dynamics, we follow the approach used by (Branisa and Cardozo, 2009). The results for the univariate kernel density estimation are presented in Figures 4 to 7.

In Figures 4 to 7 the distribution of selected indicators are drawn in terms of the value of the variable relative to the national average\(^{14}\). By construction, provinces fall above (below) zero when the value for the selected indicator is higher (lower) than the national average\(^{15}\). Figure 4 clearly shows that there has been a decrease in the dispersion of primary school enrolment rates for the period considered. This is illustrated by a decrease in the distance between both ends of the distribution making it more squeezed around its mean value in the latter periods. The evidence for the evolution of dispersion across provinces for analfa and nbi is not conclusive; although there seems to be a slight hint of a decrease in dispersion over time, the shape of the distribution for different years is very similar suggesting anything but persistence in data dispersion. In the case of morti, the estimated kernel densities do not suggest any indication of a decrease in the dispersion across provinces. It is also interesting to note the existence of distributions with two or more modes for some indicators.

\(^{13}\)This is important for the reasons explained in (Quah, 1996). In particular, since \( \beta \)-convergence is only a necessary but not sufficient requirement for the existence of \( \sigma \)-convergence, it is important to examine the dynamics of the distribution of variables over time.

\(^{14}\)By working with relatives to the national average, we abstract from shifts in the distribution due to long-term increasing (decreasing) trends in the mean values. Due to space limitations, we only present these distributions for selected variables. The kernel densities for all the variables are available from the authors upon request.

\(^{15}\)This is the case for those indicators where a higher value means an improvement; the opposite direction applies to the cases where a higher value represents worsening in the indicator, such as the mortality rates and poverty line measures.
Table 3: Coefficients of variation and confidence intervals

|          | escprim 1970 | escprim 1980 | escprim 1991 | escprim 2001 |
|----------|-------------|-------------|-------------|-------------|
| cv       | 5.15        | 2.97        | 2.12        | 1.29        |
| 95% CI   | 3.85-6.74   | 1.68-4.53   | 1.24-3.28   | 0.83-1.85   |
| escsec   |             |             |             |             |
| cv       | 24.76       | 15.30       | 14.38       | 14.24       |
| 95% CI   | 19.40-31.62 | 11.34-20.13 | 11.08-18.70 | 11.48-17.84 |
| analfa   |             |             |             |             |
| cv       | 46.74       | 47.27       | 51.15       | 54.33       |
| 95% CI   | 35.36-57.82 | 34.66-61.70 | 38.69-66.63 | 41.15-70.75 |
| nbi      |             |             |             |             |
| cv       | 34.19       | 36.71       | 37.13       |             |
| 95% CI   | 25.18-44.57 | 29.85-45.41 | 30.89-45.14 |             |
| espvid   |             |             |             |             |
| cv       | 3.30        | 1.75        | 2.03        |             |
| 95% CI   | 2.54-4.24   | 1.40-2.20   | 1.60-2.60   |             |
| mortm    |             |             |             |             |
| cv       | 48.48       | 67.37       | 75.32       |             |
| 95% CI   | 37.08-61.98 | 48.58-93.25 | 56.86-101.13|             |
| morti    |             |             |             |             |
| cv       | 26.35       | 22.01       | 29.05       |             |
| 95% CI   | 20.69-33.72 | 17.29-27.90 | 23.07-36.86 |             |
| vivinc   |             |             |             |             |
| cv       | 40.45       | 62.99       | 65.39       |             |
| 95% CI   | 32.62-50.16 | 32.25-112.90| 47.97-90.05 |             |
| prop     |             |             |             |             |
| cv       | 14.56       | 6.46        | 6.22        |             |
| 95% CI   | 12.11-17.58 | 5.44-7.83   | 4.85-7.98   |             |
| hacina   |             |             |             |             |
| cv       | 47.57       | 44.28       | 52.03       |             |
| 95% CI   | 36.62-60.90 | 33.28-56.93 | 41.66-64.90 |             |

The coefficient of variation is defined as \( \frac{sd}{\text{mean}} \times 100 \) where \( sd \) is the standard deviation and \( \text{mean} \) the arithmetic mean of the variable. Due to the small sample size, we report bootstrapped confidence intervals using a bias-corrected and accelerated (BCa) percentile confidence approach. The number of replications is 999.
Figure 4: Changes in the distribution of escprim across provinces

and years suggesting the possibility of convergence clubs; this is particularly the case for escprim and analfa in 1980, and in the case of nbi for the year 2001.

It is also useful to complement the information provided by the estimated kernel density with the evolution of the coefficient of variation for the different variables. The results are reported in Table 3. According to the table, the dispersion in the distribution has decreased over time for the cases of escprim, escsec, espvid, morti, prop and hacina while it has increased for analfa, nbi, mortm and vivinc. It can also be observed that, aside from the cases escprim and prop, there has been an increase in the dispersion for all the indicators from 1991 to 2001, despite the fact that the average per capita transfers during this period was higher for most of the provinces.

Another way at looking at the distributional dynamics is to estimate a bi-variate kernel using information for the distributions at two different points in time. This is usually illustrated through the joint kernel density estimate shown in a 3-dimensional plot. Since it is often easier to infer the dynamics of the distribution from a 2-dimensional plot, we also provide the corresponding contour plots. The densities and contour plots are included in the Appendix from Figure 9 to 16. If a large part of the probability mass is clustered around the 45-degree diagonal, then the evidence suggest persistence in the distribution and a changes in the dispersion otherwise. From these graphs, it would appear that there appears to be persistence in the distribution for the selected variables, particularly in the cases of nbi and morti. However, there seems to have occurred some changes in the relative positions of provinces from 1970 to 2001 and particularly in the case from 1970 to 1991 for the escprim variable; the position of the points in Figures 9 and 10 suggest that several provinces which were
below the national average in 1970 (negative value of the logarithm) had changed their relative position in the distribution 1991 and 2001 (positive value of the logarithm in these years). Similarly, there seem to have been some changes in the dynamics of the distribution of $analfa$ although the graphical inference is less clear than in the $escprim$ case.

