

Borradores Departamento de Economía

N°39

Mayo de 2011

Per Capita GDP Convergence in South America, 1960-2007

Elaborado por:

Danny García Callejas

Este artículo es producto de una investigación autónoma realizada por el autor. Las opiniones y perspectivas presentadas por el autor no comprometen ni representan, necesariamente, el punto de vista de la institución a la cual pertenece. Los errores y omisiones son solo responsabilidad del autor.



FACULTAD DE CIENCIAS
ECONÓMICAS

DEPARTAMENTO DE
ECONOMÍA

Medellín - Colombia

La serie Borradores Departamento de Economía está conformada por documentos de carácter provisional en los que se presentan avances de proyectos y actividades de investigación, con miras a su publicación posterior en revistas o libros nacionales e internacionales. El contenido de los Borradores es responsabilidad de los autores y no compromete a la institución.

[Click aquí para consultar todos los borradores en texto completo](#)

Per Capita GDP Convergence in South America, 1960-2007

Danny Garcia Callejas *

- Introduction. – I. Convergence: From the Neoclassical Growth Model to Economic Geography. – II. Empirical Evidence of Convergence and Divergence in Latin America. – III. Testing Convergence in South America: Method and Results. – Conclusion and Policy Implications. – References.

Resumen:

Este artículo analiza la convergencia de la producción per cápita y los patrones de especialización en Sur América. Este estudio encuentra evidencia a favor de divergencia en la producción, sin embargo, también halla que diferencia en los patrones de especialización y producción no son, necesariamente, la causa. Por último y aunque más investigación es necesaria, este artículo sugiere que la integración regional y la geografía pueden tener un papel fundamental en explicar la convergencia de la producción.

Abstract:

This paper analyzes output per capita convergence in South America and production specialization patterns. This study finds evidence of output divergence; however, it also finds that structural output differences and patterns of specialization of production are not necessarily the cause. Finally, this paper suggests that geography and regional integration may play a pivotal role in explaining convergence of output, although more research is required.

Palabras clave: Club de convergencia, comercio, convergencia, geografía económica, producción per cápita, Sur América.

Key words: Convergence, convergence club, Economic Geography, output per capita, South America, specialization, trade.

Clasificación JEL: O47, F10, F43.

* Professor, Economics Department, Universidad de Antioquia, Medellín, Colombia. Member of the Grupo de Macroeconomía Aplicada (Applied Macroeconomics Research Group) at the Universidad de Antioquia. Address: Departamento de Economía, Facultad de Ciencias Económicas, Universidad de Antioquia, Calle 67 No. 53-108, Bloque 13, Ciudad Universitaria, Medellín, Antioquia, Colombia, South America. Phone: +011 (574) 219-5820 and 219-5800. E-mail: dgceudea@gmail.com.

Introduction

Are South American countries converging? Since 1975, Latin America has followed a path of structural reforms in hopes of bringing sustainable and high growth back. Trade liberalization and financial reform became common in Argentina (1978), Chile (1975), Uruguay (1985), Bolivia (1986), Paraguay (1988), Venezuela (1989), Brazil (1990), Peru (1990) and Colombia (1990 and 1991). Although each reform was adapted to each country's economic structure, in general they all shared several common features like reducing tariffs, reducing restrictions for capital mobility and promoting economic integration in the region.

Structural reforms in Latin America provided a more homogeneous institutional environment in the region. Moreover, they facilitated the integration of markets for products and, in some cases, for factors. This added up to some of the common cultural characteristics and historical background and idiosyncrasies in the region, led to believe that the underlying conditions of the neoclassical growth model might be fulfilled. Consequently, output convergence in South America might be a possibility.

The purpose of this paper is to revisit the debate of per capita GDP convergence among 10 South American countries during the period 1960-2007, using data from the World Development Indicators and some local South American Statistical Agencies. In doing so, this paper will use a stochastic convergence approach following Choi (2004). By analyzing the impact of shocks on per capita outputs, this research will try to establish whether economies converged for this period.

Outputs are influenced by a number of factors. Not only factors of production determine the level of production for a given year also weather conditions, geographic conditions and infrastructure, technology and available resources at the time of production, among others. Furthermore, when comparing two or several countries' outputs—relative outputs—these features have crucial influence in determining the differences. Wars, internal conflicts, natural disasters, riots, civil unrest, financial crises, political turmoil or large price swings on export products are assumed as exogenous shocks that induce production to deviate from a steady path and increase differences in relative outputs among countries.

A country is said to follow a steady output path or pursue a steady state if it exhibits an output path consistent with a “stable” production growth rate with few and mild random—or stochastic—deviations through time. This process is also said to be stationary because unexpected shocks or random deviations do not have a permanent effect on the level of growth. In other words, if a country was growing 5 percent on average before a natural disaster occurred but after that event it keeps growing at the same level as before—5 percent, then this production level is said to be stationary. If two countries are compared and both present stationary process despite the presence of wars,

natural disasters, political turmoil at some point in their history, and their level of productions are getting “relatively” closer through time, then their outputs stochastically converge.

This study will test if 10 South American countries have stationary relative outputs. The presence of a unit root at the first level of the variable would indicate that this set of countries do not have stationary relative output and thus do not converge. In order to test for “convergence clubs” or that subgroups of countries converge, the ten countries are divided in four regions according to their historical relations and geographic proximity. The ten countries and their region are: Colombia, Ecuador and Venezuela, North region; Bolivia, Paraguay and Peru, East region; Brazil and Uruguay, West region; and Argentina and Chile, South region. The countries in the North region were one country until 1831—The Great Colombia. In the East region, Bolivia, Peru and a part of Paraguay constituted one country until 1839—The Peruvian Bolivian Confederation. The west region was one country until Uruguay’s independence in 1825. Finally, Chile and Argentina are grouped due to geographic proximity and sharing the largest border with one another.

The evidence provided in this study suggests that there is no regional stochastic convergence for South American countries selected in this sample. The results also indicate that there are no convergence clubs or convergence as a whole. These results are in accordance with Dabus and Zinni (2005) that find divergence for a group of 23 Latin American countries for 1960-1998 and using a panel data technique. In the best of cases, these authors find conditional and absolute convergence at high implausible speeds when adding control variables; an indication of divergence in Latin America. Dobson y Ramlogan (2002) and Caceres and Nunez (1999) also find divergence using a time series and unit root approach.

Some of the possible explanations for divergence in South American countries are that these countries are not as integrated as required to foster convergence. However, some research argues that integration does not necessarily promote convergence (Walz, 1999). Another explanation is the existence of multiple equilibria and poverty traps (Quah, 1996; Durlauf and Johnson, 1995; Galor, 1996). Finally, it is possible that institutions and geography (Acemoglu et al., 2004) or technological diffusion via trade and foreign investment (Barro and Sala-i-Martin, 2004; Romer, 1990) is not promoting innovation or imitation allowing countries to “catch up” by technological or productivity improvements.

The remainder of this paper is divided as follows. The next section provides a literature review on convergence in general. Section III provides specific empirical work on convergence for Latin America. Section IV presents the methodology and results. Finally, the last section concludes and offers some policy implications.

