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PO Box 117
221 00 Lund
+46 46-222 00 00

Article

Natural Resources Curse in the long run? Bolivia, Chile and Peru in the Nordic countries' mirror

Cristián Ducoing^{1,†,‡}  0000-0002-0970-0850*, José PeresCajías ^{2,‡}  0000-0002-9516-6825, Marc Badia-Miró³, Ann-Kristin Bergquist⁴, Carlos Contreras⁵, Kristin Ranestad⁶, Sara Torregrosa¹

¹ Department of Economic History, Lund University, Lund 221 00 , Sweden

² School of Production and Competitiveness, Bolivian Catholic University "San Pablo", Avenue 14 de Septiembre Number 2, La Paz 4807, Bolivia

³ Department of Economic History, Institutions, Policy and World Economy, University of Barcelona, Barcelona 08034, Spain

⁴ Department of Geography and Economic History, Umeå University, Umeå 901 87, Sweden ⁵ Department of Economics, Catholic University of Perú, Av. Universitaria 1801, San Miguel Lima 32, Perú

⁶ Department of Archaeology, Conservation and History, University of Oslo, Oslo 0851, Norway

* Correspondence: cristian.ducoing@ekh.lu.se; Tel.: +46-738-01-8690

‡ These authors contributed equally to this work.

Abstract: The new estimates of the Maddison Project show that the p.p.p. GDP per capita ratio between Bolivia and Finland has changed from 0.68 ca. 1850 to 0.16 in 2015; similarly, that between Chile and Norway from 0.65 to 0.28. The aim of this article is to present a review of the literature and available quantitative evidence to understand how these extreme differences became possible between countries with similarly enormous natural resources endowments. Specifically, the article seeks to a) identify some stylised facts that may help understand the divergence between Andean and Nordic countries; b) highlight research questions that will guide further work about the divergent effect of natural resource abundance in Andean and Nordic economies. In order to achieve these objectives, four topics are covered: GDPpc, population, trade and taxation. The analysis comprises three Nordic countries (Finland, Norway, and Sweden) and three Andean countries (Bolivia, Chile, and Peru) from the mid-nineteenth century to present day. The sample size, time span covered and thematic approach provide new evidence regarding previous work. [1–3]

Keywords: Natural resources; economic development; long term economic growth; Latin America; Scandinavia; trade; commodities; human capital; knowledge; taxation.

JEL Classification: Q01 Q32 N50 N56

1. Introduction

The "natural resource curse" hypothesis has been used several times to explain the poor growth performance of resource rich countries. This idea was coined by Auty, and popularized after Sachs & Warner claimed about the existence of a negative correlation between the share of natural resources exports to GDP and the economic growth rate from the 1960s to the 1980s.[4–6] Several causal mechanisms have been discussed to explain this correlation. For instance, the effects of natural resource exports on the appreciation of the exchange rate and a subsequent deindustrialization process, a phenomenon known as "Dutch disease".[7,8] Another set of explanations point towards a crowding-out effect, diverting investment from tradable to non-tradable sectors.[9] It is also often argued that dependence on natural resources exports may increase the volatility of the economy, which has negative effects on human capital and investment decisions.[10,11] From a political perspective, it is highlighted that natural resource exports may increase the concentration of power into rent-seeking elites or negatively affect the quality of democratic regimes.[12–15]

Interestingly, these mechanisms have been debated both in the public and academic arenas. This has been particularly intense during the last years because of the "commodity super cycle" that took place between 2004 and 2014.¹ For instance, institutions like the World Bank, in opposition to Sachs' view, pointed out that increases in international prices brought both opportunities and challenges to Latin American economies [6,19]. Similarly, it has been suggested that innovative fiscal policy could be a good instrument to take economic advantage of natural resources exploitation [20,21].

Once the boom is over, scepticism develops and researchers are trying to identify what has been done incorrectly [18]. In spite of this, it is also necessary to take into account those theoretical criticisms to the hypothesis of the "natural resource curse". For instance, by looking at different historical episodes, van der Ploeg stresses the existence of both positive and negative growth performances in several resource rich countries.[11] Following this approach, Smith found a positive relation between growth and natural resources when the sample is split between OECD and non-OECD countries.[22] Boschini, Pettersson, & Roine, found that the negative correlation between growth and natural resources disappeared when controlling by the quality of institutions.[23] Likewise, Brunnschweiler has stressed the existence of a positive correlation between natural resource abundance (measured by the existence of natural resources capital) and long-term economic growth.[24] Regarding politics, Haber and Menaldo have identified that natural resources do not have a significant long-term effect on the regime type (i.e., a democracy or a dictatorship).[25]

These different ideas suggest that the relationship between natural resources and economic performance still is an open question that deserves further work. This article is the first publication of a project which stresses that looking back at history can shed some light on the debate. The usefulness of history has been stressed before. [2,13,26] It is particularly important for identifying the paths through which some countries that were resource abundant transited to knowledge economies by taking advantage of their natural resources. This has been the case, for instance, of the United Kingdom and Germany, two coal abundant economies during the industrial revolution.[27] Wright has stressed the critical role of natural resource expansion and diversification in US industrialization given the existence of forward and backward linkages, the domestic market expansion and the existence of agglomeration economies.[28] Ville, Dean, & Wicken have analysed the cases of Norway and Australia, pointing out the existence of an industrialization process based on natural resources exploitation.[29] In the case of less developed economies, Hillbom stresses the critical role played by good institutions in the positive impact that mining had on Botswana.[30,31]

In this article, we compare Andean and Nordic countries from the mid 19th century onwards. The starting point of this comparison is based on the fact that the extreme differences existing today between both groups of countries were much lower in the mid-19th century. This can be clearly appreciated in Table 1 which compares GDP per capita for selected years in ppp terms. For instance, whereas the GDP per capita ratio between Bolivia and Finland is today around 0.16, it was around 0.68 in the middle of the nineteenth century. Likewise, it is noteworthy that Chilean GDPpc was similar to the Finnish one in the mid-19th century, but today is around 50%. More importantly, it makes sense to compare Andean and Nordic countries since both groups of countries were, and are, abundant in natural resources. Thus, we seek to understand how these current big differences are possible between countries with similarly enormous natural resources endowments. In this context, we wonder why Andean countries are today among those economies which tend to depend heavily on few natural resources,² while Nordic countries transited from natural resource dependent to knowledge economies.

Few previous works have compared long-term development trajectories of Latin American and Nordic countries. [1–3] In contrast to Blömstrom and Meller, our project and this article present robust

¹ See, for instance, Papyrakis & Gerlagh, and updated bibliographic review in recent surveys on this topic.[11,16–18]

² This idea can be easily proved by looking at the composition of total exports in Bolivia, Chile and Peru in 2003 and 2013, i.e. before and during the last year of the super commodity cycle.

Table 1. GDP per capita, selected years.
Sources: Bolivia, [32]. Rest of the countries from [33]

	1850	1870	1890	1913	1950	1970	2010
Bolivia	640		735	1006	1627	1759	4805
Chile	1011	1379	2174	3617	4399	6811	18075
Peru	725	933	471	916	2048	3439	9309
Finland	1035	1238	1501	2293	5208	14416	38074
Norway	1562	2095	3040	5250	7947	13333	72578
Sweden	1446	1807	2520	4825	8816	18133	42043

quantitative evidence for the pre-1950 period.[1] As we show here, this feature is critical, since it helps understanding when the initial divergence took place. Moreover, our approach is based on topics and not country case studies. Likewise, since we share the idea that trade is a critical factor to understand the divergent patterns of these economies [2], we present a very long-term analysis of trade expansion and composition. We also expand the sample of Ranestad’s previous work on human capital in Norway and Chile, to include three Andean and three Nordic countries, as well as the covered period until today.[3] Furthermore, our work also considers the potential role played by taxation in contributing to the different development paths.

