CAPITAL FORMATION IN MACHINERY IN LATIN AMERICA, 1890-1930[*]

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Summary

Investment in machinery is a key aspect in the analysis of long-term economic growth during the era of the spread of industrialisation. But, historiography has only revealed what the pace of capital accumulation was in a few Latin American economies. This article offers continuous (annual) and consistent series on the magnitude of this investment in all of the Latin American countries for the period at the height of the first globalisation, 1890-1930. The paper gives special attention to comparative analysis, showing the differences that exist at the heart of the Latin American community, in the levels of capital formation in machinery as well as in the national development of this over time. The differences in the levels appear very indicative of the unequal degree of development reached by these economies. This article puts to test the hypothesis of intraregional divergence, obtaining the tentative result that there was divergence until 1913, but that there was convergence from 1914-1930.

1. Introduction

For more than half a century there has been intellectual debate about the achievements of long-term growth of Latin America, or rather, the lack of such achievements. The big question that economic historians, as well as economists,

continue to ask themselves is: when did Latin America fall behind? And, particularly, what were the causes of this backwardness?

Many interpretations and theories have been put forward to explain the backwardness of Latin America, from structuralists and dependentists of the 1950s, 1960s and 1970s to institutionalists or neoinstitutionalists of recent years, such as Engerman and Sokoloff (1997), and of Acemoglou, Johnson and Robinson (2001, 2002). The latter have had an enormous influence on economists interested in growth. However, the debate has been encumbered by the scarcity of data, as Coatsworth highlighted (2005) in a recent state of the question. In their highly celebrated studies, Acemoglou, Johnson and Robinson resort to very simple instrumental variables to identify the institutions which favoured or inhibited investment, and hence, very long-term growth (Acemoglou, Johnson and Robinson, 2001 and 2002). This very scarcity of data has proved to be fertile ground for explanations based on geographic and climatic determinism, such as Sachs (2001). I would even dare to state that if, lately, debate has revolved around institutional factors and factors of political economy, this is because of the absence of macroeconomic data.

One of the areas where empirical knowledge is most sorely missed is that of the formation of physical capital and in particular, machinery. Nowadays, after having been neglected for some time, the study of capital formation is once again one of the central questions in analyses of long-term economic growth. Classical economists regard capital accumulation as the prime source of growth. The function of neoclassical production, as it was defined in Solow's model, led economists to believe that physical capital accumulation explained a very small part of the increase in productivity and the increase in the product. The macroeconomists who in the 1960s developed growth accounting based on Solow's thinking, contributed empirical evidence which appeared to prove that the post-war growth in developed economies was caused fundamentally by the sustained growth in total factor productivity – the famous residue in Solow's model- while it was only secondarily a consequence of greater physical capital endowment. The new economic growth theory which emerged in the 1980s strengthened the idea that the source of wealth of nations was to be found, not in a greater investment in physical capital, but rather in other factors, especially in human capital and in spending on research and development and innovation (Mankiw, Romer and Weil, 1992).

However, more recently, numerous economists interested in the growth theory and economic historians have vindicated the role of investment in physical capital, especially in equipment goods, as the engine of long-term economic growth. It must be said that what we might call good old economic history never cast any doubt on this. Expert researchers in the history of technology and in the Industrial Revolution, as well as analysts of the historical processes of sectorial modernisation from a microeconomic perspective, in effect, have always believed that investment in new machinery and the accompanying mechanisation were the real levers of riches, if I may use Mokyr's well-known expression. In a series of articles, De Long (1992) and De Long and Summers (1991, 1992 and 1993) opened the debate among growth theorists when they defended, using empirical data and econometric and analytical instruments in the style of macroeconomists, the existence of a strong causal

relation between investment in equipment goods and long-term economic growth. In their pioneer paper of the greatest impact, De Long and Summers (1991) defended the existence of a strong link of statistical causality between investment in machinery and increase in productivity in a broad sampling of developed and developing economies between 1960 and 1985. In the opinion of these authors, the link is born of the powerful externalities inherent in the investment in machinery, which lead to significant, sustained increases in total factor productivity. De Long (1992) proved that this same relation existed during the centennial period 1870-1980 in a representative group of the most advanced economies. De Long and Summers (1992) (1993) discovered that the causal link between investment in equipment goods and growth has been more powerful in semi-industrialised economies. Temple (1998) and Temple and Voth (1998) have reinforced this interpretation. The former perfected the empirical exploration undertaken by De Long and Summers, and resolved certain technical deficiencies in the econometric exercise carried out by these authors. Temple and Voth (1998) have highlighted that the social benefits which developing countries gain from investment in equipment goods are very substantial and are superior to those obtained by more developed countries. They conclude from this that physical capital accumulation played a crucial role in the initial phases of industrialisation, and this importance waned once these countries reached more advanced stages of economic development. This would become what is today the point of consensus in the field of growth theory[1]. As Temple indicated (1999) in an illuminating state of the question, it is well established that there is a clear and robust correlation between rates of investment in physical capital and economic growth rates. Analysts also take for granted the fact that physical capital accumulation has, in the long-term, decreasing returns. One area where doubts emerge and there is still room for controversy is that of the relevance of the endogenous component of investment, given that nobody challenges the notion that causality operates in both directions: from investment to growth and vice versa.

There are, therefore, good reasons for undertaking a study which investigates how investment in machinery in Latin America unfolded in the decades prior to 1930. In addition, it must be kept in mind that this was the period of the first true economic globalisation, during which all the economies in the region became intensely integrated into the international economy and, at least some of them, moved further along the path to industrialisation (Haber, 2006). This experience confronted historians of Latin American with numerous questions about the level of success achieved by the different national economies. It is impossible to give a satisfactory response to these questions without approximate knowledge of the evolution of their basic macroaggregates, among these, capital formation.

The Economic Commission for Latin America and the Caribbean (ECLAC), in the early years of its existence, understood very well the importance of determining the magnitudes of investment, to which ECLAC attributed a central role in economic development. Thus, in 1950 and in the early 1960s ECLAC undertook a series of studies of national cases in which great attention

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[1] Recently, Field (2007) questioned whether the thesis defended by De Long was applicable to economic growth in the United States in the 20th century (1919-2000).

was paid to the examination of the process of physical capital accumulation and its determining factors, especially external financial restriction. The statistical compilation work done by ECLAC was commendable – it is necessary to establish this, since economic historians have often showed indifference at the mass of data contained in this monographic collection. However, ECLAC was only able to undertake studies of some countries and rarely gathered systematic information for the period prior to 1925 (Yáñez and Tafunell, 2003). A few years ago, Hofman (2000) took up the research with a study of the growth factors in the Latin American economies in the 20th century, in which, from a growth accounting perspective, capital accumulation acquires great importance. The starting point of this research is 1900 and it confines itself to the study of six big economies: Argentina, Brazil, Colombia, Chile, Mexico and Venezuela. As is apparent, all the smaller economies in the region are absent, as well as some others, which in the early 20th century were no different in size from the six mentioned, such as Cuba, Peru and Uruguay. Studies abound of these same six national cases, which were undertaken by different economic historians specialised in this or that country. Therefore, this has not helped address the deficit of knowledge about how the formation of capital developed in the whole region, which comprises the twenty countries which in the first half of the 20th century were sovereign States[2].

This paper distinguishes itself from the preceding ones on this point. I have put great effort into quantifying the investment of *all* of the economies of the area, that is, the twenty independent republics of the period. Thanks to that, we are eventually able to determine the magnitudes of the investment of Latin America as a whole. And, most importantly, we can calibrate the performance of the smallest economies, whose macroeconomic evolution prior to the 1920s or even the 1940s we do not know very much about[3]. The quantitative elaboration presented here provides annual series for capital formation in machinery and other related equipment goods for the period 1890-1930, which corresponds to the height of the first globalisation[4]. The text which follows leaves aside any consideration or description related to the estimation procedures used (I request the reader interested in this to consult the appendix). I would simply like to point out here that, like national specialists before me, I have assumed that all machinery used to equip Latin American economies was imported.

[2] I refer to the work of Cortés Conde (1994) and Taylor (2003) for Argentina; Suzigan (2000) for Brazil; and Haber, Razo and Maurer (2003) for Mexico. The series constructed by these authors, together with those generated by Hofman (2000), have permitted me to put to the test the soundness of my estimate. The comparison yields highly satisfactory results. See Tafunell (unpublished).

[3] Maddison's compilation (2007) is revealing in this respect. Despite the author's eagerness to provide the widest territorial and temporal coverage possible in GDP series, until 1900 he could only offer annual series for Brazil, Chile and Uruguay. Therefore, the knowledge we have about the Latin American GDP in the period prior to 1900 has an extremely poor and precarious empirical base. From 1900 this improves significantly with the incorporation of the series of eight countries, Argentina, Brazil, Colombia, Mexico, Peru, Uruguay and Venezuela. The database of series would not expand again until 1920, with the incorporation of five Central American countries, Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua. Before 1938, there was only one new incorporation, that of Cuba in 1929. The GDP series of Bolivia, Ecuador, Haiti, Panama, Paraguay and the Dominican Republic start between 1939 and 1950.

[4] The goods recorded are those included in the category of machinery and other equipment goods (AN.11132) in the United Nations' System of National Accounts 1993, as well as tools (10.63). See United Nations (1993).

The main virtue of an essay like this one is, purely and simply, the quantitative reconstruction, the stock of series itself which it brings to light. However, the presentation of the results cannot be unconnected to the key ideas characterising the vision that present-day historiography has of the dynamics of Latin American economies during this period. Therefore, this paper, apart from containing and publicising the investment series, also aspires to put to the test four hypotheses which emerge from historiography. The first of these is that throughout the period studied, Latin American nations made significant economic progress through the accumulation of productive capital. The second hypothesis is that this growth was far from linear, that it suffered from marked instability, whether caused by exogenous or endogenous factors. The third hypothesis is related with diversity. Some authors – not all, by any means – have insisted that below the surface of Latin America hid a wide spectrum of realities. The preliminary results obtained by the research group I belong to and to which this paper also belongs, have led me to postulate the hypothesis that national differentiation was as important as or more important than the integration of each country in the pattern of the region[5]. The last hypothesis makes reference to an essential question which transcends the question of differentiation: the tendency towards convergence or divergence at the heart of Latin America, and this tendency relative to the most industrialised nations. The predominant vision of economic historiography is pessimistic. Growth opportunities were not equally distributed among the countries of the continent, and they were all at a disadvantage in relation to the nucleus of the most advanced Western economies. One of the objectives of this paper consists in validating this interpretation, obviously not in a direct manner but rather from the perspective of capitalisation.

This article is divided into six sections, in addition to this introduction. In each one of the following sections the abovementioned hypotheses are dealt with, in the order in which they have been presented. In the sixth section there is a brief summary of the results presented in the preceding sections as a form of conclusion. The final part of the paper is the appendix which gives a detailed account of the sources and methods I have used to carry out the estimation.

2. Long term progress in capital formation in machinery

Graph 1 represents the series for aggregate investment in machinery and other equipment goods in the twenty sovereign Latin American countries of that period. One of the outstanding features is that investment went through a long-term expansive impulse, between 1890 and 1930. The upward trend is clearly visible, despite the fact that it is overshadowed by stagnation in the first decade and the dramatic drop suffered during the war. Taking the period as a whole, investment increased at an average annual rate of 5.5 percent, that is, it multiplied by 8.4 over that period[6].

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[5] See Yáñez, Rubio and Carreras (2006), Tafunell (2007) and Tafunell and Carreras (at the press).
[6] Calculated using an adjusted curve, to avoid distortions created when the rate refers to extreme years with values inferior or superior to normal values.

Can we qualify this pace as an elevated growth rate? The answer is, without doubt, affirmative; this register reflects a sustained process of capitalisation. We can prove this by carrying out three different types of comparisons. If, in the first place, we contrast the progress of investment with that of the economy as a whole, we discover that the former expanded more rapidly. Investment in machinery grew approximately twice as much as the GDP, which gives validity to the estimations made by Maddison (2003) on this macromagnitude[7].

One field of comparison which is more appropriate for assessing the real importance of the investment effort in capital equipment made by Latin America consists in comparing it with what other regions in the world did during the same period. In this sense, what is particularly interesting is the comparison of the series with capital formation indexes in Western Europe and in the United States.

Graph 2 represents the Latin American series and another series which is fixed capital formation in Western Europe, fruit of a research paper that I am working on together with Albert Carreras[8]. The comparison is highly thought-provoking. What is most striking about the graph is that Latin America tended to accumulate capital at a rate far superior to that of Europe. It is also true that aggregates being compared introduced a bias against Europe. Presumably, investment in machinery (Latin America) increased more vigorously than investment in construction and other components of fixed capital formation (included in the aggregate for Europe). At any rate, the difference between the growth rates during 1890-1930 in both regions is so marked – 5.5 compared to 2.2 percent annually – that, in my opinion, we can assume, without fear of being mistaken, that Latin America equipped itself with new machinery at a faster pace than the Old Continent. In the end, this fits in with the situation of relative backwardness in that territory, its convergence potential and the highest capital yields.

<graph 2>

The comparison with the United States deserves particular attention, since this epitomises the paradigm of the group known as the "new countries", due to its rise to hegemonic power and access to a leadership position on a global scale, and, likewise, because of its role as investor in and trade partner of the Latin American countries. Unfortunately, and surprising though it may seem, there is no sufficiently reliable series of capital formation in equipment

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[7] The comparison is doubly limited by territorial and time restrictions. Maddison's GDP series for Latin America start off in 1950. Prior to that, and only as of 1900, the aggregate refers to the eight heavy-weight economies in the region, excluding Cuba, as indicated in note 3. Between 1900 and 1930 the joint GDP of the eight countries in question augmented at an annual rate of 3.4 percent. During this same period, investment in machinery rose by 5.2 percent.

