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LATIN AMERICA VS EAST ASIA:
THE BATTLE FOR ECONOMIC GROWTH

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A mi mamá, a mi hermana Diana
y a mi abuelita Pera
por todo su apoyo y amor

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Latin America vs East Asia: The Battle for Economic Growth

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May of 2021

Abstract

In this paper, I analyze why East Asia has grown faster than Latin America during the last decades, testing the hypothesis that convergence forces, both conditional and unconditional, could explain a substantial fraction of the gap in per capita GDP growth of those regions. To decompose that gap, I ran 3SLS regressions, and I found that most of the gap of the period 1975-1995 was caused for differences in the inflation rate and the initial income. However, after 1995, there was a sharp fall in Latin American inflation; and the East Asian income had almost reached the Latin American level, so these variables could not explain the gap of the period 1995-2015. I also found evidence of unconditional convergence within these regions.

Contents

Introduction

Many papers have analyzed the amazing economic growth of the four Asian tigers; however, the high economic growth rates are not exclusive of Taiwan or South Korea, but are generalized around all East Asia, which contrasts with the poor performance of the Latin American countries during the last decades.

Some studies have pointed out that variables like the inflation rate or the economic openness could explain this gap of per capita GDP growth; however, another possible explanation is the income convergence because Latin America had a much higher income level in 1965, which suggest that East Asia could have grown faster due to the catching up phenomenon.

The main question of this thesis is: What are the causes that explain the GDP per capita growth gap between Latin America and East Asia during 1975-2015? And the hypothesis is that the convergence phenomenon, both conditional and unconditional, can explain a substantial fraction of the gap.

The Solow model implies a conditional convergence across countries; however, recent empirical studies, like Patel, Sandefur, and Subramanian (2021), have found evidence of unconditional convergence, and that is why this thesis analyzes both types of convergence.

Studying this topic is relevant because East Asia showed a way how developing countries could progress and reach high levels of economic growth. There is a lot that Latin America can learn from East Asia, and this research can shed light on this problem.

In the first chapter of this thesis, I will present a general overview of the problem, showing descriptive statistics of the economic growth and contrasting the situation of both regions in some of the most relevant variables to explain the gap.

Later, I will analyze the growth accounting of Latin America and East Asia, decomposing the gap of economic growth into three parts: one explained by physical capital accumulation; another one explained by human capital accumulation; and the last one explained by the growth of the Total Factor Productivity (TFP). And, to test robustness, I will use different methods to measure human and physical capital, and I will consider different alpha values.

Finally, in chapter 3, I will run Barro regressions using as explanatory variables the

rule of law; the investment, the fertility, and the inflation rates; a variable of democracy; and the initial income, and I will estimate which fraction of the per capita GDP growth gap can be explained for which variable. I will also measure the degree of conditional and unconditional convergence within East Asia and Latin America. And the last chapter presents the conclusions.

Chapter 1

General View of Economic Growth in Both Regions

In the 1960s, most Latin American and East Asian countries were considered developing countries, had emerging industries and were ruled by authoritarian regimes. In fact, in many cases, these countries had military governments. Furthermore, both regions held high economic growth rates, and their developing process was taking place while many people demanded more political rights.

However, in the 1980s, while Latin America suffered a dangerous debt crisis that stopped the regional economic growth, East Asia kept growing. But even before these events and until now, there is a significant growth gap between both regions that has lasted more than four decades. Not even the Asian crisis of 1997 reversed the trend. From this, we can ask: why has one group grown while the other one has stagnated?

In this chapter, I will present some statistics and graphs that show a general view of the problem; and I will also mention some of the main political and economic differences between Latin America and East Asia.

1.1 A First Comparison Between Regions

In this research, I will consider 22 Latin American Countries and 21 East Asian countries. Table 1.1 shows the specific countries that are considered and the economic growth of these samples between 1965 and 2015.

We can see that the simple average growth of East Asian countries has exceeded that of the Latin American countries in all the periods considered.

Even more, all East Asian countries had higher economic growth than the Latin American

average in the period 1975-2015, and Chile, which was the country that grew the most in Latin America, got an economic growth lower than the East Asian average in the same period.

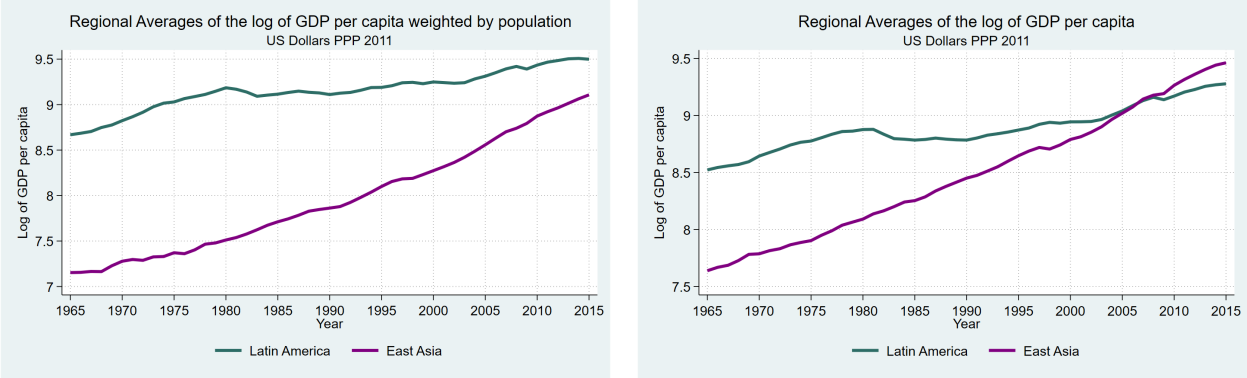
Moreover, it is remarkable that the GDP per capita of four Latin American countries (Jamaica, Venezuela, Nicaragua, and Haiti) decreased between 1975 and 2015. On the other hand, all East Asian countries experienced an income increase, with China, South Korea, and Bhutan standing out.

Countries like Bangladesh, Laos, Mongolia, and Myanmar had indeed lagged in their region, but in the new century their growth has accelerated, so that the economic growth gap between regions is not driven by some outliers, but it is a generalized phenomenon that remains true if we consider the regional growth instead of simple averages.

The first possible explanation that we can come up with is the convergence force: East Asia has grown more because it started from lower-income levels. In fact, in 1975, eleven East Asian countries were poorer than Haiti, which was the Latin American country with the lowest GDP per capita. Either with unweighted and weighted by population averages, Latin America was a wealthier region.

Nonetheless, Figure 1.1 reveals that the income evolution is different depending on how we consider the regional income. If we take the GDP per capita weighted by population, East Asia was still poorer than Latin America in 2015 as a result of the low income of China and India, giving the idea that convergence forces continue boosting East Asian growth. However, if we consider unweighted averages, East Asia reached and overcame the Latin American income around 2007 and; despite that, East Asia continues to grow faster, which could indicate that East Asian countries have higher income levels in their stationary states.

Figure 1.1. GDP per capita evolution 1965-2015



Source: Own elaboration with data from PWT 9.1.

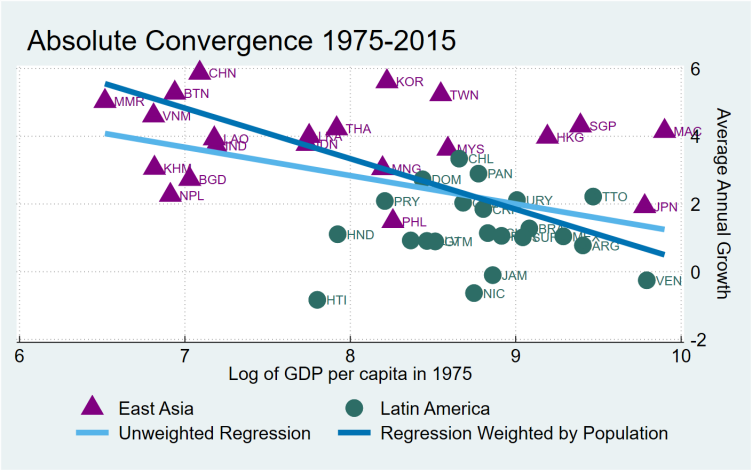
Table 1.1. Economic Growth in Latin America and East Asia

	Average Annual Growth Rate of GDP per capita						Ratio
Country	1965-1975	1975-1985	1985-1995	1995-2005	2005-2015	1975-2015	2015/1975
Latin America							
Argentina	1.84	-1.42	1.33	1.11	2.08	0.78	1.36
Bolivia	0.72	-2.10	1.16	1.34	3.30	0.92	1.45
Brazil	5.84	1.79	0.60	0.95	1.76	1.28	1.67
Chile	-0.66	1.71	5.82	3.01	2.81	3.34	3.80
Colombia	3.09	1.47	2.52	0.78	3.38	2.04	2.26
Costa Rica	3.33	0.06	2.36	2.08	2.90	1.85	2.10
Dominican Republic	5.33	1.20	2.02	3.50	4.20	2.73	2.98
Ecuador	3.77	0.80	0.46	1.08	2.22	1.14	1.58
El Salvador	1.88	-2.14	2.62	1.95	1.21	0.91	1.44
Guatemala	3.13	-0.26	1.20	1.13	1.51	0.90	1.43
Haiti	0.56	0.13	-3.28	-0.73	0.56	-0.83	0.72
Honduras	0.37	1.26	0.40	1.21	1.56	1.11	1.56
Jamaica	1.27	-3.02	3.03	-0.03	-0.38	-0.10	0.96
Mexico	3.04	1.79	-0.17	1.86	0.70	1.04	1.52
Nicaragua	1.40	-4.77	-2.98	2.46	2.77	-0.63	0.78
Panama	4.45	2.45	1.17	2.42	5.55	2.90	3.18
Paraguay	2.95	3.35	0.97	0.57	3.45	2.09	2.30
Peru	2.14	-1.63	-0.50	1.99	4.38	1.06	1.53
Suriname		1.61	-1.89	2.23	2.12	1.02	1.50
Trinidad and Tobago	2.47	1.05	-1.14	7.20	1.76	2.22	2.43
Uruguay	1.48	0.21	3.15	0.86	4.24	2.12	2.33
Venezuela	2.17	-1.73	0.60	-0.25	0.36	-0.25	0.90
SIMPLE AVERAGE	**2.41**	**0.08**	**0.88**	**1.67**	**2.38**	**1.25**	**1.81**
REGIONAL TOTAL	**3.47**	**0.89**	**0.72**	**1.26**	**1.78**	**1.16**	**1.59**
East Asia							
Bangladesh	-2.01	1.13	1.67	3.29	4.84	2.73	2.98
Bhutan		3.63	7.34	4.77	5.38	5.28	8.26
Cambodia		-2.42	3.81	5.72	5.14	3.06	3.40
China	2.42	4.83	4.67	6.52	7.45	5.87	10.45
Hong Kong	3.92	5.93	4.90	2.30	2.78	3.98	4.91
India	1.57	1.85	3.53	4.31	5.20	3.72	4.43
Indonesia	3.45	4.23	5.34	1.31	4.18	3.77	4.51
Japón	6.25	3.37	2.78	0.98	0.58	1.93	2.16
Laos		2.80	2.36	4.45	6.11	3.93	4.82
Macao		5.42	3.77	2.93	4.48	4.15	5.26
Malaysia	5.33	4.10	5.02	2.41	2.98	3.63	4.26
Mongolia		3.58	-1.32	3.59	6.35	3.05	3.39
Myanmar	0.05	2.95	0.26	8.89	8.04	5.03	7.49
Nepal	0.25	1.28	2.30	2.29	3.18	2.26	2.47
Philippines	2.14	-0.44	0.87	1.88	3.64	1.49	1.81
Singapore	8.73	5.63	5.76	2.57	3.28	4.31	5.61
South Korea	7.41	7.12	7.98	4.26	3.11	5.62	9.45
Sri Lanka	3.01	3.66	3.11	3.75	5.49	4.00	4.96
Tailandia	6.63	4.41	7.64	2.06	2.80	4.23	5.42
Taiwan	6.26	6.65	7.03	4.19	3.05	5.23	8.10
Vietnam		3.92	3.89	5.73	4.89	4.61	6.32
SIMPLE AVERAGE	**3.69**	**3.51**	**3.94**	**3.72**	**4.43**	**3.90**	**5.26**
REGIONAL TOTAL	**3.43**	**3.29**	**3.65**	**3.47**	**4.71**	**3.78**	**4.54**

Source: Own elaboration with data from Penn World Table 9.1. The GDP per capita data comes from the GDP series with 2011 PPP adjusted by National Account Growth Rates.

Figure 1.2. plots the initial income of the countries against their average economic growth in the period 1975-2015. Mankiw, Romer, and Weil (1992) argued that we should not expect an absolute convergence but a convergence conditioned by certain variables, like human capital and population growth, nonetheless, this graph shows a clear negative correlation that is even stronger if we weight by population, since China and India were some of the countries with the highest economic growth. In addition, it seems that the slow economic growth of Japan and other rich countries can be mostly explained by their initial income.

Figure 1.2. Growth and Initial Income Level



Source. Own elaboration with data from PWT 9.1.