To sum up, the goal of this paper is to present a review of the literature and available quantitative evidence to identify: a) some stylised facts that may help understand the divergence between Andean and Nordic countries; b) those research questions that guide further work about the divergent effect of natural resources abundance in Andean and Nordic economies. In the following sections we analyse data on population, gross domestic product, trade, human capital, and public finances.

2. Sources and Methods

This study is based on a literature review and the use of secondary sources, some of them developed by ourselves in previous works. When available quantitative evidence is scarce, we use primary sources such as trade and fiscal yearbooks. The article combines the presentation and description of long term series with a discussion of the existing literature.

3. Results

3.1. Long-term economic growth

Table 2 presents average growth rates for different critical periods in world economic history. Between 1850 and 1870, no major differences appear in the economic growth rates of the two groups of countries. During the following period, the size of the economic downturn of the Peruvian economy stands out. Regarding the belle époque, it is noticeable that economic dynamism was present in both Andean and Nordic countries. During the Great War, economic crisis was persistent in Nordic countries and economic performance in Andean countries was not homogenous. Thereafter, whereas economic growth rates were higher in Andean countries during the 1920s, the opposite was the case during the 1930s. Again, whereas economic dynamism was higher in Andean countries during the Second World War, Nordic countries presented a considerable dynamism during the second half of the 1940s. During the Golden Age, economic growth rates were higher in Nordic countries. This feature was clear between 1973 and 1990, a result which is certainly driven by the negative effects of the crisis in Latin America in the early 1980s. It was not until the recent super-cycle prices that economic growth in Andean countries became higher than in Nordic countries. At a glance, the similar growth rates in different periods between the two groups of countries is obvious. However, countries’ ability to reduce the size and the duration of economic crises is considered as important as growth explosions in the long term trajectory of any economy. [34] Thus, in the following paragraphs we present the main events that may allow us understanding the long-term trajectories of our economies under scrutiny.

Table 2. GDP per capita Growth Rates. Selected periods. Own estimations in base Maddison Project.[45]

	Bolivia	Chile	Peru	Norway	Sweden	Finland
1850-1870		3.1	2.3	2.8	2.2	1.2
1870-1890		3.8	-3.6	1.3	1.8	2.1
1890-1913	1.9	2.9	4.6	2.2	2.9	2.8
1913-1919	2.5	1.0	4.7	0.7	0.6	-0.5
1919-1929	3.2	4.3	4.9	3.0	3.9	5.7
1929-1939	2.0	3.6	3.4	3.3	3.6	4.2
1939-1950	2.2	3.2	2.7	3.6	3.4	3.0
1950-1973	3.1	3.8	5.2	3.9	4.0	4.6
1973-1990	0.5	3.0	1.3	3.3	1.5	3.0
1990-2003	3.4	5.3	4.2	3.3	2.3	2.9
2003-2010	4.4	4.7	6.1	2.2	2.7	3.4

In the Bolivian case, it has been stated that its long-term economic performance was harmed both by poor growth during the 19th century and the existence of three severe economic crisis during the 20th century.[32] Regarding the first period, Bolivia was among those Latin American countries that suffered the most the economic impact of independence.[35] Whereas this was obtained in 1825, economic dynamism and modernization recovered slowly in the late 1850s., i.e. decades later Moreover, silver exports regained pre-independence levels just in the 1870s, which according to Herranz-Loncán & Peres-Cajías estimates were not enough to pull an economy that was concentrated in agrarian activities (around 70% of total GDP).[32,36,37] During the early 1890s, the drop in the international price of silver affected Bolivian exports which, in turn, its composition towards tin and rubber; thus, the rapid expansion of tin exports from 1904 compensated the 1890s crisis.[38,39] During and after the First World War, Bolivian exports concentrated on tin exports and suffered from the high instability of international prices, a fact that became particularly evident during the Great Depression, the first great crisis of the 20th century.[40] The structural changes generated by the National Revolution of 1952 (radical agrarian reform, nationalization of big mines, higher state intervention, educational reform, universal vote) contributed initially to a severe economic crisis that was followed by one of the most important and sustained periods of economic growth.[41] This was still generated by the mining sector, but also by a continuous process of food import substitution, agricultural modernization and exploitation of oil in the east of the country.[42] This path, however, suddenly ended and was reversed by the crisis of the early 1980s, the third big crisis of the 20th century. This drop was driven by external shocks, a severe drought and erratic macroeconomic policy.[43,44] The structural reforms of the 1990s inspired by the so-called Washington Consensus were successful in the stabilization of the economy but less able to spur the rate of economic growth. Thus, it was not until the commodity price super cycle that the Bolivian economy recovered high economic growth rates.

The long-term evolution of the Peruvian economy has been strongly related to the evolution of natural resources exports. Towards the mid-19th century it was guano, a natural fertilizer, which was central. The state ownership of this product and the monopoly of Peru on this commodity increased state’s revenues and modified the relationship between the State and the Peruvian society.[46–49] It allowed a superficial modernization of the country featured by the spread of railways and telegraph lines across the country as well as the explosion of museums, marble statues and a European way of life in the capital. Thus, far away from an economic diversification, the exports boom generated what would be known later as the "Dutch Disease".[46,48] Moreover, once the limits of the export boom were becoming evident around the mid-1870s, the country fought the "Saltpetre War" (1879-1884) which involved the loss of vast territories rich in natural resources as well as a profound fiscal crisis. The magnitude of the crisis led to radical fiscal, monetary and structural reforms. These changes prompted a robust re-introduction of Peruvian products to the world economy towards the 1890s. In contrast to the Bolivian case, the Peruvian export basket comprised several mining and agricultural products, including sugar, cotton, wool, rubber, oil and silver.[50–52] This export-led growth strategy increased

economic growth rates considerably but ended abruptly during the Great Depression, whereas the contraction was milder than in other Latin American economies. Thereafter, the price recovery of different agricultural commodities, particularly during the Second World War, drove the recovery of economic dynamism. The export-led growth model continued during the 1950s and 1960s but became increasingly criticized. This was in part due to social and demographic changes led by the expansion of public education and a sharp increase in total population (see below). Thus, during the early 1970s, an import- substitution-industrialization strategy, promoted by a new political class of reformist militaries such as General Juan Velasco Alvarado, took place.[53–55] During the 1980s the results of the new strategy in terms of diversification were not satisfactory, the country suffered high macroeconomic instability and Maoist guerrillas appeared in the countryside. Overall, this led to a profound contraction of the economy that, as in the Bolivian case, was overcome through radical reforms inspired by the Washington Consensus. During the last years, economic dynamism has been led again by natural resource exports

