Economic modernisation in Latin America and the Caribbean between 1890 and 1925: 
A view from the energy consumption

by
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By the last decade of the 19th century, Latin America and the Caribbean had overcome some of the most important barriers to economic modernisation (Skidmore & Smith, 1996). The institutional distress which gave birth to weak governments (and states) started to ease. Disruptive contests between military ‘caudillos’ had given way to more stable governments (although no very much more representative). The series of wars over contested control of territory and natural resources (US-Mexico 1847-1848; the Triple Alliance War 1865-1870; the Pacific War 1871-1881, to mention just some) ended; so that a new set of established borders were secured. In addition, the reforms of the 1860s and 1870s paved the way towards economic modernisation: steps were taken for the formation of land markets; in Cuba and Brazil free workers replaced the slaves in the 1880s; flows of European workers to Argentina and Uruguay continue to increase. Furthermore, the limitations posed by the low quality and scarcity of land communication began to be resolved by development of railways. Cause and effect of economic modernisation, by 1890, railways were working almost in every country of Latin America. Just few of the smaller and underdeveloped Central American economies delayed the development of railways to the first decades of the 20th-century (Sanz Fernández, 1998). Last but not least, the barriers to foreign direct investment (FDI) progressively lessen, as demonstrated by the development of railways; Great Britain allowed banking branches abroad in 1870; overall, the liberal governments of the Latin America willingly accepted the entrance of foreign capital providing technological transfers and know-how to the region.

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Certainly, economic modernization did not arrive to every country at the same pace. Neither the ‘natural resource lottery’, nor the institutional advancement was equally distributed in order to take advantage of the growing international markets. The persistence of European colonialism in the Caribbean, including the defying ambitions of the US after 1898, only reflects this heterogeneity. It is true however, that with the exception of Cuba and Puerto Rico – Spanish colonies until 1898-, Jamaica and Trinidad and Tobago’s petroleum endowment, they were generally small territories with little population and little resources, but exceptionally located in the commercial geography of the time (Watts, 1987).

Nevertheless, the economic development of Latin America and the Caribbean before the Great Depression remains controversial in a number of ways. The lack of quantitative evidence for most of the smaller economies – either by population, geographical size or GDP- does add to the haze. For Brazil and Uruguay, yearly data is available since 1870. For the other large or medium size economies, namely Argentina, Chile, Colombia, Mexico, Peru and Venezuela data are available from the 1900s. Most Central American countries enter the list in 1920. Nevertheless, before 1930 very little is known of Bolivia, Cuba, Dominican Republic, Ecuador, Haiti, Panama, Paraguay, not to mention other non independent territories like Jamaica, Puerto Rico, Trinidad and Tobago, the Guiana’s and some others, for which in some cases absolutely no quantitative evidence is available (Maddison, 2003; Bulmer-Thomas, 2003; Astorga, Berges and Fitzgerald, 2005).²

The insufficient quantitative basis hampers the adequate evaluation of the relative economic progress of the different countries, and makes it difficult to answer few important questions: what are the patterns of modernization for Latin American and Caribbean countries? Were all countries equally able to profit from the opportunities brought by the first globalisation? Did the First World War have the same impact in the entire region? How did all Latin American economies recovered during the early 1920s? And in general, to what extend did it matter to be a large or a small economy within this changing international framework? Above all, the exercises of the present paper proportionate a quantitative comparative and global view of the Latin American and Caribbean economies before the Great Depression. For the first time it is possible to go beyond the partial analysis biased by the larger economies of the region.

² Bulmer-Thomas (2003) provides GDP p.c. estimates for all the independent countries and Puerto Rico in 1913 and 1928. Astorga, Berges & Fitzgerald (2005) provide estimates every ten years without going beyond what has been mentioned. Williamson (1999) provides a different database with real wages that covers our same chronological range.
In our paper, we take the apparent consumption of energy as a proxy of the degree of modernisation of Latin America and the Caribbean. The apparent consumption of modern energies, which in the period 1890-1925 correspond to mineral coal, petroleum and the first steeps of hydroelectricity, is an excellent indicator of economic modernisation. Therefore, this research achieves, for the first time, a comparative homogeneous indicator for the whole of the region. This is an evident breakthrough in the economic history of Latin America and the Caribbean. Until this very moment, similar coverage was only possible from 1945 thanks to the GDP figures of the United Nations prepared by the ECLA. Previous statistical compilations, such as Maddison (2001), Thorp (1998) or Bulmer-Thomas (2003), offer numerous series of a wide range of indicators, but none covering the entire region with a homogeneous indicator on annual basis as we do here.

The paper is organised as follows. Section I furnishes the basis of our approach and explains the basics of our data set. The data base allows answering different sets of questions. Section II focuses on the evolutions over the long run of the levels of modern energy consumption per capita in 30 Latin-American and Caribbean countries, colonies and territories. These series allow having an historical perspective of their economic progress. In the subsequent level of examination, Section III looks at the different chronologies of the economic modernization of the different countries. The degree of convergence/divergence within the region and with the rest of the world along the period is studied briefly in Section IV. Finally, Section V summarises the main findings.

I Modern energies and economic modernisation

From a conceptual standpoint, apparent consumption of modern energies -coal, petroleum and hydroelectricity- makes evident the pace at which the most modern activities evolve within each country. Those activities making use of the brand new technologies of the late 19th century and the dawn of the 20th were, with all probability, users of coal, petroleum and/or electricity.