[8] The earliest versions of this paper refer to the European Union of the fifteen (prior to the expansion in 2004), see Carreras and Tafunell (2003) (2005). The series showed here covers practically the whole of Western Europe, see Carreras and Tafunell (2006).

goods for the United States in stable values which cover the whole period analysed[9]. In the face of this limitation, I have opted to carry out the comparison at current prices, resorting to Kuznets' venerable estimation (1961, pp. 596-7). Graph 3 depicts the series to be contrasted.

<graph 3>

The contrast is very enlightening, despite the fact that, obviously, we must take into account that the gradient of the curve is, from 1914, exaggerated by inflation. Prices possibly also distort certain cycles. Although we cannot isolate and eliminate such distortions, this does not undermine the value of the comparison of medium and long-term movement of the two curves. In this sense, a startling conclusion can be drawn from the graph: during this period Latin American investment in capital equipment was as dynamic as that of the United States. Note that the curve gradient is very similar if we refer to the initial years and the last two. This is, undoubtedly, a fact worth highlighting. Latin America managed to renew and expand its machinery stock as intensely, approximately, as the economic leader.

Finally, we can gauge the importance of the advances that occurred between 1890 and 1930 by comparing them with advances which took place in other historical periods in the region. Let us take for example the period from 1950-1990, which has the same time-span and includes the era of closed economic policy based on the model of State controlled industrialisation, as well as its collapse and the devastating crisis which followed the non-payment of the sovereign debt in 1982[10]. So, during this period capital formation in equipment goods grew at an average annual rate of 4.9 percent, that is, half a percent less than in the period 1890-1930. Although the difference is not very significant, what is, is the very fact that the expansive thrust was greater during the era of the first globalisation. We must not forget that in the second period Latin America experienced the golden age par excellence of economic growth.

3. Investment volatility

I stated in the introduction that historiography on Latin America leads one to formulate the hypothesis that the growth of capital formation in machinery was very far from linear, and that it was subject to strong fluctuations, at times upwards and at times downwards. Economic historians have unanimously emphasised that the Latin American economies were exposed to intense fluctuations in foreign capital imports, in the availability of international means of payment and of internal money supply. All in all, these economies were exposed to great oscillations in investment as a consequence of their dependence in relation to the more industrialised economies, and their

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[9] See chapters Ca and Ce of volume 3 on the very latest historical statistics of the United States, Carter et al (2006). The estimations that cover the 19th century end in 1909, while the official national accounts figures start in 1929.
[10] In fact, there is no other alternative, given that no other global estimation exists for the period prior to 1950.

vulnerability in the face of the fluctuations of international demand. My quantification allows us to confirm that this was indeed the case.

In effect, upon regarding graph 1, the most striking thing is certainly not the long-term upward trend, but rather the short and medium-term fluctuations. The process of capital accumulation was intermittent, above all because there were two junctures when it came to a standstill: the depression of the 1890s and the investment paralysis caused by the World War. The former implied a very sharp slowdown in growth, while the latter had even more serious consequences – it came to represent a lost decade.

The early 1890s were a period of total stagnation. In the second five-year period there was a strong decline in 1896 and 1897 (decrement rates of around 10-11 percent). Thus, the depression which had its roots in the economic crisis of 1890 lasted for nearly a decade (until 1898). Economic historians of Latin America have rarely paid attention to the extraordinarily long duration of the turn-of-the-century depression, which qualifies it as a very noteworthy economic phenomenon. Investor sluggishness was, initially, as has always been asserted, in reaction to the Baring crisis. However, what is usually ignored is the fact that it was also caused by a drop in prices of products exported by Latin American countries. This decline was so significant that it was the greatest deterioration in the terms of trade suffered during the period 1820-1950 -even greater than that which occurred during the Great Depression- (Bértola and Williamson, 2006, p. 33). Recovery eventually began in 1898 and progressed in a short cycle starting from that year, reached its peak in 1899 and touched bottom in 1901. From then, or rather, from the following year, and until 1907, there was an extremely strong investment boom. During this golden period annual growth rates oscillated between 23 and 35 percent. The international economic crisis of 1907 brought the upswing to an abrupt halt: investment in machinery grew by only 6 percent that year, it diminished by 9 percent in 1908 and it remained steady the following year. In 1910 Latin America appeared to have recovered the path of explosive growth of the beginning of the century: investment increased by 24 percent that year. But the expansion ran out of steam immediately. In 1911 and 1912 there was slight but valuable advance (6-8 percent annually). The recession began in 1913, with Latin American importers encountering difficulties in financing their purchases in the markets of the European capitals, which were subjected to political tensions sparked by the war in the Balkans.

Taking stock of Latin American investor behaviour in the period preceding the World War, if we ignore the ups and downs of one year or another, the image that emerges is crystal clear. In the 1890s Latin America barely managed to equip itself with new means of production. It might be said that there was no growth during the period between 1890 and 1899 (average annual rate of 0.2 percent). At the start of the new century, the Belle Époque arrived in Latin America. Between 1900 and 1913 the gross stock of equipment goods increased at an astonishing rate of 11.7 percent. This stunning rise was overshadowed by its marked instability (crises of 1901 and 1907). But this would prove to be a minor problem after the outbreak of the World War.

The conflict put an abrupt stop to the strongly expansive dynamic of capital equipment which had propelled the Latin American economies in the final part of the globalisation era, when the gold standard, the massive movements of foreign investment and steadily burgeoning international trade became powerful engines of economic growth. In retrospect, the slight investment setback of 1913 forecasted the disaster which was to follow. The outbreak of war in Europe brought with it the collapse of investment in Latin America, as indicated by Albert (1988, pp. 48, 181 et seqq). In each of the years 1914 and 1915, it diminished by 42 percent. The fall was so dramatic that in the end there was a certain reactivation since governments and business people were impelled to satisfy urgent demands by turning to the North American market. But, when the United States joined the war in April 1917, recovery came to a halt. In 1918 the level of capital formation in Latin America was close to 60 percent below that of 1913 (44 percent of the value of 1913; 1913=100, having reached 34 in 1915). Between these two dates (1913 and 1918), the rate had decreased on average to an annual rate of close to 12 percent. Graph 2 and 3 show us that the conflict hit Latin America harder than Europe and certainly harder than the United States. During the conflict, Latin American economies faced shortages while the warring nations, since they were highly industrialised economies, were capable of sustaining considerable productive activity of capital goods although they tended to dedicate a lot of resources and factors of production to dealing with war needs.

With the Armistice it became possible to purchase greater volumes of equipment goods, but European industry and international markets did not regain normality until 1920. At that time, there was massive and unprecedented spending on investment due to the satisfaction of a demand repressed during preceding years and due to the fact that Latin American economies had accumulated abundant surpluses on the balance of payments which now financed this extraordinary volume of imports. The acquisition of machinery and equipment increased in 1920 by 81 percent. Such an enormous increase meant Latin America could immediately regain its pre-war high-point. The extraordinary demand, which, as mentioned, resulted from the desire to obtain equipment goods which had not been possible to purchase during the war, continued until 1921. However, the demand weakened since it coincided with the post-war crisis. In Latin America, as in the United States and in Europe, the crisis was short but severe due to the drastic fall in the price of export goods. In 1922 Latin American investment suffered a reduction of 30 percent, but the following year it recovered. As from then, it moved into an upward trend.

It is widely acknowledged that, once the most pressing problems of European monetary and financial reconstruction had been resolved, stability achieved, and the North America bank was prepared to invest heavily in the exterior, the world experienced an era of prosperity, abruptly interrupted by the 1929 crisis. Nevertheless, my quantitative reconstruction of investment in Latin America leads us to examine the nuances of this interpretation. The economic splendour of the 1920s was, for Latin America, somewhat less spectacular than believed. Judging by the progress made in capital accumulation, the outlook was less rosy in 1925. As from that year, investment barely augmented. The 1929 upswing should not deceive us: it was purely punctual and was below the brilliant records of 1923-5, to say nothing of those from the beginning of the

century. If we consider the entire post-war expansion, that is, the period between 1921 and 1929, we discover that capital formation in the region incremented at an average annual rate of 7.9 percent. Such figures doubtless point to vigorous growth, but this cannot be referred to as extraordinary.

As was inevitable, in 1930 investment contracted, as a result of the collapse of foreign investment and of prices and external demand for primary goods. In my elaboration, we only manage to witness the very first dip of the Great Depression (see graph 1). For this reason, it does not make sense to assess this final, isolated entry of the series.

Before concluding the question of investment volatility, it is appropriate to turn once more to a global perspective, which captures simultaneously the diversity and complexity that characterise the process of capitalisation. This leads us to the next section. A very apt starting point is the comparison of the instability of investment in machinery with the economic instability itself. Table 1 approaches this important issue, so emphasised by economic historiography on Latin America. This table contains the average of the absolute deviations of the rate of interannual variation of investment in machinery, relative to the average of this in each of the three periods indicated. In the cases in which it was calculated by Thorp (1998, p. 339) I have included in parenthesis the standard deviation from the annual GDP growth rate.

<table 1>

On observing the data in table 1, the most striking thing is how extremely variable capital formation is. This variability is, in effect, greater than that which affects the GDP. In every case, the rate of the former is a multiple of the latter. This fact is perfectly normal and fits into the logic of the functioning of economies whose stock of equipment goods was still relatively limited and which had to face very changeable conditions of financial restriction which hindered down their renewal and expansion. What is most surprising is that there is no apparent correlation between investment volatility and GDP volatility, as emerges from a simple reading of the figures in table 1. Possibly this is due to limitations in GDP data, since, as indicated in the table, half of the deviations calculated for the second period exclude the convulsive years of the World War. Moreover, the comparison of the first period is of dubious significance because it omits the decade of the 1890s from the calculation of GDP variability. In any case, the lack of correspondence between the deviations of the two variables raises some doubts, which can only be put to rest by acquiring more knowledge about the macroeconomic dynamic of these countries in the decades prior to 1930.

Another noteworthy aspect of the table lies in the fact that investment volatility was greater during the period 1914-30 than in 1891-13. In the whole of Latin America it doubled from one period to the next. In a minority of nations the increase in volatility was even greater. I believe that it would be excessive to deduce from this that, far from diminishing, the fluctuations tended to increment over time. Possibly, the Latin American economies were not dragged along into growing instability, but rather, quite simply, the effects of the war

were so disruptive that they seriously affected the balance of the three final five-year periods of the era of globalisation.

However, perhaps the most striking feature about the abovementioned data lies in the variety of situations experienced by the Latin American republics. Capital formation fluctuated with different intensity. Prior to 1914 the following countries enjoyed relative stability: in descending order Mexico, Costa Rica, Ecuador, Colombia and Venezuela. At the opposite extreme were Paraguay and Bolivia – their instability is, no matter how you look at it, exaggerated by the shortcomings of the sources-, Cuba – thrown into upheaval by the War of Independence-, Nicaragua, Haiti and Uruguay. If we observe the values for 1914-30, we can establish that there were more lines of discontinuity than of continuity. Ecuador remains among the most stable of the countries, but somewhat below Ecuador there are some countries which previously were not stable, such as Uruguay and Argentina, together with Peru and Mexico. The investment volatility of Paraguay in 1914-30 remains elevated – unlike that of Bolivia- and volatility is also high in Haiti, Honduras, the Dominican Republic, El Salvador and Nicaragua. Spanning the entire period analysed, the group of countries with most fluctuating investment is comprised of, in descending order, Paraguay, Bolivia, Haiti, Panama, Cuba and Nicaragua whilst the group with the most stable investment is composed of Ecuador, Mexico, Peru, Costa Rica and Argentina. It can be observed that the dividing line that separates one from the other is not related to the degree of economic development. Neither does the degree of economic development exert a great influence on the changes recorded between the two historical phases. The World War and the consequent situation in the post-war decade accentuated enormously the cycles of investment in Haiti, Costa Rica, Mexico, Honduras, the Dominican Republic, Colombia and Venezuela. On the contrary, the cyclical norm remained unchanged or without significant changes in Argentina, Cuba, Uruguay and, in a more dubious manner, in Chile, Brazil and Peru.

In the high investment volatility that can be observed in numerous countries as from 1914, there is perhaps no other common denominator than their belonging to the area of Central America and the Caribbean, which could be related to their nature as monoexporter economies of coffee or sugar. Colombia and Venezuela represent a case apart, where their redoubled investment volatility had its roots in their own economic acceleration. The process of capital accumulation in the biggest economies, with a more diversified export sector, or those which had minerals as their export base (Bolivia, Chile, Mexico and Peru) were less prone to strong fluctuations.

Without doubt, the figures in the table are not easy to interpret. There are no obvious answers to the questions we might ask ourselves. The image is crystal clear with regards the fact that capital accumulation progressed, effectively, in a very stable manner. Likewise, the image is clear with regards the fact that the instability became accentuated from the outbreak of the European war until the 1930 crisis. But, the differences in this respect among the twenty republics are shrouded in a certain mystery. What is beyond all doubt is that these differences were marked. And this brings us to the validation of the third hypothesis.