The Chilean case could be considered the most successful of the three Andean states. Firstly, Chile achieved independence with less damage and capital loss than its neighbors.[56] After a short period of political instability during the 1820s, Chile adopted a presidential regime and the economic dynamism was based on agricultural exports and mining resources, such as gold, silver and copper. This initial prosperous cycle ended in the 1870s because of a major fall in mineral prices and wheat demand. This crisis was "resolved" with the victory in the "Saltpeter War" (1879-1884), which meant the incorporation of huge new territories rich in minerals, particularly nitrates. Thereafter, Chile became a monopolistic producer of this product (one of the main non-metal minerals of the Second Industrial Revolution) which facilitated the acceleration of the economy and the increase of fiscal revenues.[57–62] Both processes have generated an abundant debate concerning the Chilean historiography and the effects that nitrates exploitation had on the economy, especially regarding the resource curse and the fiscal dependency originated by nitrates.[57,58,61,63–65] Besides this debate, the nitrate cycle is characterized by high growth rates and two deep crises, one after the First World War, and a bigger and definitive one during the Great Depression, when exports of nitrates fell over 90% and total exports circa 80%. However, the recovery was fast and the GDP per capita of 1929 was reached again in 1940. The economy post saltpetre was characterized by state led industrialization and another major mineral for export, namely copper. During 1950s the Chilean economy was facing several problems related with inflation and financial instability that lead to stabilization programs, such as the Klein-Sacks mission.[65,66] The 1960s are considered the best years of the industrialization process.[67] This period ended dramatically with the macro unbalances produced by the expansionary monetary policies under the socialist government of Salvador Allende and the coup d'état of 1973. The Dictatorship of Augusto Pinochet (1973-1990) implemented two liberalization programs, one during 1975-1981 and the second during 1983 - 1986, after the debt crisis (1982-83).[65,66] Throughout the dictatorship, copper continued to be the main export product, but the export basket became more diversified with other natural resources, mainly agricultural. In 1990 the authoritarian regime was replaced by a democratic system lead by a center-left coalition which maintained the main structure of the economic policy but increased social expenditures. The new model generated the so-called "Chilean miracle" which is featured by the existence of higher growth rates than others Latin America countries and the achievement of the highest GDP pc in the region.[65,68,69]

Regarding Nordic countries, Sweden developed from being one of Europe's poorest countries in the mid-nineteenth century to having one of the highest GDP per capita in the world in 1970. An exceptional growth of the Swedish economy took place from 1890 to 1930 with an annual GDP growth of 2.1%, and the country continued to grow even more up until the 1970s with an annually growth rate of 2.3%.[70] In the mid-19th century, agriculture accounted for 38% of the Swedish GDP, the industry for 23%, transport for 9% and other services for 28 % while the corresponding numbers in 1930s were 12%, 27%, 8%, 7% and 46%.[70,71] In the period 1890-1930, annual GDP growth was highest in the industrial sector, especially in mining, pulp and paper, and power/electric industry.[70,

229] Swedish industrial growth was based on domestic natural resources such as forests, iron ores, sulphide ores and rivers available for hydropower. After 100 years of high growth in GDP, with only short-term recessions after WWI and in the early 1930s, Sweden experienced a slow-down in GDP growth in the 1970s when a number of industries went into a structural crisis. Thus, in the 1980s, Sweden experienced a far-reaching structural change within its industry.[72] Another crisis emerged in 1991-1992 but the Swedish economy recovered in 1993, much thanks to a depreciation of the Swedish krona after a floating exchange rate was introduced. Export industries were the main driving force behind the recovery, which increased its share of GDP.[73] Sweden then saw a renewed productivity growth in natural resource-based industries such as the forest industry, but also within IT based telecommunications, biotechnologies, pharmaceutical industries and services (Schön, 2007). Today, Sweden is the biggest economy among the Nordic countries and is growing faster than the European Union on average.³

At the mid-19th century Norway had similar GDP per capita as Sweden but a relatively slow growth. Economic growth in this country has been based on a fairly equal income distribution. The country had practically no land nobility, Catholic Church or military caste. Nobility privileges were abolished when the country became independent from Denmark in 1814.[74, pp. 16-17] The feudal tendencies were weak and in the 19th century, small private farmers owned the majority of the soil. Self-owned farming represented eighty-one per cent in 1855 and to ninety-five per cent in 1875.[75, p.36] This was a particular situation in Europe.[75] In the nineteenth century, Norway had a large agricultural sector, which gradually reduced its share of GDP. Indeed, agriculture, timber and fish stood for 45.3% in 1865, but were reduced to 23.7% in 1910 and 4.6% in 1980. Shipping, mining, timber and timber-related industries were also important. Manufacturing industries have varied in size, but remained relatively small compared to other sectors.[75, p.237] From around 1930, the country took a step forward and began growing faster. This growth certainly had multiple causes, but the large-scale chemical- and electro-metallurgical industries, based on the utilisation of hydroelectric power, is emphasised as important. Production of aluminium, silicon, ferro-alloys, magnesium, steel, artificial fertilizer, and other metals and minerals, started in the early 20th century and grew rapidly. Norway was affected negatively by the Great Depression, but not nearly as much as the Andean countries. From the mid-1940s, after the recession during WWII, an economic gap emerged. Norway stayed ahead and grew considerably more than the Andean countries. The chemical- and electro-metallurgical industries grew to become one of the cornerstones of the Norwegian economy and it is found that it was this industry in particular which transformed Norway into a prosperous industrialised country. In the late 1970s, Norway surpassed Western European growth average, which is largely explained by another mineral industry, namely oil and gas, which soon became critical for the Norwegian economy. Therefore, notwithstanding slow economic growth during the nineteenth and early twentieth century, Norway is today one of the richest countries in the world. The country even surpassed Western European average in the late 1970s and productivity and income are among the highest in the world, even without the extra contribution of the country's oil and gas sector.[76,76]

Finland was for a long time was the poorest country among the Nordic countries, and Swedish long-term growth rates were higher than the Finnish up until the 1950s.[77] However, starting on a lower income level than Sweden in 1870, Finland managed to transform itself from a predominantly primary production-based economy to a modern welfare state as the other Nordic countries, with a large service sector and with a highly competitive business sector. In 1870, agriculture amounted to 75% of the employment share (% of GDP) and industry and construction to 16% and services to 9%. In 1934, the corresponding numbers were 52%, 26% and 29%.[78, pp.143-144] After the 1870s, in particular, the manufacturing sector developed rapidly, production became diversified and exports of

³ Magnusson, "Swedish GDP Hits Fastest Pace Since 2010, Trouncing Estimates." Bloomberg Markets. Available from: : <https://www.bloomberg.com/news/articles/2017-07-28/sweden-s-economy-soared-in-second-quarter-trouncing-estimates> (accessed January, 28).

manufactured goods and timber grew, especially to Russia but also western markets. Finland large forest areas have been important factor of its development.[79] Two thirds of Finland's total area is covered with forests and other wooded land, while other natural resources are scarce. Despite not blessed with abundant natural resources (the Outokumpu copper mine was exhausted in the 1980s), Finland embarked on the road to industrialization using its forest sector, and like Sweden and Norway its hydro power potential and the rural labour reserve. With a growth rate of 2.2 % per annum and capita from 1860 to 2000, Finland surpassed most other countries in the world in terms of long-term growth [80, p.62]. The significant periods for catching up with Western Europe were the interwar period and particularly the 1980s.

Behind the Nordic countries' successful economic development lie complex institutional factors, not easily quantifiable, such as high level of general trust; a historically strong presence of a Social Democratic Party; powerful unions; a public sector in charge of systems for education and health; a general welfare state and high tax levels; and state-owned companies, not the least within the transport and the energy sector.[70,74,78,80]

3.2. Economic divergence

Once revised the long-term trajectories of each economy, we focus on the relative distance between both groups of countries. We start analyzing population figures, since a late demographic transition has been said to be an important explanation for the economic divergence.[81] We then turn to GDP per capita levels.