I. Convergence: From the Neoclassical Growth Model to Economic Geography

A. *The Basic Theory*

1. Beta convergence

The neoclassical growth model developed by Solow (1956) and Ramsey (1928) suggests that economic production is a consequence of combining physical capital, human capital—in modern versions, labor and technology. However, the intensive use of these factors of production, specially capital, implies that each additional unit used in the production process provides a lesser return than the previous one. In other words, capital presents diminishing returns—as well as labor—implying that in the long run the only source of economic growth is labor force growth. If this rate of growth is constant, then economies achieve a situation in which output per worker and capital per worker do not change over time. This state is also known as a steady state.

The neoclassical growth model prediction of economies reaching a steady state in the long run implies that comparing two identical countries but on different stages in their path towards the steady will converge to the same level of output per capita and capital per capita in the long run. In other words, in the long run the poor country catches up with the rich country because the poor one grows faster than the wealthier one. This “catching up” process is known as absolute convergence and it does require that both countries converge to the same steady state.

Absolute convergence implies that there is a negative relation between initial income per capita and the growth rate of income per capita. These are the main factors included in any empirical verification of this hypothesis. The empirical equation—cross-country regression—to estimate for a group of economies, $i = 1, \dots, n$, follows.

$$\frac{1}{T} \cdot \log\left(\frac{y_{it}}{y_{i0}}\right) = \alpha - \frac{(1 - e^{-\beta T})}{T} \cdot \log(\hat{y}_{i0}) + u_{i0,T} \quad (1)$$

Where T represents the total number of periods to analyze; y_{it} is per capita income; y_{i0} is initial per capita income; α is a constant or intercept term; \hat{y}_{i0} is the effective income per capita level in the steady state, in other words, the long run income per capita excluding the growth rate of technology (in terms of effective labor); β is the speed of convergence; and $u_{i0,T}$ is the error term. The left hand side of this equation is the average growth rate for this economy in the studied time period whereas the right hand represents the speed and time required in getting to a steady state situation.

An equivalent and straightforward equation—cross-country regression—to test for absolute convergence is proposed by Barro and Sala-i-Martin (2004, p. 50):

$$\log(y_{it}) = a + (1 - b) \cdot \log(y_{it-1}) + u_{it} \quad (2)$$

Assuming that $i = 1, \dots, N$, or the number of economies to compare; $t = 1, \dots, T$, or the number of years available for the data; y_{it} is the level of GDP per capita for country i in period t ; and $y_{i,t-1}$ is the one year lagged value of GDP per capita for country t . The coefficients to estimate are a and b . If there is absolute convergence then $0 < b < 1$; and the higher the b , the greater the inclination towards convergence.

However, absolute convergence assumes that countries are identical or have very similar characteristics; this is a strong assumption, however. Thus, conditional convergence allows for convergence to occur and be compared among countries that have different economic structures but conditioned on controlling for those differences. If countries that have a higher growth rate also have a lower initial income when compared with others, after controlling or conditioning growth on the different characteristics—saving propensity, for example—and present evidence of closing the gap with respect to wealthier countries, then we describe this phenomenon as conditional convergence.

Barro and Sala-i-Martin (1991) propose estimating the following equation for conditional convergence:

$$\frac{1}{T} \cdot \log\left(\frac{y_{it}}{y_{i0}}\right) = \alpha - \frac{(1 - e^{-\beta T})}{T} \cdot \log(\hat{y}_{i0}) + \phi X_{it} + u_{i0,T} \quad (3)$$

where X_{it} is a set of variables that control for the different steady states that countries in the sample might have. A common empirical version of the conditional convergence equation is as follows:

$$\frac{1}{T} \cdot \log\left(\frac{y_{it}}{y_{i0}}\right) = \alpha - \frac{(1 - e^{-\beta T})}{T} \cdot \log(\hat{y}_{i0}) + \gamma H_{it} + \lambda I_{it} + \xi Pop_{it} + u_{i0,T} \quad (4)$$

where the set of control variables are human capital (H), investment (I) and population growth (Pop). In all cases, a $0 < \beta < 1$ is evidence favoring convergence (similar to (2)).

2. Sigma Convergence

One of the problems with absolute or conditional convergence or β -convergence is not providing evidence on the pattern followed by the distribution of income within and among countries (Quah, 1993). Absolute or conditional convergence are plausible in

situations of high inequality of income or output. In order to include this feature, Quah (1992, p. 4) suggests analyzing variation of income per capita between and within countries. Sigma convergence (σ -convergence) is the decline in the variation and dispersion of real income per capita within and between the countries being compared.

The empirical way of testing for σ -convergence is through the standard deviation of real per capita income throughout countries per each time period. The existence of σ -convergence or that countries are improving their distribution of income requires the existence of β -convergence. The opposite, however, is not true (Higgins et al., 2007). The reason is that a declining variation among and within countries— σ -convergence—implies that each countries mean income is getting closer and closer to the grand mean or mean of the incomes of all countries included in the sample. This is only possible, if those countries with low average levels of income are “catching up” to those with high levels of income— β -convergence—; thus variation must be falling.

Sigma-convergence requires beta-convergence. Specifically, beta-convergence is necessary for the existence of sigma convergence. This implication can be analyzed as follows. Beta-convergence means that poor countries are growing faster than rich countries. Suppose that poor countries surpass rich countries in period T and that income per capita levels are now reversed, having rich countries the equivalent to the initial income that poor countries have and vice versa; and thus, maintaining the same distance in absolute terms. In this case, there is evidence for beta convergence since the poor caught up and even left the rich behind, in per capita terms. However, inequality still prevails since the rich are lagging in the same amount as the poor where in the beginning of this situation. Consequently, sigma convergence does not exist although beta convergence does.

Formally, Higgins et al. (2007) proves that beta convergence is a necessary but not sufficient condition for sigma convergence. Following Higgins et al. (2007), the empirical equation for β -convergence for a set of countries ($i = 1, \dots, N$) for a specific period of time ($t = 1, \dots, T$) can be written as follows:

$$\log y_{it} = \alpha + (1 - \beta)\log(y_{it-1}) + \phi X_{it} + u_{it} \quad (5)$$

Where $\beta \in (0, 1)$; $u_{it} \sim (0, \sigma_u^2)$ and independent over t and i. Also, y_{it} is the level of GDP per capita for country i in period t; and y_{it-1} is the one year lagged value of GDP per capita for country t; and X_{it} is a set of control variables that could be human capital and investment, for example as in (4). After several manipulations Higgins et al. (2007, p. 6) show that:

$$\sigma_t^2 = (\sigma^2)^* + (1 - \beta)^{2t} [\sigma_0^2 - (\sigma^2)^*] + c(1 - \beta)^{2t} \quad (6)$$

Where c is a constant; $(\sigma^2)^*$ is the steady state variance; σ_0^2 is the initial variance or variance at $t = 0$ and β is the parameter for convergence. The consequence of this result is that if $\beta \in (0, 1)$, then sigma convergence is possible since σ_t^2 would be stable. Finally, Higgins et al. (2007, p. 7) also point out that in empirical studies sigma convergence would also depend on “whether or not disturbances are correlated, and have constant variances, across time and economies.”

B. Some Empirical Studies

1. Beta convergence

Delong (1988) criticizes Baumol (1986) for obtaining convergence by using a sample that has selection bias. Including Norway but not Spain or Canada but not Argentina misleads the estimation. Furthermore, asking if countries have converged or not by picking those countries that today are rich but in 1870 were not is problematic. That ex-ante selection should cast doubt on the results. Finally, measurement error is also a problem since rich nations in 1870 that are also rich today but not as rich are more probable to have data available and old data tend to be more imprecise. Thus, measurement error is plausible and troublesome since we are analyzing those countries that we already know have “converged.” Once measurement error and sample selection bias are corrected in Baumol (1986), evidence of convergence disappears (Delong, 1988).