The use of modern energies brought about increases in efficiency and productivity in most sectors of the economy, but especially in industry and transports, without forgetting the widespread diffusion of new ways of lighting in any modern city and home. Comparing a wide collection of countries through their apparent consumption of modern energies reveals, more than anything else, the relative degree of economic activity above the subsistence level.
Although energy consumption is an aggregated indicator of economic activity, it should not be used as direct substitute of major economic indicators as income and product. Precisely because it does focus on the modern sectors of the economy, energy consumption may exaggerate the relative differences across countries. Yet, in absence of sufficient data for the reconstruction of the national accounts, the apparent consumption of modern energy offers a good proxy for the trends and evolution of economic prosperity.

Most economic historians accept the crucial role played by fossil fuels in the process of economic development along the lines just described (Wrigley, 1988; Cipolla, 1962). In fact, primary energy consumption per capita has already been used as a proximate and measurable determinant of growth in historical exercises (Maddison, 2003). Support can also be drawn from the theoretical and applied economic literature where the focus tends to be on how energy demand is driven by economic development, and/or how a potential energy shortage may strangle economic growth. On the empirical side, numerous studies aim at providing evidence about whether the level of energy inputs thrusts economic growth or whether it is the output level what governs the energy input. According to the latest results the relationship between energy availability and output levels seems to be quite strong. Multivariate test demonstrate that the level of energy use is significant for explaining the level of output. The relevant fact for our purposes is that the overall positive correlation between economic growth and energy growth remains one of the most important stylized facts we can draw from history, even if the extent of this correlation and its patterns over time are highly variable.

A poor endowment of modern energies colluded in some cases with an overall poor resource endowment which handicapped the participation in the international markets and the modernization process. For some economies adopting inventions which required modern forms of energy to run was simply unaffordable. Thus productivity gains brought about by the new technologies were also out of reach. It is significant to observe that those countries with the lower energy consumption in the period 1890-1925 remain as the ones with the lower levels of GDP per capita to the present day, as it is shown in Graph 1.

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3 On the first aspect, see the survey by Toman and B.Jemelkova (2003); on the second issue see, for instance Solow (1974; Solow (1974); Stigliz (1974)
4 See for instance Kraft and A.Kraft (1978); Akarca and T.Long (1980); Yu and B.Hwang (1984); Yu and Choi (1985); Erol and E.S.H.Yu (1987); Abosedra and H.Baghestani (1991)
5 Stern and Cleveland (2004)
7 Grübile (2004)
Ours is not the first attempt to reconstruct the apparent consumption of energy in Latin America in historical terms. Several studies provided punctual estimates in the first half of the 20th century, with data hardly ever comparable across countries. Only three studies provide historical series of energy consumption in Latin America, namely UN-ECLA (1951), UN-ECLA (1957) and Darmstadter et al. (1971). Respectively, they provide data for 5, 7 and 11 countries of Latin America and the Caribbean starting in 1925 the earliest. Here we present the series for the earlier period of 1890-1925, where no other estimate existed.

Most Latin American countries were importers of coal and petroleum products, mostly from the United Kingdom, the US and Germany. Mexico, Peru and Venezuela also supplied a large share of petroleum within the region. Virtually none of the smaller countries of the continent were endowed with energy resources nationally (except for wood and hydraulic), and unlike the larger economies, the commercial ties of the smaller nations were stronger with the US than with the United Kingdom from before 1900. Both issues would determine a distinctive profile for the smaller countries in terms of what energy to consume (prominently oil) and the type of restrictions faced, since they were totally dependent on the exterior for the supply of fossil fuels.

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8 Punctual estimates for years 1928, 1929 and 1939, are found respectively in: U.S. Department of Commerce (by J.R. Bradley) (1931); Read (1933); Read (1945)
9 Rubio and Folchi (2005) successfully contrast the results of applying methodology used in this very paper with the existing series for 1925. We have all confidence that our estimates extend backwards the existing ECLA series neatly since the overlap is precise.
In fact only the larger countries, namely Argentina, Brazil and Uruguay were predominantly importers of coal from the United Kingdom, while Colombia and Cuba were mostly supplied by the US. In fact, in Central America and the Caribbean, British coal could only be found in sizeable amounts in British Guiana and British Honduras (and not for long). North American producers had all the geographic advantage, given the high costs of transport of bulky commodities, and they took it. Both Mexico and the US practically monopolised the supply of fossil fuels of the Caribbean and Central America, except for Nicaragua where Peru also played and important role. In Chile the domestic supply of coal made for a large proportion of all energy consumed in the country. Peruvian, Mexican and Venezuelan national oil (and coal in some instance) production also made for a large share of their consumption but still letting a share to the United States provision of fuels. In aggregate terms the story of the energy trade in Latin America before the Great Depression is one of declining importance of the British coal. It made more than 60 per cent of the energy supply of the subcontinent in 1890, but declined in favour of the US (mostly oil), Mexico and to a lesser degree Peru (both suppliers of oil, entering during the First World War) and the increasing importance for the region of the national production of energy (net of exports) and the hydroelectricity- which by the end of the period made about 6 percent of the total energy consumed-. By the mid 1920s, only 20 per cent of the energy consumed by Latin America and the Caribbean was of British origin, and the larger share, about 55 percent in fact corresponded to the domestic production, but very much concentrated in the large oil producers (Mexico, Venezuela and Peru).