Figure 1 presents data for the population ratio between Andean and Nordic countries from the mid-19th century to recent years. In the case of Bolivia, population grew at a lower or similar rate than the Nordic ones until the end of the 1950s. As for the Peruvian case, similar rates of population growth until the end of the 19th century are observed; since the 1930s, Peru had much higher growth rates. Regarding Chile, higher population growth rates since the beginning of the period under analysis are noteworthy. During the 19th century, this was in part related with the fact that Chile was a country that received migrants whereas the Nordic expelled migrants.[3,82,83] For instance, according to Grytten, between 1836 and 1930, only Ireland had more migrants than Norway.[84] Population growth rate differences thereafter are certainly explained by differences in the timing of the demographic transition, particularly after the Great Depression. Therefore, a first conclusion to bear in mind is that population pressure should be considered when examining the divergence process between the two groups. However, it is also clear that the explanatory power of this variable is not homogenous throughout time, and is not relevant at the same point in the three Andean countries under scrutiny.

The population hypothesis is one of the factors to be considered in the explanation of the divergence among our Latin American countries and the Nordic Region. In the aforementioned work by Blömsström and Møller [1], they addressed as a key factor the delayed demographic transition in Latin America. A relevant demographic burden could threaten the gains of economic growth. This appreciation should be understood in the context of these scholars: in the 1980s and 1990s, the effects of the decreased infant mortality rate were clear and the relation could be developed straightforward. Bolivia, until the 1950s, was a country with less population than the three Nordic countries analysed in this paper. At the end of the period (2010s), its population is around 2.2 and 2 times the population of Norway and Finland.

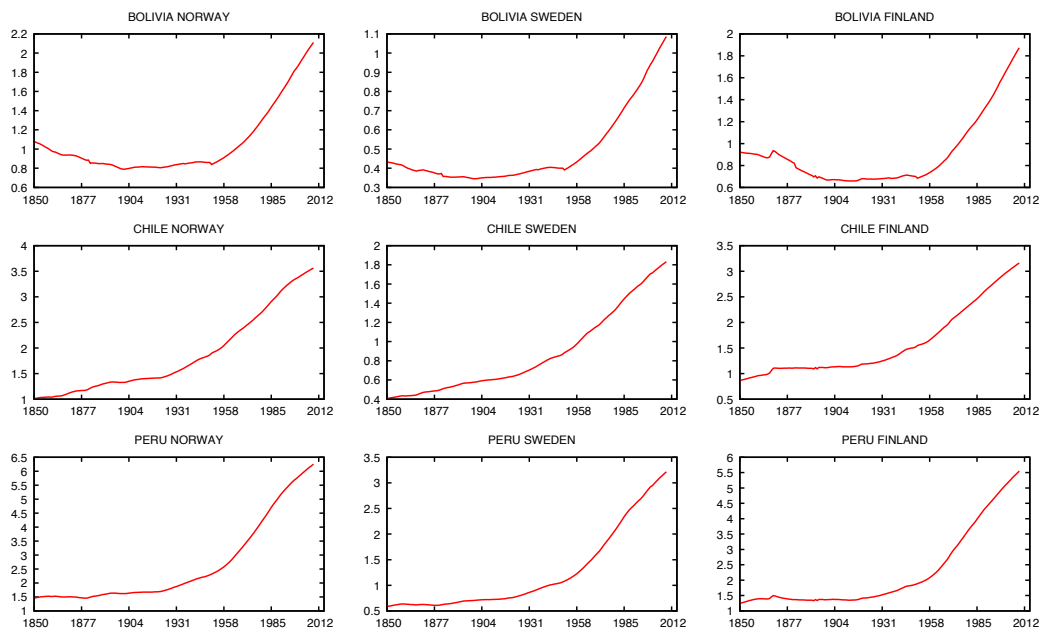


Figure 1. Population ratio, 1850 - 2010

Figure 2 presents the GDPpc ratio, which allows us to identify when Andean countries fell behind the Nordic countries. Remembering also figure 1, we can appreciate that divergence in population growth, which is mostly a phenomenon from the second half of the 20th century (when Blömstrom and Meller wrote their book), appears after the economic divergence had taken off. In terms of GDP per capita comparison, the three Latin American cases have their own histories and trends, but they share a common structural break accompanied by a change in level after the Great Depression.

In the case of Peru, the break is specially dramatic, because after more than fifty years of convergence, closing the income gap with Sweden until 0.6, it lost these gains in a few years and widened the gap with the Nordics until the eighties. The prior episode of divergence during the late 1870s and early 1880s -due to the crisis of guano and the Saltpetre War- is also remarkable. Since the mid 20th century, an erratic evolution of the Peruvian GDP and higher population growth rates led to increased economic distance with the Scandinavian countries. Divergence accelerated during the early 1970s due to pitfalls of the new economic strategy, and it was not until the turn of the century that a new sustained convergence process took place.

In Bolivia, a clear divergent pattern during the second half of the 19th century stands out. Divergence stopped during the first third of the 20th century but restarted with the Great Depression. Whereas a recovery took place during the Second World War, divergence accelerated again during the 1950s because of the economic crisis in Bolivia. From the early 1960s to the late 1970s divergence stopped, which is explained by higher GDP growth rates as well as higher population growth rates in Bolivia. Divergence accelerated again during the early 1980s due to the debt crisis and the ratio stayed constant in very low levels until 2005, when a new convergence process started.

In contrast to the previous experiences, the Chilean case stands out by the forging ahead process towards Finland and the stabilization of the GDPpc ratio with respect to Norway and Sweden. This is significant given the higher population growth rates in the Andean country. These trends, however, changed after the Great Depression when divergence started. This accelerated during the early 1970s because of the political turmoil in Chile. Thereafter, two processes of convergence are evident: the first a short one during the first half of the 1990s and the second one took place at the turn of the 21st century, and was caused again by the relevance of natural resource exports in Chile.

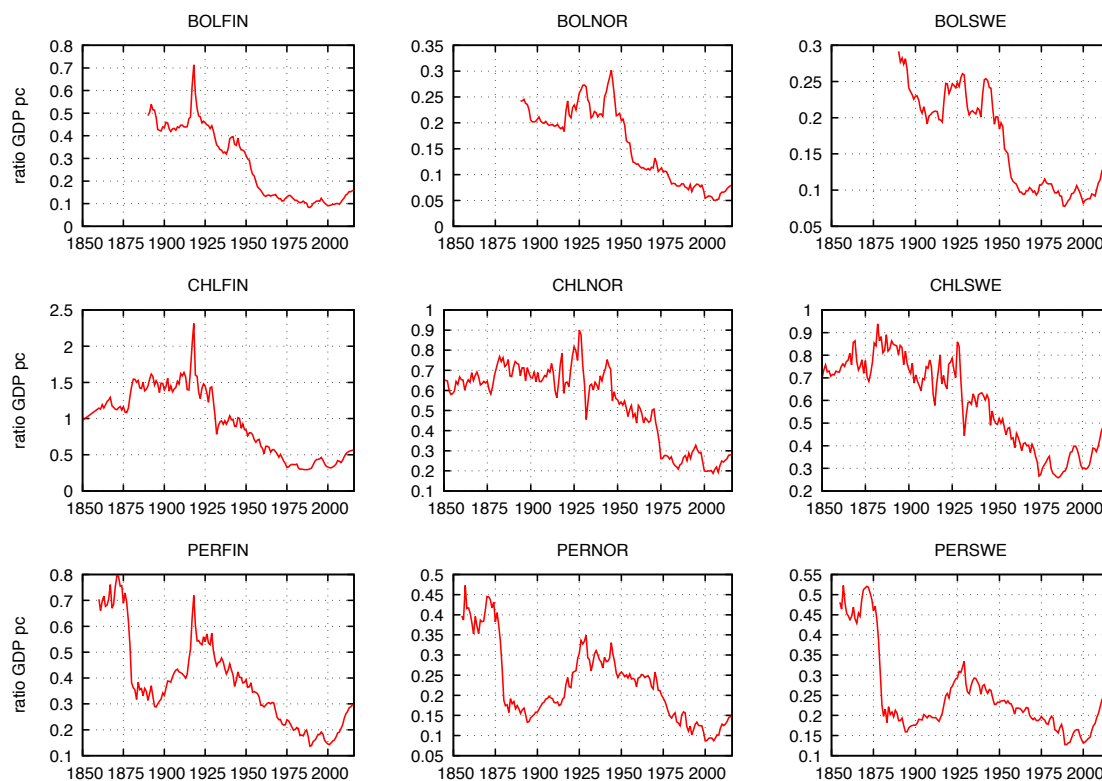


Figure 2. GDP per capita in Geary - Khamis Dollars. Ratio between Andean and Nordic Countries. 1850 - 2010