4 Testing for $\beta$-convergence

4.1 Conditional convergence in full period

Although it is often customary to test for both absolute and conditional convergence, in this paper we are mostly interested in testing for the latter. The reason is that despite the fact that the distinction between absolute and conditional convergence becomes less relevant at the state/regional level [(Barro and Sala-i Martin, 1992b)], there are sharp differences in the level of federal transfers to the Argentine provinces. Since these transfers are a key source of income for the provinces, it is likely that the level of transfers, particularly the average level of transfers to the region for a given period, could affect its steady state. We use the following standard convergence equation expanded to include our variable of interest:

16In most cross-national convergence studies starting with (Barro, 1991), there are usually controls for variables that could potentially affect the steady states of different countries such as the ratio of investment to GDP, and the like
Figure 6: Changes in the distribution of $nbi$ across provinces

Figure 7: Changes in the distribution of $morti$ across provinces
\[ \Delta Y_{i,0,t} = \alpha + \beta \ln(Y_{i,0}) + \gamma \ln(TR_{i,0,t}) + \epsilon_i \]  

(1)

where \( \Delta Y_{i,0,t} \) is the average annual growth rate of variable \( Y \) between censuses in years 0 and \( t \) for province \( i \); \( \ln(Y_{i,0}) \) is the logarithm of the value of variable \( Y \) in the initial year 0 for province \( i \); \( \ln(TR_{i,0,t}) \) is the average of automatic transfers between years 0 and \( t \) for province \( i \).^{17}

The regressions for the different variables for the overall period are presented in Table 4. Since we are interested in investigating the effects of public policy on the achievement of convergence—thus testing for conditional convergence—all the models include a control for public policy, in this case, the amount of automatic per capita transfers. Regressions testing for absolute convergence in socio-economic indicators can be found in Table 5 in the appendix.

Prior to the interpretation of our results, it is important to note the different scaling and measurement of the human development variables. In some cases, as with \( esdprim, esdsec, espvid, \) and \( prop \) a higher value of the ratios implies an improvement alongside this dimensions. For all the other cases, \( analfa, nbi, mortm, morti, vivinc \) and \( hacina \), since these measure the ratio of the population with specific deficits to the total population, a higher value of the ratio implies a deterioration of this variable. This has implications for the interpretation of the coefficients. Firstly, for the \( \beta \)-coefficient, regardless of whether higher or lower values represent improvements, the regression coefficient on the initial value of the variable has to be negative for convergence to exist.\(^{18}\)

From the table, it can be observed that the \( \beta \)-coefficient in almost all the regressions is negative and statistically significant suggesting that provinces with worse standards of well-being and human development have improved at a faster pace than provinces with higher standards across these dimensions. For the school enrolment variables, \( escprim \) and \( escsec \), the coefficients are statistically significant at the 0.01 level. The \( \beta \)-coefficient is also negative and highly statistically significant for the life expectancy variable \( espvid \). For the mortality variables, while both have a negative sign only the

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\(^{17}\)We also considered two alternative ways to control for the effect of fiscal transfer by using the value of transfers per capita in the initial year, 0 and by using the average annual growth rate of transfers per capita during years 0 and \( t \). Since we are interested in analyzing the effect of the evolution of transfers on the convergence across several well-being measures, we believe that both period averages in levels and growth rates are most suitable for our purposes. The regression tables using alternative measures are provided in the Appendix.

\(^{18}\)This can be illustrated with a simple example. Suppose \( Y \) is the variable we are interested in testing for convergence where a higher value implies a better performance. Then, convergence would require lower initial values for \( Y \) to be associated with higher positive growth rates (higher \( \Delta Y \)). Suppose now \( Y \) is a variable where a lower value implies a better performance. Then, convergence would require higher initial values for \( Y \) to be associated with lower negative growth rates (lower \(-\Delta Y\))—or higher growth rates in absolute value. In both cases, we see that the implied sign is negative. Now, suppose \( X \) is a control variable, as public transfers in our case. If \( Y \) is a variable where a higher value implies a better performance, then a positive coefficient on \( X \) implies that a higher \( X \) is associated with a higher (positive) \( \Delta Y \) (improvements in \( Y \) over time). Contrarily, if \( Y \) is a variable where a lower value implies a better performance, then a negative coefficient on \( X \) implies that a higher \( X \) is associated with a lower (negative) \( \Delta Y \) (improvements in \( Y \) over time).
Table 4: \( \beta \)- conditional convergence, 1970-2001

|          | escprim | escsec | analfa | nbi    | espvid | mortm | morti | vivinc | prop | hacina |
|----------|---------|--------|--------|--------|--------|-------|-------|--------|------|--------|
| copa0170 | 0.000   | 0.002  | -0.003 | (0.000)| (0.002)| (0.002)|       |        |      |        |
| escprim  | -0.029* | (0.002)|        |        |        |       |       |        |      |        |
| escsec   | -0.036* | (0.004)|        |        |        |       |       |        |      |        |
| analfa   |         | 0.003  | (0.002)|        |        |       |       |        |      |        |
| copa0180 | -0.010* | (0.002)| 0.000  | 0.025* | 0.002  | -0.010| 0.001 | -0.003 |      |        |
| nbi      | 0.007*  | (0.002)|       |        |        |       |       |        |      |        |
| espvid   |         |        | -0.022*| (0.005)|       |       |       |        |      |        |
| mortm    |         |        |        | -0.021*| (0.007)|       |       |        |      |        |
| morti    |         |        |        | -0.016 | (0.009)|       |       |        |      |        |
| vivinc   |         |        |        |        | 0.004  | (0.007)|       | -0.042*|      |        |
| prop     |         |        |        |        |        |       |       |        |      | -0.003 |
| hacina   |         |        |        |        |        |       |       |        |      | (0.005) |