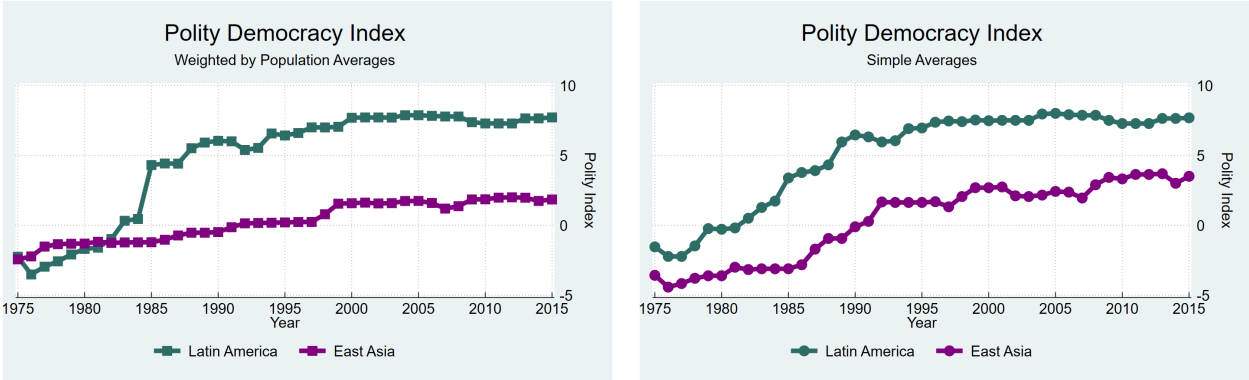
1.2 Institutional and Cultural Differences

Both regions indeed suffered from European imperialism; nevertheless, while most Latin American countries got their independence in the early eighteenth century, many East Asian countries remained as colonies until the end of the Second World War or after. Moreover, different kinds of colonies were implemented, and that caused sharp cultural differences.

In Latin America, for example, Spanish and Portuguese keep a duopoly of the language, while the native languages, like Maya, Nahuatl, and Quechua, are only spoken in a minority way. In contrast, in East Asia, both Western and Eastern languages are spoken, and there is no tongue with the monopoly. Some of the main languages in East Asia are Chinese, Hindi, Japanese, Bengali, Urdu, Indonesian, Javanese and Korean; however, there are several more that are widely spoken.

Likewise, Latin America has adopted in a deeper way the western culture imposed by

Figure 1.3. Political Regime



Source: Own elaboration with data from Polity V.

Europeans. It happens the same with religion: according to data of the Pew Research Center, in 2012, around 91% of Latin Americans professed some kind of Christianity, mainly Catholicism, while East Asia has a considerable religious diversity. Indeed, Hinduism is the most popular religion in that region and is professed only by 29% of the population. Other religions with a strong presence in East Asia are Islam, Buddhism, Confucianism, Catholicism, and Taoism, and there is also a high percentage of people without any religion.

And these cultural differences can matter for economic growth because, as Acemoglu (2009) asserted, the literature has considered three core causes of the differences in economic growth: 1) Institutions, 2)Culture, and 3)Geography.

On the institutional side, one can say that Latin America is more democratic, while East Asia has had more authoritarian governments during the last decades. In Figure 1.3. we can appreciate the evolution of the democracy level of both regions through the Polity Index, which assigns a value of 10 to full democracies and a value of -10 to the most autocratic governments. Civil liberties and political rights have indeed been extended in both regions, but Latin America has made more progress in this field. In fact, in 2005, all Latin American countries but Haiti and Suriname were classified as democracies, that is, they got a score higher than 5; and in 2015, no country in Latin America was considered as an autocracy, while China, Laos, and Vietnam were.

Nonetheless, between the 1950s and 1980s tyrannical regimes and military coups were common in practically all Latin America. Jamaica and Costa Rica were the only Latin American countries that remained democratic during all the periods of analysis. The most remarkable dictatorships took place in Argentina (1976-1983), Brazil(1964-1985), Bolivia (1971-1978), Chile (1973-1990), Ecuador(1974-1976), Haiti (1957-1986), Honduras

(1972-1982), Nicaragua (1937-1979), Panama (1968-1989), Paraguay (1954-1989), Peru (1968-1980), and Uruguay (1973-1984). I also have to mention the one-party regime of Mexico (1929-2000), the authoritarian presidency of Fujimori in Peru (1990-2000), the Civil War in El Salvador (1980-1992), the Guatemalan Genocide (1981-1983), and the Nicaraguan Revolution (1979-1990), that killed thousands of people and destroyed the Nicaraguan economy.

Usually, these authoritarian regimes were followed by neoliberal governments that ruled in the 1990s and the 2000s. These governments democratized the political systems, deregulated the market, privatized state companies, and allowed a greater economic openness. However, they also were characterized by high corruption and increasing social inequalities. Finally, in the 2000s left-wing presidents were elected in many countries: Hugo Chávez (1999-2013) in Venezuela; Nicolás Maduro (2013-present) in Venezuela; Lula da Silva (2003-2010) in Brazil; Dilma Rousseff (2011-2016) in Brazil; Néstor Kirchner (2003-2007) in Argentina; Cristina Fernández (2007-2015) in Argentina; Tabaré Vázquez (2005-2010) in Uruguay; José Mujica (2010-2015) in Uruguay; Evo Morales (2006-2019) in Bolivia; Daniel Ortega (2006-present) in Nicaragua; Michelle Bachelet (2006-2010) in Chile; and Rafael Correa (2007-2017) in Ecuador.

These governments have reduced poverty in the region; however, corruption has remained as a central problem; and some presidents, like Nicolás Maduro, have represented a threat to freedom of the press and democracy.

The political system is meaningful to economic growth since this requires a strong rule of law to attract investment. Besides, the economic contractions in Haiti and Nicaragua can be mostly explained by their political situations: in the first case, by the totalitarian dictatorships interspersed with periods of anarchy and, in the second place, by the Nicaraguan Revolution.

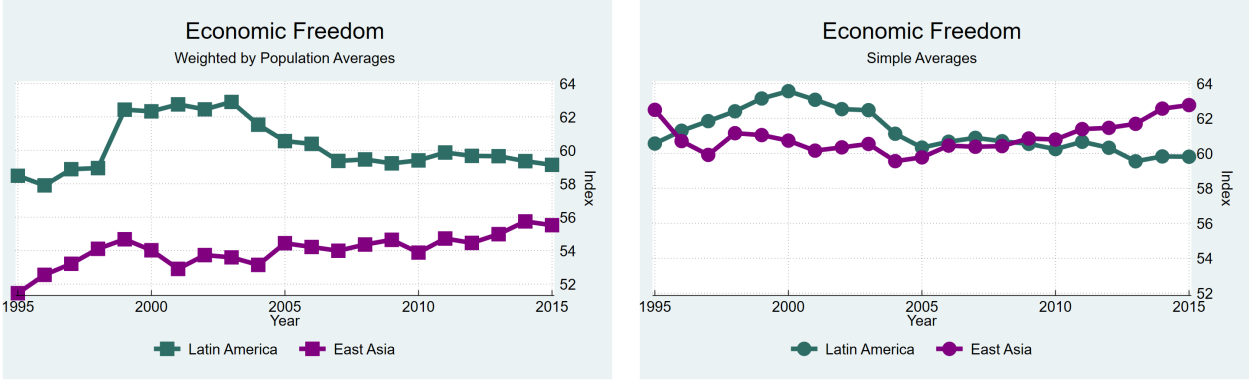
During the 1970s and the 1980s, Latin America also characterized by having high inflation rates, which was a cause of social unrest and price distortion. In fact, some countries, like Argentina, Bolivia and Brazil experienced episodes of hyperinflation that hurt their economies. And, as we will see in chapter three, this high inflation could explain the low growth rates of this region during that period and it contrasts with East Asia, that has always had much lower inflation rates.

Many autocratic dictatorships have also fallen in East Asia, but they have been replaced by authoritarian governments instead of democracies. Likewise, most of the current East Asian regimes celebrate periodical elections, and there is more freedom of the press than decades before; but the political rights are limited, and corruption is also a huge problem. For instance, even though Singapore's elections have the international endorsement, a single

Figure 1.4. Corruption Levels

Source: Own elaboration with data from Transparency International.

Figure 1.5. Index of Economic Freedom



Source: Own elaboration with data from Index of Economic Freedom.

party has held power and the majority of the Congress since its independence.

But in East Asia, authoritarianism has been accompanied by economic freedom and a pro-capitalist stance seeking foreign investment. One example is China, because the communist Mao's regime, characterized by personality cult, was replaced by a government that has introduced many capitalist reforms and promotes the freedom of trade, but has kept the one-party system and controls the media though.

All the region has been hit by rampant corruption that is as serious as the Latin American levels if we weight by population. Figure 1.4 depicts the Corruption Index of Transparency International, where 10 means full transparency and 0 means total corruption. It stands out that Latin America is more corrupted if we consider unweighted data.

Figure 1.6. Homicide Rate

Source: Own elaboration with data from the World Bank.

Regarding economic freedom, both regions are almost at the same level. There are indeed some countries in East Asia, like Singapore, Hong Kong and Taiwan, that are authentic paradises of economic freedom; however, most of the countries still have a lot of barriers. Figure 1.5 describes the evolution of the Index of Economic Freedom, where 100 represents complete liberty and 0, the opposite.

However, there is an important difference between East Asia and Latin America that could be relevant and is related to the rule of law: the criminal rate. The crime incidence has historically been much higher in Latin America, and Figure 1.6 exemplifies this using the homicide rate.

Evidently, the homicide rate is only a *proxy* of the rule of law, but other sources confirm that this is stronger in East Asia. In this research we will use the rule of law index from the International Country Risk Guide, where East Asia had higher scores than Latin America during all the period.

But there other variables where we can appreciate important differences between regions. For example, East Asia has had higher investment rates for the last decades, which could boost the regional per capita GDP growth gap increasing the economic growth of East Asian countries. On the other hand, Latin America has reported higher fertility rates, which has reduced its growth. Figures 1.7 and 1.8 illustrate these differences.

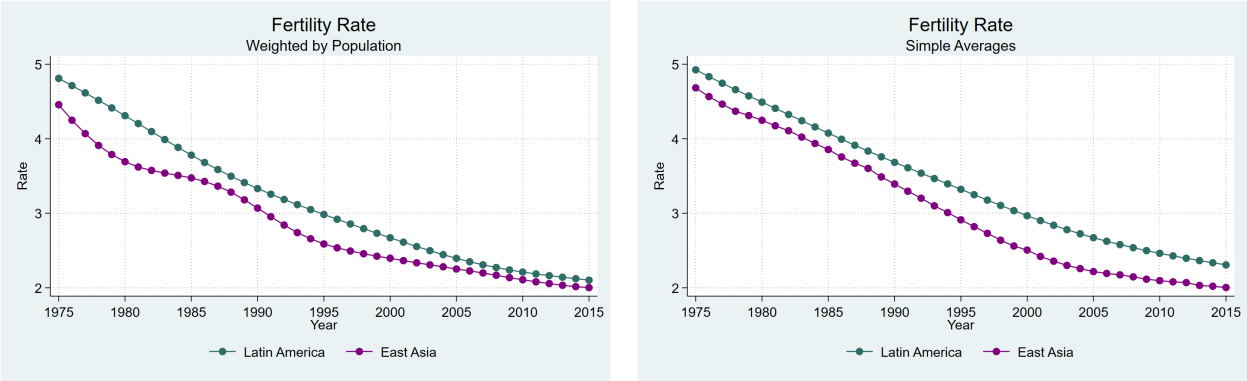
1.3 Graphic Analysis

In the economic analysis of different gaps, it is common to compare the gap among percentiles, for example, analyzing the gender wage gap. So that, it could be useful to

Figure 1.7. Investment Rate

Source: Own elaboration with data from the PWT 9.1.

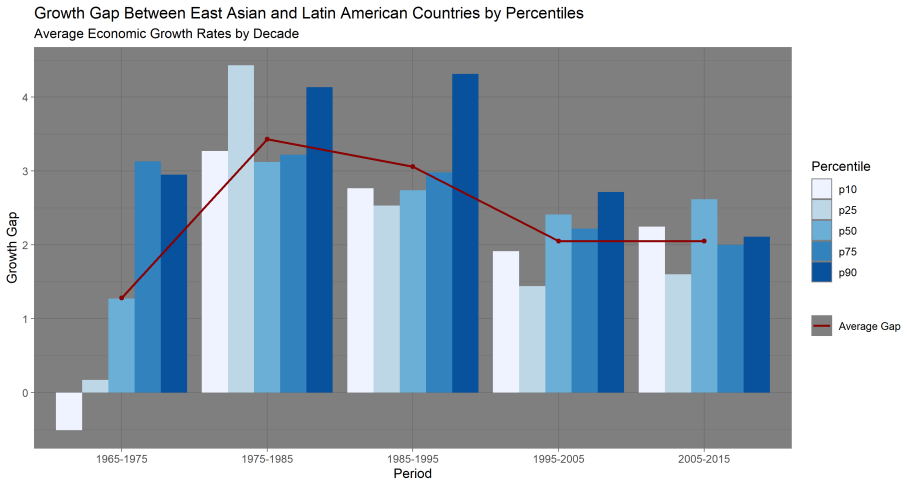
Figure 1.8. Fertility Rate



Source: Own elaboration with data from the World Bank.

replicate that exercise in this research. For that, I classified the countries of each region by percentiles according to its average economic growth rate between 1975 and 2015, and then, I compared the growth rates between percentiles of each region. Figure 1.9 portrays the growth gap for different percentiles, highlighting that the gap tends to be greater for the higher percentiles, that is, for the countries with higher economic growth.