Summing up, the quantitative evidence presented here stresses the existence of non-negligible differences between both groups of countries already at the mid-19th century.⁴ However, these differences were not as profound as those that exist today. If population growth in Latin America is the variable to blame, it should be noticed that its impact had a different timing in the three Andean countries analysed. Therefore, we suggest the need to turn the analysis into natural resources and their economic linkages. The GDPpc data show the existence of more frequent and deep economic crises in the Andean countries, as well as the relevance of the Great Depression as a breaking point in our comparison. This, in turn, highlights the need to identify the differences that emerged during the last decades of the 19th century and the first third of the 20th century in both groups of countries that may explain the divergent paths triggered by this external shock.

3.3. Trade evolution and industrial development

3.3.1. Trade

The existence (or not) of the *Natural resource curse* is fundamentally linked to trade, and, specifically to international market integration. During the 19th century, Latin American and Scandinavian countries were taking advantage of reduced trade costs given the new technologies of the industrial revolution (railways and steamships). These peripheral regions sold their natural resources to the core economies and became part of the world market.[14,72,85,86] Here appears the Prebisch-Singer hypothesis and the adverse effects of a trade matrix exclusively or mainly based in Natural Resources.

⁴ It should be noticed that these differences are not evident when the previous Maddison Project is used.[33] Given that our concern is related more with trends than levels and that trend differences do not appear between both databases, we preferred to use the last database due its methodological improvements.

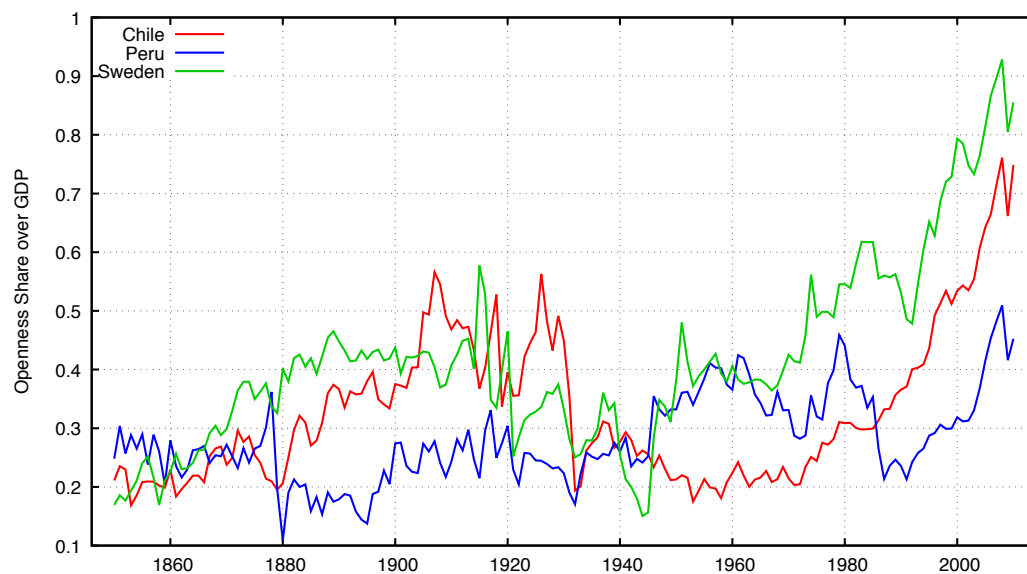


Figure 3. Openness (Exports + Imports as share of the GDP). Chile, Peru and Sweden, 1850 - 2010

How different were Andean and Nordic countries in their insertion at world market? One way to measure it is the openness indicator (share of exports plus imports on GDP). Given our current available data, we present the trends for Chile, Peru and Sweden (figure 3). Chile and Sweden had similar trends and levels until the Great depression, whereas Peru was a bit less open, specially after the War of the Pacific. The inward-looking model adopted by Chile after the Great Depression meant a reduction in openness; meanwhile, Sweden was recovering dynamism through international trade.

The main difference about trade in Sweden, comparing its path with Andean countries, is its export basket and how the country diversified its economy from a base in natural resources. As a counter-example, we could use the case of Chile. In table 1 and figure 2 we can observe until 1929 similar trends with Norway and Sweden, and a higher GDP pc in relation to Finland. If we take a detailed look to the Chilean trade structure, it's found a highly concentrated and low diversified matrix, with an enormous weight of mining, exposing the country to price volatility and structural changes (Figure 4). These changes occurred in the Great Depression. After a big drop in the GDP pc, Chile recover its growth trend and the end of the 1930's, but without any main change in the economic structure, only a replacement in the main commodity, becoming copper the main export product instead Saltpetre.

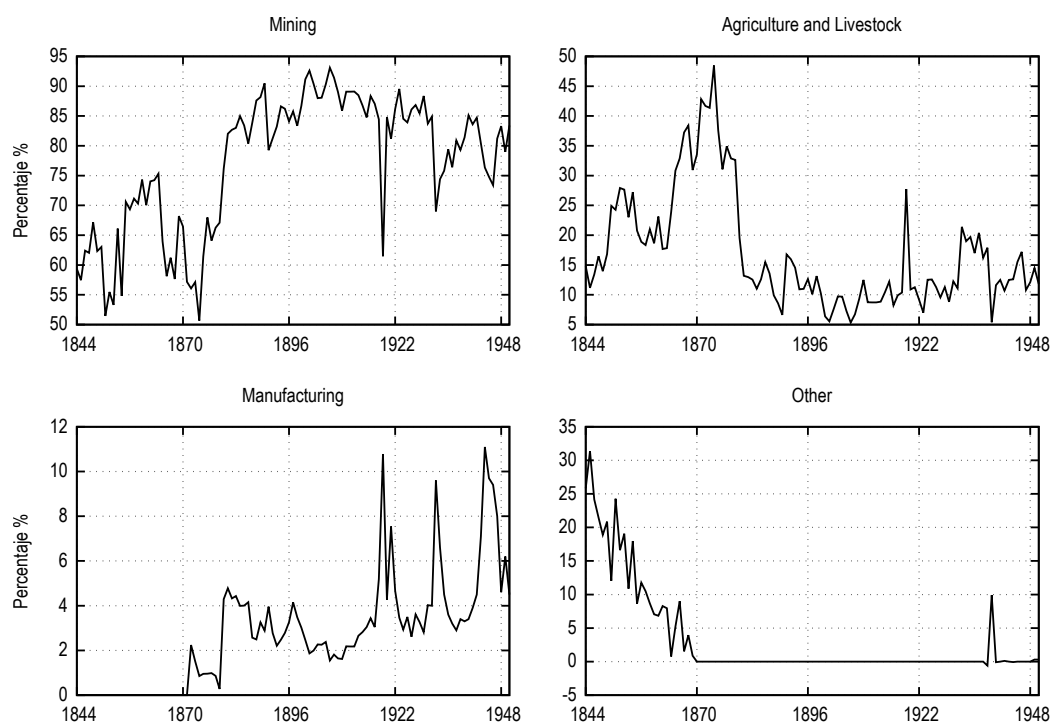


Figure 4. Chilean Exports, percentage of total exports. 1850 - 1950

Exports concentration is particularly high in Bolivia. From a long term perspective, the transition from mineral products (mainly silver and tin) to oil products (mainly natural gas) stands out. This transition is verified in the relative importance of hydrocarbons in the GDP, the export basket and taxes from natural resources exploitation.[87] Moreover, in contrast to Nordic countries, the relative importance of industrial exports has been historically negligible. This is related with the late beginning of Bolivian industrialization (around the early 1920s) and the fact that the relative importance of this sector in total GDP has barely changed since the 1940s (around 15%).