4. National diversity at the heart of Latin America

Latin America was, and in certain manner still is, a very diverse economic reality. Economic historiography has not highlighted this fact enough, as it has been prone to occupy itself with big economies, mistaking the part for the whole[11]. So, the quantitive elaboration which I present contributes conclusive empirical evidence in support of the idea that we cannot treat Latin America in a global manner, leaving aside the enormous differences that exist at its core. Such differences are reflected in multiple facets.

The series in table 2 clearly reveal the very different weight that capital formation had in the twenty republics. This should not be in the least surprising, given the disparities that exist among them in terms of their physical dimensions and the size of their populations[12]. At any rate, the table shows enormous inequalities among the Latin America nations. Argentina and Brazil alone, count for almost half (45.9 percent) of investment in the region during the period analysed. If we add Mexico, they represent close to 2/3 of the total (63.4 percent), even though the percentage does not reach half of this during the years of the World War. If we include Cuba with the three previous countries, they make up ¾ of total investment, and are always above 2/3, except for one year. If we widen the group to the five most powerful economies in terms of capitalisation and include Chile, this covers 83.4 percent of capital formation in the whole of Latin America for 1890-1930, with the highest percentage at 88.7 percent and the lowest at 75.4 percent.

<table 2>

At the opposite extreme, ten countries are situated −Bolivia, Costa Rica, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Nicaragua, Paraguay and the Dominican Republic- whose participation in regional capital accumulation had very scant importance. Among them they contributed 5.2 percent of the total, reaching a maximum of 9.3 percent at the high point of the coffee boom (1896), and a minimum of 2.9 percent in the crisis of the subsequent decade. In between these two groups of countries, there are four which, either due to their high degree of development, or because of their relatively large size, contributed rather significantly to the process of capital accumulation in Latin America. These countries are Colombia, Peru, Uruguay and Venezuela. Their participation is double that of the ten previously mentioned countries (10.3 percent), and far surpasses the quota of 15 percent in the late 1920s.

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[11] It is only fair to point out that some recent syntheses of better quality on the economic history of Latin America underline the importance of national differences, something which is reflected even in the internal organisation of such papers. See Thorp (1998), Cárdenas, Ocampo and Thorp (2000a and 2000b) and Bulmer-Thomas (2003). But others, for example the new Contemporary Economic History of Latin America edited by Cambridge, are not sensitive enough to this fact, see Bulmer-Thomas, Coatsworth and Cortés Conde (2006).
[12] In 1890 the least populated countries had between 200 thousand and 400 thousand inhabitants, while the most populated ones easily exceeded 10 million (Brazil had more than 14 million and Mexico, more than 11 million). In 1930 Brazil had 33.6 million inhabitants, Mexico 16.6 and in Argentina 11.9, whilst the population of Costa Rica and Panama was less than half a million, and Honduras, Nicaragua and Paraguay were below one million.

This does not concern a simple question of physical size or geography. There were enormous differences among the Latin American republics in terms of income levels and wealth. They were not all poor – far from that. Neither were they dynamic to the same degree during the first globalisation. Economic historiography has often underlined this question, which constitutes one of the defining features of the economic past of the region, even though it has paid less attention to this issue than to collective dependency and economic backwardness. But economic historians have never been able to back up empirically a complete hierarchy of the Latin American nations according to their degree of development at the beginning of the 20th century. This is because they lacked the reliable measurements of level of GDP per inhabitant, or failing that, any other basic macromagnitude, such as, for example, capital formation per inhabitant. Here we have a highly significant contribution of the present paper. Table 3 gathers the calculated annual series of investment in machinery per capita, expressed as index numbers, with the reference point of the volume of investment per capita of Argentina, the most advanced economy in the region.

<table 3>

The table highlights the big gap that separated the countries in the region in volume of investment per inhabitant. In order to facilitate reading, I propose turning one's attention to graph 4, which allows us to perceive at a glance the differences among the countries, by condensing each country's quota into a single point, the value of average investment (pounds sterling in 1913 per inhabitant). The graph is full of elements of the greatest of interest and it holds several surprises. Although it is known that Argentina and Uruguay featured in the early 20th century among the countries with highest income per capita in the world, it is generally unknown that Cuba also formed part of the club of the richest nations. This is what emerges from the graph and which tallies with the interpretation of specialists in the Cuban economy (Santamaría, 2003). My quantification situates Cuba in first position, overtaking even Argentina. What is also surprising is that Chile is ahead of Uruguay, when, according to estimations of GDP per capita the Andean country was behind the country of the River Plate.

<graph 4>

Another fact worth emphasising is that the remaining sixteen countries are below the Latin American average. The fact that Costa Rica touches this average should not seem strange, given what we know about its precocious economic development. But the fact that investment per capita of Mexico was one step below, at the same level as the Dominican Republic, indicates that the volume of capital formation in equipment goods did not always depend on the presence or importance of the industrial, resource extraction or manufacturing sector. Just behind Mexico is Venezuela, an economy which was moving, late but rapidly, from agricultural to petroleum specialisation. At a considerable distance from this country, Brazil and Peru are situated. Behind them we find at below half of the Latin American average, generally far below, practically all the small

economies plus one medium-sized economy, Colombia. Paraguay and Haiti are at the bottom of the ranking.

The relation between the extremes of this ranking gives a precise indication of how abysmal the economic differences were at the heart of Latin America. The level of investment per capita of the most backward countries, or, to be more exact, under-capitalised countries –Haiti and Paraguay- did not even represent 4 percent of the level of investment per capita of the two most capitalised nations, Cuba and Argentina.

There is another extremely interesting element about the existing national differentiation at the heart of Latin America. Upon analysing and comparing the national series of investment (see graph 4) one notices that, on many occasions, they do not fluctuate in a synchronised manner. There were only two years (1904 and 1920) in which investment moved in the same direction (upwards) in the twenty countries. In the other thirty eight years this was not so. And it is not a question of slight differences in the cyclical movements. There are very frequently movements in opposite directions. This poses two important questions: Were the investment paths divergent or convergent with regards to their cyclical behaviour? Did the most backward economies diverge or converge towards the level of investment per capita of the most developed economies? In the following lines I will attempt to answer the first question which concerns the similarities or dissimilarities in the cyclical pattern of investment. The second question asks us whether the statistical reconstruction carried out can contribute to existing debate about if there was or was not economic divergence during the period. Given the importance of this topic, I will deal with it in the next section.

<table 4>

A direct and simple way of measuring and visualising the differentiation in the cyclical investment patterns at the heart of the region involves calculating and representing the coefficient of variation of national investment levels[13]. Graph 5 shows the results.

<graph 5>

The graph highlights that there was not a tendency towards a greater synchronisation of investment cycles. Neither is there a trace of the opposite tendency towards lesser synchronisation. In the late 1920s statistical dispersion was approximately the same as in the early 1890s. Looking at the graph, we can project an imaginary tendency line which would be practically horizontal if we covered the period 1890-1930 in its entirety.

But graph 5 reveals something even more interesting: the existence of periods of convergence and of divergence in the cyclical pattern of investment.

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[13] I have been inclined to favour the coefficient of variation rather than other measures of dispersion. Often variability is calculated with a measure of absolute dispersion, generally the standard deviation or the variance. But, when it concerns a phenomenon which has a fundamental upward tendency, as is the case with capital formation or the GDP, then measures of absolute dispersion introduce an upward bias.

It seems they do not stem from one single cause. The duration of these periods is variable, and possibly this is determined by the sharp crises suffered by some groups of countries. The crisis triggered in Argentina in 1890, which had strong contagious effects in some countries, was in all likelihood the cause of the upturn in dispersion which took place at in the early 1890s. For the coffee producing countries, a period of opulence followed, which, as well as explaining the dramatic fall in the index, suggests that during these years there was a certain convergence in volumes of investment per capita in the most backward countries compared to the most advanced ones. The collapse of coffee prices between 1897 and 1899 reverted the process. The differentiation deepened during the first five years of the new century, probably due to a combination of the persistence of the depression in the coffee producing countries and the acceleration at different speeds in most of the remaining economies. However, forces favourable to growth which operated during the Belle Époque caused all countries, as of 1905, to show the same strongly expansive investment pattern. Unlike in the past, the crisis of 1907 seems to have affected all countries equally.

The World War broke the dynamic of the previous years, including the action of those factors which were the immediate cause of the cyclical divergence. It is evident that the conflict was a shock of exceptional nature which disrupted unequally each of the economies in the region. At no other moment were their paths so different. While capital formation fell to historic lows in some countries that were very dependent on European economies, in others the setback was not of great importance due to their connectedness with the United States, and there was even one group, specialised in sugar production, which enjoyed a spectacular boom. The post-war boom drastically reduced the exceptional levels of dispersion of the war years because everywhere a very strong investment demand, repressed during the conflict, appeared and became established. Once the effect had worn off, throughout the 1920s there were no great changes, and the situation was characterised by low and stable dispersion compared with that of preceding decades. In other words, in the post-war decade the Latin American communities shared investment cycles more than in the past. With the emergence of the international economic crisis in 1929-30, dispersion once more became evident, that is, some countries felt the international economic crisis immediately and intensely, whereas others were not significantly affected until some time later.

5. Was there or wasn't there investment divergence?

One question which is of special significance in a study such as this one is whether or not there was a process of convergence, or of divergence among the economies of the region. It constitutes one of the central themes of empirical research of modern theory of economic growth, and one of the burning questions in the debate open about the causes of the Latin America's economic backwardness. Some years ago, Williamson (1999) maintained, no without some hesitation, a moderately optimistic thesis, based on the data compiled from salaries (by himself) and GDP per capita (by Maddison). According to this last indicator, in the first decade of the 20th century a light divergence took place, which brought in its wake a strong process of convergence which did not

cease until 1930. The series of salaries gathered by Williamson suggested a different chronology, contradictory in fact: until the mid 1890s the countries in the region had diverged, while in the following decade they had noticeably reduced the distance separating them[14]. In a very recent essay, Bértola and Williamson (2006, pp. 28-9) raise the question again, introducing more data and variables, and defend a pessimistic conception. The first globalisation (1870-1930) led to a widening gap between the richest and poorest nations. The authors explore the possible role that certain forces might have played in this direction, such as geographic determining factors –the so-called "tyranny of distance"-, resource endowment and the transport revolution. Without doubting the veracity and consistency of the arguments put forward to explain that some countries had more growth opportunities and were better prepared than others in the region to take advantage of these, it cannot be taken as proved that during this period there was, at the heart of the region, a growing divergence. Such a verdict is unacceptable because it derives from an empirical base which, given its manifest precariousness, does not allow us to draw any definite conclusion with generalised relevance (the whole of the region and of the era of globalisation).

The series of capital formation in machinery and other equipment goods which I have generated allow us to test the thesis of divergence. It would be very presumptuous to declare that this enables us to carry out a conclusive exercise of refutation. And not because literature on growth theory has explored the possible existence of an inverse relation between income growth rate and initial income level, without taking into account capital formation[15]. The reality is that we are not in fact considering here the aggregate magnitude of capital formation but only a part of this, even though it is the "hard core" and is tightly linked to long term economic growth. Another weakness of my exercise lies in the fact that, in starting from 1890 this excludes the early stages of full insertion of Latin American economies in the world market, which deprives us of a very useful perspective for assessing appropriately what occurred in the quarter century prior to the World War. Lastly, and most importantly, the exercise which I am going to carry out puts to the test the existence of *absolute convergence*, that is to say, it presupposes that all the countries in the region participate from the same stationary state (Sala-i-Martín, 2000, pp. 200-1)[16]. Having admitted what I have just indicated, I understand that it remains of great interest to find out whether the distance separating investment levels of the less or more dynamic Latin American States increased or diminished. This represents a relevant contribution to the debate started by Williamson because, for the first time, all the Latin American republics are taken into account, while at the same time dealing with a relatively prolonged period.

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[14] Unfortunately, Williamson did not measure the dispersion of salaries further than 1914, which is why it is impossible to confirm the marked tendency to nearing between the most advanced and the straggler countries in GDP per capita.

[15] The absence of studies in this respect does not represent a major problem, since economic literature which predicts convergence among nations presupposes precisely decreasing returns of capital.

[16] Evidently, admitting that during the period Argentina and Haiti, to give an example, shared institutional, technological and preference parameters, is a gross simplification of reality.

In recent analyses about the economic growth theory a very simple formula of calculation is used, the beta convergence, based on the principle that what has to be verified is whether there is an inverse relation between the GDP growth rate or GDP per capita, and the initial level of this GDP. The beta convergence expresses in numerical form the compliance with or not of the principle that the lower the initial level of a country –in this case, of investment per inhabitant- the greater its long term growth rate will tend to be (Sala-i-Martín, 2000, pp. 194-6). Here, I will use this procedure here as an initial approach to such an important question.

Graph 6 shows the result obtained with my figures spanning the whole period, and excluding Bolivia and Paraguay, whose presumably spurious values affect very markedly the curve of least square adjustment. It is evidently difficult for the cloud of points to position itself along a straight line. Consequently, the value of R^2 is very low. Even if we accept that the existence of a relationship between the level of investment at the starting point and the long term growth rate of this, it has a weak inversely proportional character[17]. Observe that beta, with a negative sign, has a value inferior to 1 percent annually[18].

<graph 6>

The exercise I have just carried out is not of a conclusive nature. Despite this, I suggest that possibly the inequalities in the pace of investment growth – and income? - followed a gradual tendency towards convergence. Here we have a verification of enormous importance on this subject. However much the equation of graph 6 represents an empirical contribution which in itself neither refutes nor confirms any general interpretation about economic differentiation at the heart of the region, what it does do is to invite us to rethink the postulates which many economic historians of Latin America defend.