\( R^2 \) and adjusted \( R^2 \) are in parentheses. Independent variables are in logs. The time period is 1970-2001 for the variables \( \text{escprim, escsec, y analfa} \) and 1980-2001 for all the other variables. In both cases, observations are for census data available every 10 years. The variables \( \text{copa0170 y copa0180} \) are measured as the simple average of transfers per capita for the periods 1970-2001 and 1980-2001 respectively. * denotes significance at \( p < 0.05 \)
maternal mortality variable is statistically significant—the coefficient for morti is only significant at the 0.10 level. Only in two cases—analfa and vivinc—we fail to find a significant coefficient with a negative sign. In the case of the unsatisfied basic needs measure, nbi, the coefficient is actually positive suggesting that the provinces have tended to diverge in the levels of this indicator; this complements the previous evidence of an increase in the dispersion of this measure.

On the other hand, the coefficient for the variables capturing public policy, copa0170 and copa0180, are highly sensitive to the well-being indicator used. The coefficient is not significant for any of the schooling variables, escprim, escsec, y analfa, but it is negative and highly significant for the nbi indicator. In addition to the evidence for the $\beta$-coefficient for nbi, this would suggest that per capita transfers have actually had a positive effect on the rate of improvement of nbi therefore helping the process of regional convergence. Contrarily, the coefficient associated with the maternal mortality variable, mortm, is positive and significant. From our discussion in the previous paragraph, this implies that transfers per capita are associated with lower rates of improvement alongside this dimension.

### 4.2 Conditional convergence in sub-periods

As we suggested earlier, it is desirable to test the convergence hypothesis for the different sub-periods available. This is relevant since the overall sample extends over a period where there were significant changes in the regional economic structure and in the federal public policy towards the regions. This is illustrated in Figure 8 which follows the evolution and composition of automatic transfers per capita over time. Two trends are clearly visible in the graph; first, there is a gradual increase in transfers from the federal government and second, that several provinces—including Catamarca, Chaco, Formosa, La Rioja among others—have received ever-growing transfers per capita while the amount of transfers per capita for other provinces, such as Buenos Aires, Mendoza, Santa Fe and Neuquen, has remained stable or even decreased over the 40-year period. For these reasons, we find it useful to provide the results for the convergence regressions using data for different subperiods. In particular, we explore the convergence hypothesis for the periods 1970-80, 1970-91, and 1991-01.

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19It is important to note that provinces improve their situation when this indicator decreases. Since a positive sign suggests that those provinces starting out with the lowest levels of nbi have seen reductions (improvements) in this indicator come by at a faster pace than those provinces with the highest levels for the nbi variable.

20The graph also shows that transfers per capita in 2001 were lower for most provinces than for the year 1991. This is most likely due to the worsening economic situation that spiraled into the economic and social collapse at end of 2001. Using year 2000 instead, the graph would show an increase in the amount of transfers per capita with respect to 1991.
We start by analysing conditional convergence for different subperiods in the schooling variables. Table 5 and 6 present the results for conditional convergence using 1970 and 1980 as the initial years respectively. The first three columns of Table 5 are the models for the 1970-1980 period. In this case, the convergence hypothesis is supported only for the secondary school enrollment, escsec. The coefficient for the primary school enrollment, escprim, is negative but not significant. However, the coefficient for the public policy variable is significant and positive which suggests a positive effect of transfers on the rate of improvement in this indicator. There are no significant changes for the analfa variable as compared with Table 4 although the coefficient is negative in this case but still not significant. In the last three columns, the pattern is similar to those for the 1970-1980 sub-period and in fact the coefficient for the secondary school enrollment retains its sign and significance level. Interestingly, the coefficient for the public policy variable, is positive and significant (albeit very small) which suggests a positive effect of federal transfers. These differences in the sign and significance levels of the public policy variable for the sub-periods contrast with the results for the overall period where public policy was found to have no association with the rates of improvement in the social indicators.

We reproduce the regressions exploring conditional convergence for those indicators with data available from 1980 in Table 7. Interestingly, the hypothesis of conditional convergence is rejected for all the indicators except for the prop variable, measuring the number of households-owners as percentage of total households. The β-coefficient is negative and significant suggesting that provinces with low percentage of household-owners are improving this measure at a faster pace than those which had a higher fraction of household-owners in 1980. For all the other variables, the sign alternates
### Table 5: $\beta$- conditional convergence, periods 1970-1980 y 1970-1991