Figure 1.9. Growth Gap by Percentiles



Source: Own elaboration with data from PWT 9.1.

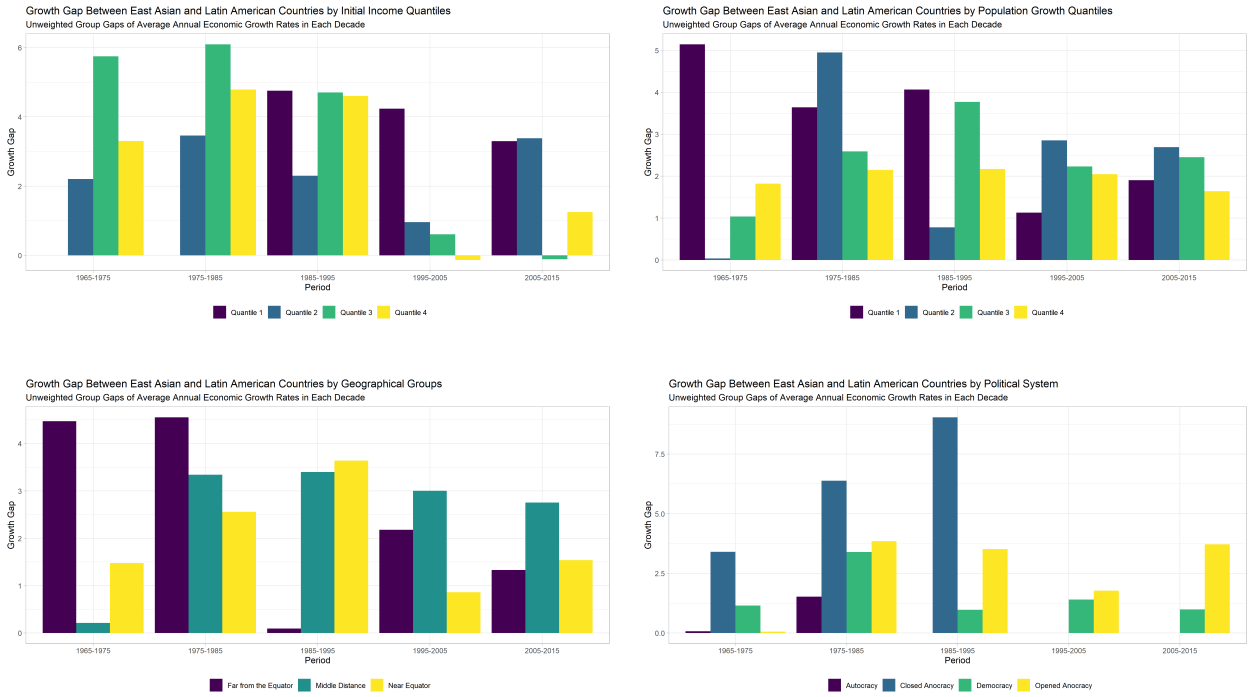
Figure 1.10 portrays more comparisons by clusters. In the first one, I compare the growth gap by income quantiles. For that, I grouped the 43 countries of interest according to their income level at the beginning of each period. Secondly, I followed the same steps to compare the economic growth gap among countries clustered by quantiles depending on their population growth of each period. That revealed that the gap is usually smaller for countries with higher rates of population growth.

Thirdly, I clustered the countries according to their distance from the equator. Far from the equator means an absolute latitude equal to or greater than 30° and near the equator means an absolute latitude less than 15°. Finally, I clustered the countries depending on their political system using the *polity* score. A score less than -5 means an autocratic regime; values between -5 and 0 include closed anocracies; values between 0 and 5 are for opened anocracies, and democracies have a score greater than 5. One can see that the gap was greater for closed anocracies. When it is missing a bar for a specific group it is because one region did not have representation in that group for that period.

Finally, I used some clustering methods to split the sample into groups to detect which countries are similar in relevant variables to explain economic growth and to verify if there is a clear division between East Asian and Latin American countries.

Through hierarchical clustering, I divided the sample into four groups. The countries of each group share similar values of variables that are relevant for economic growth. The results are presented in the dendograms of Figure 1.11. For that, I used the following six standardized variables: 1)Increase in life expectancy, 2) Average Inflation Rate, 3) GDP per

Figure 1.10. Economic Growth Gap by Clusters



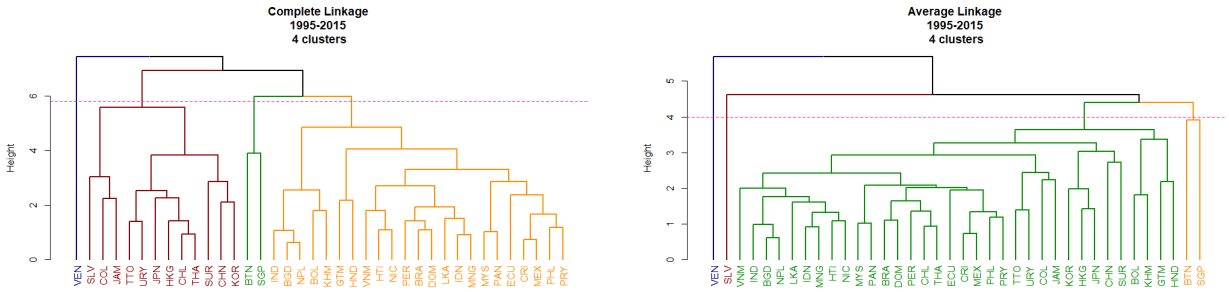
Source: PWT 9.1, Polity V and https://www.antipodas.net/coordenadaspais/

capita of 1995, 4)Homicide Rate, 5) Investment Rate, and 6) Average Population Rate. The period of the analysis is 1995-2015. Within the dendograms, the more similar two countries are, the closer they will be and the separation of their branches will be located lower.

Similarly, I used the k-mean method with the same variables and Figure 1.12 presents the results.

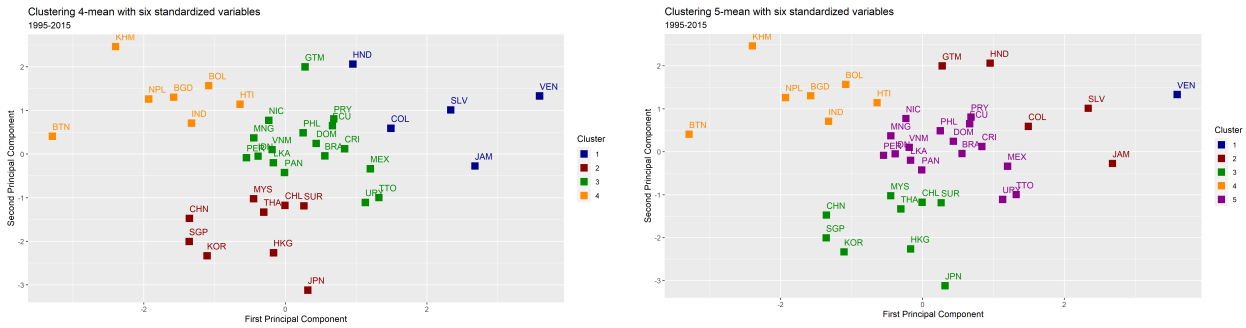
Table 1.2 shows the average economic growth of each cluster. It is remarkable that the group of Singapore and Bhutan, countries with high investment rates and population growth, had the best performance. Besides, Venezuela is a clear outlier due to its high inflation and homicide rates. In addition, hierarchical clustering does not produce a clear division between East Asia and Latin America; however, the k-mean method does. For example, in the 4-mean plot, all the countries of the blue group are from Latin America, while almost all the countries of the red and orange groups are from East Asia.

Figure 1.11. Dendograms of Clusters



Source: Own elaboration with data from the World Bank, the IMF, Barro and Lee (2013) and PWT 9.1.

Figure 1.12. Clustering by k-mean



Source: Own elaboration with data from the World Bank, the IMF, Barro and Lee (2013) and PWT 9.1.

Table 1.2. Economic Growth of Clusters 1995-2015

Cluster	Complete Linkage	Average Linkage	4-mean	5-mean
Blue	0.05%	0.05%	0.98%	0.05%
Red	2.66%	1.57%	3.01%	1.23%
Green	3.99%	1.57%	3.01%	3.01%
Yellow	2.93%	3.99%	3.47%	3.47%
Magenta				3.11%

Source: Own elaboration with data from PWT 9.1.

Chapter 2

Growth Accounting

There is an extensive literature of growth and development accounting that has tried to decompose income and growth differences across countries between a gap produced by production factors and a gap caused by the Total Factor Productivity (TFP).

In the first part of this chapter, I will present a quick review of what this literature has said about Latin America and East Asia; in the second part, I will explain the methodology that I will follow; and, finally, I will show the results obtained by this research that can contribute to the growth accounting literature. It is important to remark that this chapter will focus on the gap of output per worker, while chapter 3 will analyze per capita output growth.

2.1 Literature Review

It is common in this literature to start assuming the following aggregate production function[1]:

$$Y = AK^{\alpha}(Lh)^{1-\alpha} \tag{2.1}$$

Here, Y depicts the aggregate production; A, the TFP; K, the stock of physical capital; L, the total labor; and h is the human capital per worker.

Dividing equation 2.1 by the number of workers, we obtain:

$$y = Ak^{\alpha}h^{1-\alpha} \tag{2.2}$$

Lowercase letters represent the same variables as uppercase letters but in terms per worker.

[1]For example, Caselli (2005), Senhadji (1999) and many others.

Usually, we obtain K through the perpetual inventory method, but there are many ways to construct h. Most of the time, h takes into account the average years of schooling and the Mincerian returns of education, but, in some cases, it also tries to include the education quality and some health indicators.

Besides, the parameter α is usually assumed equal to $\frac{1}{3}$ for all countries. Gollin (2002) showed that once informal work is taken into account, there is no systematic difference of that parameter across countries, nor any trend over time. But there are concerns that this parameter may be higher, and that is why some studies present different results for a wide range of alpha values, generally between 0.3 and 0.6. Other papers, like Senhadji (1999), try to estimate alpha and allow variation among regions; however, the estimation is challenging since equation 2.1 probably has endogeneity problems. Also, the assumption of constant returns to scale is questionable.

Hall and Jones (1999) found that most income differences across countries are attributable to differences in the TFP. This fact has been confirmed by many other papers. For example, Hsieh and Klenow (2010) concluded that TFP could explain between 50% and 70% of income differences, while physical capital accounts 20%, and human capital explains between 10% and 30% of income differences.

But the literature has also found important facts that can shed light on the growth gap between Latin America and East Asia, however, it is important to say that, while almost all the papers use the same sample for Latin America, there is not an universally accepted agreement about what countries should be classified within East Asia and each research has included different samples.

Using data from Hall and Jones (1999), that includes the same Latin American countries as this research but only fourteen East Asian countries out of the 21 that I consider, we can see that in 1988 both regions had almost the same average income levels, nonetheless, East Asia had accumulated more human capital, while Latin America had a higher capital-income ratio. It is also remarkable that at that moment, both regions had almost the same TFP levels. Mexico, Venezuela, and Trinidad and Tobago were the Latin American countries with the highest TFP, while in East Asia, the highest levels were in Hong Kong, Singapore, and Bangladesh. On the other hand, Jamaica and Haiti reported the lowest TFP levels in Latin America, while China and Myanmar were in the same situation within East Asia.

Young (1995) studied in great detail the situation of the four Asian tigers [2] and discovered that most of their spectacular economic growth was attributable to factor growth, except for Taiwan. Table 2.1 summarizes the results found by Young.

[2]Hong Kong, Singapore, South Korea, and Taiwan.

These TFP growth rates are only slightly higher than the rates estimated to the richest Latin American countries. For example, Elias (1990) estimated a TFP annual growth of 1.6% for Brazil (1950-1985), 1.2% for Mexico (1940-1985), and 0.8% for Chile (1940-1985).

In the same line, Krugman (1994) predicted that East Asia's growth was going to slow in the next years because was based on factor accumulation, not on productivity growth. Today we can say that economic growth in East Asia has accelerated since the 1990s; and, although the growth of the Asian Tigers has slowed, it remains at levels much higher than the Latin American average.

Table 2.1. Results of Young (1995) for the period 1966-1991

Country	TFP Annual Growth	Contribution of TFP
Hong Kong	2.3%	48.9%
Singapore	0.2%	4.8%
South Korea	1.7%	34.7%
Taiwan	2.6%	54.2%

Source:Own elaboration with data from Young (1995).
The column of Contribution of TFP shows the contribution that TFP growth had to output per worker growth in each country.

