

CONVERGENCE IN THE SOUTHERN CONE

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Abstract

The main objective of this paper is to analyze the degree of regional economic convergence in the Southern Cone, using regional data of Argentina and Chile during the 1960-1985 period. This study found a more rapid convergence in the case of Chile than in the case of Argentina (which could be due in part to the much higher degree of openness adopted by Chile during the second part of the period analyzed here). The homogenization of the series of GDP between both countries using purchasing power parity exchange rate, and the consideration of the behavior of the GDP per unit of labor input instead of the GDP per capita, improves substantially the fit of the Barro and Sala-i-Martin equation, when pooling the data of both countries. The "exogenous" variables used in the conditional convergence model increase substantially the estimates of the speed of convergence from 0.71 percent up to 2 percent.

Resumen

El principal objetivo de este artículo es analizar el grado de convergencia regional en el Cono Sur, usando datos regionales de Argentina y Chile durante el período 1960-1985. Se encontró una más rápida convergencia en el caso de Chile que para Argentina (lo cual podría ser debido en parte a la política de mayor apertura internacional seguida por Chile durante la segunda parte del período que es analizado). La homogenización de las series de GDP entre ambos países usando la paridad del poder de compra, y la consideración del comportamiento del GDP por unidad de trabajo, en vez del GDP per cápita, mejoraron sustancialmente el ajuste de la ecuación de Barro y Sala-i-Martin, al integrar los datos para ambos países. Las variables "exógenas" utilizadas en el modelo de convergencia condicional incrementaron sustancialmente las estimaciones de la velocidad de convergencia desde 0,71 por ciento a más de 2 por ciento.

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1. INTRODUCTION

The main objective of this paper is to analyze the degree of regional economic convergence in the Southern Cone, using regional data of Argentina and Chile during the 1960-1985 period. This approach will allow a broader set of data that could help to identify the conditional convergence equation developed by Barro and Sala-i-Martin as an implication of the neoclassical Solow's growth model¹. Many common characteristics in both countries (historical and at the present), the fact that they are neighbors, and a long time period of economic relationship between them justify the pooling of their regional performance to verify the convergence hypothesis under this theory.

The integration of the regional economic trends of both countries requires a previous effort of homogenization of the measurement of the main variables that enters in the model. The Penn Table developed by Summers and Heston (1991), allows to use purchasing power parity exchange rate (PPPER) that makes comparable the GDP in US dollars between the two countries. In 1960 both countries had a very similar PPPER with respect to the US dollar. The PPPER of 1985 in Argentina was very similar to the one of 1960, but for Chile the PPPER registered a big increase.

The paper will explore both β and σ convergence. For the former type of convergence the analysis will consider the role of many relevant variables that could affect the steady-state growth rate, which is known as the conditional convergence hypothesis. In this case the analysis of these variables will also help to understand the growth path of each country. As a complement of this approach, the behavior of the standard deviation of the log of the GDP per capita across regions σ convergence will be presented.

This study found a more rapid convergence in the case of Chile than in the Argentina (which could be due in part to the higher degree of openness adopted by Chile during the second part of the period analyzed here). The homogenization of the series of GDP between both countries using purchasing power parity exchange rate, and the consideration of the behavior of the GDP per unit of labor input instead of the GDP per capita, improves substantially the fit of the Barro and Sala-i-Martin equation, when pooling the data of both countries. The "exogenous" variables used in the conditional convergence model increase substantially the estimates of the speed of convergence from 0.71 percent up to 2 percent.

The structure of the paper is as follows. In section two a brief summary of the main features of the political division of each country is presented. Part three exhibits the growth behavior of the provinces of Argentina and the Chilean regions. Section four discusses the estimation results of convergence in the Southern Cone. The paper ends with a chapter on concluding remarks.

¹ See Solow (1956), Barro and Sala-i-Martin (1995). Many recent studies extended the number of verification of the β convergence (see References in the last section).

2. REGIONAL CHARACTERISTICS OF ARGENTINA AND CHILE

In this section, we will illustrate the political division of each country. It is important to highlight that many times the political division does not coincide with a relevant economic geographic division. For example, if one believes in models with spillovers or scale effects in the growth rate, the relevant division will not coincide with the political one.