We use the trade statistics of the principal energy trade partners of the Latin American countries, - the United Kingdom, the US, Germany, Mexico and Peru - plus data on home production of coal and petroleum and subtracting exports (were existed) for constructing our estimates. The methodology follows the one by Rubio and Folchi (2005). Their results demonstrated there is no difference in using the trade partners’ statistics rather than the home statistics, while at the same time, using the exporters’ data allows covering those countries lacking domestic statistics. As a consequence, data on energy consumption can be produced for 19 republics and 11 colonies/territories of Latin American and the Caribbean for the period 1890–1925.

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10 In truth it is a consequence of our own data set, we do not have export data of either Mexico or Peru before 1920. Although this may obscure the contribution of Mexico to the overall consumption of energy in Latin America during the War, before the War it was unlikely that any sizeable amount of Mexican oil ended elsewhere than in the US.

11 Data sources are quoted at the end of the paper.
To the apparent consumption of fossil fuels per capita we have added an estimation of hydroelectric production. There is very little information in this area; the United Nations produced an estimate of the hydroelectric production in Latin America by 1929. We projected backwards the electricity production of 1929 using the stock of electrical generators of each country. Assuming that no electrical machinery was produced in the whole of the subcontinent, for the construction of the stock of electricity generators we used again the trade statistics, this time those of the US, the United Kingdom, Germany plus Switzerland. We assess the value of the stock of imported generators, and we deflate it with the estimated Swiss export price index of electrical machinery. These series are transformed into hydroelectric production using the factor found for 1929

The sum of imports plus national production of modern energies (net of exports), including hydroelectric power, constitute our indicator of apparent energy consumption; divided by population is the gauge we use through the paper.

II The patterns of energy consumption for Latin American and Caribbean countries

Table 1 offers the ranking of energy consumption per 1000 habitants for 1890, 1900, 1913 and 1925. Leaving aside the colonial possessions for the moment, the first thing that call our attention is the wide gap in modern energy consumed across the subcontinent. In 1890, the average Uruguayan citizen disposed of 730 times the energy (specifically coal) that an average Salvadorian or Guatemalan habitant. By 1900 close to nothing had changed, but in 1913 and 1925 the difference widen even more once Panama enters the list. Excluding Panama, given its exceptionality discussed below, the five countries above the regional average (weighted) – Uruguay, Chile, Argentina and Cuba-, consumed in 1890, 17 times more per capita than the twelve countries below the average; the proportion was reduced to 12 times by 1900, and remained thereafter (13 times in 1913; precisely 12 by 1925).

From this depiction, it is clear that the differences in the levels of economic modernisation across Latin America were already present by 1890 and changed very little in the following decades. The early integration to world markets seems to be as important as the natural endowment. Among the large consumers only Uruguay and Cuba had absolutely no national production of modern energies. Yet Uruguay was present in the world market since the first half of the 19th century with its ‘tasajo’ exports and Cuba was the first supplier of sugar to the international markets from the 1830s; Chile was well endowed with mineral coal for home
consumption, but also with silver and cereals first and, nitrates and copper later for exports. Argentina joined later, but with force, to the international trade flows.

Another potential explanation lies with the opportunity cost of the transition from traditional energies of organic origin to modern fossil fuels. While Uruguay and Argentina had no option

| Table Nº1 |
| Levels of energy consumption per capita in Latin America and the Caribbean 1890, 1900, 1913 y 1925 |
| 1890 | 1900 | 1913 | 1925 |
| **Republics** |
| Uruguay 278.6 | Uruguay 360.3 | Panama 1.276.4 | Panama 2.197.9 |
| Chile 171.5 | Chile 189.5 | Chile 503.8 | Chile 490.3 |
| Argentina 116.9 | Cuba 158.3 | Uruguay 449.8 | Cuba 484.0 |
| Cuba** 114.3 | Argentina 122.9 | Cuba 391.7 | Argentina 331.0 |
| A.L. & C. 44.3 | México 70.6 | Argentina 335.0 | Uruguay 287.2 |
| Brazil 33.3 | A.L. & C. 63.4 | A.L. & C 142.9 | Mexico 251.6 |
| Peru 17.3 | Brazil 34.5 | México 111.1 | A.L. & C. 176.9 |
| Puerto Rico** 16.2 | Peru 27.5 | Peru 91.4 | Honduras 127.5 |
| Costa Rica 13.3 | Costa Rica 26.4 | Costa Rica 89.3 | Costa Rica 113.6 |
| Venezuela 11.7 | Puerto Rico 16.9 | Brazil 76.7 | Peru 89.6 |
| Nicaragua 10.4 | Dominican R. 8.3 | Puerto Rico 26.1 | Brazil 75.1 |
| México 10.1 | Nicaragua 6.4 | Guatamala 24.1 | Puerto Rico 55.6 |
| Colombia 8.7 | Colombia 5.5 | Dominican R. 16.9 | Dominican R. 41.4 |
| Dominican R. 5.8 | Venezuela 4.9 | Honduras 11.2 | Guatemala 39.5 |
| Haiti 3.1 | Haiti 3.0 | Ecuador 12.0 | Colombia 26.5 |
| Honduras 0.8 | Honduras 2.8 | Nicaragua 9.7 | Ecuador 21.1 |
| Ecuador 0.5 | Guatemala 1.5 | Venezuela 8.6 | Nicaragua 19.6 |
| El Salvador 0.4 | Ecuador 0.9 | Haiti 5.4 | Venezuela 16.5 |
| Guatemala 0.4 | El Salvador 0.5 | Colombia 3.4 | El Salvador 12.6 |
| **Colonies and territories** |
| Bermuda 353.7 | Danish W.I. 1.543.5 | Danish W.I. 2.700.0 | Danish W.I. 3.301.6 |
| Br. Guiana 208.0 | Bermuda 1.075.2 | Dutch W.I. 784.1 | Trinidad & T. 868.3 |
| Br. Honduras 9.8 | French W.I 82.2 | Bermuda 572.5 | Dutch W.I 806.2 |
| Dutch W.I 74.1 | Trinidad & T. 484.6 | Bermuda 488.6 |
| Br. Guiana 65.2 | Barbados 289.1 | Barbados 149.9 |
| Dch. Guiana 49.9 | Br. Honduras 106.2 | French W.I. 131.3 |
| Br. Honduras 28.8 | French W.I. 83.0 | Br. Honduras 70.9 |
| Br. Guiana 73.5 | Br. Guiana 63.3 |
| Dch. Guiana 57.9 | Jamaica 44.7 |
| Jamaica 50.4 | Dch. Guiana 23.7 |
| Fr. Guiana 27.3 | Fr. Guiana 17.9 |
| **Pro memoria: United States and Spain** |
| United States 3.571.6 | United States 4.913.2 | United States 7.869.8 | United States 8.889.9 |
| Spain 123.0 | Spain 194.2 | United States 274.3 | Spain 255.1 |