Daude and Fernandez-Arias (2010) pointed out that the lack of productivity growth is the main reason that explains the lag of Latin America compared to other regions. They also found that since the 60s to the 90s, both factor accumulation and TFP growth were crucial to explain the economic growth gap between East Asia and Latin America, however, since the 90s, almost all the gap can be explained by the difference in the TFP growth of those regions. They also concluded that the TFP of Latin America was not catching up, but it has remained at low levels. Also, they found that in 2005 Chile and Costa Rica were the countries with the highest TFP in Latin America, while Bolivia, Peru, and Honduras had the lowest TFP. Fernandez-Arias and Rodriguez (2016) confirmed those results and concluded that, in contrast with East Asia, there is no evidence of convergence of the TFP for Latin America. [3]

Collins and Bosworth (1996), like Krugman (1994), assert that the TFP growth has played a small role in the East Asian economic growth per worker, and this one is mostly explained by physical capital accumulation. Nonetheless, they found that East Asia was the region with the highest TFP growth during 1960-1994, and Senhadji (1999) came to the same results. Furthermore, both papers conclude that Latin America experienced a decrease in its TFP or, at most, no growth during the same period.

[3]However, both Daude and Fernandez-Arias (2010) and Fernandez-Arias and Rodriguez (2016) only take the Asian tigers for their East Asian sample.

It is common to use equation 2.1 to decompose the gap of economic growth per worker across different regions with the following equation for the region i:

$$g_y^i = g_A^i + \alpha g_k^i + (1-\alpha) g_h^i \tag{2.3}$$

Where g_y represents the growth of the output per worker; g_A, the TFP growth; g_k, the capital per worker growth and g_h, the human capital growth. If we subtract the growth of a region j from equation 2.2, we can decompose the growth gap between two regions into three components: TFP, physical capital per worker and human capital. Table 2.2. summarizes the decomposition of the growth gap between Latin America and East Asia that Collins and Bosworth (1996) and Senhadji (1999) estimated for the period 1960-1994. [4]

One stylized fact is that decreasing the alpha value expands the contribution of the human capital and the TFP, while reduces the contribution of the physical capital. This is because physical capital grows faster than human capital, so decreasing the alpha value augments the fraction that is not explained, that is, the contribution of the TFP.

Table 2.2. Decomposition of the output growth gap per worker between East Asia and Latin America 1960-1994

	Percentage Contribution to the Gap		
Alpha Value	TFP	Physical Capital	Human Capital
0.20	62%	31%	7%
0.35	33%	59%	8%
0.40	33%	62%	5%
0.60	3%	93%	4%
First Differences	59%	29%	12%

Source:Own elaboration with data from Collins and Bosworth (1996) and Senhadji (1999). The estimation with alpha equal to 0.35 is from Collins and Boworth (1996) and the others are from Senhadji (1996). The row of First Differences shows the results where alpha was allowed to vary across regions and the different values were estimated in a panel model with first differences.

2.2 Methodology

I will follow equations 2.1-2.3 to decompose the growth gap between East Asia and Latin America and, unless otherwise said, I will assume an alpha equal to one third. However, I will follow different steps to estimate levels and growth rates.

[4]It is important to remark that usually equation 2.2 is built taking simple averages of growth rates from all countries in region i.

For the levels of Y, K and L, I will use data from the PWT 9.1. For Y, I will take the variable CGDPO, which is comparable across countries in each year; for L, I will use the total number of workers; and for K, I will take the variable ck, which expresses the physical capital of each country as a ratio of the U.S. level in each year.

On the other hand, to get the growth rates, I will use the variable RGDPNA for Y; the same variable of the number of workers for L; and I will take two variables for K to test robustness: RNNA and RKNA. All these variables are from the PWT 9.1 and the difference between the last two variables is that the last one takes into account the user cost of capital and represents capital services rather than capital stock.

For human capital, I built two different variables. For the first one, I followed Hall and Jones (1999):

$$h = e^{\phi(s)} \tag{2.4}$$

Where s depicts the average years of schooling. Hall and Jones assumed a function $\phi(s)$ that is linear in parts:

$$\phi(s) = \begin{cases} 0.134s & \text{if } s \leq 4 \\ (0.134 \cdot 4) + 0.101 \cdot (s-4) & \text{if } 4 < s \leq 8 \\ (0.134 \cdot 4) + (0.101 \cdot 4) + 0.068 \cdot (s-8) & \text{if } 8 < s \end{cases}$$

The slopes are based on Psacharopoulos (1994) and represent the Mincerian returns to education. I got the data from Barro and Lee (2013); however, there was no available information for all the countries of the main sample. To expand the information, I used the UNDP database to impute data to Suriname and Bhutan for the years 1995, 2005, and 2015. Name this variable h_1. [5]

I built a second human capital index based on Collins, Susan, and Bosworth (1996), who proposed the following function:

$$h_t = \sum_{j=1}^{7} W_{jt} P_{jt} \tag{2.5}$$

where P_{jt} is the percentage of the population who completed educational level j, and W_{jt} are different weights based on the Mincerian returns to schooling. For that, I supposed a return of 9 percent to one extra year of schooling based on Psacharopoulos and Patrinos (2018). I used data from Barro and Lee (2013), where there is available information about seven different educational levels. Name this variable h_2.

[5]To impute data, I ran a regression by OLS using as dependent variable the data from Barro and Lee and as explanatory variable, the data from UNDP.

To estimate the TFP level, I expressed all the variables as a ratio to U.S. level, and then, I substitute in equation 2.1, so the TFP is also expressed as a ratio. On the other hand, to calculate the TFP growth, I used equation 2.3, and I applied four different methods, varying the variables employed: I used the variable h_1 in methods 1 and 3; h_2 for methods 2 and 4; RKNA for methods 1 and 2; and RNNA for methods 3 and 4.

At the end of the chapter, I will apply a test for unconditional convergence of TFP within both regions based on Barro (1994) and Patel, Sandefur, and Subramanian (2021), who used the following equation to estimate the unconditional convergence of GDP per capita:

$$\frac{1}{T} log\left(\frac{y_{i,t+T}}{y_{i,t}}\right) = B - \left(\frac{1-e^{-\beta T}}{T}\right) log(y_{i,t}) + \epsilon_{i,t+T} \tag{2.6}$$

In equation 2.6, t is the initial year; T is a period of time; y_i is the GDP per capita of the country i, and ϵ is the error term. A positive β indicates unconditional convergence, while a negative value shows unconditional divergence. Barro (1994) estimated a β of 0.0175 for the estates of the U.S. using the period 1880-1988[6]; a β of 0.0095 for the OECD countries using the period 1960-1985; and a β of -0.0037 for a sample of 98 countries around the world using the period 1960-1985. In contrast, Patel, Sandefur, and Subramanian (2021) found evidence of unconditional convergence across countries around the world for the period 2000-2019, estimating a β of 0.00425.

I applied equation 2.6 to estimate the unconditional convergence of TFP within these two regions with the idea that this convergence could partially explain the growth gap of TFP between these two regions. For that, I replaced y for the TFP as a ratio of the U.S. level and I used OLS to estimate $\lambda = -\frac{1-e^{-\beta T}}{T}$ and then, I calculated β.

2.3 Economic Growth Gap Decomposition

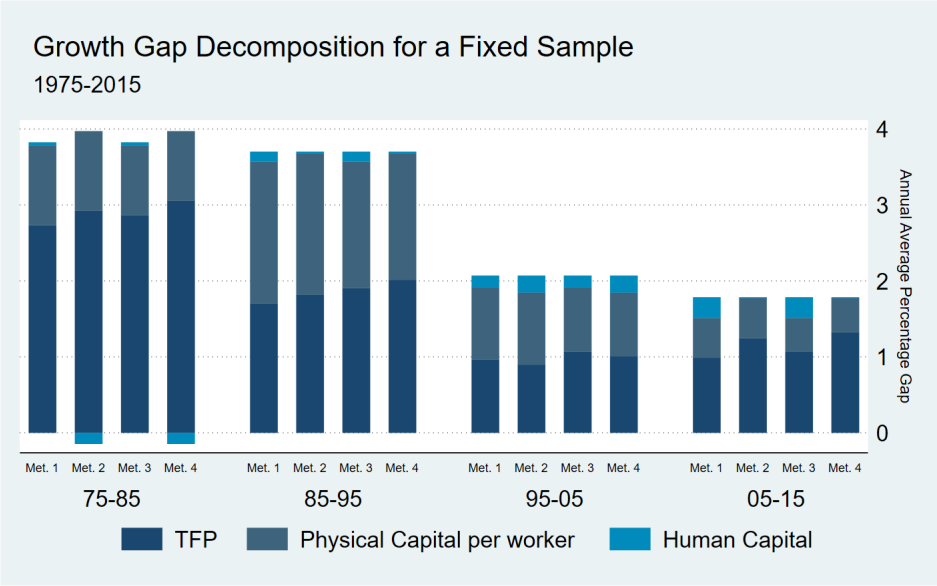
Unfortunately, not all the data was available for all the countries of our sample for all the years; hence, the results presented in this section come from a fixed sample of countries composed of nineteen Latin American countries and fifteen East Asian countries, for which we had full information.

Figure 2.1 shows the decomposition of the output per worker growth gap for different decades using the four methods described above. Firstly, we can see that results do not experience a drastic change across methodologies, which gives robustness to the following assertions: 1) Human Capital practically can not explain anything of the gap; 2) Physical Capital growth has been relevant, and it caused half of the gap between 1985 and 2005; 3)

[6]For the regressions, Barro added some dummy variables for some regions.

TFP has been the principal cause of the gap; however, the gap in TFP growth has declined, and this has contributed to the reduction of the gap in the growth of output per worker.

Figure 2.1. Comparison of Growth Gap across methods



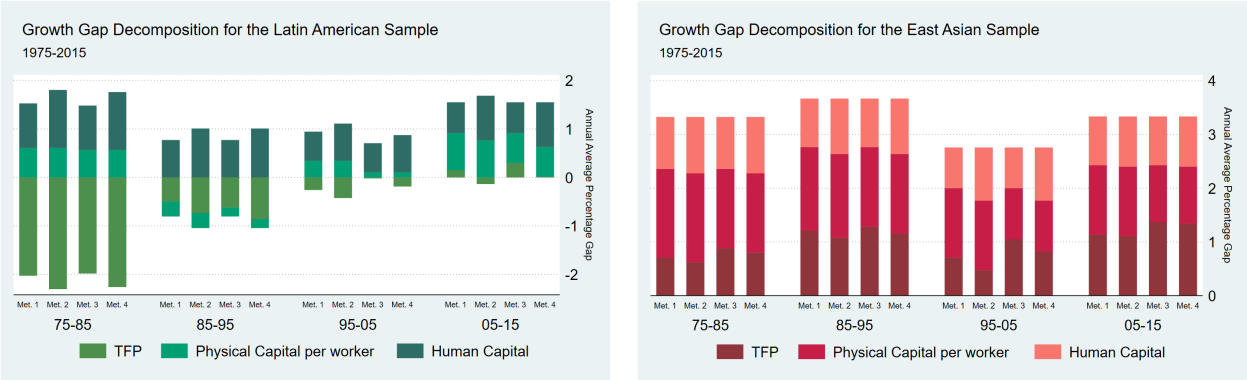
Source. Own elaboration with data from PWT 9.1 and Barro and Lee (2013). The fixed sample includes nineteen Latin American and fifteen East Asian countries. The countries of the original sample that were excluded are: El Salvador, Haiti, Suriname, Bangladesh, Bhutan, Cambodia, Myanmar, Nepal and Vietnam. All the methods supposed an alpha equal to one third.

TFP in Latin America has systematically decreased throughout all the periods, as we can see in Figure 2.2, which also reveals that the decrease rate has tended to moderate over the decades and, according to methods 1 and 3, the Latin American TFP experienced a slight increase during the last decade. This situation contrasts with East Asia, whose TFP has always grown at rates above 0.5% per year. Therefore, contrary to what Krugman (1994) and other authors have said, it seems that TFP has been relevant in boosting East Asian growth; and during the last decade, East Asian countries reached their highest rate of TFP growth, which suggests that this region could accelerate its growth of output per worker during the following years. However, it is true that more than half of the growth in East Asia is explained by factor accumulation.

Moreover, physical capital per worker has been the main engine of East Asian growth, but in Latin America, this factor has not performed a constant growth since it decreased between 1985 and 1995. In fact, it appears that human capital has been the main driving force of growth in Latin America.