The following table from De La Fuente (1997, p. 48-49) provides some of the results of studies on convergence including the control variables used by several authors and their expected signs.

Table 1. Economic Growth and Convergence for World Data

Source	Dependent variable	y_0	h_0	s_k	n	Other Variables	Sample and Time
Landau (1983)	g_Q	0.0021 (6.18)	0.026 (7.64)			GCONS(-), POP(O), CLIM(Y)	1961-1976 96 countries
Landau (1986)	g_Q	-0.311 (4.80)	0.032 (4.87)	0.059 (1.37)	-0.262 (1.35)	POP(O), GCONS(-), GINV(O), GED(O), T(O), INF(-), OIL(+), DP(-), SDY(+), SRM(-), MDEXX(+), MDINF(-)	1960-1980 65 countries
Kormendi and Meguire (1985)	g_Y	-0.0063 (3.50)		0.12 (3.30)	0.60 (0.15)	SDY(+), SRM(-), MDEXX(+), MDINF(O)	1950-77 47 countries
Baumol et al. (1989)	g_Y	0.622 (1.72) -1.47 (2.47)	1.615 (5.00)				1960-1981. 103 countries.
Grier and Tullock (1989)	g_Q	-0.00083 (8.61)				Period dummies, SDY(+), MDGC(-), INF(O), MDINF(O), SDINF(-)	1951-80 24 OECD countries
		0.00057 (1.89)				Period dummies, SDY(+), MDGC(-), INF(-), MDINF(O), SDINF(-)	1961-80 89 ROW countries
Barro (1991)	g_Q	-0.0075 (6.25)	0.0305 (3.86)				
		0.00077 (8.56)	0.025 (4.46)	0.064 (2.00)	-0.004 (3.07)	CCONS(-), DISTOR(-), REV(-), ASSAS(-)	1960-1985 98 countries
Dowrick and Nguyen (1989)	$g_Y * 100$	-2.01 (9.67)		0.064 (2.54)	0.58 (0.155)		

Source: De La Fuente (1997, p. 48 and 49).

Note: The dependent variable is the average growth rate of real per capita income (g_o) or of aggregate real income (g_r) during the sample period. When the dependent variable is g_r , the null hypothesis is that the coefficient of population growth will be smaller than one, rather than negative as is the case when the dependent variable is g_Q , t statistics (in parentheses) or standard errors [in brackets] are shown below each coefficient.

Landau (1986) and Grier and Tullock (1989) use pooled data (with 4- and 5-year subintervals respectively); the rest of the regressions use cross-section data by countries.

(+) and (-) indicate a significant coefficient of the corresponding sign; (Y) denotes significance, and (0) lack of it.

Definition of h_0 : (*) = secondary enrollment rate, (***) = primary enrollment rate. Landau uses a weighted average of three enrollment rates (primary, secondary, and university).

Other variables: GCONS = public consumption/GDP; POP = total population; CUM = climate zone dummy; T = trend; GINV = public investment/GDP, GED = public expenditure in education/GDP; INF = inflation rate; OIL = dummy for oil producers; DP = distance to the closest harbour; DISTOR = Barre's index of distortions affecting the price of capital goods; REV = number of coups and revolutions; ASSAS = number of political assassinations; SDY = standard deviation of real output growth; SRM = standard deviation of money supply shocks, MDEXX = mean growth of exports as a proportion of output; MDINF average growth of inflation; MDGC = rate of growth of government's share of GDP; INF = average inflation rate; SDINF = standard deviation of the inflation rate.

Sala-i-Martin (1996) concludes that in general, when convergence is found, the average rate of convergence is 2%. This means that the approximate time required to close half of the gap—half-life—in income between high and low income world economies is 35 years.

For the case of Korea, Koo et al. (1998) find evidence of beta and sigma convergence in the 1967-1992 period. They estimate a speed of convergence of 4.5% or that the estimated half life to close the income gap among Korean regions is 15 years. However, their results are not consistent and present several structural breaks suggesting that the estimated coefficients are not constant for all sub-periods. Furthermore, the analysis suggests large swings among coefficient associated with convergence, casting doubt on this result. In general, it seems to be a rule that convergence speeds greater than 2% are suspicious.

Nevertheless, one possibility for irregular speeds of conversion is regions not being analyzed as groups; this points to the notion of convergence clubs (Baumol and Wolff, 1988). Convergence clubs are a set of economies that have share technology or received the positive spillovers of technological improvements from their “club members” allowing them to increase international trade and investment. These elements combined with education, should encourage all members of the club to increase their productivity levels, thus promoting convergence. However, DeLong (1988) criticizes this notion by implying that convergence clubs are a way to justify the existence of convergence among a set of countries and not others, indicating that those that are not members of the club should follow the same institutional arrangements as club members. One can infer, then, that convergence clubs are “forcing” convergence to show up in empirical estimations by being a ground for justifying selection bias in the sample of club members.

Siriopoulos and Asteriou (1997) also challenge the notion of convergence clubs but empirically. These authors analyze the case of 13 regions in Greece for 1971-1996. The authors run regressions on absolute and conditional convergence for 3 periods: 1971-1981; 1981-1996; 1981-1996. In all cases the authors find no evidence of convergence among Greek regions. The authors also test for convergence clubs by separating the regions into the Northern and Southern region; however, their estimations also provide weak evidence in favor of conditional convergence. Yet, their results improved when dividing the data by groups of regions, no club convergence was found.

2. Sigma Convergence

Tsionas (2000) finds evidence of sigma divergence in the U.S., concluding that the dispersion of income has not declined over time. Similar results are obtained by Higgins et al. (2007) at the national and state levels but using a larger and longer data set for the U.S.

Analyzing social expenditure as a percentage of GDP, Boeri (2002) finds convergence within European countries with similar state structures but not between European

countries. Specifically, he finds that the variation among social expenditure within the Nordic (Denmark, Sweden, Finland Netherlands), Anglo-Saxon (Ireland and the UK), Continental (Austria, Belgium, France, Germany and Luxembourg) and Mediterranean (Greece, Italy, Spain and Portugal) regions have diminished over time but not between them. In other words, social expenditure keeps being unequal among these regions for the 1980-1999 period in Europe.

Lacas (2001) provides evidence on sigma-divergence in regions of Finland for the 1985-1995 period. However, he compares this case with the province of Quebec in Canada and finds that the opposite is true for this region. However, a stronger convergence is observed in the 1985-1990 subperiod.

Nevertheless, Rey and Dev (2004) caution on the bias created by spatial effects on sigma convergence estimations. Their study is pointing to the fact that geography matters (Krugman, 1991). In fact, regions tend to sigma-converge because there are similar structural and geographical characteristics that are not common with other regions or countries. Connectivity through integrated road systems, communication systems and research networks provide positive externalities enjoyed by the region but that as distance, for example, increases become costly to share.

In this same line of reasoning, Magalhaes et al. (2005) provide evidence that spatial correlation is an important factor in sigma-convergence. When analyzing Brazilian regions for the 1975-2000 period, the authors find only some regional convergence limited by geography and no national convergence. This in contrast with Ferreira (2000) and Ferreira and Diniz (1995) that ignore spatial dependence.