However, we need to ask ourselves: Would we obtain the same result if we broke down the period into two halves, distinguishing the pre-war and post-war periods? When we have had the opportunity to check, World War I represented a powerful shock to the process of capital accumulation in the whole region. In most countries, there was an investment collapse of greater intensity than that experienced at any other juncture of the period studied. In a minority, ultra-specialised in the export of sugar, there was an investment upswing of extraordinary proportions. If we admit the possibility that the impact of the conflict was so great that it went beyond what occurred during the war itself and had medium term effects on the growth of capital formation, then we must divide the period analysed into two sub-periods, with the dividing line at 1913. Graph 7 and 8 show the values corresponding to the two sub-periods, and the resulting equation of beta convergence.

<graph 7>

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[17] The equation yields the following result: $\quad$ log y = -0.982 log 1890 + 5.508 R^2 = 0.08

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ (1.13) $\qquad\qquad$ (3.35)**

where ** indicates significance to 1 percent.

[18] What is most problematic is that, from a statistical point of view, there is no reasonable certainty about the value of beta: the probability that the statistic is false is higher than 5 percent.

Graph 7 will probably be of comfort to many analysts, given that the cloud of points forms a curve with a positive gradient. From this it emerges that before World War I the gap between the more or less capitalised Latin American economies tended to widen. Concretely, the divergence increased at a not insignificant rate of 2.1 percent annually between 1890 and 1913. This evidence is in keeping with the dominant vision in historiography on the impact that integration in the international economy had on economies that did not start off from the same conditions, given the varying fortune of countries in terms of the lottery of natural resources –using Díaz Alejandro's famous expression-, in the lottery of geographical barriers, and given their greater or lesser success in developing an institutional and political system capable of taking advantage of growth opportunities afforded by economic globalisation in the late 20th century. With insertion in the international economy all the Latin American economies benefited, but the most advantaged economies would have gained more; consequently, they would have increased their capital stock more rapidly than the straggler economies. However, no matter how plausible such an interpretation may be, the evidence that I have just shown is not statistically conclusive[19].

It is extremely interesting to note that, contrary to what is usually maintained by those who defend the divergence theory, it does not appear that the tendency continued permanently until the start of the Great Depression. The data I am dealing with do not support the idea that the economic globalisation and the primary-exporter model carry with them an inexorable tendency towards divergence at the heart of Latin America. Graph 8 is very revealing in this respect.

<graph 8>

Between 1913 and 1930, there was apparently a tendency which was opposite to that of a quarter of a century before. Levels of capital formation per inhabitant tended to converge. The value of beta is similar to the preceding period, with the opposite sign. This is why, being also of similar length, we do not observe a definite tendency towards convergence or divergence when spanning the period 1890-1930 (see graph 6). It is also true that the last statistical exercise also yields poor results[20], which means empirical investigation does not reach a sufficiently firm conclusion from a statistical point of view.

Probably, the elevated dispersion reflected in graph 8 originates, fundamentally, in the disruption caused by the War. Naturally, this reflects a very real fact, which certainly brought along with it profound changes in the growth patterns of the economies in the region. The economic environment of the post-war was less liberal than that of the pre-war, with markets less open to certain products. What is most important and widely recognised, is that the War brought about technical change and transformations in the international

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[19] The equation below the graph is: $\log y = 2.146 \log 1890 \quad -0.004 \qquad R^2 = 0.14$
$\qquad\qquad\qquad\qquad\qquad (1.58) \qquad\qquad (0.00)$

[20] The corresponding equation is: $\log y = -2.469 \log 1913 + 12.752 \qquad R^2 = 0.05$
$\qquad\qquad\qquad\qquad\qquad (0.90) \qquad\qquad (2.08)$

economic structure and in the wealth of the nations, all of which caused a geographic reorientation of trade and financial flows. The new context must have affected resource allocation in such a way that the most fortunate in the period prior to the War, like Argentina and Uruguay, were not necessarily in the best position to maintain elevated rates of investment. In the same way as some of the backward countries, such as Colombia and Venezuela, they now enjoyed unexpected growth opportunities thanks to the growing demand for new primary products such as petroleum.

The question which I have just raised goes beyond the limits of the present study. At any rate, the upside of this is that it indicates the need to keep on the research agenda, the issue of the effects of internationalisation on the growth of the Latin American economies in the half century preceding the crisis of the 1930s. Without doubt, the differences in the levels of investment at the heart of Latin America were always very big, even abysmal (see table 3). But, when we ask ourselves not about the differentiation, but whether or not it deepened, we come up with a univocal answer. We need at our disposal a significantly greater number of observations of the volume of investment in the different countries –perhaps dealing with various types of capital goods- in order to be able to make more statistically robust inferences. Although for now we cannot avoid uncertainty, if we attribute to these results some value as an index, we must agree that these are of a contradictory nature. The last three graphs do not allow a simplistic interpretation. It can be deduced from them that there were neither winners nor losers, or, rather, it was not always the same countries who gained the most. Before 1914 those who gained the most generally came from the ranks of the richest countries. After this date, the empirical evidence presented in this paper suggests that, instead, what occurred was the opposite.

6. Summary

This article offers, in essence, a reconstruction of the magnitudes of investment in machinery in Latin America during the period between 1890 and 1930. These four decades span the culminating phase of the first economic globalisation, a historical era in which, as is well know, the Latin American nations were intensely integrated into the international economy. Until now, economic historians have relied on limited empirical evidence on the pace of capitalisation of the economies of the region, this evidence being limited to a minority of countries –not even all the medium-sized economies- and not going back, in general terms, further than 1900.

Scholars of Latin American economic growth during the era of the first globalisation have been able to formulate consistent interpretations about the dynamic of such economies without relying on an adequate database of basic macro variables. This has been possible because the account given by historiography has been based on the supposition that the determining factor in the economic development of the Latin American countries during this period, as much in the long term as in the short, was the export sector –about which sufficient statistical evidence is available. It was on exports that capital formation itself depended (Cortés Conde and Hunt, 1985, p. 16), given that

capital formation stemmed from imports of equipment goods which were financed either with foreign currency earned from exports, or with foreign capital. Economic historians have tended to think that this only occurred in times of export bonanza, meaning Latin American countries were, inevitably, subjected to permanent financial restriction on growth. The hypothesis is plausible, but it has not been sufficiently proved. And even if it were true in general terms, it may well not be in particular circumstances or in some cases of countries which managed to develop modern productive sectors aimed at satisfying home demand.

Only if there is access to positive, precise knowledge about how physical capital formation developed in general and the machinery endowment in particular, will it be possible to put to the test some of the basic conceptions defended by economic historians of Latin America. Examples of these are the generalised and extreme macroeconomic instability associated with the ups and downs in the export sector, or the supposed close correspondence between export cycles and investment cycles. This is what gives meaning and importance to a paper such as this one, which above all, contributes a quantification which is complete in its temporal and territorial coverage of the nucleus of productive investment.

In the first part of the article I present and analyse the behaviour of investment in machinery in the whole of Latin America. The long term tendency was clearly upward. Throughout the period 1890-1930 it increased to an average rate of 5.5 percent annually, causing capital equipment to increase at double the output. The image of dynamism of the investment in machinery in the whole of Latin America has been reinforced on comparing it with that of Europe and the United States. This contrast highlights the fact that Latin America's capitalisation effort was clearly superior to that of the Old Continent and was on a par with the capitalisation effort of the United States, the leading economy. Another significant aspect of the Latin American grouping of countries is to be found in the existence of two phases where the process of accumulation came to a halt: the depression of the 1890s and the investment collapse caused by the World War. Both episodes brought with them the loss of a decade of growth. A third movement that warrants attention is that of the very strong expansion that characterised the early years of the 20th century. The Belle Époque proved to be a more favourable juncture than the famous 1920s.

The obvious instability of investment serves to confirm the interpretation of consensus among scholars of the economic past of the region. This quantitative elaboration reveals that the investment in machinery fluctuated far more than the output, with fluctuations being sharper in the period 1914-1930 than in 1891-1913. This supports the classical historiographic view which has emphasised the great instability which the economies of the region suffered during the export era, especially in the final years. But, the results which are made known here are not easy to interpret because, apart from showing the lack of apparent correlation between the volatility of GDP growth and of investment, they also show that the relatively greater or smaller level of this volatility did not depend on the degree of economic development. The data suggest that, irrespective of what this was, the high investment volatility was related with belonging to the Central American or Caribbean area, which could be because

the countries situated in this area were monoexporter economies of coffee and sugar.

One element which absolutely cannot be ignored in any analysis of the economic reality of the region is the existing diversity at the heart of the region. The statistical reconstruction which has been undertaken highlights the fact that within the regional grouping, there are great underlying national differences. It is simply incorrect to refer to the process of capitalisation of Latin America without distinguishing among the countries. Although there are some patterns common to all of them, these are outweighed by the differences. The first and most spectacular of these differences lies in the magnitudes of capital formation in the different republics. Argentina and Brazil were in a dominant position, accumulating almost half of the investment in the region. And almost all investment is accounted for when Mexico, Cuba and Chile are added to these first two countries, since the five together accounted for 5/6 of total capital. However, in view of the disparate territorial and demographic size of the States that make up the Latin American community, the most outstanding differentiating feature is not so much what I have just explained in terms of observable inequalities in levels of investment in machinery per capita. There is an abysmal gap separating the head group –formed by Cuba and Argentina, and at a considerable distance, Chile and Uruguay- from the straggler group –Haiti, Paraguay and Bolivia, and one rung above them Ecuador, El Salvador, Colombia, Guatemala and Honduras. The distance between the Latin American countries with greater or lesser volume of investment per inhabitant in capital equipment was, probably, far superior to that found within Europe and other areas of the Western world.

National differentiation did not only concern the absolute and relative magnitudes of capital formation, but also its cyclical pattern. The statistical analysis of the results shows that there are no traces that throughout the first globalisation Latin American countries tended towards a greater synchronisation of their investment cycles. During the period studied there were various episodes of one or the other sign –greater or lesser cyclical synchronisation- which seem to suggest that the economies of the region were unequally affected by the changes produced in the international economy. It is noteworthy that the World War meant an exceptionally serious supply shock which had a very unequal impact, more so than any other phenomenon.

Finally, the national series generated have made it possible to put to the test the thesis of divergence among the economies in the region, which enjoys great prestige among many specialists. Effectively, most authors defend the idea that the first globalisation widened the gap between the wealthiest and poorest nations in the region. By carrying out a very simple econometric exercise, which assumes the possibility of absolute convergence, we come up with some results of great interest. Spanning the entire period 1890-1930, the most backward nations in investment per inhabitant would have tended to converge with the most advanced ones, at a rate of close to 1 percent annually. However, if we distinguish between the period preceding the World War and that after the start of hostilities, we discover that in the former, Latin American countries diverged, at an annual rate superior to 2 percent. Between 1914 and 1939 the opposite occurred, and they converged at a rate of 2.5 percent. This evidence challenges

up to a point the vision established by historiography. Unfortunately, the exercise is not statistically conclusive. What must continue to feature on the research agenda is the fundamental question of whether or not the existing differences among the Latin American economies deepened as a result of their growth and internationalisation.

APPENDIX

The quantitative elaboration which I present in this paper is based on the massive and systematic use of foreign trade statistics (FTS from now on) of the three countries which supplied by far the largest part of the machinery with which all the Latin American countries were equipped; namely Germany, the United States and the United Kingdom (G-3 from now on). This assertion is not based on a simple presumption or on general, known data on the value of the goods purchased from the G-3 out of the total imported by Latin American countries[21]. One concludes that the G-3 had, a stable and overwhelming predominance as supplier of the region, judging by the relative importance of imports of machinery manufactured in these three countries out of the total machinery imported by the Latin American nations. The results that I have obtained from an elaboration based on the Latin American FTS for the years 1913 and 1925 speak for themselves:

Relative weight of machinery exported by the most industrialised nations within imports of machinery from Latin America (in percentage)								
	United States		U. Kingdom		Germany		G-3	
	1913	1925	1913	1925	1913	1925	1913	1925
8 Latin American countries	43.0	55.3	23.3	14.7	20.3	17.9	86.5	87.9
15 Latin American countries		57.4		14.2		16.9		88.5

The use of the FTS of the G-3 as a source of evaluation of Latin American imports has three great advantages. One is that it simplifies enormously the task of selection and processing of the data, since it reduces to a minimum the heterogeneity of the information sources. This is the natural result of dealing with a small number of different statistical publications, instead of 20 −one for each Latin American state. The second, and not less important, virtue lies in the fact that the FTS of the industrialised countries inform us about the exports in the whole region, or a little less (see below). It is thus easy to reach a degree of maximum territorial coverage, which would otherwise be impossible to achieve. In addition, there is a third advantage in terms of Latin American FTS, namely the maximum time coverage. The FTS of the G-3 supply the minimum indispensable information for the whole period being studied, unlike Latin American FTS.

Without doubt, the foreign trade statistics of the G-3 are not without limitations which complicate the calculation of the magnitudes of machinery imports, or any other type of capital goods, on the part of Latin America. In the following paragraphs I will refer to these deficiencies, while at the same time describing the method I have used to carry out the estimation, without going into too much detail in order not to draw out the explanation excessively. For

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[21] See, for example, the mass of data contained in the Pan American Union (1952).

greater clarity, the criticism of the sources and the methodological description deal with each of the members of the G-3 separately[22].