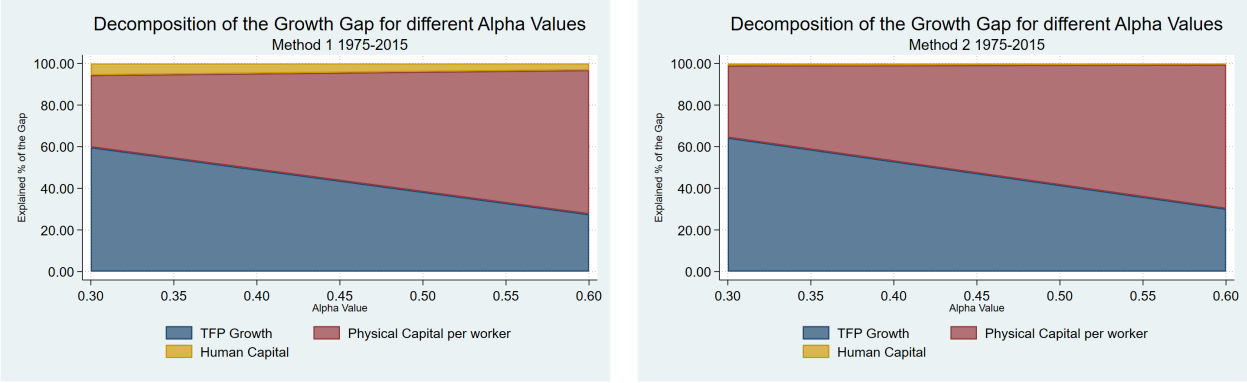
Figures 2.1 and 2.2 show that there is not a large change across methods. However, the value of the parameter alpha is crucial: if we change our assumption of alpha equal to one

Figure 2.2. Decomposition of the output per worker for both regions



Source: Own elaboration with data from PWT 9.1 and Barro and Lee (2013). Read more details in Figure 2.1.

Figure 2.3. Growth Gap for different alpha values



Source: Own elaboration with data from PWT 9.1 and Barro and Lee (2013). Read more details in Figure 2.1.

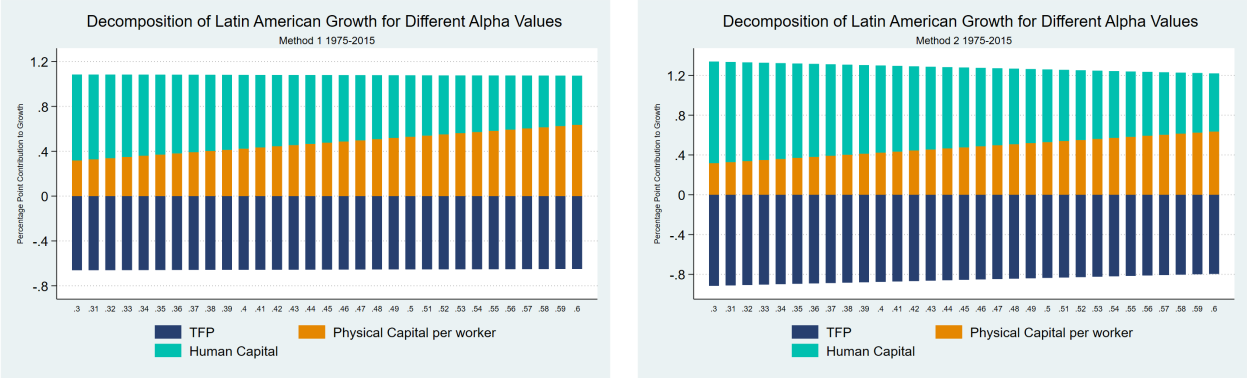
third, we will get completely different results. This is what we can appreciate in Figure 2.3, where I varied the alpha value between 0.3 and 0.6 using methods 1 and 2.

As we can see, method 2 gives a little more importance to TFP, but this change is negligible compared to the fluctuation between an alpha equal to 0.3 and an alpha equal to 0.6. An increase in the alpha value systematically increases the importance of the physical capital and diminishes the role of human capital and TFP.

The difference is brutal: using method 1, TFP goes from explaining 60% of the gap to only 30% changing the alpha from 0.3 to 0.6. In any case, even if TFP only explains 30% of the gap, it should be recognized as one important source of the inequality between the growth of both regions.

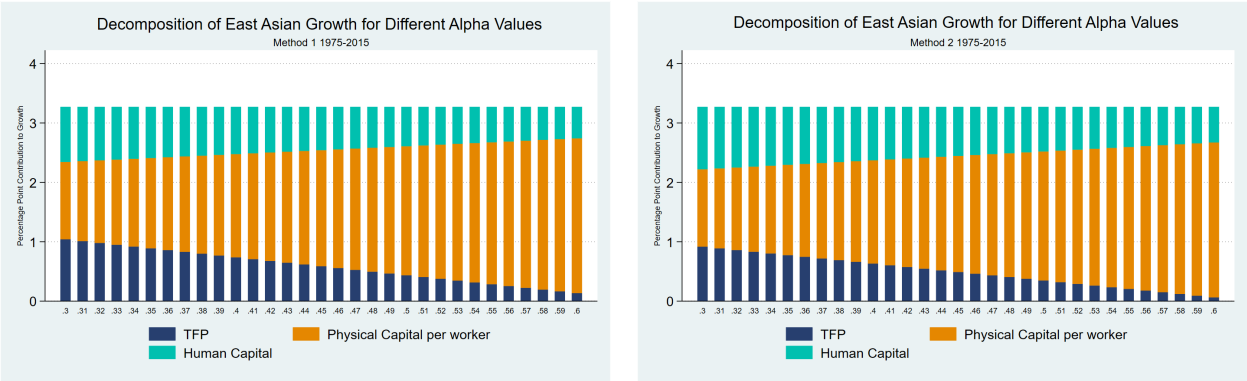
Figures 2.4 and 2.5 show how the decomposition of Latin American and East Asian growth changes if we vary the alpha value. It stands out that in Latin America TFP growth hardly changes across alphas, while in East Asia, productivity growth goes from a rate of one percent to almost zero. Hence, it is clear that the TFP annual growth rate in Latin America was between -0.7% and -0.9% during 1975-2015, but for East Asia, there is a lot of darkness.

Figure 2.4. Latin American growth for different alpha values



Source: Own elaboration with data from PWT 9.1 and Barro and Lee (2013). Read more details in Figure 2.1.

Figure 2.5. East Asian growth for different alpha values



Source: Own elaboration with data from PWT 9.1 and Barro and Lee (2013). Read more details in Figure 2.1.

I have to say that the reason why TFP does not change across alphas for Latin America is that physical capital per worker grew almost at the same rate as human capital so that increasing alpha only rises the fraction explained by physical capital and reduces the part explained by human capital, but the fraction unexplained does not change.

But even when we can not say what was the TFP growth in East Asia and, therefore, we can not say if it was relevant to explain its economic growth, we can assert that TFP is essential to explain the growth gap between regions: the productivity of factors decreased in Latin America, while in East Asia remained stagnant in the worst case. The question is: why?

The Latin American debt crisis of the 80s could explain the problem if we think that the shock had long-term effects. One can also argue that TFP is endogenous and that the low growth of physical capital in Latin America has caused a drop in productivity. However, the hypothesis that I will test in this thesis is that there has been a phenomenon of unconditional convergence of TFP.

2.4 Convergence of TFP

If there is a phenomenon of unconditional convergence, one would expect that countries with higher TFP[7] grow slower than countries with lower TFP, and since Latin American countries had a higher level of TFP in 1965, one could think that this convergence indeed took place during 1965-2015. However, one problem is that Latin America did not experience low positive growth rates of TFP; but negative growth rates and this is suspicious.

To test the hypothesis of convergence I estimated equation 2.5, which was used for the first time by Barro and Sala i Martin (1994) to test unconditional convergence of GDP per capita across states in the U.S.

Equation 2.6 was built assuming the standard neoclassical growth theory that implies a stationary state for the output per effective worker. That is why we have to take the results of this section with caution because TFP could follow a different dynamic than output.

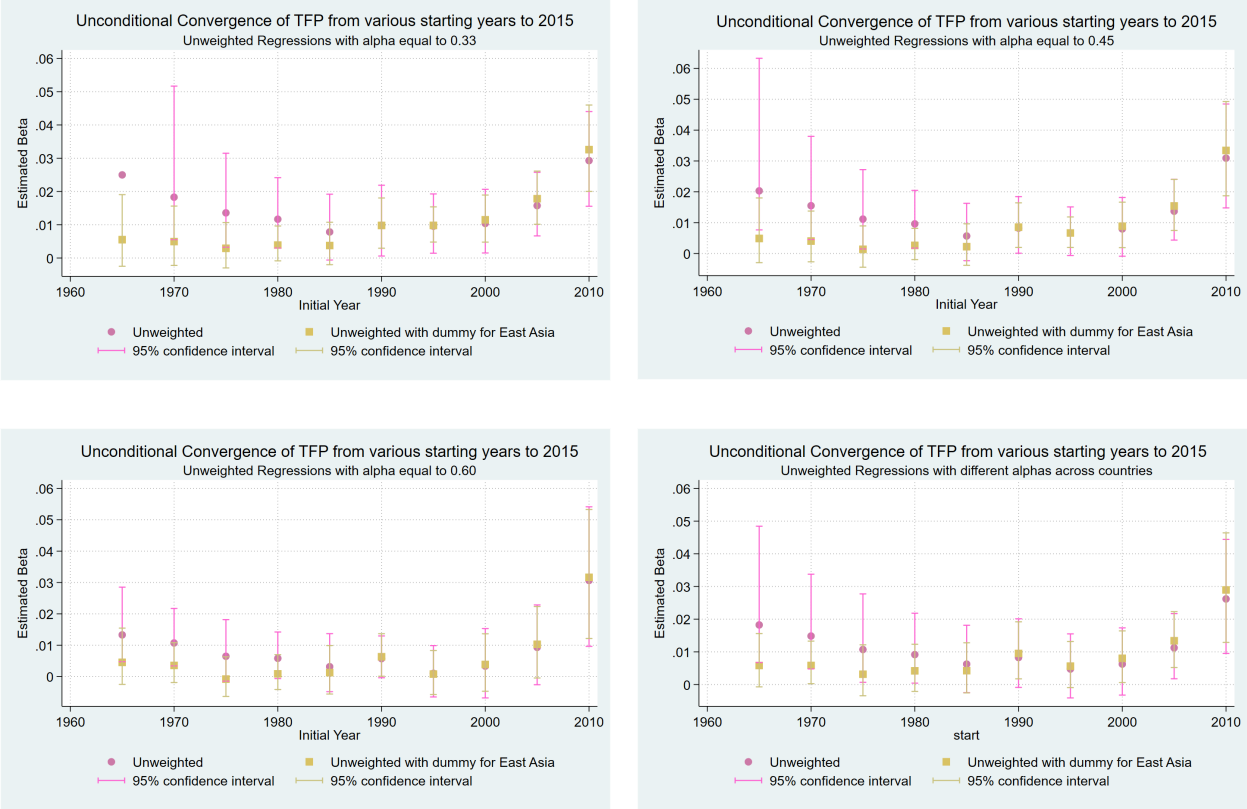
Nonetheless, we can see these results as an empirical test of convergence without using much economic theory. And to control for different variables that also affect TFP, I also ran regressions with a dummy for East Asia.

Figure 2.6 shows the results of the regressions, revealing again that the alpha value is essential and can drastically change the results; however, the trend is almost identical in the four plots: the estimated beta without the dummy is higher until 1990 and the estimated beta with the dummy has an upward trend. Moreover, the beta without the dummy is significant for any alpha value for the period 1965-2015.

On the other hand, the estimated beta falls if we increase the alpha value. It is also useful to know that in the fourth plot, the average alpha was 0.50 for Latin America and

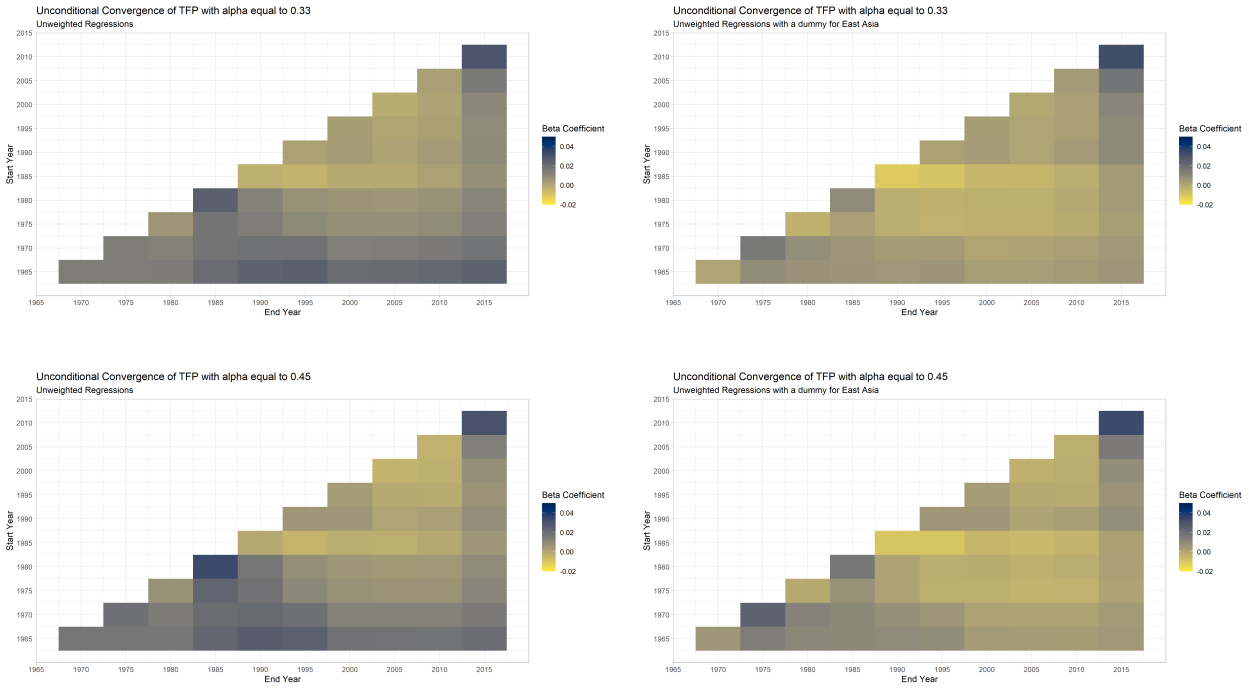
[7]The TFP is measured as a ratio to the TFP of the U.S.