Notes: TOE: Tons of oil equivalent. *TOE/cap are actually TOE per 1000 habitants. **Cuba and Puerto Rico were Spanish colonies up to 1898. The former obtained independence in 1902, the latter remained under US influence till today. Sources quoted at the end of the paper.
but the fossils, for their rich regions of the pampas did not offer much to burn as energy, the cases of Cuba and Chile –better endowed with wood and sugar cane for burning- are better explained by the fact that their export activities grew much faster than the organic energy they could provide. In this regard, it is quite possible that the countries with access to the Amazon (Brazil in particular, but also Peru, Ecuador, Colombia and Venezuela, plus the Guiana’s) had higher opportunity costs for modernising given the plentiful abundance of wood. In the small economies of Central America and the Caribbean, always in the last positions of our modernisation list, the handicaps collude: a poor natural endowment, a late integration in the world markets and the perpetuation of traditional small economic activities, made possible to continue without much need for modern energies. For these economies, the energy surge came with the delayed arrival of railways, which in turn became the larger consumer of modern energies.

As much as the main differences in the levels of energy consumption per capita were already present by 1890, the permanence within the groups of large and small consumers was also present from the beginning. Uruguay, Chile, Argentina and Cuba are the four countries ahead of the economic modernisation –see Graph 2, below-. Reporting of Argentina as a rich a prosperous country is common place in the economic history literature (Díaz Alejandro, 1970; Della Paolera & Taylor, 2003). What is somehow surprising here is that it does not take the first position in our indicator of economic modernisation. Yet, as said earlier, our indicator tends to push upwards industrial, mining, commercial and/or urban countries and push downwards predominantly agrarian and/or rural economies. Therefore, the explanation for the Argentinean case surely lies within the marked agricultural profile of its economy, which implied relatively low modern energy consumption (limited to the railways and the urban centres). By contrast, the mining intensity of the Chilean economy, which needed to melt its copper before export, and the extensive and dense railway network of Cuba, plus their key role as bunkering ports in the main commercial routes help to understand their higher levels of energy consumption. In the Cuban case, the increase of modern energies is a further indicator of the replacement of the traditional organic fuel of the sugar industry: the sugar cane bagasse resulting from the crushing process which traditionally fuelled the industrial process. Bagasse was first replaced by mineral coal and later on by petroleum. By its part, Uruguay appears as the higher consumer of modern energies, by some means an unexpected position. Sharing the traffic of the River Plate with the Argentinean colossus, it is possible that even if only few of the bunkering activities of
Montevideo’s port actually corresponded to ships entering or departing from Buenos Aires, our per capita estimate for Uruguay would come down –given the large scale of the port activities relative to the small population of the country.\(^\text{12}\)

As noted earlier, the position of Panama is exceptional. With US backing, Panama seceded from Colombia in 1903 and promptly signed a treaty with the US allowing for the construction of a canal and US sovereignty over a strip of land on either side of the structure (the Panama Canal Zone). The Panama Canal was built by the US Army Corps of Engineers between 1904 and 1914. Over the construction period, but overall once opened, the Canal received huge amounts of coal and petroleum for bunkering purposes. With less than half a million inhabitants it is implausible that the Republic of Panama consumed between half and a million tonnes of oil equivalent however prosperous the former Colombian province might have been. It is not possible at this time to distinguish between the energy consumption of the Republic of Panama and that of the Panama Canal. As a bunkering post, the consumption of the Canal was among the highest in the region. Most of the Caribbean colonial possessions must also be considered as bunkering stations of their metropolis, thus their energy consumption can not be taken at face value for our purposes.

Oil producers within the region deserve special attention.\(^\text{13}\) Mexico closed the gap with the leaders over the 1920s but still not reaching the top of the list. Petroleum abundance was not per se an advantage at that stage –they consumed very little of it and mostly related to the petroleum industry itself- a clear symptom of the difficulties for modernising their economies. It was not easy shake the burden of the predominance of activities based in organic energies and the late integration in the world markets, both rooted in the pre-1890 period.