From this perspective the European Community as a whole could be a region where the spillovers are expanded, that is to say an innovation that takes place in Germany can be transmitted to the rest of the countries in the region. On the other hand, regions in a country could be so heterogeneous that an innovation in one province is not transmitted to the entire country, but could be expanded to a region of a neighboring country.

Argentina

Argentina is composed of 24 provinces (the Federal District included), and these provinces have a total of 503 counties. The head of each province is the Governor chosen by election. Each county does not have only one major authority, but instead it has local government officials for municipalities and rural communities. However, some offices of the county depend directly from the Governor of the province. The reason for this kind of organization is due to the fact that the county division is mainly relevant for the election of representatives of the different part of the province for the House of Representatives and the Senate. Table 1 presents a general description of each province.

Chile

In 1974 the government of Chile implemented a new political and administrative division of the country, with the objective of decentralizing and improving the efficiency of the governance of the country. The new division consists in thirteen regions and each region was divided in different amount of provinces. In Table 2 appears the corresponding information.

Each region and province counts with its own administrative authorities. Thus, the Intendent is the major regional authority, who acts on the behalf of the President of the Nation in the region. He or she has the internal governance of the region and follows the instruction of the President. His or her objective is the social, cultural, and economic development of the region.

The Governor, who is the next authority in the ladder, is in charge of the province. He or she is also named by the President of the Republic and has also the same role of the Intendent but at the level of the province. Besides these authorities, there exist the so-called Seremis, who are the regional representatives of the public ministers. The Seremis work closely with the Intendent.

Finally, the people vote to elect the council who is lead by the Major. The latter is in charge of the municipality. They have the goal to develop the district and to administrate the funds of the municipality.

TABLE 1

REGIONAL DIVISION OF ARGENTINA: PROVINCES,
NUMBER OF COUNTIES, SIZE, AND POPULATION

Provinces (name)	Number of counties	Size (square (Km.))	Population Year 1997
Capital Federal (Federal State)	—	200	3,059,619
Buenos Aires	127	307,571	13,789,752
Catamarca	16	102,602	302,573
Córdoba	26	165,321	3,014,828
Corrientes	25	88,189	890,525
Chaco	24	99,633	925,408
Chubut	15	224,686	421,905
Entre Ríos	16	78,781	1,094,395
Formosa	9	72,066	473,622
Jujuy	16	53,219	577,802
La Pampa	22	143,440	294,247
La Rioja	18	89,680	262,199
Mendoza	18	148,827	1,559,632
Misiones	17	29,801	936,220
Neuquén	16	94,078	505,666
Río Negro	13	203,013	588,029
Salta	23	155,488	1,007,662
San Juan	19	89,651	568,972
San Luis	9	76,748	341,217
Santa Cruz	7	243,943	192,925
Santa Fé	19	133,007	3,027,378
Santiago del Estero	27	136,351	714,615
Tierra del Fuego, Antártida, e Islas del Atlántico Sur	4	1,002,445	102,500
Tucumán	17	22,524	1,255,686
Total	503	3,761,274	35,907,377

TABLE 2

REGIONAL DIVISION OF CHILE: REGIONS, NUMBER OF PROVINCES, SIZE, AND POPULATION

Región	Name	Number of Provinces	Size (square Km.)	Population Year 1997
I	Tarapacá	3	58,072.7	379,710
II	Antofagasta	3	125,306.3	449,776
III	Atacama	3	78,267.5	259,799
IV	Coquimbo	3	39,647.0	553,363
V	Valparaíso	7	16,108.9	1,507,118
RM	Metropolitana	6	13,807.8	5,831,294
VI	Libertador General Bernardo O'Higgins	3	18,192.9	758,351
VII	Maule	4	30,518.1	889,805
VIII	Biobío	4	36,823.5	1,874,124
IX	La Araucanía	2	31,759.7	846,038
X	Los Lagos	5	67,089.8	1,028,211
XI	Aisén del Gral. Carlos Ibáñez del Campo	4	108,998.6	90,770
XII	Magallanes y Antártica Chilena	4	1,382,033.5	153,995
Total		51	2,006,626.4	14,622,354