|           | escprim80 | escsec80 | analfa80 | escprim91 | escsec91 | analfa91 |
|-----------|-----------|----------|----------|-----------|----------|----------|
| copa.8070 | 0.030*    | 0.018*   | -0.005   |           |          |          |
|           | (0.009)   | (0.004)  | (0.005)  |           |          |          |
| escprim   | -0.126    |          | -0.065   |           |          |          |
|           | (0.072)   |          | (0.051)  |           |          |          |
| escsec    |           | -0.064*  |          | -0.046*   |          |          |
|           |           | (0.012)  |          | (0.007)   |           |          |
| analfa    | -0.003    |          |          |           |          | 0.002    |
|           | (0.004)   |          |          |           |          | (0.003)  |
| copa.9170 |           |          | 0.014    | 0.007*    |          | -0.003   |
|           |           |          | (0.007)  | (0.003)   |          | (0.002)  |
| $N$       | 22        | 22       | 21       | 22        | 22       | 21       |
| $R^2$     | 0.360     | 0.705    | 0.062    | 0.248     | 0.745    | 0.076    |
| adj. $R^2$| 0.293     | 0.673    | -0.043   | 0.169     | 0.718    | -0.027   |
| Resid. sd | 0.018     | 0.012    | 0.009    | 0.012     | 0.007    | 0.005    |

Robust standard errors in parentheses. Independent variables are in logs. The time period is 1970-1980 for the first three columns and 1970-1991 for the last three columns. Observations are for census data available every 10 years. The variables copa.8070 y copa.9170 are measured as the simple average of transfers per capita for the periods 1970-1980 and 1970-1991 respectively. * denotes significance at $p < 0.05$

### Table 6: $\beta$- conditional convergence, subperiods 1980-1991 y 1980-2001

|               | escprim91 | escsec91 | analfa91 | escprim01 | escsec01 | analfa01 |
|---------------|-----------|----------|----------|-----------|----------|----------|
| copa.9180     | 0.003     | 0.005    | -0.003   |           |          |          |
|               | (0.005)   | (0.004)  | (0.002)  |           |          |          |
| l.escprim     | -0.031    |          | -0.095   |           |          |          |
|               | (0.060)   |          | (0.048)  |           |          |          |
| l.escsec      |           | -0.043*  |          | -0.035*   |          |          |
|               |           | (0.016)  |          | (0.010)   |           |          |
| l.analfa      | 0.006*    |          |          |           |          | 0.006*   |
|               | (0.002)   |          |          |           |          | (0.002)  |
| copa.0180     |           |          | -0.000   | 0.001     |          | -0.003   |
|               |           |          | (0.003)  | (0.003)   |          | (0.002)  |
| $N$           | 22        | 22       | 21       | 22        | 22       | 21       |
| $R^2$         | 0.011     | 0.224    | 0.198    | 0.145     | 0.411    | 0.326    |
| adj. $R^2$    | -0.094    | 0.143    | 0.109    | 0.055     | 0.349    | 0.251    |
| Resid. sd     | 0.013     | 0.012    | 0.005    | 0.007     | 0.006    | 0.004    |

Robust standard errors in parentheses. Independent variables are in logs. The time period is 1980-1991 for the first three columns and 1980-2001 for the last three columns. Observations are for census data available every 10 years. The variables copa.9180 y copa.0180 are measured as the simple average of transfers per capita for the periods 1980-1991 and 1980-2001 respectively. * indicates significance at $p < 0.05$

and but the coefficients are not statistically significant. Similarly, we test for conditional convergence during the period 1991-2001 and present the results in Table 8. In this case, the convergence hypothesis is not supported by the evidence since the $\beta$-coefficients are very sensitive to the choice of indicator. Interestingly, the coefficients for the public policy variable, copa0191, are always negative (transfers as having a negative impact on the rates of improvement in the social indicators) although they are not significant in any of the different models.
Table 7: β- conditional convergence, period 1980-1991

|                | nbi   | espvid | mortm  | morti  | vivinc | prop   | hacina |
|----------------|-------|--------|--------|--------|--------|--------|--------|
| copa9180       | 0.001 | -0.003 | 0.002  | 0.003  | 0.003  | -0.000 | 0.000  |
| (0.007)        | (0.007) | (0.005)  | (0.006)  | (0.005)  | (0.005)  | (0.006)  |
| 1.nbi          | 0.007 |        |        |        |        |        | (0.009) |
| l.espvid       | -0.137|        |        |        |        |        |        |
| (0.101)        |        |        |        |        |        |        |        |
| l.mortm        | -0.001|        |        |        |        |        |        |
| (0.005)        |        |        |        |        |        |        |        |
| l.morti        | -0.007|        |        |        |        |        |        |
| (0.013)        |        |        |        |        |        |        |        |
| l.vivinc       |        | 0.010  |        |        |        |        |        |
| (0.007)        |        |        |        |        |        |        |        |
| l.prop         |        |        |        |        |        | -0.043*| (0.015) |
| l.hacina       |        |        |        |        |        |        | 0.008  |
| (0.006)        |        |        |        |        |        |        |        |
| N              | 22    | 22     | 22     | 22     | 22     | 22     | 22     |
| $R^2$          | 0.033 | 0.083  | 0.007  | 0.019  | 0.103  | 0.223  | 0.077  |
| adj.$R^2$      | -0.068| -0.013 | -0.098 | -0.084 | 0.009  | 0.141  | -0.020 |
| Resid. sd      | 0.013 | 0.013  | 0.013  | 0.013  | 0.013  | 0.012  | 0.013  |

Robust standard errors in parentheses. Independent variables are in logs. The time period is 1980-1991 for all the variables. Observations are for census data available every 10 years. The variable copa9180 is measured as the simple average of transfers per capita for the periods 1980-1991. * indicates significance at $p < 0.05$.