\(^\text{12}\) By 1905, on an average round trip Liverpool-New York consumed 5,000 Tons of coal, therefore few misallocated ships bunkering would make a great difference for Uruguayan energy consumption per capita. A recent research paper by Bertoni and Roman (2006) re-estimated downwards the Uruguayan energy consumption taking bunkering into account, which still remains among the highest in the continent.

\(^\text{13}\) Peruvian production started in 1896, exports in 1897; Mexican production began in 1901, but meaningful exports only began in 1911; Argentinian oil was first found in sufficient amounts in 1908, with some very small exports from 1915; Trinidad & Tobago commercial oil production began in 1909, exporting almost entirely to the UK from 1911; Venezuela and Ecuador official start of oil production is 1917, but the War delayed exports until 1920 in the first case and 1925 in the second; Colombia first reported production is from 1922 and export in 1926. ‘Together they amounted to 15 per cent of the world’s petroleum output, while the United States represented 72 per cent. In other words, Latin America extracted more than half of the petroleum obtained outside the United States’ Rubio and Folchi (2005)
Economic modernisation in Latin America

Graphs 2-8: Tones of oil equivalent per 1000 habitants. Sources quoted at the end of the paper
Among the countries in the midrange of Table 1 we find Brazil, the larger country of the region by all measures (Leff, 1997; Summerhill, 1997, 1998). Although it manages to increase its consumption per capita, Brazil loses positions in the ranking, which is probably related to the opportunity cost of switching to modern energies for a country with huge woodland resources. In fact, the only jump up of Brazil occurs between 1900 and 1913, and for the last period energy consumption levels fall slightly. The Peruvian case is similar to the Brazilian, one of losing positions, but it is different inasmuch as Peru was the eldest of the oil producers of the region. The evolution of these two countries can be observed in Graph 3. While Peru stagnated from 1908 reflecting the exhaustion after the effort of the precedent decades of overlapping petroleum, copper and silver surges (Thorp & Bertram, 1978). Brazil interrupted its progress with the outbreak of First World War, which severely hurt its coffee trade, and did not recover until 1925. In this group of midrange consumers of Table 1 we also find Costa Rica and Puerto Rico. The former surpassed Brazilian and Peruvian levels of energy consumption after the war, the latter carry on losing positions being unable to keep pace with Cuba.

At the bottom of Table 1 the same countries are systematically found: Haiti, El Salvador and Guatemala a group of small and poor economies of Central America and the Caribbean (Pérez Brignoli, 2000) –see graphs 4 and 5-. The trajectory of Haiti earns by its own merits the category of ‘regional minimum’ by 1925 and allows describing it as the less developed country of the region. The worse of it all is that it was not so at the beginning. Haiti is a story of long run decline, especially from 1896 through 1905, and from 1913 through 1919, barely compensated by the period of in between. In the other half of the island, by contrast, the Dominican Republic takes the journey in the opposite direction: only up (with some minor downs). So it does Honduras, which by 1925 already reached the levels of Costa Rica, in part thanks to the railway construction initiated in 1913, undertaken by US investors.

El Salvador could have turned into another ‘Haiti’, installed in a long lethargy. But from 1910 it slowly started its modernisation process, hardly noticing the effect of the First World War, all explained by the railway construction by foreign investors. The same factor explains the growth of Guatemala from 1895 to 1913, which basically stagnated after implying very little or null modernisation besides the railway itself. The only exception in this respect may be Nicaragua, which levels of energy consumption continue to increase once the expansion of the railway
network concluded. The strong relationship between the size of the railway network and modern energy consumption by 1890 can be seen in Graph 9.

**Graph 9: Energy consumption (toe) and railroads (km) per capita in 1890**

![Graph showing energy consumption and railroads per capita in 1890](image)

**Notes and sources:** Actually per 1000 habitants in both cases. Railways from Mitchell (2003), energy as in Table 1.

A final separate group is constituted by the Andean region, Colombia and Ecuador (and the landlocked Bolivia and Paraguay for whom sources issues inhibit offering confident data at this time). Colombia suffered the secession of Panama and it did not recover until the 1920s. Ecuador is more alike Honduras and the Dominican Republic, despite increasing the levels of energy consumption per capita, it is not enough to leave the bottom of the ranking.

The comparisons and contrasts reveal clearly that for most of the Andean and Central American regions the first globalisation was nothing more than a lost opportunity. In contrast, a few other small economies, such as Costa Rica, Panama, Dominican Republic, Jamaica or Puerto Rico, managed to find their niche in the world economy. They profited from it, but the benefits were not always capitalised in the longer run. Latin America and the Caribbean fragmented itself in portions that pursued modernisation at very different paces. The emergence at this time of regional clusters is a relevant finding.
IV The timing of economic modernization

In a second level of examination we focus on the different chronologies of the economic modernization of the regions. There is a clear cut between the pre First World War era—with high modernization rates (5.1 per cent yearly per capita modern energy consumption growth)—and the war and post war era—with modernization slows down (1.9 per cent). The first period—1890-1913—has been properly described as the first globalization, or the years of the making of an integrated international economy. According to the best of our knowledge, some Latin American and Caribbean countries fully enjoyed the opportunities provided by the increased specialization and integration of the world economy. All these opportunities implied a larger consumption of modern energy sources.