3.3.2. Industry

In spite of the current trends towards services in advanced economies, the industrial sector has been crucial for development in many historical cases.[14] In this section, we summarize briefly the main traits of industry and its relation with natural resources in our six cases.

Industry has been historically weak in Peru. The trade liberalization in the 19th century dismantled the colonial industrial establishments. At the end of the century, industry began to be reconstructed around the export sector, with activities such as repairing furnaces, tools and pieces used for refining sugar and minerals. After the First World War, however, the growing sophistication of the technology used by the export economy ended with this incipient industry. Japanese, Spanish and Italian settlers who arrived in Peru around 1900 started a light industry of food and beverages, which grew during the 20th century thanks to urban expansion and protectionist tariffs. In the final decades of last century, the urban construction sector joined (cement, toilets, faucets, etc). The first steel factory was created in 1956, and enjoyed state protection until the 1990s. At this point, the opening of the economy entailed the crisis of a large part of the industrial sector, and virtually only construction, food and clothing remained.[88,89]

The foundation of the School of Engineers in 1875, during the guano boom, was a fundamental milestone in the history of Peruvian industry. However, its orientation towards mining and the saltpeter war limited for a long time the role of this institution for manufacturing. Industrial workers were trained at the School of Arts and Crafts, established in 1864 but without great effects initially

given the weakness of industry and the fiscal crisis due to the saltpeter war. It reopened in 1905, during the government of José Pardo (which is why this School now bears the name of José Pardo Higher Technological Institute). In 1961 the training of industrial personnel was reinforced with the founding of the SENATI (National Training Service in Industrial Work). The professional aspiration of the majority of young people, who identify social progress with office work, typical of the middle classes, limited the role of these institutions.

Regarding Chile, its industrialization has been focus of several debates. For example, the Chilean industrial GDP in the period 1880-1830 has been revisited several times, and still is cause of controversy among economic historians.[59,68,90,91] One of the consensus achieved about this period, is related to the industrial backwardness. The share of the industrial GDP in the total Output was between 10 and 15% and was concentrated in consumer goods. During the First World War, an incipient industrialization was growing, in response to the lock of international market, however, with the end of the conflict, the Country resumed its dependence in foreign markets.[57-59,61]

The state led industrialization (also known as Import Substitution Industrialization, ISI) strategy has been object of several critics, especially for the poor economic performance during the 1950s. However, the analysis should not only look at the 1940-1973 period but take into account the structural restrictions of the Chilean industrialization process (1870 - 1970) as a whole. Thus, if we keep our view just in the ISI years, we are not considering the problems faced by the Chilean economy to consolidate a diversified economy in the years previous to these policies.[57,61,91] In a long term perspective, the ISI period could be considered a failure in GDP growth terms, but, taking into account structural transformation and development, the share of industry was growing and real wages kept matched with productivity gains.[67]

In the case of Sweden, during the 1880s, iron and forestry were the dominating export sectors and they were mainly driven by the British market. During the end of the century, iron and steel started to be transforming into machinery products before exports, and forestry based exported commodities changed from being timber, to sawn wood, and pulp and paper.[70,92,93] Indeed, Swedish firms became successful in exploiting the technologies of the Second Industrial Revolution from the late nineteenth century through engineering entrepreneurship that grew into large export-oriented corporations backed up by strong commercial banks.[92,94] The development of Swedish engineering reflected a small number of specific technical innovations introduced by Swedish inventors and entrepreneurs - the so-called 'genius industries', including companies like Ericsson, SKF (a ball bearing), ASEA (today ABB), and Alfa Laval (the separator).[93-95] At the same time, overseas experience among Swedish engineers was, like in the Norwegian case, far from uncommon between the 1880s to the 1940s. For instance, around 40% of newly graduated Swedish engineers started their careers in the United States or in Germany (Grönberg, 2003). Thus, the combination of export-based manufacturing industries based on refined and processed materials (e.g. pulp and paper industry, steel) and multinational engineering firms came to drive Swedish economic growth. In the 1950s, the share of manufacturing in Swedish exports was getting close to 50% and only the United States had a higher share among the OECD countries.[93, p.271] The engineering industry became, and still is, a strategic sector for modernizing the Swedish economy.

As in Sweden, industrialization in Finland was based on its iron and rich forest resources, and sawn timber was sold to both Russia and western markets.[78, p.144] An export led growth of the sawmill industry and gradually of the pulp and paper industry took place, with several companies emerging like Kymmene AB (today UPM), W Gutzeit & Co Ab (today Stora Enso) and A. Ahlström Oy (Alström Corp.) that grew into large corporations. Like in Sweden, Finland saw a growth in innovating entrepreneurship, including Fredrik Idestam foundation of Nokia. Nokia was established in 1865 to produce pulp and paper, and subsequently diversified into unrelated sectors, such as forestry (tissue), rubber, and cables, and later during the 1960s into electronics.[96] Forests have been the most important natural resource for the Finish economy historically until present.[80, p.16] Overall, Finland

became efficient in exploiting opportunities in export markets and was during the catch-up phase a good adopter and copier of foreign models.[78, p.205]

In Norway, natural resource products have represented a large share of exports. Timber and fish traditionally dominated the foreign trade.[97, p.97] Timber accounted for the largest export industry in the late 19th century and after the turn of the century, timber, pulp and paper represented more than 40%. Agricultural products stood for over 30% in the late 19th century and continued to be important export goods after the turn of the century together with fish, food and beverage products. Minerals, metals and chemicals were also important export products, especially aluminium, ferro-alloys, magnesium, steel and artificial fertilizer from the late 19th century. Exports of mineral and metal products increased from less than six percent before 1913, to over 20% in 1930.[98] In the 1970s, the mineral production branched out the extraction of oil and gas, which in turn developed to be the most important economic industry. Oil and gas products has accounted for more than fifty per cent of exports some years. Some years oil and gas products have accounted for more than fifty per cent of exports. It should be stressed, however, that the country developed multiple relatively big natural resource industries - as well as a large shipping industry - from an early stage, which expanded during the 20th century. The diversified industrial structure made the country less dependent on one industry, and in turn less vulnerable than many of the Andean countries, and contributes to explain the country's remarkable growth.