Germany
The German FTS present the following problems:

1) There were no annual statistics published between 1914 and 1919[23].
2) The statistics from the years 1920, 1921 and 1922 record only the quantities exported, always expressed in 100 kilograms, and, additionally, in quite a few epigraphs, in units.
3) The territory which the FTS of Germany refer to is not the same before and after the World War, since owing to the war Germany lost some regions (Luxemburg, Alsace-Lorena, Sarre, Northern Schleswig, Dantzig, Western Poland and High Silesia, as well as others of little significance).
4) The German FTS, like that of the USA, and in contrast to that of Britain, give information about the exports to all countries of every type of product registered in the customs tariffs (see the particular exceptions in 7). However, the German FTS does not record those with a value of less than 5.000 marks[24].
5) The values are in thousands of marks, which lead to mistakes being made due to imprecision in certain calculations, such as small aggregates and unitary values of specific products.
6) The structure of the statistics remains stable throughout the period, except for March 1906, when, as a result of the new tariff law, the number of epigraphs multiplied, which in practice made it impossible to match up the prior classification with classification subsequent to that date[25].
7) Exports to Costa Rica, Guatemala and the Dominican Republic did not appear individually until 1897; the same applies to exports to El Salvador, Honduras and Nicaragua until 1906 (before they were grouped together in an entity called Central America). Cuba and Puerto Rico are distinguished between in terms of statistics only from 1896.

Some of the disadvantages which I have just pointed out are insurmountable and must simply be accepted, such as for example the territorial change or the dearth of information of the war period[26]. Other limitations, which appear to represent a serious impediment to a truthful calculation of equipment exported, as in 4), are in fact of little importance: the threshold in question, namely exports below the value of 5.000 marks, is low in relation to the unitary value of equipment goods, which is why they are almost in entirety registered in the German FTS.

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[22] In Allen & Ely (1953) the characteristics of the statistics of the most industrialised countries are reviewed in detail, and also, in a more superficial manner, the Latin American countries. It is, likewise, extremely useful to consult the monographs on foreign trade published by the Society of Nations in the 1920s, such as, for example, Société des Nations (1928).
[23] The data for trade from January to June 1914 were published in the monthly statistics, which I have not been able to find for these months. Furthermore, the statistics for 1921 refer to the period from 1 May to 31 December.
[24] Operations of smaller amounts are totalled in the last epigraph of miscellaneous.
[25] Until 1905 the number of epigraphs for machinery amounted to 36. The tariff structure instituted in 1906 –in force in 1930- broadened the number of product categories to 145.
[26] All the evidence I know indicates that German sales of equipment goods to Latin America dropped to virtually zero during the war.

Seemingly, the greatest difficulty we face is related to point 6). There is no manner of avoiding the break in the series in 1906. However, in view of the results obtained from the simple calculation of values registered in the customs tariffs from 1905 to 1906, there is no significant bias[27].

This is why with regards the lack of information for 1914-1922, I have opted for the following: 1) to extrapolate the magnitudes of 1913 and the period May-December 1921 to the first semester of 1914 and to the first four months of 1921, respectively[28]; 2) to estimate the quantities exported in 1920-22. I have not assigned any monetary value, in terms of current prices, to the aggregate of the quantities. I have dealt with it as an index of volume which allows an automatic conversion into values when one moves to operate in constant marks. Naturally, behind this simple arithmetical transformation there lie two strong suppositions, namely: that the relative prices remained constant and that the composition of the equipment goods exported remained unaltered. The second supposition is perhaps realistic given that we are dealing with such a brief period, but the first is most probably not, due to the hyperinflation experienced throughout these three years (and which is precisely the reason why the FTS do not give information about the product values). The objection is clear. Nonetheless, I have not reviewed the valuation criterion because I do not feel it is feasible to use an alternative procedure.

Finally, there are statistical gaps to fill in terms of some countries in the initial years (see 7). After considering different possibilities, I have tended towards evaluating these data as a derivation of the statistical registers of American exports. When I refer to the treatment of United States' FTS, I will return to this issue.

The United States
The North American FTS constitute a source of extraordinary quality, clearly greater than German statistics and more still than the British. One of the most appreciable virtues of the United States FTS is that they give information about United States trade with all sovereign states and American colonial territories, however small the amount[29]. Another noteworthy virtue lies in the classification of goods, which uses coherent, rational criteria from the point of view of

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[27] The rate of interannual variation in 1906 (calculated with the new customs tariff structure) maintains a relation with the variation registered for British and American equipment goods exports. The doubt arises as to whether the 1906 classification in fact encouraged the appearance of a group of new goods such as electric equipment, which until then had formed part of categories that classified equipment goods generically.

[28] Specifically, I have supposed that between January and the end of July 1914 Germany exported half of what they did the previous year. This seems a sensible supposition, in view of how European sales to Latin America evolved. Neither do I have evidence to dissuade me from generalising export activity from May to December 1921, to the whole of that year, and consequently, I have multiplied the figures for these months by the coefficient 1.5.

[29] The United States trade statistics provide complete data of its foreign trade with: Bermudas, Barbados, British Honduras (Belize), Jamaica, Trinidad and Tobago, British Guyana, French Guyana, Dutch Guyana, the remaining British possessions in America, the Virgin Islands and other Danish possessions in America, the remaining Dutch possessions and the French possessions.

economic analysis, and which gives a break-down of equipment goods which is extremely useful for the researcher. Nevertheless, they cannot be considered a perfect source for the goals we are pursuing here. Below we indicate those characteristics which lead to methodological problems:

1) Until 1917 the natural year is not used, but rather the financial year which ends on 30 June (and, logically, begins on 1 July of the previous year).
2) There are no data of quantities for a considerable portion of the types of products registered in the customs tariffs. The information is heterogeneous for the rest (units, different measurements of weight, capacity, etc.). Consequently, it was only possible to obtain aggregate magnitudes in value (expressed in dollars).

The second limitation implies that the quantification of equipment goods exported by the G-3 can only be done in monetary values. Quantity indexes or any type of volume series is ruled out precisely because they lack the information necessary in the case of American exports. Given the importance of these in the total exported by the G-3 to Latin America, the limitation is indeed insurmountable. The same applies to the limitation I mentioned in the first place, but it is far less significant. Given the non-existence of monthly statistics, the adjustment of the export figures from fiscal years to natural years can only be done in one way: taking the average of consecutive pairs of financial years and assigning the resulting value to the first natural year used in the calculation. The information available does not allow another solution, but in spite of this we should not ignore the fact that this is an estimation which is subject to margins of error, though admittedly these are tolerable. The method of calculation assumes that every year the export activity evolved at the same rate for both semesters, which would only be true had there been no seasonal variation or economic cycles. Since in reality it is not like this, it cannot be expected that the magnitudes derived from the American statistics for the period prior to 1918, once adjusted to calendar years, express with precision the annual amount of its foreign trade.

The calculation of goods exported by the United States to Latin American nations holds no mystery, which is why I need make no comments on this. It is worth adding that North American statistics have to provide us with yet another service: that of completing the estimation of machinery exported by Germany and the United Kingdom. As I indicate in the respective sections, in the calculation of both countries there were some loose ends, in reference to the sales to some small countries in certain years. I left these loose ends in the German and British export series unresolved because it was easier and safer to deal with them based on American exports. As a general criterion, I have made use of North American exports, and occasionally those of one of the other two exporters, as the base for extrapolation, as long as they represented a large part of the total exports of the G-3 in the years close to those for which I have all the information. If the data for estimation refer to very few years and there is a clear tendency apparent in the following years, I have been inclined towards back-extrapolate the tendency.

The United Kingdom
The British statistics pose many more problems than the German or American FTS when one is attempting to find out the quantity of machinery exports to Latin American nations. The main disadvantages are the following:

1) In terms of machinery exported to most countries in the region, statistics only offer the total figure (in one epigraph first titled 'Machinery and Mill work, and parts thereof', later simply 'Machinery'). All that is registered are the figures of exports of the different types of products registered in the customs tariffs included in the aggregate of machinery destined for Argentina, Brazil, Chile and, generally, Mexico and Uruguay.

2) British statistics do not offer data about exports to the smallest Latin American countries of certain equipment goods closely related with machinery, such as electrical material separate from electrical machinery –the group 'Electrical goods and apparatus other than Electrical Machinery'- and similar tools and utensils –the group 'Implements and Tools'.

3) Sales to some small countries did not appear as individual cases in the initial years. Specifically, until 1891 Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua are grouped under the same name 'Central America'. The same occurs with Cuba and Puerto Rico while they are Spanish colonies. The statistics do not distinguish between Haiti and the Dominican Republic either until 1912. Finally, exports to Bolivia are not registered until 1909.

4) The classification of capital goods into the different categories shown in the statistics and the breakdown of these does not remain unchangeable throughout this period. The most important changes took place in 1909 and 1920.

5) The FTS give information about the value of export goods (in pounds sterling), but on many occasions do not inform us of the quantities exported. This happens in the case of the groups of electrical equipment and tools, and also that of machinery prior to 1904. From this date onwards, the total in metric tons is registered.

One of the greatest headaches for the researcher lies in 4), or rather the combination of 4) with 1) and 2). In the early years, the breakdown of machinery is extremely limited. Despite the fact that Great Britain was the factory of the world, it appears that the authorities in charge of trade statistics attributed scant importance to the publishing of export data of the different types of machinery. Furthermore, until 1919 locomotives were included in the machinery group. The fact that in the first two decades information was so scarce, implies that it is difficult to be sure that we are working with a homogenous group of goods.

The quantification of sales of British machinery to Latin America demands, therefore, that in the first place we subtract the value of (steam) locomotives for

the period prior to 1920[30]. In the cases in which the FTS of the United Kingdom does not give export figures, I have calculated them as a linear function of the size of the railway network of the country in question, and then made some reasonable suppositions in order to make the calculation work[31]. Unfortunately, I have had to estimate other products in order to reach a final figure for machinery and related equipment goods exported by the United Kingdom. Going by the criteria of national accounts established by the United Nations, the desired aggregate consists of the sum of three categories of goods from the FTS: machinery (excluding locomotives), implements and tools, and electrical goods and apparatus (other than machinery and telegraph and telephone wire). The statistics always give the data concerning the first category, except in the case that this does not contain data for any product exported to a any country in specific (small, and in the earliest years, see 1). With regards the group of tools, the statistics are incomplete. We do not know anything concerning Bolivia, Panama and the Dominican Republic, and almost nothing about Honduras and Paraguay. For some of the remaining countries there are some gaps: Costa Rica, 1910-1914; Cuba, 1890-1894; Haiti, Nicaragua and Venezuela, 1926-1930. I have filled in the abovementioned gaps by evaluating the value of the tools by means of the application of the value of exported machinery of the average percentage of tools over machinery. The procedure used is reasonably solid because it extrapolates to the unknown cases, the average national percentages, which in virtually all cases cover fifteen countries, and because it is definitely sensible to fix the value of tools exported (imported) in agreement with the value of machinery exported (imported) for each country.

Finally, it remains to determine the magnitudes of electric goods exported by the United Kingdom. Here, the quantification is not as firmly founded. British FTS only register systematically, this type of product dispatched to seven countries: Argentina, Brazil, Colombia (from 1915), Chile, Mexico, Peru and Uruguay (the latter three, from 1895). There is little doubt that all together they gathered together the immense majority of electrical equipment bought by Latin America from Great Britain. But, it must be remembered that, unlike the majority of historic-economic studies on the region, my research does not back itself up with this line of argument, but with another which defends the supreme importance of constructing series on investment for each and every country in the area. With this principle reaffirmed, the question emerges: how can we assess the value of British electrical material compared to the other thirteen nations? In my understanding, the best alternative we have is to apply the average percentage

[30] This is not insignificant: in the period 1890-1919 the value of locomotive exports to the whole world represented nearly 10 percent of the value of machinery exported by the United Kingdom (excluding locomotives). In the case of Latin America the percentage was much higher, to be precise 24 percent, for those countries for which trade statistics provide the data.

[31] The first step in the calculation was to calculate the percentage which the railway network represents, annually for each country for which we do not know British exports of locomotives, of the sum of the networks in all these countries. The source of these data is Mitchell (2003), complemented by Sanz (1998). The abovementioned percentage applies to the figure of British locomotive exports to this grouping of countries. Naturally, I have had to estimate the figure in question. For lack of anything better, I have derived it from the proportion represented by the total value of machinery exports to these countries proportional to the value of total British machinery exports. The quotient is applied to the value of total exports of locomotives, assuming that they resemble the aforesaid.

represented by this group of goods in relation to the groups of machinery and tools in the seven countries about which we have complete information. I have tended to use as coefficient the simple arithmetic average instead of the weighted one since the latter is excessively dominated by the strong prevailing weight of Argentina and Brazil. But, we should not simply dismiss the explanation of this step of the quantitative elaboration. Before doing so, it is necessary to consider if the margins of error are tolerable, or, at least to form an opinion about the extent of these margins. The goods grouped into the category electrical goods represent, in value, 15.1 percent of the machinery and tools exported between 1890 and 1930 by the United Kingdom to the seven abovementioned nations[32]. However, the relative importance of these goods changed noticeably after the World War: in the pre-war period they were situated at slightly below 10 percent, while in 1919-1930 they rose to nearly 25 percent. Consequently, my estimation is more risky in this final period. Another element to consider is the degree of statistical dispersion of the national percentages. If it were very elevated, obviously the estimation would be quite risky. Fortunately, this is not the case, especially for the period prior to 1914. During this period, the coefficient of variation of the percentages was, on average, 6.3 percent; only in three years did it surpass the threshold of 10 percent. The statistical markers corresponding to 1914-1930 do not yield such comforting results: the average coefficient of variation is 20.8 percent. It is true that the great disparities were concentrated in the war period, except for two particular years (1922 and 1926). I strongly believe that we can be reasonably sure that handling the abovementioned annual average percentage we are not deviating significantly from the percentage that the group of electrical goods really should have represented for the countries that we do not have information about in this regard.