3. GROWTH BEHAVIOR OF THE PROVINCES OF ARGENTINA AND REGIONS OF CHILE

Before entering to the estimation of the so-called β convergence model we describe the information gathered for all the provinces of Argentina and region of Chile. Table 3 presents the growth behavior of the GDP-Labor ratio during the period 1960-1985, the 1960 initial value of the GDP-Labor ratio, and some of the variables that could be considered relevant for the conditional convergence model. These variables are the 1960 value of the human capital per unit of labor (taken as the average years of schooling of the labor force), the 1960 initial economic sector composition (taken as the share of agriculture), and indicators of the dynamic of the country and region (like growth differential between economic sectors in the whole period 1960-1985, population growth, and rate of migration).

Table 3 presents the quantitative behavior of these variables for the provinces of Argentina and regions of Chile, for the period 1960-1985. In the first column, the average annual growth rate of the GDP per unit of labor for this period is presented.

TABLE 3
AVERAGE ANNUAL RATE OF GROWTH OF THE GDP-LABOR RATIO IN THE PERIOD 1960-1985, LEVELS OF THE GDP-LABOR RATIO, AVERAGE YEARS OF SCHOOLING OF THE LABOR FORCE, AND OF THE SHARE OF AGRICULTURE IN THE GDP FOR THE INITIAL YEAR 1960, GROWTH RATE FOR THE WHOLE PERIOD 1960-1985 OF MIGRATION OF THE ECONOMIC SECTOR COMPOSITION INDICATOR. PROVINCES OF ARGENTINA AND REGIONS OF CHILE

Provinces and Regions 1960-1985	g(GDP/L)	(GDP/L)	Schooling of labor	Agriculture share	Economic sector	Demographic rate	
	1960 %	1960 US\$ 1986	1960 No. of years	%	1960-1985	Popul.	Migration %
Capital Federal	0.497	18.835	5.58	0.0	2.128	-0.001	-0.400
Buenos Aires	0.276	8.775	4.58	14.3	2.116	2.004	1.390
Catamarca	4.118	2.631	4.00	11.3	2.135	1.458	-1.000
Chaco	-0.463	5.218	3.40	28.0	2.072	1.407	-0.650
Chubut	1.947	14.329	4.12	1.9	2.751	2.974	1.210
Córdoba	0.722	7.661	4.39	28.4	2.088	1.471	0.240
Corrientes	3.722	3.358	3.57	16.1	2.154	1.294	-1.150
Formosa	1.869	3.980	3.44	20.3	1.969	2.578	-0.160
Jujuy	2.686	4.534	3.46	24.2	2.178	2.431	0.170
La Pampa	1.758	9.244	3.97	44.3	2.070	1.607	-0.530
La Rioja	4.748	3.821	4.07	8.6	2.308	1.762	-0.540
Mendoza	1.153	7.398	4.29	19.7	2.462	1.737	0.260
Neuquén	2.547	11,620	3.71	3.8	2.644	4.075	0.630
Salta	2.156	5,527	3.73	14.2	2.142	2.389	0.260
San Juan	1.529	4,883	4.08	18.0	2.117	1.314	-0.350
San Luis	4.216	4,250	4.15	26.3	2.031	1.603	-0.270
Santa Cruz	3.569	10,623	4.72	8.0	2.447	3.564	1.120
Santiago del Estero	1.638	3,816	3.62	21.2	2.026	1.106	-0.500
Santa Fé	2.151	8,576	4.87	17.6	2.105	1.274	0.009
Tierra del Fuego	2.814	33,122	5.01	1.1	2.776	5.923	4.080
Tucumán	3.176	5,566	4.13	13.6	2.134	1.255	-0.550
Región I	1.788	5,179	6.16	1.5	1.765	3.540	0.657
Región II	3.443	5,216	5.90	2.0	3.565	1.920	-0.117
Región III	3.100	3,033	4.99	6.9	3.183	1.780	-1.550
Región IV	3.221	1,953	4.14	20.4	3.292	1.530	-1.427
Región V	0.945	3,923	5.87	9.6	3.189	2.060	0.037
Región VI	2.640	3,384	3.83	25.5	3.210	1.370	-0.432
Región VII	3.552	1,535	3.72	30.1	3.196	1.350	-0.753
Región VIII	2.686	2,672	4.26	9.0	3.144	1.480	-0.563
Región IX	2.858	1,219	3.65	30.3	3.126	1.100	-1.231
Región X	2.906	1,559	3.83	34.3	3.259	0.970	-0.847
Región XI	2.648	2,215	3.93	32.0	3.126	2.440	0.156
Región XII	0.521	11,835	6.14	6.6	3.276	2.570	-0.146
Metropolitan Region	1.314	3,750	6.29	3.7	3.223	2.560	0.691