Table 2. Convergence Studies for Asia

Country	Sources	Number of Regions	Sample Periods	Results	Methodology
Japan	Kawagoe(1999)	47	1955-1991	No convergence	Markov matrix
	Braun and Kubota (1998)	46	1955-1994	Two converge (Tokyo and Others)	Markov matrix
	Fujita and Tabuchi (1997)	47	1955-1975 1975-1988	Bell shape Divergence	Theil's Measure
	Barro and Sala-i-Martin (1992)	47	1930-1987	Convergence	Barro regression
Korea	Koo, Kim and Kim (1998)	10	1967-1992	Convergence	Barro regression and sigma convergence
Malaysia	Togo (2000)	14	1970-1995	Divergence	Sigma convergence
Thailand	Dixon (1999)	7	1960-1992	Divergence	Data observation
Phillipines	Hosono and Toya (2000)	13	1975-1997	No convergence	Barro regression
			1975-1986	Conditional convergence (human capital)	
			1986-1997	Convergence	
				No convergence	
Indonesia	Takeda and Nakata (1998)	27	1976-1995	Divergent after 1985 (GDP per capita excluding petroleum and gas)	Coefficient of variation
China	Wei (2000)	29	1978-1996	Interregional inequality increase Interprovincial inequality decrease	Coefficient of variation

Source: Togo (2001, p. 17).

Finally, Togo (2000) analyzes 14 Malaysian states over the 1970-1995 period. His results indicate an increase in the variance of regional per capita GDP thus favoring sigma divergence. He concludes by attributing this lack of convergence to high unequal concentration of capital in major cities in each region (Togo, 2001, p. 8-9).

II. Empirical Evidence of Convergence and Divergence in Latin America

The research on convergence in Latin America seems to favor divergence. Although some studies have found conditional convergence and absolute convergence, it seems as if their results were imprecise due to the use of non-stationary data. For instance, Dobson et al. (2003) finds evidence of conditional convergence in Latina America. In contrast, Dabus and Zinni (2005) explain that their initial findings favoring convergence were misleading due to the implausible speeds of convergence predicted by the data. Table 3 provides evidence of studies using time series analysis or panel data and finding divergence or convergence for Latina America.

Table 3. Empirical Studies for Latin America

Source	Methodology	Number of countries and Period	Results	Other variables
Helliwell and Chung (1992)	Cross section regression	18 1960-1985	Conditional convergence	Investment, population growth, human capital, scale effects
Utrera (1999)	Cross section regression	20 1950-1990	Conditional convergence	Investment, human capital, public expenditure, composition by sector, life expectancy and infant mortality
Utrera (1999)	Unit root tests	20 1950-1990	Divergence	
Utrera (1999)	Distribution dynamics	20 1950-1990	Divergence	
Dobson and Ramlongan (2002)	Cross section regression	19 1960-1990	Absolute and conditional divergence	Composition by sector, dummy for oil
Dobson and Ramlongan (2002)	Fixed effects panel data	19 1960-1990	Conditional convergence	Composition by sector, dummy for oil
Dobson and Ramlongan (2002)	Cross section regression	19 1960-1997	Absolute and conditional divergence	Composition by sector, dummy for oil
Dobson and Ramlongan (2002)	Fixed effects panel data	19 1960-1997	Absolute and conditional divergence	Composition by sector, dummy for oil
Rincon (1998)	Fixed effects panel data	18 1960-1990	Conditional convergence	Investment, population growth, human capital and inflation
Caceres and Nunez (1999)	Unit root tests	17	Stochastic divergence	
Dobson, Goddard and Ramlogan (2003)	Unit root tests, panel data	24	Convergence (for some countries)	

Source: Dabus and Zinni (2005, p. 6).

However, the research on convergence in Latin America also suggests that when convergence is confirmed also an increase in income dispersion is found (Blyde, 2005). This implies that the benefits of economic growth are not being spread out equally to all the population and regions. This shows the region's need for a comprehensive system that redistributes wealth within countries as well as between them. Blyde (2006) provides evidence of Latin American countries converging in two groups or clubs: rich countries and low and middle income countries. This reinforces the need of redistribution.

Finally, several studies on convergence for Latin America focus on regions within individuals countries. For Colombia Gomez (2006) finds conditional convergence for the

1970's and 1960's whereas Cardenas and Ponton (1995) estimate a convergence speed around 3.8% (18 years to close half the gap in income among Colombian provinces). Bonet and Meisel (1999) find convergence for the 1926-1960 period but divergence in the 1960-1995 period. The reason for this phenomenon is attributed to the concentration of resources and capital in Bogota in an unequal fashion with respect to the rest of the country's cities.

The following table summarizes some of the other empirical applications for regions within countries in Latin America.

Table 4. Studies of Convergence within some Latin American Countries

Country	Source	Finding
Argentina	Garrido et al. (2002)	Convergence but increasing unequal distribution
Brazil	Magalhaes et al. (2005)	Club convergence in some regions. Spatial dependence counts.
Chile	Duncan and Fuentes (2006)	No clear evidence of convergence
	Soto and Torche (2004)	No convergence
Peru	Odar (2002)	Two convergence clubs. Spatial dependence counts.
Peru and Brazil (includes other South American Nations)	Serra et al. (2006)	Convergence Clubs. Trade liberalization has not supported convergence.
	Aroca et al. (2005)	Divergence. Spatial dependence. Nafta does not encourage convergence.
Mexico	Diaz-Bautista and Celaya (2002)	Some convergence and divergence. Includes proxies for institutions.

Source: Own elaboration.

III. Testing Convergence in South America: Method and Results

A. The Data

This paper analyzes 10 South American countries for 1960-2007, using data from the World Development Indicators and some local South American Statistical Agencies. The 10 countries included in this study are: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay and Venezuela.

The variables to analyze are output per capita per country and region; and the GDP composition of each country, in order to compute the specialization index.

In order to test for the presence of convergence among subgroups of countries, the ten countries are divided in four regions according to their historical relations and geographic proximity. The ten countries and their region is: Colombia, Ecuador and Venezuela, North region; Bolivia, Paraguay and Peru, East region; Brazil and Uruguay, West region; and Argentina and Chile, South region. The countries in the North region were one country until 1831—The Great Colombia. In the East region, Bolivia, Peru and a part of Paraguay constituted one country until 1839—The Peruvian Bolivian Confederation. The west region was one country until Uruguay's independence in 1825. Finally, Chile and Argentina are grouped due to geographic proximity and sharing the largest border with one another.

B. Methodology and Results

This paper follows a stochastic convergence analysis to determine if output per capita convergences among 10 South American countries or a group of these countries for the 1960-2007.

In order to determine the presence of a unit root and establish if there is any stochastic convergence, this paper will use the Augmented Dickey Fuller test (DF-GLS), the Kwiatkowski et al. test (KPSS) and the Philips Perron test (PP). These test all have as null hypothesis the existence of a unit root. Consequently, a low p-value would reject the existence of a unit root in the series.

However, since panel unit roots are to be analyzed as well as time series, this study will use the Levin Lin Chu (2002) test that assumes as null hypothesis that the series are non-stationarity. This study will also use the Im et al. (1997) test that has non-stationarity as its null hypothesis, as well. Consequently, low p-values would suggest rejecting the null hypothesis.