All that remains to point out is that the gaps in the series of some small countries mentioned in 2) have been filled based on series from Germany and very particularly, from the United States, as I have explained previously.

Elaboration of aggregate series

As I have indicated, the quantification of transport equipment exported by the most industrialised countries can only be done in monetary values. The quantum indexes or any type of series of volume are excluded because they lack the information necessary in the case of the United States and, in part, Great Britain. Along with the handling of monetary values comes the need to use exchange rates between the currencies of the G-3 so as to assign to the different groups of goods, values in the same currency, and also, thereafter, the use of a price index to transform these into stable values.

Once completed the calculation of machinery exported by Germany, the United States and the United Kingdom, I have converted the series of the first two into pounds sterling. This conversion does not pose the slightest problem[33].

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[32] The proportion is practically the same in exports to the whole world: 14.2 percent.

[33] I have used the series of exchange rates contributed by specialists, gathered in Carter (2006, vol. 5, pp. 565-7) following the recommendations of his compiler Lawrence H. Officer, when various possibilities existed. The assessment of German exports could have turned out to be

The subsequent addition offers us the export series of the G-3 expressed in current pounds. All that still remains is the step of deflating the series to obtain the aggregates of the exports in real terms. As a deflator I have used the price indexes of equipment goods drawn up by Charles Feinstein (1972) (1988)[34]. With this we obtain series that are sufficiently consistent, in pounds of 1913, of the exports of the G-3 to Latin America. Taking the precaution of converting these series of real values into index numbers, I believe that we get a clear image of the evolution of the total import of machinery and other related equipment goods.

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extremely complicated in the hyperinflationary interval of 1920-3, but the absence of a nominal valuation in the German FTS highlighted the problem and obliged me to construct a chain index based on the quantities.

[34] The index used for the period 1860-1920 (Feinstein, 1988, pp. 470-1) has been spliced in 1920 with the index previously constructed by this author (Feinstein, 1972, pp. T136-7), after having converted both to base 100 in 1913.

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TABLES AND GRAPHS

Table 1. Volatility of investment growth and GDP growth[1] (in rates of annual variation)			
	1891-1913[2]	1914-1930[3]	1890-1930
Argentina	26 (8,0)	25 (9,5)	25
Bolivia	117	29	82
Brazil	23 (5,2)	31 (4,8)	26
Colombia	19	34	26
Costa Rica[4]	14	37 (8,3)	24
Cuba[5]	37 (23,4)	35 (17,6)	36
Chile	23 (3,0)	29 (12,4)	26
Ecuador	14	21	17
El Salvador[4]	23	39 (9,9)	30
Guatemala[4]	24	34 (6,1)	28
Haiti	28	73	45
Honduras[4]	21	42 (8,4)	30
Mexico[6]	13 (5,7)	27 (4,1)	19
Nicaragua[4]	29	39 (11,6)	33
Panama		29	37
Paraguay	130	169	146
Peru	20	26 (3,8)	22
Dominican Rep.	22	41	30
Uruguay	28	24	26
Venezuela	19 (6,2)	34 (11,6)	26
Latin America	11	22	15

[1]In parenthesis.
[2]1900-13 in the case of the volatility of GDP growth, unless otherwise indicated.
[3]1913-29 in the case of volatility of GDP growth, unless otherwise indicated.
[4]The GDP data of the second period cover the years 1920-9.
[5]The GDP data of the first period cover the years 1903-13.
[6]Data unavailable on the GDP between 1911 y 1920.

Table 2. Capital formation in machinery and equipment of the various countries as a percentage of the Latin American total, 1890-1930 (%)

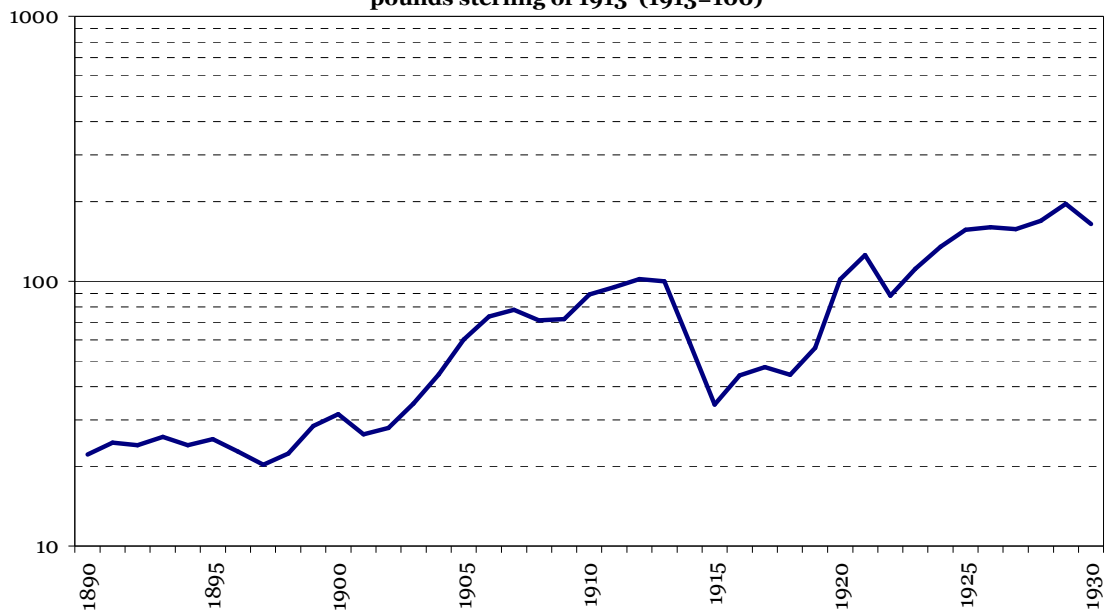|	Argentina	Bolivia	Brazil	Colombia	Costa Rica	Cuba	Chile	Ecuador	El Salvador	Guatemala	Haiti	Honduras	Mexico	Nicaragua	Panama	Paraguay	Peru	Dominican Republic	Uruguay	Venezuela	TOTAL 20
1890	21,9	0,0	23,7	2,9	0,8	12,1	8,4	0,4	0,7	1,3	0,3	0,4	15,3	0,7		0,1	2,8	1,1	4,7	2,5	100
1891	7,7	0,0	40,1	2,6	0,8	14,4	5,2	0,5	0,7	1,4	0,2	0,3	16,0	0,6		0,0	3,3	1,2	2,6	2,4	100
1892	17,7	0,1	26,5	2,2	0,7	19,9	8,0	0,5	0,8	1,5	0,3	0,2	14,0	1,2		0,0	1,8	1,2	1,5	1,9	100
1893	24,4	0,0	25,8	2,0	0,5	16,2	8,9	0,5	0,5	1,7	0,3	0,2	12,2	0,3		0,0	1,6	1,3	1,8	1,9	100
1894	24,7	0,1	25,7	2,0	0,5	12,6	7,3	0,6	0,6	2,1	0,3	0,2	14,8	0,4		0,0	1,4	1,6	2,8	2,3	100
1895	17,3	0,0	32,1	2,1	0,6	6,6	9,3	0,5	0,9	2,5	0,2	0,2	18,7	0,8		0,0	1,9	1,3	2,4	2,5	100
1896	16,8	0,0	29,5	3,2	0,8	2,9	7,7	0,7	1,3	3,9	0,4	0,2	22,3	0,7		0,0	3,2	1,2	2,9	2,2	100
1897	19,8	0,1	23,5	3,8	0,9	1,7	6,9	0,8	1,1	3,0	0,3	0,3	29,1	0,7		0,0	3,1	0,9	1,8	2,3	100
1898	25,1	0,1	18,2	3,0	0,9	2,4	4,9	0,9	0,5	1,1	0,1	0,2	34,2	0,4		0,0	3,0	0,8	2,3	1,6	100
1899	25,4	0,2	16,3	1,3	0,8	5,5	5,4	0,8	0,3	0,5	0,1	0,2	35,9	0,4		0,2	2,5	0,8	2,4	1,0	100
1900	21,8	0,2	20,3	0,7	0,9	6,5	6,1	0,8	0,4	0,5	0,2	0,2	33,8	0,5		0,1	3,5	0,8	2,0	0,8	100
1901	24,9	0,4	12,9	1,0	0,7	8,6	7,4	0,9	0,5	0,7	0,2	0,3	33,3	0,4		0,1	4,0	0,7	2,0	1,1	100
1902	25,0	0,2	15,5	1,0	0,6	7,7	7,8	0,7	0,4	0,6	0,2	0,2	32,7	0,4		0,1	3,6	0,4	2,3	0,6	100
1903	31,6	0,3	14,1	1,7	0,6	6,4	8,6	0,7	0,4	0,3	0,2	0,2	27,8	0,4		0,1	3,9	0,3	1,8	0,8	100
1904	33,5	0,5	14,1	1,5	0,5	8,8	8,0	0,6	0,5	0,5	0,2	0,2	23,1	0,4	0,6	0,2	3,8	0,3	1,5	1,1	100
1905	33,9	0,4	12,8	1,2	0,3	10,7	11,3	0,5	0,4	0,5	0,1	0,1	19,7	0,3	1,5	0,1	2,9	0,4	1,9	0,8	100
1906	35,1	0,2	14,2	0,8	0,4	8,0	10,3	0,4	0,3	0,4	0,1	0,1	20,9	0,2	1,9	0,3	2,6	0,3	2,6	0,7	100
1907	28,7	0,5	18,9	1,0	0,5	6,9	11,0	0,5	0,4	0,4	0,1	0,1	20,7	0,2	2,4	0,2	2,7	0,4	3,7	0,7	100
1908	33,7	0,5	19,2	1,3	0,5	6,0	9,2	0,5	0,4	0,4	0,2	0,2	18,3	0,2	3,3	0,1	2,2	0,4	2,8	0,8	100
1909	36,6	0,4	19,7	1,3	0,5	7,0	6,8	0,5	0,4	0,5	0,2	0,2	16,5	0,2	3,0	0,1	1,9	0,5	2,9	0,8	100
1910	35,3	0,4	21,2	1,3	0,4	8,3	7,0	0,4	0,4	0,4	0,2	0,2	15,6	0,2	1,8	0,1	2,0	0,6	3,3	0,8	100
1911	32,4	0,4	24,0	1,4	0,4	8,4	8,7	0,5	0,5	0,4	0,2	0,2	13,9	0,3	1,2	0,1	2,0	0,7	3,3	1,0	100
1912	31,2	0,6	25,8	1,7	0,5	7,8	8,9	0,4	0,4	0,5	0,2	0,2	12,0	0,3	1,7	0,2	2,1	0,9	3,4	1,2	100
1913	30,0	1,0	25,9	2,0	0,5	7,6	9,2	0,5	0,5	0,6	0,1	0,3	10,9	0,3	2,3	0,2	2,8	0,8	2,7	1,5	100
1914	30,3	0,9	21,7	3,2	0,6	10,2	9,4	0,8	0,5	0,7	0,1	0,6	8,7	0,4	3,0	0,1	3,7	0,8	2,5	1,8	100
1915	25,5	0,6	12,6	4,0	0,6	25,2	6,1	0,8	0,7	0,5	0,2	0,8	7,8	0,6	4,2	0,0	3,5	1,4	2,4	2,5	100
1916	18,2	0,5	13,1	2,6	0,5	33,0	8,8	0,6	0,5	0,5	0,2	0,5	8,1	0,7	3,0	0,0	4,0	1,5	1,8	2,0	100
1917	13,2	0,6	14,2	2,4	0,2	33,9	9,1	0,7	0,4	0,4	1,1	0,4	10,2	0,6	2,4	0,3	3,9	2,3	1,9	1,6	100
1918	16,4	1,1	12,4	2,6	0,2	25,3	13,6	0,6	0,2	0,3	0,8	0,3	13,5	0,4	2,8	0,3	5,2	2,4	1,5	1,1	100
1919	18,0	1,0	18,3	2,1	0,3	22,1	9,3	0,8	0,4	0,5	0,2	0,4	14,5	0,4	1,4	0,1	5,2	1,3	2,5	1,3	100
1920	18,4	0,5	17,6	3,4	0,4	25,4	5,6	0,6	0,4	0,5	0,2	0,7	14,5	0,5	1,0	0,3	4,9	1,8	1,7	1,6	100
1921	21,7	0,9	14,8	2,9	0,4	17,3	6,3	0,4	0,5	0,7	0,2	0,9	21,0	0,5	1,3	0,1	4,7	2,4	1,6	1,6	100
1922	27,4	0,8	19,7	3,5	0,4	9,5	7,9	1,0	0,4	0,8	0,2	0,7	17,6	0,2	0,6	0,1	3,3	1,2	2,4	2,3	100
1923	32,0	1,0	15,0	3,5	0,4	12,6	7,9	0,8	0,4	0,9	0,4	0,7	13,8	0,3	0,7	0,1	4,1	1,0	2,3	2,2	100
1924	29,1	0,9	17,9	3,4	0,4	13,4	7,6	0,7	0,7	1,0	0,2	0,4	13,0	0,4	0,8	0,1	3,9	1,2	2,0	2,7	100
1925	28,8	0,8	19,7	4,0	0,4	10,9	7,5	0,5	0,6	0,9	0,3	0,3	13,0	0,4	0,8	0,1	3,8	0,8	2,5	3,8	100
1926	30,7	0,8	15,7	5,3	0,3	6,3	11,4	0,5	0,7	0,9	0,2	0,3	12,6	0,2	0,7	0,1	3,7	0,6	2,2	6,6	100
1927	32,3	0,8	15,7	6,2	0,4	8,1	7,4	0,5	0,6	1,0	0,3	0,3	11,8	0,3	0,9	0,1	3,6	0,9	2,6	6,3	100
1928	36,9	0,8	16,9	5,9	0,5	5,4	6,0	0,6	0,6	0,9	0,3	0,4	12,0	0,4	1,1	0,1	2,7	0,7	2,7	5,0	100
1929	37,3	0,8	17,2	4,8	0,5	4,8	8,1	0,5	0,5	0,8	0,2	0,4	11,1	0,3	1,0	0,1	2,7	0,5	2,8	5,6	100
1930	35,7	0,8	12,3	2,8	0,3	4,1	11,6	0,5	0,4	0,4	0,2	0,5	15,3	0,3	1,8	0,1	2,4	0,4	4,8	5,3	100