The results in this section suggest evidence for conditional convergence during certain time periods in recent decades which yields additional support for the results for the full period in our sample. However, we should be cautious about drawing inferences from these results at this stage given that the empirical analysis has some limitations. Firstly, our models in Tables 4 to 8 may be omitting important variables that are behind the rates of improvement in this social indicators. For example, one may argue that the evolution of these indicators is related with economic conditions such as differences in regional unemployment rates and/or differences in investment-to-GDP ratios; similarly, it can be argued that the rates of improvement may also be related with historical, geographical and other factors that we are not controlling in our regressions. The main reason, aside from data limitations, for not including other controls is the small sample size which limits the flexibility for including additional controls in the regression. Secondly, the cross-sectional analysis only provides us with a static dimension of the analysis. One way to approach this issue is by providing the kind of distributional dynamics analysis we carried out in section 3. Another way is to increase the amount of statistical information available for the empirical analysis. In the next section, we test for convergence using all the data points for each census year in a pooled sample while also controlling for specific characteristics.

21 The magnitude of this problem can be partially assessed by looking at the differences in the explanatory power of the different models as captured by the adjusted $R$-squared measure.
4.3 Regressions using panel data

In this section, we explore the convergence hypothesis using panel data both for census and annual data. However, in the latter case the analysis is limited to only the two variables measuring child and maternal mortality due to data availability. Despite this limitation, using annual data not only increases the sample size but also allows us to deal, albeit only in a partial way, with the problem of potential omitted variables in the cross-section regressions.

We use the following econometric specification:

\[
\Delta Y_{i,t,t-1} = \alpha + \beta \ln(Y_{i,t-1}) + \gamma \ln(TR_{i,t,t-1}) + \alpha_t + u_i + \epsilon_{i,t}
\]  

(2)

where \(\Delta Y_{i,t,t-1}\) is the average annual growth rate of variable \(Y\) between censuses in years \(t-1\) and \(t\) for province \(i\); \(\ln(Y_{i,t-1})\) is the logarithm of the value of variable \(Y\) in the previous census \(t-1\) for province \(i\); \(\ln(TR_{i,t,t-1})\) is the logarithm of the average of automatic transfers per capita between years \(t-1\) and \(t\) for province \(i\).

The results for the convergence models using a panel with the available census data are displayed in Table 9. The results support the hypothesis of conditional convergence for all the schooling measures – escprim, escsec y analfa. Not only are the coefficients negative and significant but also are significantly higher than for the cross-section models. However, the coefficient for the public policy variable is not significant in
any of the models except for the case of the secondary school enrollment rate. The fact that this coefficient is negative lends some support to our theoretical presumption, that fiscal transfers affect the rate of improvement in social indicators (enrollment in secondary education in this case) negatively. Actually, the signs and coefficients in the middle column in this table suggests that convergence has taken place *despite* higher transfers per capita rather than as a result of them. Contrarily, higher transfers per capita do not seem to have had any effect on the other two schooling variables.22

**Table 9: β- conditional convergence, 1970-2001**

|             | escprim | escsec | analfa |
|-------------|---------|--------|--------|
| copa.a      | -0.002  | -0.024* | 0.004  |
| (0.002)     | (0.013) | (0.008) |
| escprim     | -0.070*** |        |        |
| (0.011)     |         |        |
| escsec      |         | -0.077*** |        |
| (0.009)     |         |        |
| analfa      |         |         | -0.066*** |
| (0.013)     |         |        |
| N           | 66      | 66     | 64     |
| $R^2$       | 0.555   | 0.644  | 0.432  |

Driscoll and Kray robust standard errors in parenthesis. The dependent variable is the average annual growth rate. The conditioning variable, *copa.a* is measured as the simple average of transfers per capita for the period considered, 1970-1980, 1980-1991 and 1991-2001, respectively.

* $p \leq 0.1$, ** $p \leq 0.05$, *** $p \leq 0.01$

The results for the conditional convergence regressions for the social indicators other than schooling are presented in Table 10. Since we only have three census data points available, the panel contains only two data points (we lose one time period when we regress growth rates against initial values). It can be observed that the $\beta$-coefficients are negative and significant in all the models considered, except for the life expectancy indicator, *espvid*. Unlike the results for the cross-section regressions, where nearly half of the variables were either not significant or had a positive sign, the panel results supports the hypothesis of conditional convergence for a wide range of well-being measures. There is no evidence of a significant relationship between the average amount of automatic transfers per capita and the rate of improvement in social indicators as the coefficient for the public policy variable is almost always not significant. Only for two variables we found a positive and significant coefficient associated with transfers per capita: *mortm* and *hacina*. In these two cases, the evidence suggests that transfers per capita have had a negative impact on the regional convergence process since they are associated with smaller growth rates (in absolute values). For the maternal mortality variable, this result reinforces those obtained in the cross-section regressions.

22These results remain unchanged if we choose the initial level or the average annual growth rate of *copa* as a proxy for the effect of regional public policy. These can be consulted in the appendix.
Table 10: Convergencia β condicional, 1980-2001

| Variables | nbi  | espvid | mortm  | morti  | vivinc | prop  | hacina |
|-----------|------|--------|--------|--------|--------|-------|--------|
| copa.a    | 0.023| -0.001 | 0.444*** | 0.011 | -0.108 | 0.009 | 0.08*  |
|           | (0.024) | (0.005) | (0.152) | (0.077) | (0.108) | (0.019) | (0.04) |
| nbi       | 0.011| -0.108 | 0.009  | 0.08   |
|           | (0.024) | (0.005) | (0.152) | (0.077) |
| espvid    | -0.083*** | (0.021) |
| mortm     | -0.038 | (0.025) |
| morti     | -0.136*** | (0.017) |
| vivinc    | -0.103** | (0.037) |
| prop      | -0.173*** | (0.025) |
| hacina    | -0.072*** | (0.011) |
|           | -0.05** | (0.023) |
| N         | 44   | 44     | 44     | 44     | 44     | 44     | 44     |
| R²        | 0.453| 0.106  | 0.775  | 0.305  | 0.719  | 0.678  | 0.305  |

Driscoll and Kray robust standard errors in parenthesis. The dependent variable is the average annual growth rate. The conditioning variable, copa.a is measured as the simple average of transfers per capita for the period considered, 1980-1991 and 1991-2001, respectively.