Notes:

- (a) Before computing the average annual rate of growth of the GDP per unit of labor (GDP/Labor ratio), the GDP which is expressed in US \$ of 1986 were corrected by the Purchasing Power Parity Exchange Rate (PPPX) with respect to U.S. In 1960 both PPPX of Argentina and Chile were very similar, so the GDP for this year were not adjusted. In 1985 the PPPX of Argentina and Chile were very different, and to homogenize both GDP it was necessary to inflate the GDP of Chile by 44%. The estimates of the PPPX comes from the work of Summers and Heston and available through the well known Penn Table.
- (b) The variable reflecting the effect of different economic sector composition of the GDP of each Province and Region, is measured following the suggestion of Barro and Sala-i-Martin. It is computed as the weighted average annual rate of growth of the value added by economic sector at the country level, with the weights corresponding to the share of each economic sector on the GDP within each province and region. According to this definition the average annual rate of growth of the value added of each economic sector, as it is computed at the country level, is common for each province and region. This indicator it is capturing differences in the growth among economic sectors at the country level, and economic sectors composition at the the province and region level.

The estimates at the province and regional level in Argentina and Chile are based on the GDP concept instead of Income. At this level there could be a big discrepancy between these two concepts. In Argentina there is no income sources of data coming from tax revenues offices, and in Chile it could be available in the near future, as there were some efforts in this sense.

The average annual rate of growth of the GDP per unit of labor varies from negative 0.5% to positive 4.7%. The provinces of Argentina display a much greater variation in the growth rates than the regions of Chile. The initial value of the GDP per unit of labor varies from 1,219 US dollars of 1986 (IX Region of Chile) to 33,122 (Tierra del Fuego in Argentina). Again, the range of variation of the GDP per unit of labor is higher (but not much higher) across provinces of Argentina than among regions of Chile. The range of variation of income per unit of labor it should be much less than the range of variation of the GDP per unit of labor. This problem should be taken into account above in interpreting the results of the degree of convergence obtained from the regression analysis. Table 4 shows the main descriptive statistics of the variables used in the estimation of conditional convergence.

TABLE 4
DESCRIPTIVE STATISTICS OF THE SAMPLE

Variables	Mean	Maximum	Minimum	Std. Dev.
Agricultural share	0.162	0.443	0.000	0.114
Log (education)	4.400	6.290	3.400	0.860
Growth rate 60-85	0.023	0.047	-0.005	0.012
Log (initial GDP)	8.515	10.408	7.106	0.735
Population	0.020	0.059	0.000	0.011
Migration	-0.064	4.080	-1.550	1.026
Sectoral composition	2.571	3.565	1.765	0.540

The average years of schooling of the labor force in 1960 varies from 3.40 (Chaco in Argentina) to 6.29 (Metropolitan Region in Chile). The variable that captures the differences in the economic sector composition shows a very low variation between the provinces of Argentina and between the regions of Chile, even though there are important differences between both countries. The rate of migration looks to be very important for some provinces and regions, and the initial share of agriculture in the GDP is very different across provinces and regions.

Other variables that could be important to take into account as initial condition, like: infrastructure availability, local public sector efficiency, labor market flexibility, and some other, will be not included here as we did not get reasonable estimates of them.

4. CONVERGENCE

In Figure 1, we present the relationship between the average growth behavior in the whole period and the initial level of the GDP per unit of labor, which will give a rough picture of the performance of the unconditional beta convergence model.