Figure 2.6. Testing Unconditional Convergence of TFP



Source: Own elaboration with data from PWT 9.1 and Barro and Lee (2013). Regressions were performed using OLS and took into account all countries with available information in each case, not only the countries of the fixed sample, so that each regression uses a different sample size. The TFP growth rate comes from method 1. Read details in section 2.2. There is no confidence interval for the period 1965-2015 with an alpha equal to 0.33 because the upper limit of the lambda was too negative, so that the beta can not be obtained. In the fourth plot, I assigned to each country the average estimated alpha of the period using data from the PWT 9.1.

Figure 2.7. Heat Maps of TFP Convergence I



Source: Own elaboration with data from PWT 9.1 and Barro and Lee (2013). See more detail in Figure 2.6.

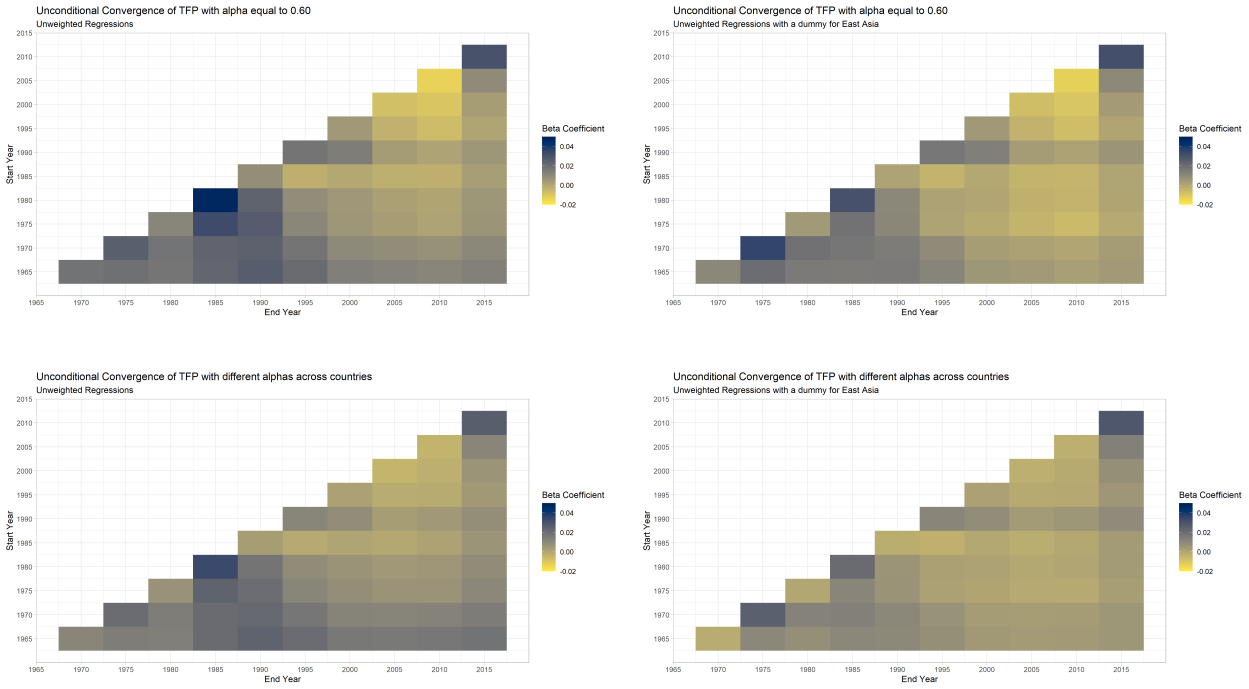
0.52 for East Asia. Therefore, the results of the fourth plot are halfway between the plot with alpha equal to 0.45 and the plot with alpha equal to 0.60.

It is noticeable that assuming an alpha equal to 0.33, the beta without the dummy was significant for almost all the periods, while the beta with the dummy was always significant since 1990. Besides, the estimated beta values are high compared to the results obtained by Barro (1994) for GDP per capita. And things barely change with alpha equal to 0.45.

These results support the hypothesis of convergence, and it seems that this catching up has accelerated in the last years. Nonetheless, assuming an alpha equal to 0.60, there is no longer evidence of convergence. The results with different alphas across countries are very similar.

I also present heat maps in Figures 2.7 and 2.8 that compare the estimated beta for different periods, and the conclusions are the same: convergence disappears with high alpha values. But it is also remarkable that with the dummy for East Asia and assuming an alpha lower than 0.45, then catching up is stronger if we take as a starting point 1990 or any year later. The convergence is also more noticeable taking 1965 as a starting point for regressions without dummy.

Figure 2.8. Heat Maps of TFP Convergence II



Source: Own elaboration with data from PWT 9.1 and Barro and Lee (2013). See more detail in Figure 2.6.

In conclusion: there is no enough evidence to assert with security that there has been a convergence of TFP across countries of both regions, but we can be almost sure that at least there has not been divergence.

Chapter 3

Barro Regressions and Convergence

In this chapter, we will use the most common variables of the literature, such as the investment rate, fertility, the rule of law, and inflation, to explain the gap in per capita GDP growth between East Asia and Latin America. To do that, in the first section, I will follow De Gregorio and Lee (2004) to identify which fraction of the gap can be explained by each variable. And in the second section, I will test the principal hypothesis of this thesis to see to what extent convergence, both conditional and unconditional, can explain the gap in economic growth and measure the level of convergence within these two regions.

3.1 Barro Regressions

3.1.1 Literature Review

Barro (1991) was a very influential paper because established a way to empirically analyze economic growth that has been followed by many other studies. In that paper, Barro used panel data of 98 countries and found that the initial GDP per capita, the initial human capital, the government spending, the rule of law, the fertility of women, and the investment rate were significant to explain the economic growth for the period 1960-1985, however, it seems that the omitted variables bias was present because dummies for African and Latin American countries were also significant.

In a later article, Barro (1997) added new variables, and under the new specification, all the regional dummies were no significant. The paper analyses the economic growth of 100 countries during 1960-1990 using panel data. And to deal with endogeneity problems, Barro ran three-stage least square regressions (3SLS) using fertility, the investment rate, a democracy index, the government spending, and the inflation rate as endogenous variables. And one of the most important results was that the high inflation of Latin American countries

could explain their low growth rates.

De Gregorio and Lee (2004) analyzed the period of 1970-2000 also using 3SLS, and with almost the same specification that Barro had used, they found that the economic openness could explain 0.62 percentage points of the gap in per capita GDP growth; the investment rate could explain 0.60 points; the fertility rate, 0.50 points; the rule of law, 0.37 points; other variables, 0.98 points; and that 0.55 points of the gap could not be explained by any of the variables considered. However, some of the variables that they used to explain the gap were not significant at the 95% confidence interval, as is the case of years of schooling, the inflation rate, the economic openness, and growth of exchange terms, which is concerning since those variables had the most explanatory power.

3.1.2 Methodology

To explain and decompose the economic growth gap between East Asia and Latin America, I will also use 3SLS using panel data of 118 countries[1] to estimate the coefficients of a typical Barro regression. After that, I will use those estimations to identify what fraction of the gap can be explained by each variable. The reason why I will use data from more countries and not only from Latin America and East Asia is to take advantage of a bigger sample.

I will use four different periods: 1975-1985, 1985-1995, 1995-2005, and 2005-2015. Furthermore, I selected all countries around the world with available data for the main variables that had a population of over half a million in 2015 and I also excluded the oil-producing countries mentioned by Mankiw, Romer, and Weil (1992). [2] It is also important to say that for each decade, I included all countries with available data for that period so that each decade used only a sub-sample from the 150 countries. Specifically, several East Asian countries were omitted for the first periods, and in consequence, the regional averages of the variables differ from those shown in the first chapter.

The dependent variable is the annual average growth rate of GDP per capita for each decade, and as explanatory variables, I chose the most common variables used by the literature. In the first place, I will consider the logarithm of the initial level of the GDP per capita. Secondly, I will take into account the index of the rule of law from the International Country Risk Guide. The values included of that variable correspond to 1984 for 1975-1985; 1990 for 1985-1995; 2000 for 1995-2005; and 2010 for 2005-2015. These are

[1] This sample only includes 21 Latin American and 15 East Asian countries. The countries mentioned in Table 1.1 that were excluded are: Dominican Republic, Bhutan, Cambodia, Laos, Macao, Nepal, and Taiwan.

[2] These countries are: Gabon, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates.

expressed on a 0-100 scale, where 100 means a perfect rule of law.

For fertility and inflation rates, I used period averages from the World Bank; and for the investment rate, I took period averages from the PWT 9.1. The depreciation rate is the growth rate for each decade of the exchange rate of the currency of each country to the US dollar. This data was also obtained from the PWT 9.1.

For the democracy index, I will use two different sources to verify robustness: Polity V and the Freedom House.[3] In both cases, I re-scaled the scores to get a 0-1 scale, where 1 represents a full democracy, while 0 is for absolute tyrannies.

The schooling variable represents the average years of schooling for each country period and comes from Barro and Lee (2013). The economic openness depicts the ratio of the sum of exports plus imports to GDP with data from the PWT 9.1. And, finally, the variable conflict takes values from 0 to 10 and shows the number of years of each decade that the country experienced a situation of anarchy or a foreign intervention according to Polity V.

Besides the economic growth, the democracy index and fertility, inflation, depreciation, and investment rates are considered endogenous. As instrument variables, I use all the exogenous variables; the absolute value of the latitude; dummies for countries that were colonies of Spain, France, Portugal, or the United Kingdom; the percentage of Christians, Muslims, Hindus, Buddhists, not religious and practitioners of folk religions in 2010 according to the Pew Research Center; life expectancy; regional dummies; and lags of all endogenous variables but inflation.

Once the regression is estimated, I do the gap decomposition by decade. For it, I follow De Gregorio and Lee (2004). Basically, for each decade, I calculate the regional averages for each variable using all countries included in the sample. Finally, I multiply the difference between the regional averages of the variable x with its estimated coefficient to see what difference in the growth rate is produced by that variable.

3.1.3 Empirical Results

Not all the countries of these regions had available data for all the variables. That is why I used a variable sample for the regressions. In fact, for the 3SLS regressions, I only included 10 East Asian Countries for 1975-1985, 13 for 1985-1995, and 14 for 1995-2015. On the other hand, I only included 18 Latin American countries for 1975-1985, 19 for 1985-1995, and 21 for 1995-2015, when the sample presented in chapter 1 includes 21 East Asian and 22 Latin American countries.

[3]The data from the Freedom House are the simple average of the score of civil liberties and political rights.

As we saw in chapter 1, Latin America started from a higher GDP per capita level, which boosted East Asian growth due to the convergence phenomenon. However, using unweighted data, East Asia reached the Latin American level in 2007[4], so that since then, the convergence should have contributed to narrow the gap.

On the other hand, older literature has shown that rule of law and investment increase economic growth, and East Asia had higher average values for these variables over all the period. In contrast, inflation and fertility reduce the growth, and Latin America has had higher averages in those fields. I also include a variable for democracy, and Barro (1997) found that democracy has a positive linear coefficient but a negative squared term. And, as we saw in chapter 1, Latin America has historically had a stronger democracy. Finally, it is included the depreciation rate, a variable that has not been common in the literature; however, I found that this variable has a positive impact on economic growth, possibly through improving the balance of trade.

Table 3.1 shows the regression results. The principal regression that I will use is the number one because that got the same results that have been found by older literature and all the variables are significant at 90% confidence. However, democracy does not seem a robust variable because it is not significant in regression two, which uses another source for democracy data. In regression number two, the depreciation rate is not significant either. However, in regression three, removing variables of democracy, the depreciation regains significance at 95% confidence.

Regression number four has the same specification as number one but is weighted by population. As we can see, democracy variables are not significant here either. It is also remarkable that the convergence coefficient is lower here in absolute value, while the importance of investment increases.

I added new variables in equation five, but these are not significant. Regression number six includes regional dummy variables, which are not significant either. Finally, I also show what happens if we estimate Barro regressions with OLS and 2SLS.

Using equation number 1, I decomposed the gap as Table 3.2 shows. As we see, the model is powerful in explaining the gap between 1975 and 1995, but it gives very poor explanations of the gap during 1995-2015. This is because, during the first two decades, there was a huge difference between East Asia and Latin America in their income levels and their inflation rates; however, since 1995, the average inflation of Latin American countries has fallen to a digit and is only slightly higher than that of East Asia. Moreover, East Asia narrowed the income difference, so inflation and convergence could not explain anymore the gap of per

[4]See Figure 1.1.