* p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01

Finally, we test the previous results for robustness using annual data. Due to the lack of data, we are only able to do so for only two of the variables in our dataset, mortm y morti, the variables measuring different types of life expectancy. The results for the regressions are in Table 11. The results are in line with those from the cross-sectional regressions. For both variables, the β coefficient is negative and statistically significant suggesting that there has been conditional convergence in these indicators. However, while the γ coefficient is negative and not significant for the maternal mortality variable, the coefficient is positive and significant for the infant mortality indicator. This supports our evidence found earlier that higher transfers per capita are not actually relevant to explaining the process of conditional convergence; actually, in this case, the positive sign of the coefficient suggests that higher transfers per capita are associated with lower reductions in mortality rates (in absolute value) –since provinces improve when they reduce the value of this indicator, the ones that “grow” faster are those with larger negative numbers, or in other words, those with lower (more negative) growth rates. However, given that the coefficient is only significant at the 0.10 level and is not significant for the other mortality indicator, it appears that, if anything, the level of per capita transfers does not seem to help the convergence process.
Table 11: $\beta$- conditional convergence - Panel with annual data

|            | (1)      | (2)      |
|------------|----------|----------|
| morti      | -0.02*** |          |
|            | (0.002)  |          |
| copa.gr    | 0.015*   | -0.039   |
|            | (0.008)  | (0.046)  |
| mortm.lag  |          | -0.131***|
|            |          | (0.011)  |
| N          | 618      | 573      |
| $R^2$      | 0.171    | 0.206    |

Driscol and Kray robust standard errors in parenthesis. The dependent variable is the average annual growth rate. The conditioning variable, $copia.gr$ is measured as the annual average growth rate of transfers per capita.

* (p $\leq$ 0.1), ** (p $\leq$ 0.05), *** (p $\leq$ 0.01)

5 Concluding remarks

There are several conclusions that we draw from the analysis in this study. Firstly, the evidence suggests that there has been a convergence process between the Argentine provinces in the levels of different socio-economic and well-being standards. Although the evidence suggest that there is absolute convergence in some indicators, we found better support for the hypothesis that provinces have tended to converge to their own stationary states. Similarly, we also found that the hypothesis of convergence within selected sub-periods has little empirical support but it is validated for almost all selected indicators over the full period.

Concerning the role of public policy towards regional governments, the evidence suggests that federal fiscal transfers have not had any impact on the rates at which provinces improve their well-being standards. In fact, if anything, we find that fiscal transfers are negatively correlated with these improvement rates for a few indicators. This seems to be the case with some educational (secondary school enrollment rate), health-related (rate of maternal mortality) and housing standard (overcrowding rate) variables. A similar negative effect of federal transfers is also found for the primary school enrollment rate when we use annual data.

These results provide partial support to our theoretical presumption on the negative effects of transfers per capita. Regardless of any positive spillovers effects associated with transfers per capita to the provinces (possibly through greater spending capacity due to higher public employment and wages), the evidence presented here does not seem to support the idea that fiscal federal transfers are allocated to the type of public spending that improves well-being and human development in a long-run perspective.
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# Data Appendix

## Table 12: Variable definition, description and data sources

| Code   | Definition | Source | Period                  |
|--------|------------|--------|-------------------------|
| escprim| Primary school enrollment. Ratio of population between 6 and 12 years attending primary school to total population between 6 and 12 years | 1970, 1980, 1991, 2001 | National Census, INDEC |
| escsec | Secondary school enrollment. Ratio of total enrolled students in secondary schools to total population | 1970, 1980, 1991, 2001 | National Census, INDEC |
| analfa | Illiteracy rate. Percentage of population aged 14 who lacks the ability to read and write. | 1970, 1980, 1991, 2001 | National Census, INDEC |
| nbi    | Unsatisfied basic needs. Percentage of households with any of the following: 1) Overcrowding in housing conditions –more than three (3) persons per room; 2) Deficient dwellings; 3) Deficient sanitary conditions; 4) School non-attendance –at least one child aged 6-12 does not attend school | 1980, 1991, 2001 | National Census, INDEC |
| espvid | Life expectancy at birth. Estimated average life expectancy of newborns from a given population at a given year. This calculation holds mortality rates by age fixed at the time of birth. | 1980, 1991, 2001 | National Census, INDEC |
| mortm  | Maternal mortality rate every 10000 live births. Defined as the ratio of the number of maternal deaths during pregnancy and childbirth per 10000 live births. | 1980, 1990, 2001 and 1980-2007 (annual) | Dir. Estadísticas e Información de Salud, Ministerio de Salud de la Nación |
| morti  | Infant mortality rate every 1000 live births. Ratio of the number of deaths of child under one (1) year of age per 1000 live births. | 1980, 1991, 2001 and 1980-2007 (annual) | Dir. Estadísticas e Información de Salud, Ministerio de Salud de la Nación |
| vivinc | Percentage of deficient dwellings. Ratio of the number of deficient dwellings (shacks, tents, mobile homes) to the total number of dwellings | 1980, 1991, 2001 | National Census, INDEC |
| prop   | Dwelling ownership. Ratio of households whose members have ownership of both dwelling and land to the total number of households. | 1980, 1991, 2001 | National Census, INDEC |
| hacina | Housing overcrowding. Ratio of households with more than three (3) persons per room to the total number of households. | 1980, 1991, 2001 | National Census, INDEC |
| copa   | Automatic transfers per capita. Defined as the amount of resources transferred from the National to the regional level corresponding to the Regímenes de Coparticipación in prices of 2001. | 1970-2007 | Secretaría de Hacienda, DNCFP and (Porto, 2004). |
7 Statistical Appendix