FIGURE 1
DISPERSION DIAGRAM BETWEEN THE ANNUAL AVERAGE RATE OF GROWTH OF THE GDP-LABOR RATIO DURING THE PERIOD 1960-1985, WITH THE INITIAL LOGARITHM OF THE GDP-LABOR RATIO (YEAR 1960). PROVINCES OF ARGENTINA AND REGIONS OF CHILE

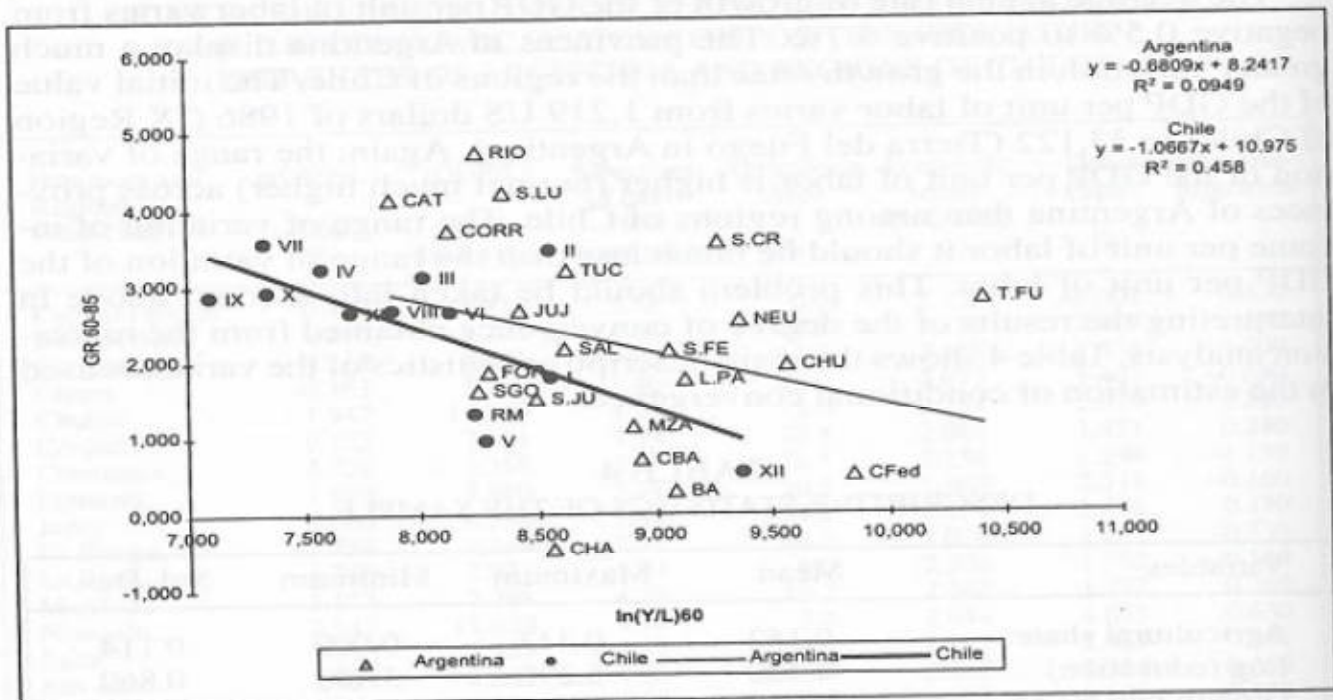


Figure 1 shows a slight negative association between the annual average rate of growth and the initial level of the GDP-labor ratio for the pool of provinces and regions of both countries. The simple correlation coefficient is negative and around 0.40. The figure also shows separately this kind of relationship for each country, where the Chilean regions present a much higher negative association than the provinces of Argentina. Running the non-linear estimation the very slow convergence is confirmed. In fact the speed of convergence for Argentina is 0.74 percent and not statistically different from zero. For Chile the same exercise gives a speed of 1.2 percent². The faster speed of convergence shown by Chile is probably due to the greater variation in the growth rate across its regions compared to the Argentinean provinces. On the other hand, pooling the data for both countries the speed of convergence is as slow as 0.71.