The Levin Lin Chu test follows an Augmented Dickey-Fuller framework but applied to panel data. Formally, the initial equation to estimate is:

$$\Delta y_{it} = \alpha y_{it-1} + \sum_{j=1}^{\rho} \lambda_{ij} \Delta y_{it-j} + \delta \mathbf{X} + v_{it} \quad (7)$$

Where Δy_{it} is the differentiated version of variable y , which in this case is each of the variables involved in equation 1. \mathbf{X} is a vector of seasonal dummies, for example. As in equation 1, $i = 1, \dots, 10$ or the number of countries; and $t = 1960-2007$ or the number of years. Similarly, j would equal the number of lags in the test. Finally, v_{it} represents the error term for this regression.

Using the residuals from equation 1 to approximate Δy_{it} and y_{it-1} , and estimating these approximations, α can be obtained. This test uses a modified t-test to determine the significance of α and verify if the null hypothesis of non-stationarity is rejected.

The following table shows the results for the unit root tests applied to regional aggregates.

Table 5. Test Results for Regional Aggregates

1960-2007				1984-2007				
A. Univariate Tests								
DF-GLS	KPSS	Philips-Perron	Inference	Regions	DF-GLS	KPSS	Philips-Perron	Inference
-1.863	0.143	0.3656	I(1)	North	-1.497	0.087	0.8346	I(0)
I(0)	I(1)	I(1)			I(0)	I(0)	I(1)	
-3.128	0.0749	0.9588	I(1)	East	-2.236	0.0708	0.9270	I(0)
I(1)	I(0)	I(1)			I(0)	I(0)	I(1)	
-1.586	0.197	0.6757	I(1)	West	-1.780	0.143	0.9857	I(1)
I(0)	I(1)	I(1)			I(0)	I(1)	I(1)	
-1.574	0.237	0.9903	I(1)	South	-2.149	0.0665	0.9787	I(0)
I(0)	I(1)	I(1)			I(0)	I(0)	I(1)	
B. Panel Tests								
IPS	LLC	Pescadf	Inference	Panel	IPS	LLC	Pescadf	Inference
0.999	0.9452	0.666	I(1)	Four	0.005	0.5711	0.400	I(1)
				Regions				
I(1)	I(1)	I(1)	I(1)		I(0)	I(1)	I(1)	I(1)

Source: Own elaboration.

Note: At 10% level of significance.

Table 5 presents mixed results. Nonetheless, it suggests that some regions have a non-stationary output per capita (North, East, South) for the 1984-2007 period, suggesting possible convergence among the countries in those regions. However, when compared with the whole period 1960-2007, the results tend to suggest that there is no convergence. This might be implying that some of the economic integration process started at the end of the 1990's might be promoting output per capita convergence throughout the region.

Table 6 presents the results for the unit root test at the country level. In general and for both periods (1960-2007 and 1984-2007), output per capita per country have a unit root. If there is any convergence process, it must be at a very early stage that the data is not yet capturing.

Table 6. Univariate Tests on Country Level Data

Region	Country	Country Average 1960-2007				Country Average 1984-2007			
		DF-GLS	KPSS	Philips-Perron	Inference	DF-GLS	KPSS	Philips-Perron	Inference
North	Colombia	-3.561 I(0)	0.118 I(0)	0.9782 I(1)	I(0)	-2.080 I(1)	0.108 I(0)	0.9648 I(1)	I(1)
	Ecuador	-1.882 I(1)	0.236 I(1)	0.8865 I(1)	I(1)	-1.155 I(1)	0.162 I(1)	0.9931 I(1)	I(1)
	Venezuela	-1.795 I(1)	0.136 I(1)	0.4621 I(1)	I(1)	-1.643 I(1)	0.0805 I(0)	0.3184 I(1)	I(1)
East	Bolivia	-2.279 I(1)	0.17 I(1)	0.4264 I(1)	I(1)	-3.165 I(0)	0.0925 I(0)	0.9885 I(1)	I(0)
	Paraguay	-1.519 I(1)	0.336 I(1)	0.5584 I(1)	I(1)	-2.252 I(0)	0.134 I(1)	0.4680 I(1)	I(1)
	Peru	-1.416 I(1)	0.179 I(1)	0.6404 I(1)	I(1)	-1.275 I(1)	0.171 I(1)	0.9377 I(1)	I(1)
West	Brazil	-1.840 I(1)	0.325 I(1)	0.6843 I(1)	I(1)	-1.858 I(0)	0.121 I(1)	0.8277 I(1)	I(1)
	Uruguay	-2.693 I(1)	0.121 I(1)	0.9687 I(1)	I(1)	-2.344 I(1)	0.0946 I(0)	0.935 I(1)	I(1)
South	Argentina	-2.107 I(1)	0.128 I(1)	0.7725 I(1)	I(1)	-2.242 I(0)	0.747 I(0)	0.8755 I(1)	I(0)
	Chile	-0.629 I(1)	0.406 I(1)	0.9999 I(1)	I(1)	-1.756 I(0)	0.113 I(0)	0.9733 I(1)	I(0)

Source: Own elaboration.

Table 7 analyzes if there is presence of stochastic convergence among the four regions being analyzed and the 10 countries in the sample. This is coherent with the notion of convergence clubs. However, the data indicates that we cannot reject the null hypothesis of nonstationarity in all cases. Therefore, output per capita is not converging within regions and between the 10 countries in the sample. This rules out the possibility of convergence clubs, at least as the ones (regions) chosen here.

Table 7. Panel Unit Root Test Results

		Region-Country	LLC	IPS	Inference
			p-value	p-value	
1960-2007		10 Countries	0.9903	0.999	I(1)
		North	0.3574	0.657	I(1)
		East	0.4800	0.576	I(1)
	National Average	West	0.6414	0.488	I(1)
		South	0.3226	0.5379	I(1)
1960-2007		10 Countries	0.9903	0.999	I(1)
		North	0.3793	0.657	I(1)
		East	0.4940	0.576	I(1)
	Regional Average	West	0.6926	0.488	I(1)
		South	0.5379	0.628	I(1)
1984-2007		10 Countries	0.2568	0.957	I(1)
		North	0.3179	0.177	I(1)
		East	0.9316	0.739	I(1)
	National Average	West	0.2367	0.479	I(1)
		South	0.0154	0.035	I(1)
1984-2007		10 Countries	0.2568	0.957	I(1)
		North	0.3179	0.177	I(1)
		East	0.9316	0.739	I(1)
	Regional Average	West	0.2367	0.479	I(1)
		South	0.0154	0.035	I(1)

Source: Own elaboration.

Table 8 estimates the relation between income volatility and the country specialization index. This index is comprised of the participation that the agricultural, manufacturing, services and industrial sectors have in the economy of each country. This index compares how similar is a country to other countries inside the same region and with the other countries outside the region. A country with a GDP specialized in one of these sectors would have an index of 0, if compared with another country that specializes in the same sector. In contrast, a country specialized in one sector compared to another specialized (totally) on a different sector would have a value of 2. The equation estimated in Table 8 is as follows:

$$SDY_{ij} = \alpha + \beta S_{ij} + \varepsilon_i \quad (8)$$

where SDY_i is the standard deviation of output disparity between countries i and j at time t ; and S_{ij} is the average specialization index for the period 1960-2007 for country i in comparison with the other countries in the sample.