Indeed, growth in Norway has largely been based on linkages between industries and specialisations within natural resource sectors. Development has been characterised by industries naturally encouraging one another. One of the cornerstones of the Norwegian economy in the 20th century - before oil and gas - was the large-scale chemical- and electro-metallurgical industry, which branched out of the mining sector. This new industry was largely based on large foreign investments, notably, Swedish, British and North American.[99] Total foreign capital in Norwegian industry represented 38.8% in 1909 and 80.3% in mineral and metal extraction.[99, p.36] Important companies, such as Elektrokemisk and Norsk Hydro, were established with Swedish capital (Wallenberg) and normally employed hundreds of workers.[99, p.34] A key point here is that it seems like multinational companies have been more integrated in the Norwegian economy - and Nordic economies more widely - than in the Andean economies, and that Nordic countries have benefitted more from foreign investments than Andean countries.[81,99] It is reasonable to believe that differences in 'absorptive capacity', which in turn can be related to discrepancies in knowledge development, contribute to explain such differences.[3] The 'knowledge gap' between the Nordic and the Andean countries is further discussed in the next section.

3.4. *A knowledge gap*

Industrial development in the Nordic countries has relied heavily on transfer of technology from abroad. Innovation has involved the transfer of equipment, machinery, working methods, techniques etc. from other countries, , and adapting them to local conditions. Transfer of technology, notably from large industrial powers, is often stressed as key for small 'catching-up economies' of the Industrial Revolution.[100, p.34] An open and flexible attitude towards new ideas and knowledge development, and measures to enable transfer and absorb knowledge, has a long history in these countries. Copper and silver mining in Norway, which developed in the 18th century, was based on German expertise. Kristine Bruland shows that the advance of the textile industry in the mid-19th century involved multifaceted technology transfers from Britain in collaboration with local workers.[100] Similarly, the development of the workshop industry from the 1840s was a result of "... training and education, access to information on foreign technical advances and the ability to use information." [100, p.73] In his analysis of travelling Swedish engineers from 1880 to 1930, Per-Olof Grönberg finds that learning experiences from abroad was highly valued by Swedish firms.[101] This 'outward-looking' and open position persisted. In Norway, large-scale mining from the late 19th century, and the important oil and gas industry largely developed based on the adoption of foreign extraction techniques.[99]

The importance of international knowledge transfer in the Swedish interwar copper industry is also clearly demonstrated by Bergquist and Lindmark in their study of the Swedish company Boliden.[102] In exploring the strategies adopted by this firm in constructing its large copper smelter in the 1920s, they find the Swedish industrialists, who worked as engineers in the US, went back overseas to access knowledge through their established networks. In developing a metallurgical process for Boliden's copper smelter, both in-house R&D and transfer of knowledge from US copper companies became embodied in its smelter technologies.

In line with these evidences, Kristin Ranestad hypothesises that the diverging paths of the Nordic the Andean countries is partly explained by differences in knowledge development. She analyses and compares two of the 'natural resource-intensive economies' countries which are considered here, namely Chile and Norway.[3,103] They have been closely similar in industrial structure and geophysical conditions, and they had similar growth during the 19th and early twentieth centuries, yet they have had different development trajectories thereafter. Her thesis contributes to the debate about how and why some economies based on natural resource activities have been more dynamic and innovative than others by indicating contributing factors of key differences in one natural resource sector both countries developed, namely mining. Initiatives were made both places to develop and accumulate knowledge, notably through the establishments of domestic and foreign mining enterprises, formal mining education, industrial societies, technical journals, travel scholarships and research centres. However, more knowledge was developed and accumulated in Norway than in Chile, which indicates that there was a knowledge gap between the two countries. Mining instructions were similar, but there were striking differences when it came to (1) number of graduates, (2) number of travel arrangements for practical learning and (3) organised geological mapping and ore surveys. These differences contribute to explain the emerging gap of the two sectors, which in turn may be linked to the role of the state. In Norway, the state was much more active in supporting knowledge development through funding of basic and technical education, scholarships and the National Geological Survey. In Chile, these key knowledge organisations were given lower priority by political decision-makers.

In wider terms, differences in literacy rates and levels of basic and technical education in the 19th and 20th centuries between the Nordic countries and the Andean countries indicate a higher degree of knowledge development in the former than in the latter. Indeed, Norway started early with a national alphabetising. Campaigns to improve the reading and writing skills of the Norwegian population have roots back to the 17th century.[104, p.271] The Church encouraged reading through religious texts from early on and the first school law in Denmark-Norway was introduced in 1731. The oldest primary school in the Nordic countries opened in Bergen in 1740 and was financed by the Cross Church. During the 19th, the government gradually increased public funds to education.[97] From 1827, all children in the country between seven and fourteen years old should receive teaching in reading, writing and some calculation for at least three months a year .[105, pp.242-243] In 1837, 86.4% of the children in the appropriate age obtained instruction. In 1860, a law, which established a school system with regular school for all during seven years, was introduced .[105, pp.242-244] The share of literate people in Norway was very high from early on compared to other European countries. Fritz Hodne finds that in 1873, around 87% were able to write and read and 99% were able to read.[105, p.250] Other sources show that by the 1890s, the literacy estimate rate was near a 100%. According to Carlo Cipolla, more than 70% of the adult population was literate by 1850 and Norway became one of the countries with highest literacy in Europe.[106, p.113]

Literacy among the Swedes was also comparatively high in an European perspective already before the mid-19th century, much due to the Swedish Church efforts from the 18th century to control the Swedes ability (including the impoverished population) to read religious text. Literacy was reinforced by the Elementary School Reform of 1842.[70, pp.75-76] In Finland, in 1880, only around 10% of the population was able to both write and read. Then the situation changed considerably. In 1920, 58% of the population could both write and read.[78, p.148] In the 20th century, Finland came

to heavy invest in education, training and technological and industrial R&D, especially during the second half of the twentieth century.[78,107]

In contrast, there is an agreement among scholars that education and literacy were very poor in the Latin American region during the 19th century.[108] Likewise, despite some improvements during the 20th century, it has been suggested that these changes were not enough in terms of the quantity and equity of public spending and not outstanding from an international perspective.[109,110] In the Chilean case, for instance, it was only in 1920, more than a century after independence, that compulsory primary education was introduced. As late as the 1950s, approximately 9% of the school age population never attended school; 30% of those who entered the first grade abandoned school within the first two years and only 28.6% of the school age population completed their primary education. In 1960, only about 20% of a given age cohort entered secondary education. Moreover, only one half, or fewer, of the high school graduates succeeded in passing the final high school exam.[111, pp.305-306] A large share of the population in Chile was illiterate up until recent decades. In 1865, only 18% of the population was literate, which increased to 30.3% in 1885.[112,113] In 1950, 19.8% of the population was still illiterate.[1, p. 7] A similar pattern is evident in the Peruvian case: according to official statistics, illiteracy was 81% in 1876, 79% in 1902, and still 39% in 1961. Children between 6 and 14 who attended school were 29% in 1902, and 35% in 1940. As for the Bolivian case, it should be noticed that in spite of radical political changes and the continuous increase of public spending in education from the late 1930s, full literacy and full primary attendance was achieved just at the turn of the 21st century.[114]

3.5. Fiscal policy

Another possible explanation for the divergence between Nordic and Andean countries is the role of the public sector. Today, the Nordics are known for having high levels of public involvement in their economies. For instance, the Norwegian public sector manages the country's oil wealth and Scandinavians enjoy encompassing welfare states which provide for their needs in studying, keeping healthy, parenting, and aging. Were the Nordic states active in economic development already early in our period? Could this contribute to explaining the different outcomes in the six countries?

The literature has indeed identified the public sector as a driver of economic growth in Scandinavia, already in the late 19th century. The Swedish case can serve as an example: according to Schön, the state took on a prominent role in investment in physical infrastructure (railways, telegraph, electrification), and in education.[115] Similar patterns have been found in the Norwegian and Finnish economies. In the case of Chile, there is a debate about the destination of nitrates's rents and how the resources boom was managed. There was a noticeable investment in infrastructure, but extremely concentrated.[60].