Table 3. Capital formation in machinery and equipment per capita of the various Latin American countries, 1890-1930 (Argentina 1913=100)

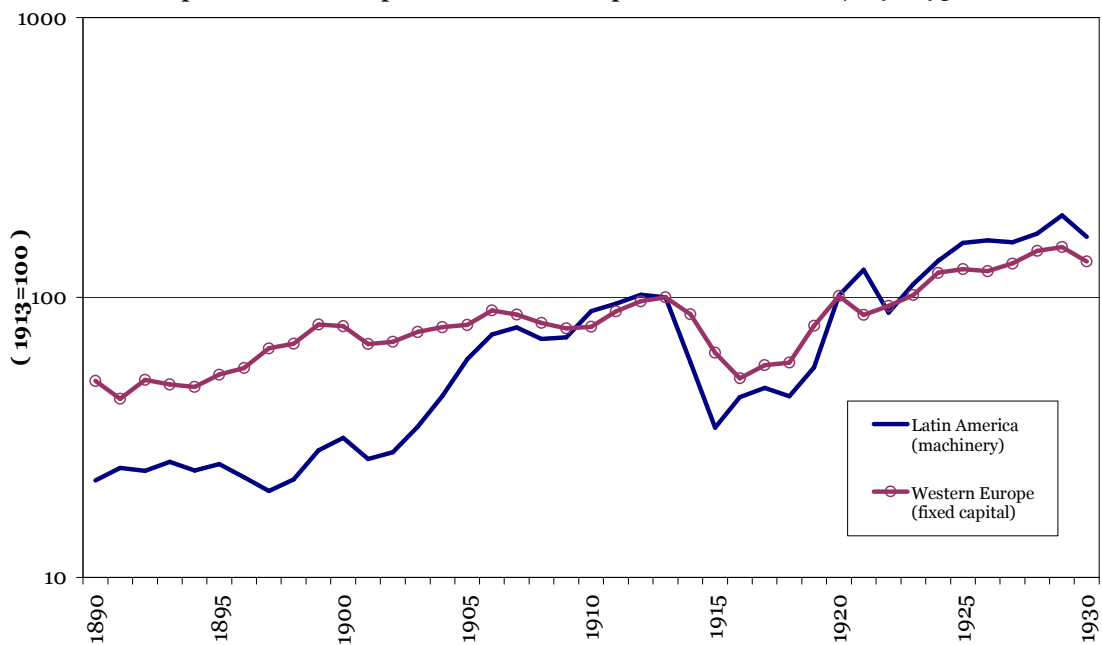|	Argentina	Bolivia	Brazil	Colombia	Costa Rica	Cuba	Chile	Ecuador	El Salvador	Guatemala	Haiti	Honduras	Mexico	Nicaragua	Paraguay	Peru	Dominican Republic	Uruguay	Venezuela	Latin America-20
1890	37	0	9	5	19	42	18	2	6	6	1	6	7	11	1	6	13	38	6	11
1891	14	0	17	5	20	56	12	3	7	7	1	6	8	10	0	8	15	22	6	12
1892	31	0	11	4	17	76	19	2	7	7	1	4	7	18	0	4	15	12	5	12
1893	44	0	11	4	12	67	22	3	5	8	2	3	7	4	0	4	17	15	5	13
1894	40	0	10	3	12	49	17	3	5	10	2	3	7	6	0	3	20	22	6	11
1895	29	0	13	4	14	27	22	2	8	14	1	3	10	14	0	4	16	19	7	12
1896	24	0	10	5	17	11	16	3	10	20	2	3	10	10	0	6	13	21	5	11
1897	25	0	7	5	16	6	13	3	7	14	1	4	12	8	0	6	8	11	5	9
1898	33	0	6	5	17	9	10	4	4	6	1	3	15	6	0	6	8	15	4	10
1899	42	1	7	3	19	25	14	5	3	4	1	3	19	7	3	6	10	19	3	12
1900	39	1	9	1	23	33	17	5	4	4	1	4	20	10	1	9	10	18	3	14
1901	36	1	5	2	16	34	17	5	4	5	1	5	16	6	1	9	8	15	3	11
1902	37	1	6	2	14	31	18	4	3	5	1	3	17	7	2	8	4	17	2	12
1903	57	1	6	4	17	30	25	4	4	5	1	4	17	8	1	10	4	16	3	14
1904	75	3	8	4	18	53	29	5	6	5	2	5	18	9	5	13	6	17	5	18
1905	100	3	10	4	16	85	55	6	7	7	1	4	21	10	2	13	9	29	5	24
1906	122	2	13	4	23	76	61	6	7	7	1	4	27	9	10	14	10	46	5	28
1907	101	6	18	5	27	68	68	7	8	7	1	4	28	9	6	15	11	68	6	29
1908	102	5	16	5	23	52	52	6	7	6	2	6	22	8	4	10	9	46	5	26
1909	107	4	17	5	28	60	38	6	7	8	2	6	20	8	2	9	13	47	6	26
1910	121	5	22	6	28	85	48	6	10	7	2	6	23	10	5	12	17	64	7	31
1911	113	5	26	7	29	88	63	8	11	9	3	8	22	14	4	12	22	66	9	33
1912	112	8	29	9	34	87	68	8	11	11	2	9	21	14	7	13	31	71	11	35
1913	100	13	28	10	36	81	68	8	12	13	2	13	19	13	9	17	26	55	15	33
1914	57	6	13	9	24	61	40	8	8	8	1	16	9	10	2	13	16	29	10	19
1915	28	3	4	6	14	85	15	5	5	4	1	12	5	9	0	7	15	16	8	11
1916	25	3	6	5	13	139	27	4	5	5	1	9	6	14	0	10	21	15	8	14
1917	19	4	7	5	7	149	30	6	5	4	7	8	8	12	5	10	34	17	7	15
1918	22	6	5	3	6	101	42	5	2	3	4	5	10	7	5	13	31	13	5	14
1919	30	6	10	5	9	109	35	8	5	6	2	8	14	10	2	16	21	26	7	17
1920	54	6	17	15	23	219	38	10	9	10	3	24	26	20	11	26	54	31	15	31
1921	76	13	17	15	31	180	52	9	12	17	2	40	47	23	2	31	83	35	17	37
1922	66	8	16	13	20	67	46	13	8	13	2	20	27	7	2	15	29	37	18	26
1923	94	13	15	15	25	109	57	14	9	17	5	26	26	13	2	23	30	43	22	32
1924	100	13	21	18	34	138	65	14	20	23	3	18	30	21	4	26	42	44	32	38
1925	110	14	26	24	33	127	73	12	20	23	5	15	34	25	6	29	30	64	51	43
1926	117	15	21	31	28	73	113	11	22	25	4	13	33	15	4	29	24	56	91	43
1927	118	13	20	35	34	91	71	11	17	24	5	15	30	16	4	26	30	64	84	41
1928	141	15	23	35	47	66	61	14	17	23	6	18	32	23	6	21	27	69	71	44
1929	161	18	26	33	54	67	94	14	16	22	5	21	34	21	8	24	19	84	91	50
1930	126	14	15	16	23	47	111	11	10	10	4	22	39	18	5	18	12	117	71	41

Table 4. Capital formation in machinery and equipment of the various Latin American countries, 1890-1930 (1913=100)

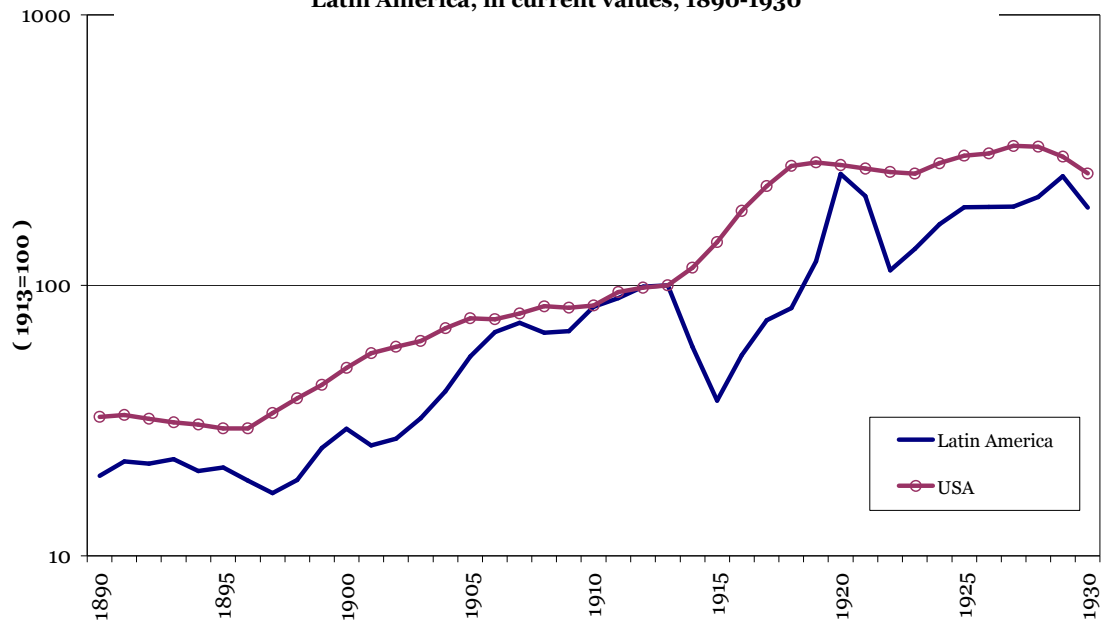|	Argentina	Bolivia	Brazil	Colombia	Costa Rica	Cuba	Chile	Ecuador	El Salvador	Guatemala	Haiti	Honduras	Mexico	Nicaragua	Panama	Paraguay	Peru	Dominican Republic	Uruguay	Venezuela	TOTAL 20
1890	16	0	20	31	32	35	20	20	32	49	42	26	31	55		6	22	31	38	37	22
1891	6	1	38	31	36	46	14	27	39	60	34	27	36	48		3	29	36	23	38	25
1892	14	1	25	27	32	62	21	23	41	62	45	19	31	93		0	15	37	13	30	24
1893	21	1	26	26	23	55	25	27	30	73	64	13	29	23		1	15	42	17	33	26
1894	20	2	24	23	24	40	19	32	31	84	57	14	33	29		1	12	50	25	36	24
1895	15	1	31	26	29	22	26	25	49	109	47	14	44	71		3	17	41	22	42	25
1896	13	1	26	36	34	9	19	33	61	150	73	17	47	54		2	26	35	24	33	23
1897	13	3	18	38	33	5	15	34	46	102	44	23	54	45		2	22	23	13	30	20
1898	19	2	16	33	37	7	12	43	25	43	22	14	70	32		4	24	23	19	23	22
1899	24	4	18	18	41	20	17	49	17	25	26	15	94	39		28	25	28	24	19	28
1900	23	8	25	11	50	27	21	56	26	25	40	19	98	53		7	39	31	23	17	32
1901	22	9	13	12	35	30	21	51	25	30	38	26	81	35		13	37	25	19	19	26
1902	23	6	17	14	32	28	24	41	22	30	38	16	84	38		15	36	13	23	12	28
1903	36	9	19	28	41	29	32	48	27	19	45	22	88	50		13	47	12	22	19	35
1904	50	23	24	33	43	51	39	61	43	34	67	28	94	57	11	47	60	19	24	33	44
1905	68	25	30	36	39	84	74	67	54	50	49	26	109	61	39	20	62	29	42	32	60
1906	86	15	41	30	57	77	83	63	50	49	60	29	142	59	59	96	68	32	69	34	74
1907	75	42	57	39	69	71	93	80	64	51	54	30	148	63	80	60	75	37	105	37	78
1908	80	34	53	45	60	56	71	70	56	42	81	40	119	58	101	44	55	32	73	36	71
1909	88	31	55	46	73	66	53	72	53	57	104	39	109	56	93	16	49	48	76	38	72
1910	105	35	73	59	73	97	68	75	83	54	120	45	127	74	70	55	65	63	106	48	89
1911	103	41	88	65	78	104	90	96	90	64	167	60	121	103	49	40	67	81	113	63	95
1912	106	61	102	84	94	105	99	95	92	87	117	65	112	101	75	75	76	116	125	78	102
1913	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
1914	59	49	49	92	67	78	59	96	67	66	51	125	47	79	75	24	78	61	52	70	59
1915	29	22	17	67	40	113	23	61	48	29	39	92	24	67	61	2	43	60	29	57	34
1916	27	21	22	55	37	190	42	56	46	37	79	69	33	110	56	5	62	85	29	57	44
1917	21	29	26	55	22	210	47	71	42	33	385	62	44	96	48	57	66	140	33	51	47
1918	24	48	21	35	19	147	65	57	21	25	267	40	55	61	53	63	82	132	25	33	44
1919	34	53	40	57	26	162	56	97	45	47	103	68	75	83	34	26	103	91	52	47	56
1920	62	53	69	170	71	338	62	123	83	83	186	220	135	171	46	126	175	233	63	106	102
1921	91	112	72	181	96	284	86	119	119	151	142	386	242	197	68	29	210	375	73	128	126
1922	80	69	67	154	62	110	76	178	76	120	130	197	143	59	23	29	104	134	78	134	88
1923	119	108	65	192	79	183	95	189	93	165	320	272	141	113	33	28	161	143	93	162	111
1924	131	115	94	225	109	236	111	202	212	223	222	192	162	182	49	58	189	210	97	243	135
1925	150	122	119	311	111	224	127	173	211	229	354	168	187	213	57	76	211	156	145	388	157
1926	163	129	97	413	94	132	198	155	236	257	272	147	185	132	49	58	211	130	129	695	160
1927	170	118	96	477	117	168	127	168	195	258	363	179	170	136	61	52	198	170	150	651	157
1928	208	138	111	486	163	119	110	229	200	258	396	208	186	202	82	88	164	156	166	559	169
1929	244	162	130	466	191	123	171	219	186	252	333	254	200	184	81	118	187	113	203	721	196
1930	196	131	78	227	84	87	206	178	125	115	276	271	231	163	127	81	139	73	289	571	164