This degree of association could be considered low compared to the one found among countries of Europe or at the state level for the US economy as presented by Barro and Sala-i-Martin (1995). It should be said that the degree of association shown by this figure, using GDP per unit of labor, is much higher than using per capita GDP.

However, it is important to look at conditional convergence, especially when we are working with data for regions in different countries. The variables that are used in this study are:

² Fuentes (1996) found a speed of unconditional convergence about 1.5 per cent, using a longer period of time (1960-1990).

Log (initial GDP):	Log of 1960 GDP
Log (education):	Log (number of years of education of the labor force)
Agricultural share:	The share of Agricultural GDP on regional GDP
Migration:	Immigration rate into each region
DARG:	Dummy variable that is equal to 1 for the case of Argentinean Provinces
DCHI:	Dummy variable that is equal to 1 for the case of Chilean Regions
DFUEGO:	Dummy variable that is equal to 1 for the province Tierra del Fuego

The results on conditional convergence are presented in Table 5. The speed of convergence is around 2 percent in the case that we control by agricultural share and the country and Tierra del Fuego dummies. Migration and education are not statistically significant in explaining the growth rate among regions and provinces.

TABLE 5
REGRESSION RESULTS ON CONVERGENCE
CONSIDERING 34 OBSERVATIONS

Variables	Equation 1	Equation 2	Equation 3
Log (initial GDP)	0.0071 (2.1739)	0.0142 (1.7939)	0.0199 (3.0500)
Log (education)		-0.0032 -0.7995	
Agricultural share		-0.0486 (-2.1425)	-0.0392 (-2.0080)
Migration		-0.0018 (-0.5883)	
DARG		0.1479 (3.4128)	0.1657 (4.5227)
DCHI		0.1426 (3.5757)	0.1560 (4.6369)
DFUEGO		0.0287 (0.0837)	0.0259 (2.1322)
R-squared	0.1502	0.3809	0.3590
S.E. of regression	0.0115	0.0107	0.0105
Log likelihood	104.55	109.936	109.345

Note that Tierra del Fuego has a different behavior than the rest of the regions and provinces. It shows on average a higher growth rate after controlling by any relevant variable. Also despite of the coefficients of the dummy for Argentina and Chile look very similar, they are not statistically equal.

A weak evidence of σ -convergence also confirms the slight β convergence observed in equation 1 of Table 4. Thus, the standard deviation of the natural logarithm of the GDP-labor ratio decreases from 0.7232 in the initial year 1960 to 0.6682 in the end of the period (1985), declining around 8 percent. Thus, we have fragile evidence supporting both kinds of convergence: beta and sigma.

5. CONCLUDING REMARKS

This study has explored convergence in the Southern Cone. Pooling data from the 13 regions of Chile and 21 Provinces of Argentina over 1960-1985 period, there was found evidence of conditional convergence at the speed of 2 percent. However, Chile shows a higher speed of convergence than Argentina. Taking unconditional convergence estimation the speed is 0.70 percent for Argentina and 1.2 percent for Chile, while for the pooling data is about 0.71 percent. This difference could be due to the higher dispersion shown by the growth rate across regions in Chile compared to the one across the Argentinean provinces.

The share of agricultural sector on total GDP of each region was an important conditioning, while neither education nor migration shows to be statistically significant variables in explaining the growth rate. Also, different constants were estimated for each country showing that they may be converging to a different steady state.

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Abstract

Abstract for the issue on convergence and growth is especially in the emerging regions. While countries having low growth substantially grew or even declined in their industrial. The paper provides evidence on the patterns and their evolution with respect to and more than manufacturing. The study also analyzes world saving patterns and the role of research puzzles and

Resumen

El artículo estudia la convergencia de los países de América del Sur y el mismo tiempo los países de Europa. Se usa datos, incluyendo una gran muestra de países en desarrollo y América del Sur. El artículo muestra que la convergencia de los países de América del Sur y Europa es similar a la convergencia de los países de América del Sur y Europa. Este trabajo muestra evidencia de la existencia de un patrón de ahorro mundial y el papel de la convergencia con respecto a los países de América del Sur y Europa. Finalmente, se discuten un número de diferencias y temas de política que deberían surgir en el futuro.