Table 8. Income Volatility and Country Specialization Index

Region	Country	Specialization Index		Income Volatility and Specialization			
		Inside Region	Outside Region	beta	Standard Error	T-Ratio	R ²
North	Colombia	0.297	0.245	10.448	3.900	2.68	0.407
	Ecuador	0.256	0.220	16.624	4.116	4.04	0.629
	Venezuela	0.294	0.377	10.298	3.954	2.60	0.391
East	Brazil	0.253	0.292	11.053	3.459	3.19	0.505
	Uruguay	0.144	0.166	16.556	5.546	2.53	0.374
West	Bolivia	0.228	0.196	20.678	5.256	3.93	0.616
	Paraguay	0.304	0.257	9.828	3.440	2.86	0.443
	Peru	0.234	0.229	7.764	4.241	1.83	0.207
South	Argentina	0.177	0.219	16.006	5.368	2.98	0.467
	Chile	0.235	0.234	15.752	4.189	3.76	0.593

Source: Own elaboration.

As Table 8 suggests, the countries throughout the region have similar economic composition. Additionally, the estimated beta from the relation standard deviation of GDP disparity between country i and j and specialization index is significant in all cases at a 10% level and positive. This indicates that the more economically similar are two countries, the more they should experience less volatile patterns of relative per capita output. Consequently, the source for divergence does not seem to come from structural differences in the economies of the countries in South America.

However, several authors and specifically Krugman (1991) have pointed out the importance of geography in economic convergence and development. Might it be that the lack of convergence is coming from geographical differences? Table 9 tries to capture the impact of this variable by using the distance from the capital in each country in the sample to five geographic centers: Bogota, Brasilia, La Paz, Lima and Montevideo. The equation estimated in Table 9 is as follows:

$$SDY_i = \alpha + \delta D_i + \varepsilon_i \quad (9)$$

where SDY_i is the standard deviation of output disparity and D_i is the logarithm of geographical distance from country i relative to the specified geographic center.

Table 9. Geographic Distance and Income Volatility

Geographic Center	Delta	Standard Error	T-Ratio	R ²
Bogota	.0741089	.0232606	3.19	0.1775
Brasilia	.0163755	.0243867	0.67	0.0084
La Paz	-.0289928	.0319802	0.391	0.0261
Lima	.0399542	.023091	1.73	0.0479
Montevideo	-.0235472	.0354644	-0.66	0.0182

Source: Own elaboration.

The results in Table 9 are not consistent and only significant in one case. In this case, we cannot conclude that increasing the distance among two countries in the region might make relative output more volatile. Consequently, it is unclear if distance or geography captured as such is playing an important role in convergence. Although it does and should play a role, the distance among countries might not be the best way to capture it. Especially because the geographic differences throughout the region are significant. Some countries are located in the Andes and have access to two oceans directly, while others do not have any direct access (Paraguay and Uruguay). Nevertheless, I included other geographic variables to capture this phenomenon and used other cities as reference but the results where all insignificant.

In conclusion, the econometric analysis suggests that there is divergence among the ten countries in the sample for the 1960-2007 period. Although the analysis suggests that economic structural differences are not the reason and that maybe geography is not playing a major role, more research is required especially in the latter issue. Since the proxy for geography was distance and it does not capture all transaction costs involved in transport and trade barriers, for instance, further research should pursue a more comprehensive index or measure for geography.

Conclusion and Policy Implications

The results in this study suggest that South American countries diverge in terms of output per capita. In other words, the richer countries in the region are become richer and the poorer ones are not necessarily “catching up.” The first possible implication is that other factor such as institutions, civil unrest, corruption and political environment are important in explaining such divergence. However, if one assumes that these aspects do no matter then two possible explanations potentially arise. First, integration in the region is still at an early stage and thus not promoting economic convergence. The important implication of this is that economic and political integration agreements in the region should not be seen as a mean for generating economic growth, on the contrary they should be seen as an end. Policymakers should focus on developing national markets first in order to create a regional one. Regional markets are not the solution to economic development. The other possibility is that South America must go further in its integration process to gain convergence. However, the empirical evidence indicates that this is no guarantee (Walz, 1999).

Second, countries in South America follow paths that lead to multiple equilibriums. It is possible that some of those countries are stuck in poverty traps that are worsening with shocks (natural disasters, political turmoil) and leading every time to an equilibrium that is worse than the previous one. Perhaps this alludes to the need of a more comprehensive social agenda in the region, more expenditure on education and health as a percentage of GDP and a regional system that transfers resources from the rich countries allocating them to the poorest in the region. Indeed, improving these factors could sponsor productivity and push a country out of the poverty trap.

Third, the region might be lacking a transportation infrastructure that connects countries throughout the region and reduces transaction costs. Developing a railroad and highway system for the region as a whole would work. Moreover, reducing or eliminating the barriers—violence, restricting access to vehicles and merchandise, administrative restrictions—that do not foster mobility would also help. Finally, an interconnected system of tunnels for those countries on the Andes would facilitate mobility.

Lastly, but not least, countries might not be converging because they are not benefiting from the spillovers of regional innovation. Imitation and reverse engineering are limited in the region due to a lack of a centralized system of patents or networks that allow scientific information to flow from one country to another. In that sense, alliances and joint ventures among universities and research centers in the region would allow to share the costs of research and development but also spread the consequent wealth. Perhaps South American countries should start focusing more on regional networks without abandoning international ones.

References

- Acemoglu, Daron, Simon Johnson, and James Robinson (2004), “Institutions as the Fundamental Cause of Long-Run Growth,” CEPR Discussion Papers 4458, C.E.P.R. Discussion Papers.
- Aroca, Patricio; Mariano Bosch and William Maloney (2005), “Spatial Dimensions of Trade Liberalization and Economic Convergence: Mexico 1985–2002,” *The World Bank Economic Review*, Vol. 19, No. 3, pp. 345-378.
- Barro, Robert J. and Xavier Sala-i-Martin (1991), “Convergence across states and regions,” *Brookings Papers on Economic Activity*, No. 1, 107-182.
- Barro, Robert J. and Xavier Sala-i-Martin (2004), *Economic Growth*, MIT press, Cambridge.
- Baumol, William J. (1986), “Productivity Growth, Convergence, and Welfare: What the Long-run Data Show,” *American Economic Review*, Vol. 76, No. 5, pp. 1072-85.
- Baumol, William J. and Edward N. Wolff (1988). “Productivity Growth, Convergence, and Welfare: Reply,” *American Economic Review*, Vol. 78, No. 5, pp. 1155-1159.