Figure 9: Dynamics of the distribution of escprim across provinces, 1970 and 2001

Figure 10: Dynamics of the distribution of escprim across provinces, 1970 and 1991
Figure 11: Dynamics of the distribution of $analfa$ across provinces

Figure 12: Dynamics of the distribution of $analfa$ across provinces, 1970 and 2001
Figure 13: Dynamics of the distribution of \( nbi \) across provinces, 1980 and 2001

Figure 14: Dynamics of the distribution of \( nbi \) across provinces, 1980 and 1991
Figure 15: Dynamics of the distribution of morti across provinces, 1980 and 1991

Figure 16: Dynamics of the distribution of morti across provinces, 1980 and 1991
Table 13: \(\beta\)-absolute convergence, period 1970-2001

|       | escprim | escsec | analfa | nbi  | espvid | mortm | morti | vivinc | prop  | hacina |
|-------|---------|--------|--------|------|--------|-------|-------|--------|-------|--------|
| escprim | -0.029* |        |        |      |        |       |       |        |       |        |
|        | (0.002) |        |        |      |        |       |       |        |       |        |
| escsec |        | -0.036*|        |      |        |       |       |        |       |        |
|        |        | (0.004)|        |      |        |       |       |        |       |        |
| analfa |        |        | 0.002  |      |        |       |       |        |       |        |
|        |        |        | (0.002)|      |        |       |       |        |       |        |
| nbi    |        |        | 0.003  |      |        |       |       |        |       |        |
|        |        |        | (0.002)|      |        |       |       |        |       |        |
| espvid |        |        |        |      | -0.023*|       |       |        |       |        |
|        |        |        |        |      | (0.004)|       |       |        |       |        |
| mortm  |        |        |        |      | -0.019*|       |       |        |       |        |
|        |        |        |        |      | (0.009)|       |       |        |       |        |
| morti  |        |        |        |      | -0.015 |       |       |        |       |        |
|        |        |        |        |      | (0.008)|       |       |        |       |        |
| vivinc |        |        |        |      |        |       |       | -0.042*|      |        |
|        |        |        |        |      |        |       |       | (0.004)|      |        |
| prop   |        |        |        |      |        |       |       |        |       | -0.004|
|        |        |        |        |      |        |       |       |        |       | (0.005)|
| hacina |        |        |        |      |        |       |       |        |       | -0.019|
|        |        |        |        |      |        |       |       |        |       | (0.003)|
| N     | 22      | 22     | 21     | 22   | 22     | 22    | 22    | 22     | 22    | 22     |
| \(R^2\) | 0.937   | 0.800  | 0.058  | 0.022| 0.588  | 0.141 | 0.111 | 0.016  | 0.806 | 0.030  |
| adj. \(R^2\) | 0.933 | 0.790  | 0.008  | -0.027| 0.567  | 0.098 | 0.067 | -0.034 | 0.796 | -0.019 |
| Resid. sd | 0.000  | 0.004  | 0.004  | 0.006| 0.001  | 0.028 | 0.009 | 0.015  | 0.003 | 0.010  |

Robust standard errors in parentheses. Independent variables are in logs. The time period is 1970-2001 for the variables \(escprim, escsec, y\) \(analfa\) and 1980-2001 for all the other variables. In both cases, observations are for census data available every 10 years. * denotes significance at \(p < 0.05\)
|          | escprim | escsec | analfa | nbi   | espvid | mortm  | morti  | vivinc | prop  | hacina |
|----------|---------|--------|--------|-------|--------|--------|--------|--------|-------|--------|
| copa1970| 0.000   | 0.006* | -0.006*|       |        |        |        |        |       | 0.002  |
|          | (0.000) | (0.002)| (0.002)|       | (0.002)| (0.002)| (0.002)| (0.002)| (0.002)| (0.002)|
| escprim | -0.029* |        |        |       |        |        |        |        |       |        |
|          | (0.002) |        |        |       | (0.002)| (0.002)| (0.002)| (0.002)| (0.002)| (0.002)|
| escsec  |         | -0.033*|        |       |        |        |        |        |       |        |
|          |         | (0.003)|        |       | (0.003)| (0.003)| (0.003)| (0.003)| (0.003)| (0.003)|
| analfa  |         |        |        |       |        |        |        |        |       | 0.002  |
|          |         |        |        |       | (0.002)| (0.002)| (0.002)| (0.002)| (0.002)| (0.002)|
| copa1980| -0.011* |        |        |       | 0.000  | 0.015  | -0.001 | -0.009 | 0.001 | -0.007 |
|          | (0.002) |        |        |       | (0.002)| (0.011)| (0.005)| (0.007)| (0.002)| (0.005)|
| nbi     |         | 0.006* |        |       |        |        |        |        |       |        |
|          |         | (0.002)|        |       | (0.002)| (0.002)| (0.002)| (0.002)| (0.002)| (0.002)|
| espvid  |         |        | -0.021*|       |        |        |        |        |       |        |
|          |         |        | (0.006)|       | (0.006)| (0.006)| (0.006)| (0.006)| (0.006)| (0.006)|
| mortm   |         |        |        | -0.020*|       |        |        |        |       |        |
|          |         |        |        | (0.008)|       | (0.008)| (0.008)| (0.008)| (0.008)| (0.008)|
| morti   |         |        |        |        |        | -0.014 |        |        |       |        |
|          |         |        |        |        | (0.008)| (0.008)| (0.008)| (0.008)| (0.008)| (0.008)|
| vivinc  |         |        |        |        |        |        |        | 0.004  |       |        |
|          |         |        |        |        |        |        | (0.007)|        | (0.007)| (0.007)|
| prop    |         |        |        |        |        |        |        |        | -0.042*|        |
|          |         |        |        |        |        |        |        |        | (0.004)| (0.004)|
| hacina  |         |        |        |        |        |        |        |        |       | -0.003 |
|          |         |        |        |        |        |        |        |        |       | (0.004)|