Table 2: Rates of growth of per capita modern energy consumption (%)

<table>
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<tr>
<th></th>
<th>1890-1900</th>
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<td>7.2</td>
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Sources: as in Table 1.
The figures in table 2 provide data to support this view. The whole of the region had a yearly increase in modern energy per capita consumption of 5.1 per cent. It more than trebled. The large Latin American economies had a growth rate on the same range: Argentina, 4.7, Brazil, a bit lower, 3.7, but Mexico, much higher, 11.0. Mexico manages to switch from an underperformer in Latin American terms to an over performer. These are the years of the “porfiriato”, up to the abrupt revolutionary interruption of 1910. The “medium” size progressive economies also enjoy a good time: Cuba at 5.5 per cent, Chile at 4.8, but Uruguay, perhaps the richest by 1890, only 2.1. These six countries represent 83.8 per cent of total modern energy consumption in 1913 Latin America. But a number of other small countries are also showing amazing performances. Guatemala shows a 20.1 per cent growth rate, Ecuador a 14.2 per cent, Honduras, 12.4, Costa Rica, 8.6, Peru, 7.5, El Salvador, 6.9. All of them, but Peru, were small countries—in population terms—, in the tropical range, and initially very poor. They jump from extremely low levels of modern energy consumption per capita to simply low levels.

On the other side, a few countries fully missed their opportunities: Colombia is the most spectacular with a –4.0 per cent, Venezuela, -1.3, Nicaragua, -0.3, and Haiti, 2.4. The Colombian case is highly interesting as it reflects the loss of its wealthiest province—Panama, independent from 1903. It is unfair to consider both countries as separated entities, as what remained of Colombia was much poorer by 1903. If we consider Colombia and Panama together what we get is a yearly increase in 10.5 per cent, close to the Mexican levels for instance. The other three cases seem real. By the early 1890 Nicaragua enjoyed some advancement compared with most Central American economies (but Costa Rica) but could not sustain it subsequently, and there could have been some intraregional convergence. The energy data suggests that such a trend did exist: Guatemala and Honduras overcame Nicaragua and approached Costa Rica. Only El Salvador remained stagnant.

Venezuela and Haiti do not have any excuse for their underperformance. Haiti is the most intriguing country, as it becomes the poorest one—in per capita energy consumption terms—precisely during these years. At the starting point it was on the same range than Dominican Republic—the other half of the Hispaniola island— or Colombia. By 1913, after more than two decades of low growth, it was close to the bottom. It will reach this position during the War. The very small colonial territories followed quite different paths, generally positive, but with some curious exceptions such as the British Guyana.
It is worth to underline the fact that the highest growth rates correspond to the Andean axis, from Mexico to Peru. The temperate Southern countries did well, but just below the average. Brazil, and mostly Uruguay and Venezuela appear as clear underperformers. The region as a whole managed to increase its modern energy consumption a third quicker than the US. A catching-up experience, but it was not spectacular. Neither spectacular was the intraregional catching up. For all the rapid growth of the poorer countries that our figures unveil, the fact is that the 1890 ranking was quite similar in 1913. Only Mexico made a promising difference.

A closer look at the Latin American average evolution suggests an accelerating trend, particularly since 1902, peaking in 1911. The 1890-1902 growth rate for the whole region is 4.5, while 1902-1911 jumps to 8.1. A more conventional breakdown by decades –before and after 1900- provides the same acceleration trend –but a bit blurred- from 3.6 in 1890-1900 to 6.4 in 1900-1913. The acceleration is quite general, with clear upturns for Argentina, Brazil and Chile, that jump to the 6-8 range in 1900-1913 from one per cent per year or less in the last decade of the nineteenth century. The only significant economy experiencing the contrary movement is Mexico, that goes down to 3.6 from 21.4. But this can be explained by the Mexican Revolution. Indeed, growth rates outside Mexico during the “Edwardian era” are really impressive. Only Uruguay experiences slow growth (1.9 per cent). The comparison with the US figures underlines the strong dynamism of the early twentieth century economic upswings for the whole of Latin America, even compared with the world energy consumer leader.

We use to accept that Revolutionary Mexico suffered from an acute shortage of data. Our modern energy consumption approach, using exports from the major western economies, allows overcoming a bit of this shortcoming: our figures go down one third from 1910 to 1914. But the road down includes a very good 1911, and the strong recovery after 1914 has to be underlined.

The outbreak of the First World War was a watershed for Latin America, as for the rest of the world. It is fair to mention that the years immediately prior to the war were of economic crisis or deceleration for some of the large economies (Argentina, Brazil, Mexico and Uruguay), with a 10.8 fall from 1911 to 1912, only partially recovered in 1913. The overall Latin American and Caribbean performance was pretty bad: 30.2 per cent fall from 1913 to the through of 1919 (and a 35.1 fall if comparing 1911 to 1919). Contrary to what happened during the pre-war globalization years, when the per capita energy consumption was growing for almost every country, the war years showed very different country experiences. If we focus in the period 1913-1918, when most of the impact was felt, we have countries with yearly growth rates
ranging from –33.0 per cent in Guatemala to +24.7 per cent to its neighbor Honduras. These extremes were not isolated. The largest economies also experienced such a discrepancy. Argentina fell at a 29.0 per cent rate and Brazil at a 15.6, but Mexico grew at 11.5. Uruguay went down at 14.5 and Chile at 5.3, but Cuba remained almost stagnant (-0.1). The downs were more important than the ups, as it happened with the whole of the region (-6.2), but what strikes the most is the diversity of the experience, even among close neighbors. Generally speaking, we know and we see that all the economies closely linked with the European markets –United Kingdom, mainly, but also Germany and France- suffered the most the war. This was the case of all the large South American economies –Brazil, Argentina, Chile and Uruguay-, and for some others like Guatemala (-33.0), Costa Rica (-23.8), Haiti (-17.2), Jamaica (-14.5), in Central America and the Caribbean. But these were the only eight economies suffering more than the average.14

A number of economies enjoyed positive growth during the war years. Below the Honduras maximum rate we have Nicaragua (18.6), Venezuela (17.9), Dominican Republic (13.6), El Salvador (12.9), Mexico (11.5), Trinidad & Tobago (3.2) and Peru (1.3). Panama (-3.2), Ecuador (-3.6), and Colombia (-5.1) were in the negative range, but above the regional average, just as the previously mentioned cases of Chile (-5.3) and Cuba (-0.1).