Table 3.1. Cross-Country Panel Regressions for Per Capita Growth Rate

	3SLS						OLS	2SLS
Explanatory Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Per capita GDP (in logs)	-1.6711***	-1.6366***	-1.7732***	-1.4033***	-1.7379***	-1.5901***	-1.9733***	-1.7379***
	(0.2314)	(0.2368)	(0.2150)	(0.1461)	(0.2121)	(0.2331)	(0.1722)	(0.2121)
Rule of Law	0.0507**	0.0385*	0.0420**	0.0435***	0.0534***	0.0569**	0.0499***	0.0534***
	(0.0228)	(0.0222)	(0.0214)	(0.0141)	(0.0198)	(0.0222)	(0.0132)	(0.0198)
Fertility	-0.8327***	-0.9091***	-0.8195***	-0.5630***	-0.8762***	-0.8194***	-0.9054***	-0.8762***
	(0.1367)	(0.1400)	(0.1362)	(0.1191)	(0.1373)	(0.1504)	(0.1096)	(0.1373)
Investment/GDP	7.1911***	6.5825***	7.8408***	10.4059***	5.1914**	5.4661**	5.5984***	5.1914**
	(2.6256)	(2.5474)	(2.5705)	(1.6333)	(2.5971)	(2.7229)	(1.5442)	(2.5971)
Inflation	-0.0135***	-0.0121***	-0.0143***	-0.0111***	-0.0102**	-0.0126***	-0.0013**	-0.0102**
	(0.0038)	(0.0033)	(0.0038)	(0.0027)	(0.0045)	(0.0037)	(0.0005)	(0.0045)
Depreciation	0.0530**	0.0351	0.0568**	0.0328*	0.0419	0.0562**	-0.0016	0.0419
	(0.0256)	(0.0256)	(0.0258)	(0.0180)	(0.0265)	(0.0247)	(0.0074)	(0.0265)
Democracy Index	6.5998*	5.0600		-0.0725	6.2219**	9.4774**	-0.8101	6.2219**
	(3.5218)	(4.8870)		(1.7672)	(3.0967)	(4.2096)	(1.5554)	(3.0967)
Democracy Index Squared	-5.9725*	-4.8401		-1.2672	-5.7066**	-8.3244**	0.1099	-5.7066**
	(3.1366)	(4.2826)		(1.8373)	(2.7676)	(3.7344)	(1.3110)	(2.7676)
Schooling					-0.0122		0.0428	-0.0122
					(0.0750)		(0.0540)	(0.0750)
Openness					0.4263		0.2996	0.4263
					(0.3041)		(0.1934)	(0.3041)
Conflict					-0.2322		-0.5452***	-0.2322
					(1.8903)		(1.1611)	(1.8903)
Asia						0.3340		
						(0.4647)		
Latin America						-0.5627		
						(0.4176)		
Observations	378	369	379	378	378	378	400	378

Standard Errors in Parentheses.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Regressions were estimated using panel data for the periods 1975-1985, 1985-195, 1995-2005 and 2005-2015. For columns 1-6 and 7, I used the following instrumental variables: Dummies for old colonies of Spain, Portugal, France and the UK; the percentage of people who are Christians, Muslims, Buddhists, Hindus, No religious or practitioners of folk religions; the absolute value of the latitude; life expectancy; regional dummies; and lags of all endogenous variables but inflation.Column 2 uses data from Polity V for democracy, while columns 1-2 and 4-8 use data from the Freedom House. All regressions but number 4 are unweighted, while number 4 is weighted by population.

capita GDP growth between regions. Despite that, the gap has remained at high values, more than two percentage points.

Fertility and Investment rates can explain together almost one percentage point but nothing more. So, the question is: if inflation has decreased in Latin America and convergence forces are not boosting East Asian growth anymore, why East Asia continue growing much faster than Latin America? It is clear that the gap of the last decades can not be explained by traditional variables, which suggests that other variables are playing an important role.

It is also remarkable that the high levels of depreciation in Latin America during 1975-1995 helped to narrow the gap, but since 1995 this is no longer a decisive variable.

From these results, we can say that the convergence explanation hypothesis was true only for the first two decades but between 1995 and 2015 was not important to explain the gap and we can expect that since 2015 convergence forces will help Latin America to narrow the gap.

Table 3.2. Contributions to Growth Differentials between East Asia and Latin America

					1975-2015	
Indicator	1975-1985	1985-1995	1995-2005	2005-2015	Contribution	Share
Actual Gap	2.99	2.97	2.10	2.19	2.56	
Predicted Gap	3.09	2.92	1.26	0.83	2.58	
Explanatory Variable						
Initial Income	1.13	0.65	0.44	0.09	1.13	43.96
Rule of Law	0.53	0.22	0.13	0.12	0.25	9.63
Fertility	0.59	0.64	0.54	0.33	0.55	21.47
Investment Rate	0.45	0.66	0.39	0.46	0.49	19.17
Inflation	1.31	2.58	0.06	0.02	0.94	36.69
Depreciation	-0.93	-1.68	-0.06	-0.09	-0.65	-25.45
Democracy	0.02	-0.14	-0.23	-0.10	-0.12	-4.79
Unexplained	-0.10	0.05	0.84	1.36	-0.02	-0.68

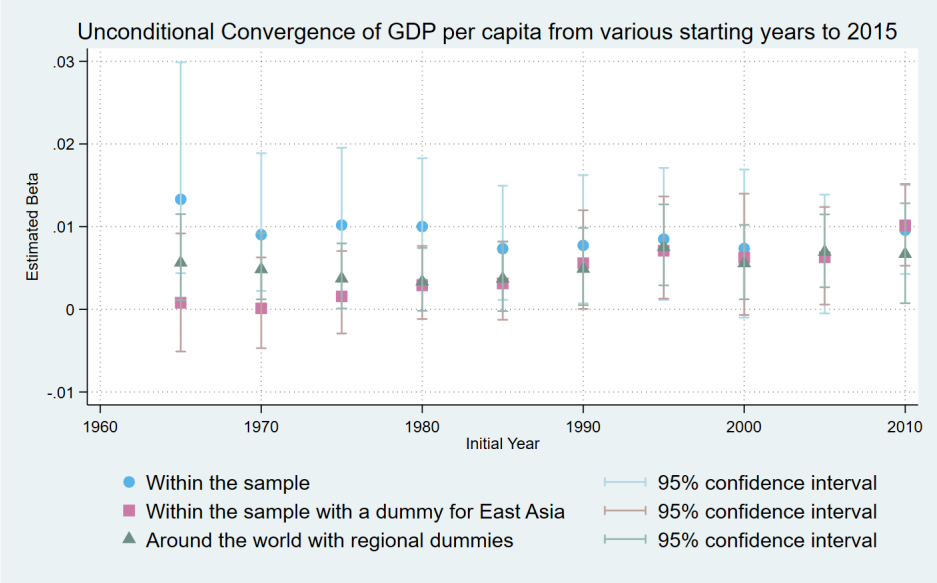
Source: Own elaboration. The table was built using estimated coefficients of column 1 from Table 3.1 and regional averages of each variable.

3.2 The Convergence Hypothesis

We saw in the last section that convergence forces can explain more than half the percentage point of the per capita GDP growth gap between 1975 and 1995. However, here we will measure the level of this convergence within these regions, and I will review if the convergence forces are stronger here than in other regions.

Alike chapter 2, I will estimate equation 2.6 by OLS, but now to measure GDP per capita convergence instead of TFP convergence. Figure 3.1 presents the results, estimating the beta within East Asia and Latin America with and without a regional dummy; and it also shows the estimated beta around the world with regional dummies. And, as in chapter 2, a positive beta means convergence while a negative beta means divergence.

Figure 3.1. GDP per capita Convergence

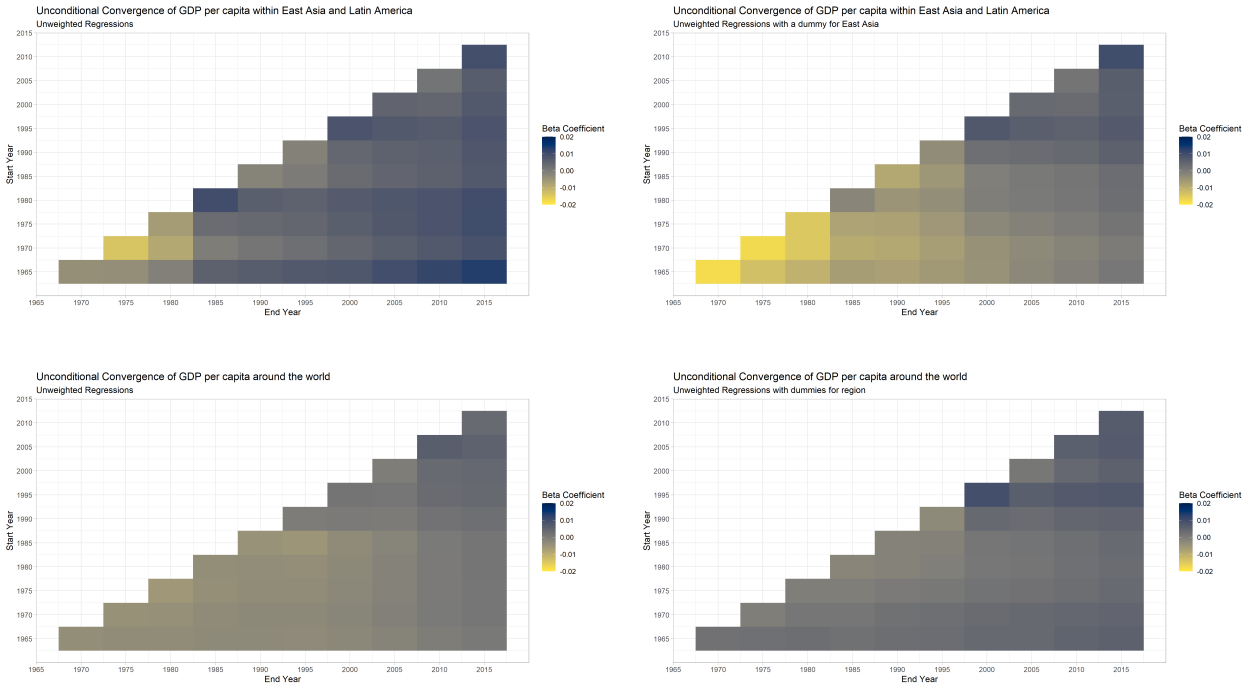


Source: Own elaboration with data from PWT 9.1. The sample includes all Latin American and East Asian countries mentioned in chapter 1, while the beta for convergence around the world was calculated taking into account the 150 countries of section 3.1.Betas were estimated using OLS.

What we see is that the unconditional convergence within East Asia and Latin America without any dummy is significant at 95% confidence for almost all the periods. However, adding a dummy for East Asian countries reduces beta and made it not significant. This could indicate that the reason why East Asian countries have grown more is explained by idiosyncratic characteristics and not by their lower levels of income.

It is true that by adding regional dummies, we are measuring more conditional than unconditional convergence; nonetheless, I presented the comparison because, in the case of

Figure 3.2. Heat Maps of GDP per capita Convergence



Source: Own elaboration with data from PWT 9.1 and Barro and Lee (2013). See more detail in Figure 3.1.

Latin America and East Asia, we know *a priori* that the last region started from a lower level and has grown faster, so regressions without dummy within these regions could fall into begging the question: since East Asian countries grew more, it is not surprising that regressions show convergence, but their higher growth could have not been caused by their initial low levels, so the regional dummy controls idiosyncratic factors.

Figure 3.2 shows the estimated betas for different periods. These graphics confirm that unconditional convergence is very strong within East Asia and Latin America; however, these results are diluted by adding a dummy for East Asia. Besides, the unconditional convergence around the world has been very weak, but it has increased since 1995, like Patel, Sandefur, and Subramanian (2021) pointed out. And, in this case, adding regional dummies enhances convergence.

Table 3.3 summarizes most of these results. The first point that I want to underline is that unconditional convergence has been higher within OECD countries; in fact, the estimated beta has been significant there since 1965. Second, convergence within East Asia and Latin America was not significant between 1965 and 1990, but between 1990 and 2015 was both with and without the dummy. So, it seems that unconditional convergence has been greater

Table 3.3. GDP per capita Convergence for different samples

Sample	Period	Regional Dummies	$\hat{\beta}$	Lower Limit	Upper Limit	Conclusion
East Asia and Latin America	1965-2015	No	0.0133	0.0043	0.0298	Convergence
East Asia and Latin America	1965-2015	Yes	0.0007	-0.0051	0.0091	No Significance
OECD	1965-2015	No	0.0158	0.0034	0.0538	Convergence
World	1965-2015	No	0.0005	-0.0018	0.0031	No Significance
World	1965-2015	Yes	0.0056	0.0011	0.0115	Convergence
East Asia and Latin America	1965-1990	No	0.0065	-0.0039	0.0206	No Significance
East Asia and Latin America	1965-1990	Yes	-0.0059	-0.0143	0.0015	No Significance
OECD	1965-1990	No	0.0147	0.0003	0.0374	Convergence
World	1965-1990	No	-0.0030	-0.0058	0.0001	No Significance
World	1965-1990	Yes	0.0028	-0.0025	0.0089	No Significance
East Asia and Latin America	1990-2015	No	0.0077	0.0007	0.0162	Convergence
East Asia and Latin America	1990-2015	Yes	0.0056	0.0001	0.0120	Convergence
OECD	1990-2015	No	0.0132	0.0059	0.0221	Convergence
World	1990-2015	No	0.0025	-0.0002	0.0055	No Significance
World	1990-2015	Yes	0.0049	0.0005	0.0098	Convergence

Source: Own elaboration with data from PWT 9.1. See more detail in Figure 3.1. For the OECD, I included all 37 countries with available data that were members in 2021. The upper and lower limits show the interval at 95% confidence.

within these regions in the last years when it was no longer relevant to explain the GDP per capita growth gap according to the results of the last section.