- Blyde, J. (2005), "Convergence Dynamics in Mercosur," Inter-American Development Bank (IADB) Working Paper. Available at: <http://ssrn.com/abstract=900120>.
- Blyde, J. (2006), "Latin American Clubs: Uncovering Patterns of Convergence," Inter-American Development Bank (IADB) Working Paper. Available at: papers.ssrn.com/sol3/papers.cfm?abstract_id=900124.
- Boeri, Tito (2002), "Social Policy: one for all?," Working Paper, Bocconi University and Fondazione Rodolfo De Benedetti.
- Bonet, J., Meisel, A. (1999), "La convergencia regional en Colombia: una visión de largo plazo, 1926-1995", *Coyuntura Económica*, Vol. 29, No. 1, pp. 69-106.
- Cáceres, L. and O. Nuñez Sandoval (1999). "Crecimiento económico y divergencia en América Latina" . *El Trimestre Económico*, Vol. LXVI, No. 4.
- Choi, Chi-Young (2004), "A Reexamination of Output Convergence in the U.S. States: Toward which Level(s) are they Converging?," *Journal of Regional Science*, Vol. 44, No. 4, pp. 713-741.
- Dabus, Carlos and Belen Zinni (2005), "No Convergencia en America Latina," Working Paper No. 1997, Asociacion Argentina de Economia Politica, La Plata 2005. Available at: http://www.aaep.org.ar/espa/anales/works05/dabus_zinni.pdf.
- De La Fuente, Angel (1997), "The empirics of growth and convergence: A selective review," *Journal of Economic Dynamics and Control*, Vol. 21, No. 1, pp. 23-73.
- DeLong, James Bradford (1988), "Productivity Growth, Convergence, and Welfare: Comment," *American Economic Review*, Vol. 78, No. 5, pp. 1138-1154.
- Diaz-Bautista, Alejandro and Diana Celaya (2002), "Crecimiento, Instituciones y Convergencia en Mexico: Considerando A La Frontera Norte," *Estudios Fronterizos*, Vol. 3, No. 6.
- Dobson, S. and C. Ramlogan (2002), "Economic growth and convergence in Latin America," *Journal of Development Studies*, 38, pp. 83-104.
- Dobson, S.; J. Goddard and C. Ramlogan (2003), "Convergence in Developing Countries: Evidence from Panel Unit Root Tests," Discussion Paper 0305, Department of Economics, University of Otago, Dunedin, New Zealand.
- Duncan, Roberto and Rodrigo Fuentes (2006), "Regional Convergence in Chile: New Tests, Old Results," *Cuadernos de Economía*, Vol. 43, No. 127, pp. 81-112.
- Durlauf, S., and P. Johnson (1995), "Multiple Regimes and Cross Country Growth Behavior," *Journal of Applied Econometrics*, Vol. 10, No. 4, pp. 365-384.

- Ferreira, A. (2000), "Convergence in Brazil: Recent Trends and Long Run Prospects," *Applied Economics*, Vol. 32, pp. 479-490.
- Ferreira, A. and C. Diniz (1995), "Convergencia entre las rendas per capita estatales en Brasil," *EURE Revista Latinoamericana de Estudios Urbano Regionales*, Vol. 21, No. 62.
- Galor, Oded, (1996), "Convergence? Inferences from Theoretical Models," *Economic Journal*, Vol. 106, No. 437, pp. 1056-69.
- Garrido, Nicolás; Adriana Marina and Daniel Sotelsek (2002), "Convergencia económica en las provincias argentinas (1970-1995)," *Estudios de Economía Aplicada*, Vol. 20, pp. 403-421.
- Gómez Cuenca, Carolina (2006), "Convergencia Regional En Colombia: un enfoque en los Agregados Monetarios y en el Sector Exportador," *Investigaciones Sobre Economía Regional* No. 002201, Banco De La República.
- Koo, Jaewoon, Young-Yong Kim and Sangphil Kim (1998), "Regional Income Convergence: Evidence from a Rapidly Growing Economy," *Journal of Economic Development*, Vol 23, No. 2, pp. 191-203.
- Krugman, Paul (1991), *Geography and Trade*, Cambridge University Press, Cambridge.
- Lacas, Jean Dominic (2001), "Sigma Convergence in Northern Regions: a comparison between Finland and the Canadian Province of Quebec," Master's Thesis, University of Helsinki. Available at: <https://dspace.it.helsinki.fi/manakin/bitstream/handle/10224/860/2001-1261.pdf?sequence=1>.
- Magalhães A., G. Hewings and C. Azzoni (2005), "Spatial dependence and regional convergence in Brazil," *Investigaciones Regionales*, Vol. 6, pp. 5-20.
- Odar Zagaceta, Juan Carlos (2002), "Convergencia y polarización. El caso Peruano: 1961-1996," *Estudios de Economía*, Vol. 29, No. 1, pp. 47-70.
- Quah, Danny (1992), "International Patterns of Growth:II. Persistence, Path Dependence, and Sustained Take-Off in Growth Transition," Working Paper London School of Economics. Available at: <http://econ.lse.ac.uk/~dquah/p/9210ip2.pdf>.
- Quah, Danny (1996), "Twin Peaks: Growth and Convergence in Models of Distribution Dynamics," *Economic Journal*, Vol. 106, No. 437, pp. 1045-55.
- Quah, Danny T. (1993), "Galton's Fallacy and the Convergence Hypothesis," *Scandinavian Journal of Economics*, Vol. 95, pp. 427-443.

- Ramsey Frank (1928), "A Mathematical Theory of Saving," *Economic Journal*, Vol. 38, No. 152, pp. 543-559.
- Rey, Sergio J. and Boris Dev (2004), "Sigma-convergence in the presence of spatial effects," Urban/Regional 0404008, EconWPA, revised 22 Apr 2004.
- Romer, Paul M. (1990), "Endogenous Technological Change," *Journal of Political Economy*, Vol. 94, No. 5, pp. 71-102.
- Sala-i-Martin, Xavier (1996), "Regional Cohesion: Evidence and Theories of Regional Growth and Convergence," *European Economic Review*, Vol. 40, pp. 1325-1352.
- Siriopoulos, Costas and Dimitrios Asteriou (1997), "Testing the Convergence Hypothesis for Greece," *Managerial and Decision Economics*, Vol. 18, No. 5, pp. 383-389.
- Solow, Robert (1956), "A Contribution to the Theory of Economic Growth," *Quarterly Journal of Economics*, Vol. 70, pp. 65-94.
- Soto, Raimundo and Aristides Torche (2004), "Spatial inequality, migration, and economic growth in Chile," *Cuadernos de Economía*, Vol. 41, No. 124.
- Togo, Ken (2001), "A Brief Survey on Regional Convergence in East Asian Economies," Mushashi University Working Paper No. 5F8, Mushashi University, Japan.
- Tsionas, E. (2000), "Regional Growth and Convergence: Evidence from the United States," *Regional Studies*, Vol. 34, No. 3, pp. 231 – 238.
- Utrera, Gaston Ezequiel (1999), "El Crecimiento Economico en America Latina," Working Paper No. 1453, Asociacion Argentina de Economia Politica, Rosario 1999. Available at: http://www.aep.org.ar/espa/anales/pdf_99/utrera.pdf.
- Walz, Uwe (1999), *Dynamics of Regional Integration*, Physica-Verlag , New York.
- Young, Andrew; Matthew Higgins and Daniel Levy (2007), "Sigma Convergence versus Beta Convergence: Evidence from U.S. County-Level Data," MPRA Paper No. 2714, posted 07. Available at: Online at <http://mpa.ub.uni-muenchen.de/2714/>.