The fluctuations during the war years unveil a number of country and regional features. Argentina reduced its energy consumption at an accelerating rate, mirroring the war economy developments in Western Europe: increasingly poor economic conditions and increasingly risky and expensive freight rates. It is not surprising that the worst moment was 1918, at an 18 per cent of the 1913 value. Brazil, on the contrary, suffered a tough decline in 1914 and 1915, much smoother from 1916 to 1918, when a minimum was reached of the 42.8 per cent of 1913. It is likely that Argentina reflected the pattern of the wheat and meat European importing markets, both difficult to compress. Brazil reflected the coffee and the colonial European importing markets, a luxury that could be skipped since the start of the war. Indeed, the only Latin American countries to suffer a long and deep fall during the First World War were of the Argentina or of the Brazil kinds: Costa Rica, Guatemala and Uruguay. A total of five. Two of them large economies, and one more a medium size prosperous economy. The other two small and poor, even if promising. But it is impossible to distinguish, for other countries, anything similar to what they suffered.

14 Plus other scarcely populated territories like British Honduras (-26.1) and French Guiana (-15.0) .
Mexico fully recovered from the Revolution. The 1911 maximum was difficult to reach, but it is impossible to draw a negative picture of 1914-1918. Cuba also enjoyed pretty good years, around 1911-1913 levels: not extraordinary, but not bad. Chile had a poor 1915, but the other years were on the 1910-1913 range, and much better than 1912. Here and there a bad year appear, like in Ecuador (1915) or in Jamaica (1918), but the rule was stability or stagnation. It is also difficult to find big spurts, although Honduras, Nicaragua, Dominican Republic and El Salvador are cases in point. They were small economies, but they enjoyed –no doubt about it- a golden era during First World War.

Can we assign any responsibility to what happened to the Panama channel? As we know, it was inaugurated in mid 1914, and by itself it was a real watershed in American life. Did the poor performance of the South Atlantic economies and the pretty good development of the Pacific rim linked to the new shipping routes opened by the Panama channel? It is quite likely. Our figures suggest that this interpretation could be true. Mexico and the Central American Republics, that happened to be just in the middle of the new route from the US East and West coasts did quite well. The Andean countries reduced dramatically their distance to the Northern Atlantic world and could enjoy many more business opportunities. On the contrary, Brazil, Uruguay and Argentina had to be net losers.

For a few economies the worst came in 1919. Recovering from the Great War was not easy at all. For the whole of Latin America 1920 seemed to be the recovery year, but 1921 did not continue the growth trend, and 1922 collapsed again. Only 1923 provided a better performance than any previous year, including 1911. The following years, 1924 and 1925 confirmed the recovery and the new growing trends. Its real strength was another issue that we plan to explore in another paper. As far as we can see with our figures, three economies were outstanding from 1920 to 1925: Honduras (25.1), Panama (25.4) and Colombia (47.0). The dynamism of Colombia and of Panama had local roots in the success of the Channel, for Panama, and in the combination of coffee exports and early import substitution policies in Colombia. Ecuador (10.1), Dominican Republic (8.8), and Costa Rica (8.8) did also pretty well.

The success of the small and poor economies suggests some intraregional convergence. This was the case during the war years, and also, albeit with lower intensity, during the early 1920s. There is also evidence to suggest moderate catching up to the US. These issues are briefly analyzed in the last section of the paper.
IV Convergence and divergence with the rest of the world and within the region

Most of what has been said in the foregone paragraphs is also reflected in the exercises of this section which focus specifically on convergence and divergence issues. It is worth contrasting the pace of economic modernisation of the Latin American economies with the most modern economy of the time, the US. In parallel, it is also possible to contrast the evolution of all countries with the Spanish case, ex-metropolis and origin of many migrants to the region.

Graph 9: Latin American average energy per capita consumption vs Spain and US

Sources: Latin American weighted average from our dataset, the US from Schurr and Netschert (1977) and Spain from Rubio (2005)

The US energy consumption per capita has been for over a century and a half ranking as the highest in the world. That is why it comes as no real surprise that Latin American weighted average consumption per capita ranks to about 1 and 2 per cent of the US. What it is most interesting of this contrast, however, is the irregular pace at which Latin American small levels of energy consumption converge to the US levels. Very much the same occur with respect to Spain, but a much rapid pace of convergence to the Spanish levels. It is interesting to remember
here that the four countries that were well above the Latin American weighted average energy consumption per capita namely - Argentina, Chile, Cuba and Uruguay (excluding the bunkering countries), were also above the Spanish levels of energy consumption. The implication is that these four were more modern countries than Spain. This proposition is further grounded if we consider that it is fully consistent with the standard knowledge on GDP and migratory flows over the period.

Then it is also clear that the catch up process had few distinctive periods. Running from 1890 to the dawn of the new century a relative stagnant, at times a little divergent period. Then rapid catch up during the first decade of the 20th century, which trend broke off by the early 1910s further aggravated by the War. Finally the post war period led to the levels achieved in the first decade of the century or even higher in the case of the convergence with Spain.