Graph 1. Aggregate investment of Latin America in machinery, 1890-1930, in pounds sterling of 1913 (1913=100)
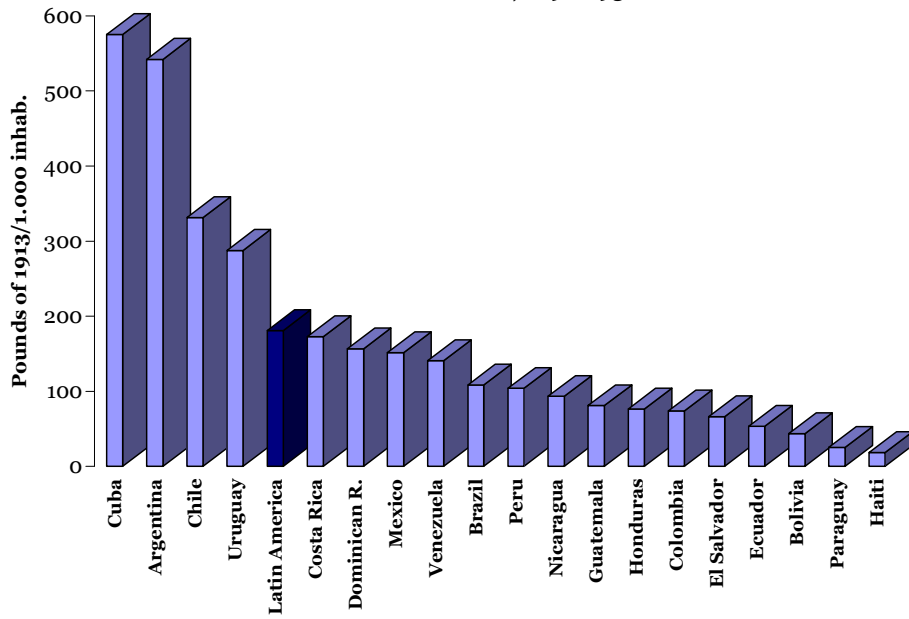

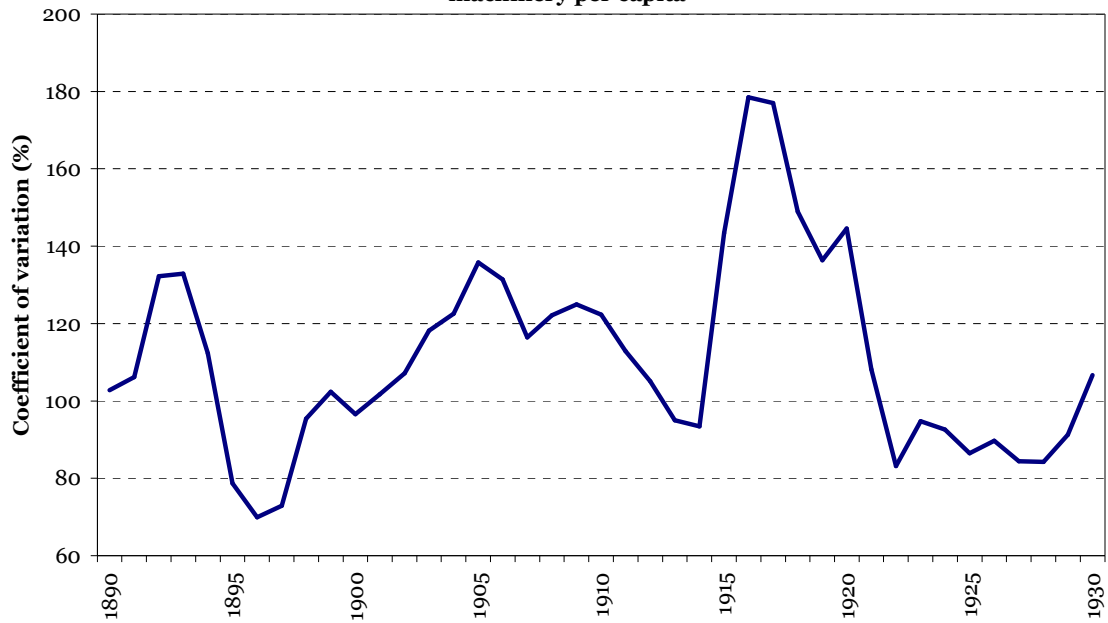**Graph 2. Indexes of capital formation. Europe and Latin America, 1890-1930**

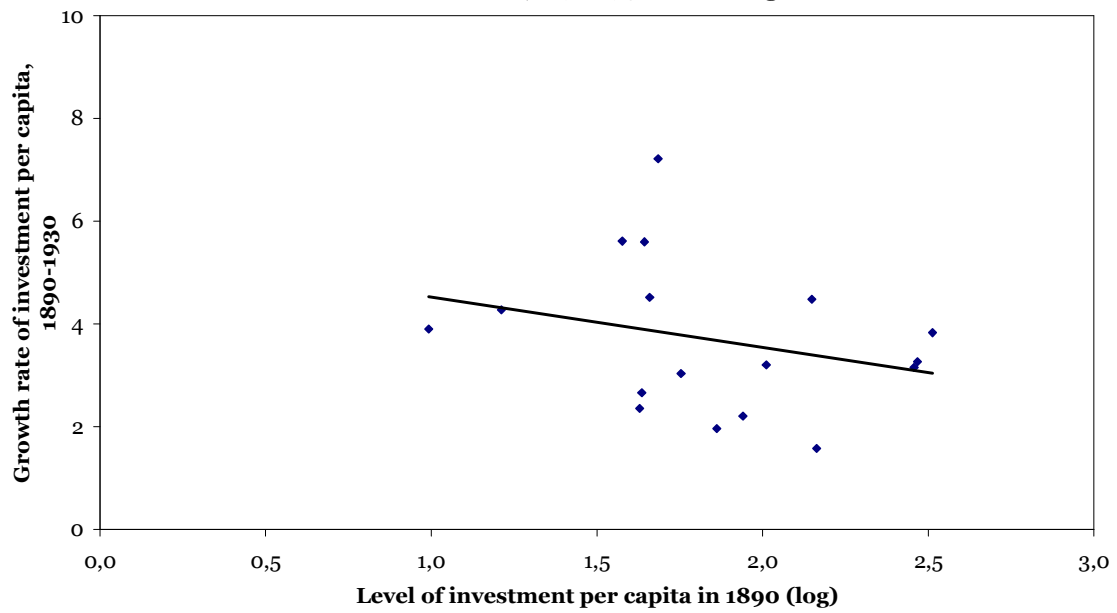**Graph 3. Indexes of capital formation in equipment goods of United States and Latin America, in current values, 1890-1930**

Graph 4. Average investment in machinery per inhabitant of the Latin American countries, 1890-1930

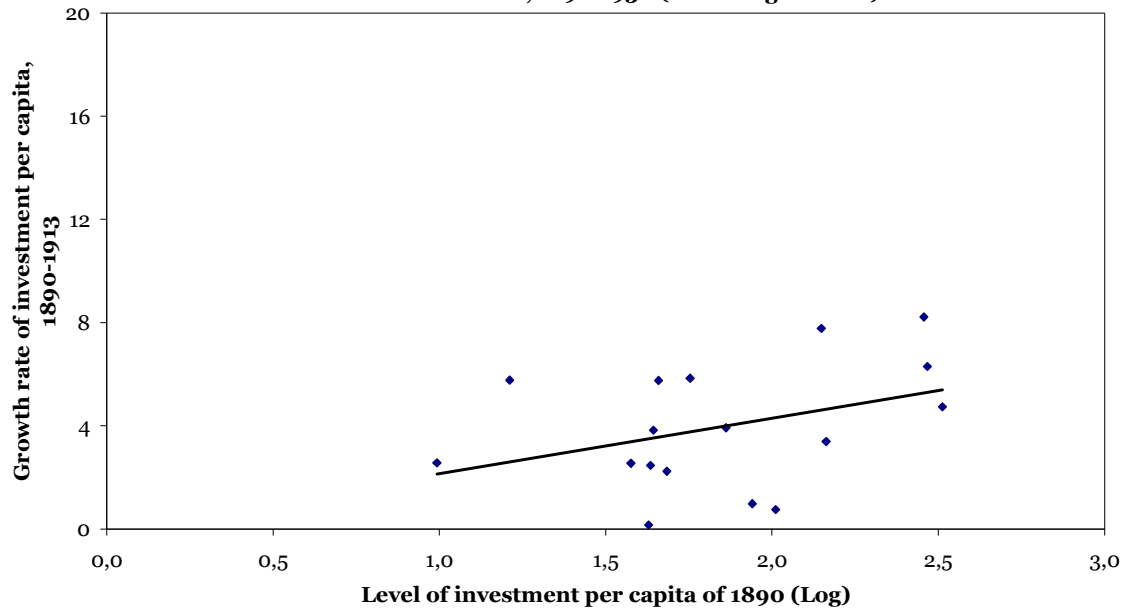**Graph 5. Statistical dispersion in international levels of investment in machinery per capita**

Graph 6. Tendency to convergence in the levels of investment per capita of the Latin American countries, 1890-1930 (excluding outliers)*
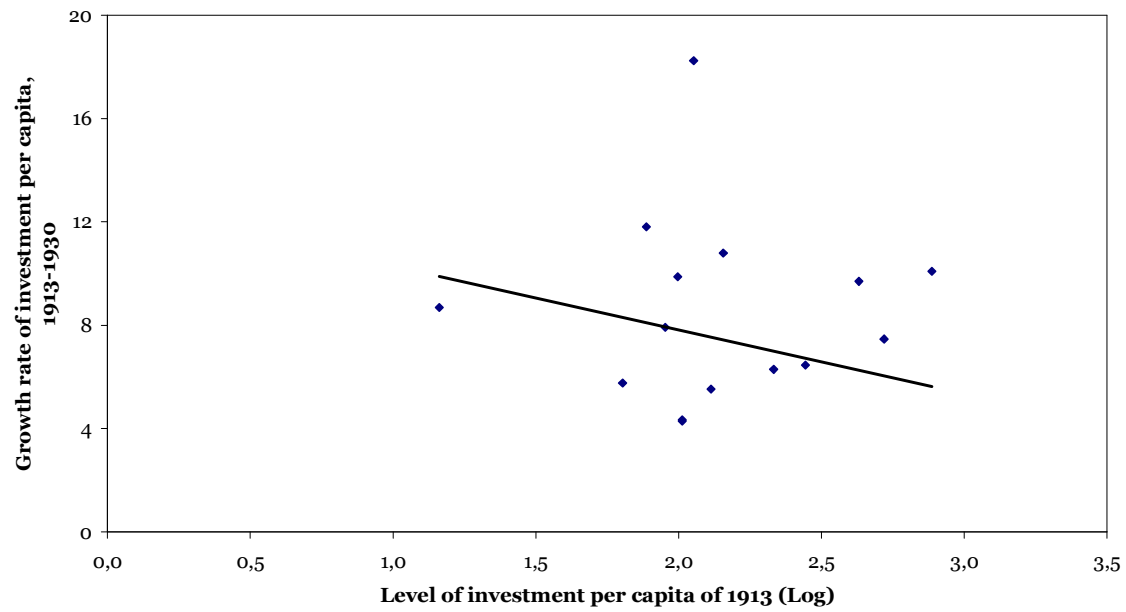

* Bolivia and Paraguay (see text)

**Graph 7. Tendency to divergence in the levels of investment per capita of the
Latin American countries, 1890-1930 (excluding outliers)***

*Bolivia and Paraguay (see text)

**Graph 8. Tendency to convergence in the levels of investment per capita of the
Latin American countries, 1913-30 (excluding outliers)***

* Bolivia and Paraguay (see text)