Borradores del CIE

No.	Título	Autor(es)	Fecha
01	Organismos reguladores del sistema de salud colombiano: conformación, funcionamiento y responsabilidades.	Durfari Velandia Naranjo Jairo Restrepo Zea Sandra Rodríguez Acosta	Agosto de 2002
02	Economía y relaciones sexuales: un modelo económico, su verificación empírica y posibles recomendaciones para disminuir los casos de sida.	Marcela Montoya Múnera Danny García Callejas	Noviembre de 2002
03	Un modelo RSDAIDS para las importaciones de madera de Estados Unidos y sus implicaciones para Colombia	Mauricio Alviar Ramírez Medardo Restrepo Patiño Santiago Gallón Gómez	Noviembre de 2002
04	Determinantes de la deserción estudiantil en la Universidad de Antioquia	Johanna Vásquez Velásquez Elkin Castaño Vélez Santiago Gallón Gómez Karoll Gómez Portilla	Julio de 2003
05	Producción académica en Economía de la Salud en Colombia, 1980-2002	Karem Espinosa Echavarría Jairo Humberto Restrepo Zea Sandra Rodríguez Acosta	Agosto de 2003
06	Las relaciones del desarrollo económico con la geografía y el territorio: una revisión.	Jorge Lotero Contreras	Septiembre de 2003
07	La ética de los estudiantes frente a los exámenes académicos: un problema relacionado con beneficios económicos y probabilidades	Danny García Callejas	Noviembre de 2003
08	Impactos monetarios e institucionales de la deuda pública en Colombia 1840-1890	Angela Milena Rojas R.	Febrero de 2004
09	Institucionalidad e incentivos en la educación básica y media en Colombia	David Fernando Tobón Germán Darío Valencia Danny García Guillermo Pérez Gustavo Adolfo Castillo	Febrero de 2004
10	Selección adversa en el régimen contributivo de salud: el caso de la EPS de Susalud	Johanna Vásquez Velásquez Karoll Gómez Portilla	Marzo de 2004
11	Diseño y experiencia de la regulación en salud en Colombia	Jairo Humberto Restrepo Zea Sandra Rodríguez Acosta	Marzo de 2004
12	Economic Growth, Consumption and Oil Scarcity in Colombia: A Ramsey model, time series and panel data approach	Danny García Callejas	Marzo de 2005
13	La competitividad: aproximación conceptual desde la teoría del crecimiento y la geografía económica	Jorge Lotero Contreras Ana Isabel Moreno Monroy Mauricio Giovanni Valencia Amaya	Mayo de 2005
14	La curva Ambiental de Kuznets para la calidad del agua: un análisis de su validez mediante raíces unitarias y cointegración	Mauricio Alviar Ramírez Catalina Granda Carvajal Luis Guillermo Pérez Puerta Juan Carlos Muñoz Mora Diana Constanza Restrepo Ochoa	Mayo de 2006
15	Integración vertical en el sistema de salud colombiano: Aproximaciones empíricas y análisis de doble marginalización	Jairo Humberto Restrepo Zea John Fernando Lopera Sierra Sandra Rodríguez Acosta	Mayo de 2006
16	Cliometrics: a market account of a scientific community (1957-2005)	Angela Milena Rojas	Septiembre de 2006
17	Regulación ambiental sobre la contaminación vehicular en Colombia: ¿hacia dónde vamos?	David Tobón Orozco Andrés Felipe Sánchez Gandur María Victoria Cárdenas Londoño	Septiembre de 2006
18	Biology and Economics: Metaphors that Economists usually take from Biology	Danny García Callejas	Septiembre de 2006

19	Perspectiva Económica sobre la demanda de combustibles en Antioquia	Elizeth Ramos Oyola Maria Victoria Cárdenas Londoño David Tobón Orozco	Septiembre de 2006
20	Caracterización económica del deporte en Antioquia y Colombia: 1998-2001	Ramón Javier Mesa Callejas Rodrigo Arboleda Sierra Ana Milena Olarte Cadavid Carlos Mario Londoño Toro Juan David Gómez Gonzalo Valderrama	Octubre de 2006
21	Impacto Económico de los Juegos Deportivos Departamentales 2004: el caso de Santa Fe De Antioquia	Ramón Javier Mesa Callejas Ana Milena Olarte Cadavid Nini Johana Marín Rodríguez Mauricio A. Hernández Monsalve Rodrigo Arboleda Sierra	Octubre de 2006
22	Diagnóstico del sector deporte, la recreación y la educación física en Antioquia	Ramón Javier Mesa Callejas Rodrigo Arboleda Sierra Juan Francisco Gutiérrez Betancur Mauricio López González Nini Johana Marín Rodríguez Nelson Alveiro Gaviria García	Octubre de 2006
23	Formulación de una política pública para el sector del deporte, la recreación y la educación física en Antioquia	Ramón Javier Mesa Callejas Rodrigo Arboleda Sierra Juan Francisco Gutiérrez Betancur Mauricio López González Nini Johana Marín Rodríguez Nelson Alveiro Gaviria García	Octubre de 2006
24	El efecto de las intervenciones cambiarias: la experiencia colombiana 2004-2006	Mauricio A. Hernández Monsalve Ramón Javier Mesa Callejas	Octubre de 2006
25	Economic policy and institutional change: a context-specific model for explaining the economic reforms failure in 1970's Colombia	Angela Milena Rojas	Noviembre de 2006
26	Definición teórica y medición del Comercio Intraindustrial	Ana Isabel Moreno M. Héctor Mauricio Posada D	Noviembre de 2006
Borradores Departamento de Economía			
27	Aportes teóricos al debate de la agricultura desde la economía	Marleny Cardona Acevedo Yady Marcela Barrero Amortegui Carlos Felipe Gaviria Garcés Ever Humberto Álvarez Sánchez Juan Carlos Muñoz Mora	Septiembre de 2007
28	Competitiveness of Colombian Departments observed from an Economic geography Perspective	Jorge Lotero Contreras Héctor Mauricio Posada Duque Daniel Valderrama	Abril de 2009
29	La Curva de Engel de los Servicios de Salud En Colombia. Una Aproximación Semiparamétrica	Jorge Barrientos Marín Juan Miguel Gallego Juan Pablo Saldarriaga	Julio de 2009
30	La función reguladora del Estado: ¿qué regular y por qué?: Conceptualización y el caso de Colombia	Jorge Hernán Flórez Acosta	Julio de 2009
31	Evolución y determinantes de las exportaciones industriales regionales: evidencia empírica para Colombia, 1977-2002	Jorge Barrientos Marín Jorge Lotero Contreras	Septiembre de 2009
32	La política ambiental en Colombia: Tasas retributivas y Equilibrios de Nash	Medardo Restrepo Patiño	Octubre de 2009
33	Restricción vehicular y regulación ambiental: el programa "Pico y Placa" en Medellín	David Tobón Orozco Carlos Vasco Correa Blanca Gómez Olivo	Mayo de 2010
34	Corruption, Economic Freedom and Political Freedom in South America: In Pursuit of the missing Link	Danny García Callejas	Agosto de 2010

35	Karl Marx: dinero, capital y crisis	Ghislain Deleplace	Octubre de 2010
36	Democracy and Environmental Quality in Latin America: A Panel System of Equations Approach, 1995-2008	Danny García Callejas	Noviembre de 2010
37	Political competition in dual economies: clientelism in Latin America	Angela M.Rojas Rivera	Febrero de 2011
38	Implicaciones de Forward y Futuros para el Sector Eléctrico Colombiano	Duvan Fernando Torres Gómez Astrid Carolina Arroyave Tangarife	Marzo de 2011
39	Per Capita GDP Convergence in South America, 1960-2007	Danny García Callejas	Mayo de 2011