And using the estimated betas of Table 3.2, I can measure the extent to which unconditional convergence alone has contributed to the growth gap between East Asia and Latin America for different periods of time. Table 3.4 reveals that, if we add a regional dummy, the estimated betas are very low or even negative; while without a dummy, unconditional convergence only can explain substantial fractions of the gap if we take long periods of time.

Indeed, without dummies, unconditional convergence only can explain less than 0.3 percentage points if we measure convergence by decade, but for longer periods, estimated betas are higher, and, therefore, the explanatory power of the unconditional convergence increases. For example, taking the period 1975-2015, unconditional convergence could explain around 0.85 percentage points of the gap. This is compatible with economic theory, which asserts that convergence is a phenomenon of the long run.

Table 3.5 makes a comparison between conditional and unconditional convergence. It is clear that conditional convergence is stronger than unconditional because the conditioned beta includes both convergence forces, but there are some facts that I have to remark. Firstly,

Table 3.4. Contribution of Unconditional Convergence to the growth gap between East Asia and Latin America

Period	Without dummies		With dummy for East Asia	
	$\hat{\beta}$	Explained Gap	$\hat{\beta}$	Explained Gap
1965-1975	-0.0039	-0.3513	-0.0131	-1.2326
1975-1985	0.0033	0.2840	-0.0077	-0.6980
1985-1995	0.0001	0.0035	-0.0052	-0.2826
1995-2005	0.0073	0.1595	0.0060	0.1322
2005-2015	0.0064	0.0125	0.0063	0.0123
1965-1990	0.0065	0.5567	-0.0059	-0.5389
1990-2015	0.0077	0.2482	0.0056	0.1808
1975-2015	0.0102	0.8462	0.0016	0.1359
1965-2015	0.0133	1.1013	0.0007	0.0696

Source: Own elaboration with data from Table 3.2. Betas were estimated within East Asia and Latin America and the Explained Gap is in percentage points. There are included the 21 East Asian and 22 Latin American countries from Table 1.1.

the conditioned beta for OECD countries is only slightly higher than the unconditioned. There are at least two possible explanations for this: one is that most of the convergence for those countries is unconditional; but another possibility is that, since those countries are very similar in important variables, the unconditioned beta is already capturing the conditional convergence.

Secondly, conditional convergence, both by OLS and 2SLS, is stronger within East Asia and Latin America than outside those regions, which is interesting because that does not happen with unconditional convergence.

Finally, all the conditioned betas were significant.

We also could obtain estimated betas for conditional convergence from regressions of Table 3.1, which would give us the conditional convergence levels of countries around the world between 1975 and 2015 using 3SLS, 2SLS and OLS. Table 3.6 present these results.

As we can see, betas from Table 3.6 are near but below conditional betas for all the world from table 3.5, with a range between 0.0151 and 0.0220, but the highest estimation comes from the OLS regression.

In this thesis, we have discovered evidence of unconditional beta-convergence within East Asia and Latin America, but another question would be if these regions have also experienced

Table 3.5. Conditional and Unconditional Convergence 1965-2015

Sample	Control Variables	Method	$\hat{\beta}$	Lower Limit	Upper Limit
World	No	OLS	0.0005	-0.0018	0.0031
World	Yes	OLS	0.0219	0.0161	0.0302
World	Yes	2SLS	0.0216	0.0159	0.0294
OECD	No	OLS	0.0158	0.0034	0.0538
OECD	Yes	OLS	0.0218	0.0094	0.0609
OECD	Yes	2SLS	0.0194	0.0100	0.0376
East Asia and Latin America	No	OLS	0.0133	0.0043	0.0298
East Asia and Latin America	Yes	OLS	0.0255	0.0177	0.0384
East Asia and Latin America	Yes	2SLS	0.0288	0.0198	0.0455

Source: Own elaboration with data from PWT 9.1. See more detail in Figure 3.1. For the OECD, I included all 37 countries with available data that were members in 2021. Regressions do not include dummies. The control variables were economic openness, and the inflation, fertility and investment rates. For the 2SLS regressions, inflation, fertility and investment rates were considered endogenous; and the instrumental variables were the same than in the regressions of table 3.1 with the exception of the lags of the endogenous variables. The upper and lower limits show the interval at 95% confidence.

Table 3.6. Conditional Convergence Levels around the World 1975-2015

Regression	Beta
1 (3SLS)	0.0183
2 (3SLS)	0.0179
3 (3SLS)	0.0195
4 (3SLS)	0.0151
5 (3SLS)	0.0191
6 (3SLS)	0.0173
7 (OLS)	0.0220
8 (2SLS)	0.0191

Source: Own elaboration with data from Table 3.1.

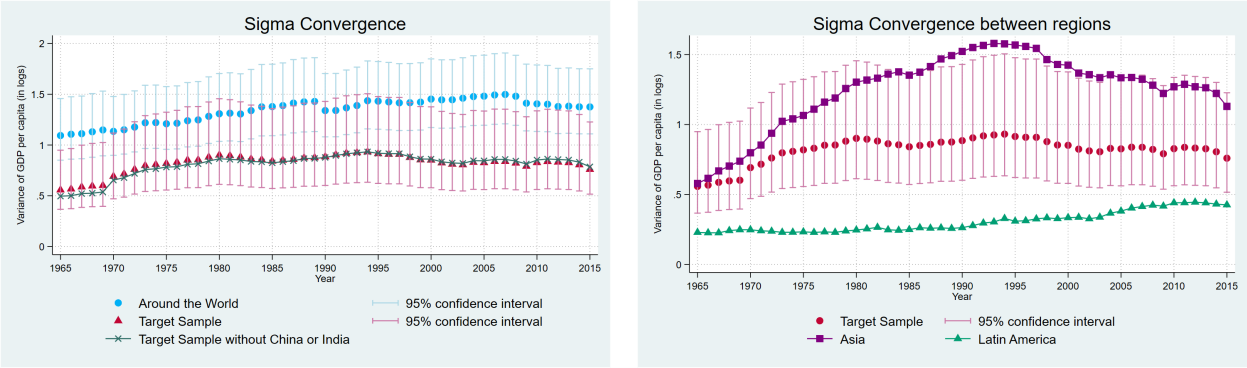
sigma-convergence, that is if income inequality across countries has diminished the last years.

Young, Higgins, and Levy (2008) proved that beta-convergence is a necessary but not sufficient condition for sigma-convergence; and therefore, it is possible to have growing income inequality with a tendency for poorer countries to grow faster.

In this chapter, we have seen there is enough evidence of conditional convergence both around the world and within East Asia and Latin America; and I have also found some evidence of unconditional convergence within these two regions at least since 1990. Moreover, Patel, Sandefur, and Subramanian (2021) found evidence of unconditional convergence across the countries in the world since 1995. However, Figure 3.3 shows that these convergence forces have not always reduced income inequality across countries.

Globally, the variance of GDP per capita had sustained growth until the 2008 crisis, when suffered a little drop. On the other hand, the variance within East Asia and Latin America began to fall several years earlier, since 1995, but the fall was very small and the variance has remained steady the last years. However, in both cases, it seems that beta convergence has not translated into sigma convergence.

Figure 3.3. Sigma Convergence

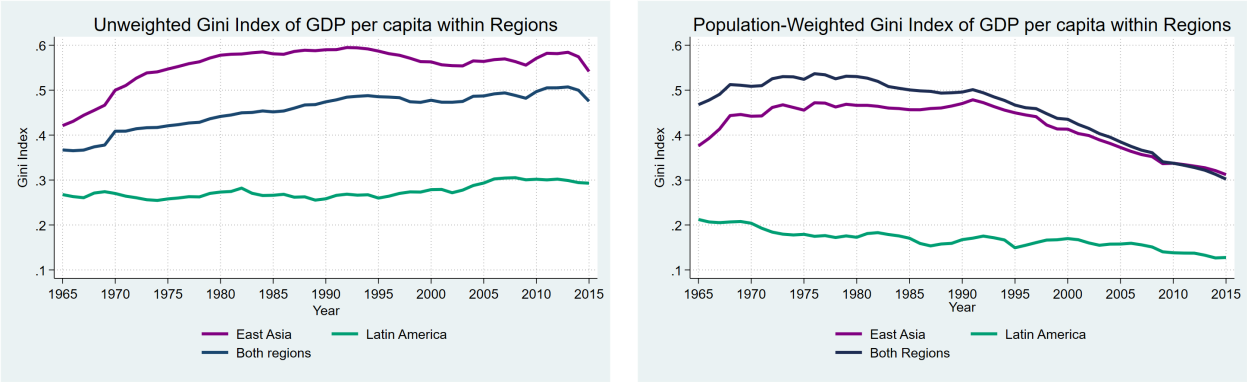


Source: Own elaboration with data from PWT 9.1. There are included the 22 Latin American and 21 East Asian countries from Chapter 1.

But we can discover interesting things if we analyze the sigma convergence by region: until 1995, the variance in Latin America remained steady, while East Asia went through a very strong increase in income inequality, but since then, trends have reversed: inequality has fallen in East Asia and while has augmented in Latin America. It is also remarkable that East Asia shows much higher income inequality across countries than in Latin America.

Figure 3.4 presents another way to see income inequality across countries through the Gini Index. With unweighted data, we have seen a slight upward trend in inequality in both regions, but with weighted data, the inequality has dramatically fallen since the 1990s in

Figure 3.4. Gini Index



Source: Own elaboration with data from PWT 9.1. There are included the 22 Latin American and 21 East Asian countries from Chapter 1.

East Asia.

Conclusions

The purpose of this thesis was to research what are the causes that explain the gap in per capita GDP growth between East Asia and Latin America in the last decades. And the hypothesis was that convergence forces, both conditional and unconditional, could explain a substantial fraction of the gap.

In chapter 1, I presented a general overview of the problem, showing that Latin America has experienced higher criminal, fertility, and inflation rates and that it has had a stronger democracy. Moreover, in 1965 Latin America was much wealthier than East Asia, which suggested that convergence forces had boosted East Asian growth until the 2000s when this region exceeded the Latin American average income. However, the economic theory asserts that the greater the difference between income levels, the stronger the convergence forces. Therefore, convergence must have been irrelevant to explain the gap since the 1990s when both regions already had very similar per capita GDP levels.

Older literature had found that factor accumulation had been crucial to explain East Asian growth and that the TFP of Latin America has decreased since the 1980s. This thesis confirms these results in chapter 2, concluding also that differences in TFP growth have been essential to explain the gap between regions; however, it is difficult to know the extension of this contribution since results dramatically change across different alpha values. But for a coherent range of alpha, TFP can explain at least 30% of the gap between 1975 and 2015.

Finally, in chapter 3, I ran 3SLS regressions to decompose the growth gap, and I found that the most relevant variables for this problem were the inflation rate and the initial income. However, these variables only can explain the gap between 1975 and 1995; but, since then, the Latin American inflation fell to the East Asian levels, and the income levels of both regions were very close to each other during 1995-2015. Nonetheless, the gap has remained at high levels; and traditional variables can not explain why East Asia grew two annual percentage points more than Latin America during the last two decades.

I also measured the degree of convergence within East Asia and Latin America, and I found some evidence of unconditional convergence since 1965; however, this has become stronger since 1990. Besides, the conditional convergence seems to be higher within these

regions than in the rest of the world. I also showed that the beta-convergence of these regions has not caused sigma convergence.

Taking into account all the above, I conclude that my hypothesis was only partially true because convergence was only relevant to explain the gap until 1995. Specifically, convergence forces explained around 1.1 percentage points of the gap for 1975-1985; around 0.7 points for 1985-1995; 0.4 points for 1995-2005; and almost zero for 2005-2015.

Moreover, within these regions, unconditional convergence has been higher during the last years, when convergence was not relevant anymore to explain the gap. However, nowadays East Asia has become wealthier than Latin America, and therefore, we can expect that convergence forces will boost Latin American growth to reach the East Asian levels, and the growing unconditional convergence could accelerate this process.

On the other hand, this thesis left several questions without answering them. For example, this work does not present enough evidence of TFP convergence within Latin America and East Asia; and without information on the accurate value of alpha, the thesis could not specify if the TFP has been important to explain the growth of East Asian countries. And, finally, it is clear that the Barro Regressions of chapter 3 are omitting important variables, and, as a consequence, I could not find which variables explain the 1995-2015 gap.

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