The intraregional convergence issue can be explored using the usual criteria applied to other macroeconomic indicators: beta and sigma convergence. We say that there is beta-convergence if the smaller consumer countries tend to grow faster than the large ones (for us if the less modernized tended to modernize faster than the ones already modern). We say that there is sigma-convergence if the cross-sectional standard deviation of the energy consumption per head for a group of economies is falling over time. The alternative way is to use the coefficient of variation: i.e. dividing the standard deviation by the mean of the sample when comparing samples of different sizes. Since it is not possible for the gap between groups to narrow down if

**Graph 10: Sigma-convergence on the levels of energy consumption per capita**
the initially small consumers do not grow faster than the initially large, the beta-convergence is a necessary condition for sigma convergence. But, beta-convergence is not a sufficient condition for sigma-convergence. In other words, that the small grow faster than the large ones is not enough to guarantee a fall in the standard deviation of the energy consumption per head in the cross-section. We use the coefficient of variation to test for sigma convergence in Graph 10.

There is evidence of a slow sigma-convergence (thus there has to be beta-convergence too) among all the Republics after 1910. But individual groups of countries do not have the same periods of convergence and divergence. Over the first decade, while there is no strong evidence of overall convergence, the small ones converged among them relatively fast. Yet, there after the evidence of convergence among the bottom of the list is not so convincing. The War and the post war made this group diverge internally. The medium size consumers converge all the way up to the War which again had differential effects making the group diverge within. Among the large consumers the story is one of convergence in the long run (which is actually driving the overall regional convergence), with the mentioned episodes of divergence over the War years. It is interesting to note that only the large consumers exhibit convergence among them in the post-war years. For the small and medium size consumers the post-wars increased the differences within each of the groups. It seems that Latin American economies had heterogeneous behaviours over the first half of the 1920s. And in general, it appears from our exam that it mattered to be a large economy within the changing international framework because small countries were far more vulnerable to the international closure from 1920 onwards.

V Conclusions

Our approach offers sufficient quantitative basis for a first evaluation of the relative economic progress of 30 Latin American and Caribbean countries for the period 1890-1925. We resolve that not all countries were equally able to profit from the opportunities brought by the first globalisation; that, the First World War did not have the same impact in the entire region; that, clearly, Latin American economies had heterogeneous behaviours in recovering from the war. And, in general, the entire region, up to 1925, remained at a very low level of modern energy consumption even if some intraregional catching up did exist and with the US. This research achieves, for the first time, a comparative homogeneous indicator for the whole of the...
region for a period for which no much quantitative evidence was previously available. This is an
evident breakthrough in the economic history of Latin America and the Caribbean.

**Data Sources**

- **COAL** and **PETROLEUM** sold to Latin America and the Caribbean countries by:
  - **Germany**: Der Auswärtige Handel Deutschlands, (Berlin, various years)
  - **México**: Departamento de Estadística Nacional Anuario Estadístico: Comercio exterior y navegación (México D.F., various years). –OIL ONLY-
  - **Perú**: Superintendencia General de Aduanas, Estadística especial del Perú (Callao, various years). -OIL ONLY-
  - **United Kingdom**: Statistical Office of the Customs and Excise Department, Annual Statement of the Trade of the United Kingdom with Foreign Countries and Britain possessions (London, various years).

- **COAL** produced and exported by Latin America and the Caribbean countries:
  - **Argentina** (coal re-exports): Dirección General de Estadística, Anuario del comercio exterior de la República Argentina (Buenos Aires, various years)
  - **Chile** (coal production):
    - For 1890-1902: Boletín de la Sociedad Nacional de Minería (various years);
    - For 1903-1907: Oficina Central de Estadística, Estadística minera de Chile;
    - For 1908-1930: Dirección General de Estadística, Anuario de Minería: Minería y Metallurgia (Valparaíso, various years).
  - **Chile** (coal exports): Oficina Central de Estadística, Anuario Estadístico de la República de Chile: Comercio Exterior (Valparaíso, various years).

- **PETROLEUM** produced and exported by Latin America and the Caribbean countries:
  - **Argentina** (petroleum exports): Dirección General de Estadística, Anuario del comercio exterior de la República Argentina (Buenos Aires, various years)
  - **Colombia** (petroleum exports): GRECO, Comercio Exterior y Actividad Económica de Colombia en el siglo XX: exportaciones totales y tradicionales, (Bogota, 2002 mimeo)
  - **Ecuador** (petroleum exports): estimated at 90 per cent of production.
  - **Perú** (petroleum exports): Superintendencia General de Aduanas, Estadística especial del Perú (Callao, various years).
  - **Venezuela** (petroleum exports): as in Mexico

- **HIDROELECTRICITY** (production estimates)
  - Tafunell, X., 2006. ‘Nota explicativa sobre el procedimiento de estimación de la producción hidroeléctrica’ (mimeo).
-POPULATION of Latin American and Caribbean, republics, colonies and territories:
Except for:
1890-1900 for Dominican Republic, Ecuador, El Salvador Haití, Nicaragua and Panama, where no census data was available then the cumulative yearly growth rate of the population data for this countries by Maddison, A.; *The World Economy: Historical Statistics*, (OECD, 2003) were used to backcast Michell’s data.

References
Oxlad (Oxford Latin American Economic History Database), http://oxlad.qeh.ox.ac.uk