Robust standard errors in parentheses. Independent variables are in logs. The time period is 1970-2001 for the variables escprim, escsec, y analfa and 1980-2001 for all the other variables. In both cases, observations are for census data available every 10 years. The variables copa1970 and copa1980 denote the value of automatic transfers per capita at the initial (base) year for the period, 1970 and 1980, respectively.

* denotes significance at p < 0.05
Table 15: $\beta$-conditional convergence, period 1970-2001 - Alternative measurement for transfers

|        | escprim | escsec | analfa | nbi  | espvid | mortm | morti | vivinc | prop  | hacina |
|--------|---------|--------|--------|------|--------|-------|-------|--------|-------|--------|
| copa.gr.0170 | 0.000   | 0.004  | -0.048 | -0.029* | (0.002) | -0.036* | (0.004) | 0.003   | 0.002  |        |
| escprim     |         |        |        |       |        |       |       |        |       |        |
| escsec      |         |        |        |       |        |       |       |        |       |        |
| analfa      |         |        |        |       |        |       |       |        |       |        |
| copa.gr.0180 | 0.156   | -0.026 | 2.400* | 0.538 | -0.441 | 0.113 | 0.533* |        |       |        |
| nbi         | 0.002   |        | (0.004) |       |        |       |       |        |       |        |
| espvid      |         |        |        |       |        | -0.024* | (0.004) |       |       |        |
| mortm       |         |        |        |       |        | -0.027* | (0.007) |       |       |        |
| morti       |         |        |        |       |        | -0.018* | (0.007) |       |       |        |
| vivinc      |         |        |        |       |        |        |        | 0.004  | (0.007) |       |
| prop        |         |        |        |       |        |        |        | -0.043* | (0.004) |       |
| hacina      |         |        |        |       |        |        |        |        | -0.006 | (0.005) |
| N           | 22      | 22     | 21     | 22   | 22     | 22    | 22    | 22     | 22    | 22     |
| $R^2$       | 0.937   | 0.800  | 0.084  | 0.065 | 0.638  | 0.509 | 0.287 | 0.823  | 0.189 |
| adj. $R^2$  | 0.930   | 0.779  | -0.018 | -0.034 | 0.600  | 0.457 | 0.212 | -0.027 | 0.804 | 0.103  |
| Resid. sd   | 0.000   | 0.004  | 0.004  | 0.006 | 0.001  | 0.022 | 0.009 | 0.015  | 0.003 | 0.010  |

Robust standard errors in parentheses. Independent variables are in logs. The time period is 1970-2001 for the variables escprim, escsec, y analfa and 1980-2001 for all the other variables. In both cases, observations are for census data available every 10 years. The variables copa.gr.0170 y copa.gr.0180 are defined as the average annual growth rate in automatic transfers per capita for the periods 1970-2001 and 1980-2001, respectively.

* denotes significance at $p < 0.05$
Table 16: $\beta$-conditional convergence - Panel with census data using alternative measurement for transfers

Fixed-effects model with the *within* estimator and two-way effects

| Variable | escprim.l | escsec.l | analfa.l | escprim.r | escsec.r | analfa.r |
|----------|-----------|-----------|-----------|-----------|-----------|-----------|
| copa     | -0.002    | -0.012    | 0.001     | -0.072*** | -0.078*** | -0.064*** |
|          | (0.001)   | (0.008)   | (0.005)   | (0.01)    | (0.009)   | (0.013)   |
| escprim  | -0.072*** |           |           | -0.072*** | -0.076*** |          |
|          | (0.01)    |           |           | (0.011)   | (0.01)    |           |
| escsec   |           | -0.078*** | -0.076*** |           |           |          |
|          |           | (0.009)   | (0.01)    |           |           |           |
| analfa   |           |           | -0.064*** |           | -0.064*** |          |
|          |           |           | (0.013)   |           | (0.012)   |           |
| copa.r   |           | -0.006    | -0.011    | -0.027    |           |          |
|          |           | (0.017)   | (0.102)   | (0.053)   |           |           |

N: 0.556 0.631 0.428 0.543 0.613 0.431

Driscol and Kray robust standard errors in parenthesis. The dependent variable is the average annual growth rate. In the first three models, the conditioning variable, copa, is the value of the automatic transfers at the $t-1$ period, while in the last three models the variable copa.r is defined as the average annual growth rate of the automatic transfers between periods $t-1$ and $t$. measured as the simple average of transfers per capita for the period considered, 1970-1980, 1980-1991 and 1991-2001, respectively. Observations correspond to census data available every 10 years.

* $p \leq 0.1$, ** $p \leq 0.05$, *** $p \leq 0.01$