Public investment, of course, needs public resources. The Nordics have high tax-to-GDP ratios to fund their extensive public services, a trait whose historical roots can be traced quite a way back. Figure 5 shows tax revenues as a share of GDP for our six countries. Even though some of the series are not complete - and will be the object of future work -, some general facts can be appreciated. First, the levels in Andean and Scandinavian countries lied quite close to each other at our point of departure. Chile is seen together with Norway, Finland and Sweden with a tax revenue ratio between 5 and 10% of GDP, which was the standard for Western countries at the time. Bolivia and Peru were slightly less able to obtain public revenues, but the difference was not large. Today, however, Scandinavian countries provide their public sectors with incomes corresponding to 40-45% of GDP, whereas the corresponding number in the Andean countries is near 20%. The difference between both groups is now very acute, although tax ratios have decreased in the Nordic countries in recent times, while the opposite evolution has occurred in Bolivia, Chile and Peru.

When did this divergence appear? The earliest signs seem to show around World War I, which prompted increases in the tax revenue in Norway and Sweden, whereas the Chilean ratio decreased. The image of two groups of countries is not clear, however, until the 1930s-40s. At this point, the

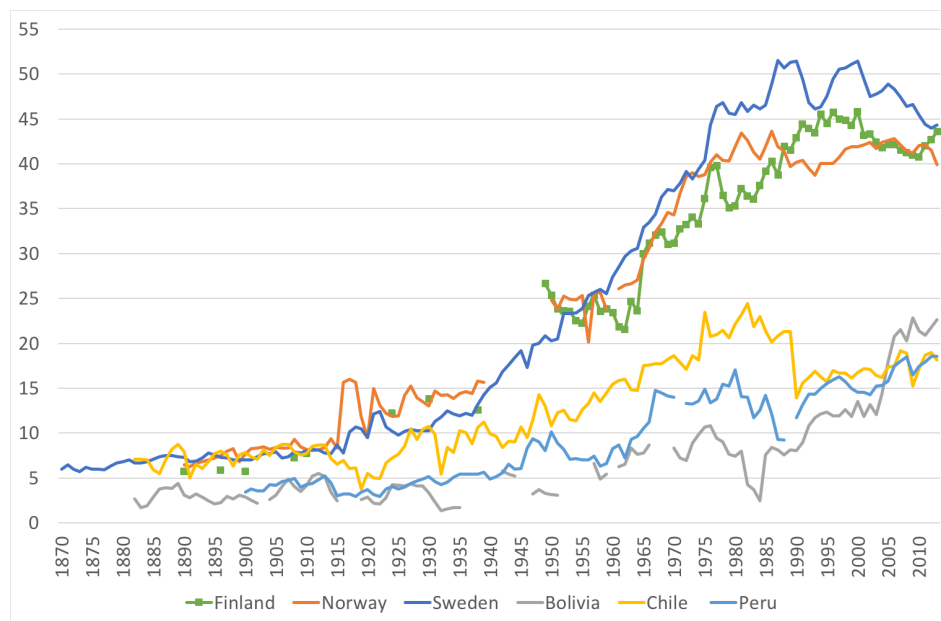


Figure 5. Tax revenues as a share of GDP, 1850-2010 (%). Sources, see Appendix A.1

Nordic tax revenue levels had taken off intensely. Our American countries, however, showed a lower and more erratic evolution of their fiscal capacity.

Changes in the tax structure could be a driver of the increase in tax revenue levels. The introduction of modern forms of taxation implied a diversification of the tax base, which would have allowed obtaining more public revenues and, in turn, funding public investment. The literature has identified the occurrence of several tax transitions along the path of economic development.[116,117] In the late 19th century, public revenues in many countries were heavily based on taxes on external trade: these were relatively easy to administer and also the place where some economic surplus was found.[118] Gradually, new forms of taxation came to be and grew in importance: modern personal income taxes were introduced in some countries in the late 19th or early 20th century, but were not big sources of revenue until World War I or much later.[119,120] Within indirect taxation, the general development was the decrease in the role of customs and export taxes, and the corresponding increase in internal taxation, mostly of the general type - turnover or, eventually, value added taxes.

The tax history of Scandinavia has identified them as early modernizers. They introduced personal income taxes near the turn of the 20th century, and these soon provided high levels of tax revenue. The Nordics were also determined users of heavy consumption taxes in the second half of the 20th (value added taxes with comparatively high rates and few exceptions). These, together with social contributions, were the fiscal bases of active welfare states.[121,122] Bolivia, Chile and Peru (like Latin America in general) have been more late in enacting income taxes, which still today represent very low shares of their GDPs and public budgets.[123] Fiscal capacity remained limited.[124]. Value added taxes were introduced in the region during the 1970s, allowing an increase in revenue at a time of tariff reduction (Bolivia 1973, Chile 1974, Peru 1976).

Our future work will evaluate the tax divergence and the several possible factors that can account for it. These can be classified as economic, political, and administrative. Firstly, higher levels of economic development provide the surplus from which public revenue has to obtain its resources. It is no coincidence that in the 1930s we see Nordic countries forging ahead from the Andean, who were heavily affected by the Great Depression (Figure 2). But the story does not end with the size of the economy. Political channels are also potentially important. Lindert has signaled democracy as a determinant for increased social spending - and the corresponding revenue needs.[122] Aidt & Jensen examined the expansion of income taxes in Western countries, also finding that the extension of the

franchise tended to favor this development.[125] Together with a prolonged democratic experience, Nordic countries also have a history of significant local autonomy (including in fiscal management), which is a differential trait with respect to Latin America.

The impact of democratic institutions may, however, be highly intertwined with inequality levels. Sokoloff and Zolt pointed out that, within the Americas, regions with higher inequality developed tax systems with lower revenues and in turn lower social spending.[126] Scandinavian countries display today the lowest levels of inequality in comparative terms, but whether this was likewise in the long 19th century remains to be clearly established. Roine & Waldenström showed that top income concentration in Sweden was similarly high at the onset of the 20th century as in other Western countries - although it decreased intensely thereafter.[127] The literature has, in any case, remarked the importance of the structure of land property, with small freeholders in Scandinavia having a political voice early in the 20th century.[71,115,128]

Administrative considerations should also be taken into account. All taxes are not similarly easy to collect, and the context to which they are applied makes a difference .[129,130] Our work will consider primarily two such factors: literacy / numeracy and the business structure. Concerning the first, basic numeracy skills are needed for an income tax system where people are asked to file their own returns and self-assess their incomes and tax payments. Several works point towards Scandinavia having high levels of numeracy already at the beginning of our period, which would have made the administration of an income tax system feasible.[131,132] (Remember as well the references about high literacy in the previous subsection). Business size is another determinant of tax collection, and has been acknowledged as such in modern times.[133,134] The business structure conditions as well the potential for formation of powerful pressure groups, which might position themselves against high taxes.

To sum up, here we propose a research agenda about the evolution of fiscal systems in Scandinavian and Andean countries. While the literature has provided national tax history accounts, a comparative approach will shed light on the divergence in fiscal terms and the role it played for the different paths taken towards economic development. We aim to establish when and how the Nordics were able to diversify their tax bases and increase their tax revenues. Their experience could help us understand the lack of success of our Latin American cases in this respect. We suggest that the details of the tax transitions could be intertwined with the levels of fiscal dependency from natural resources.

4. Discussion and further work

The current extreme income differences between Nordic and Andean countries it has not been a constant. The role of Natural resources regarding this feature has been highlighted through the article and new questions have opened. Natural resources played a role in the divergence. This role requires much more research to find useful policies for developing countries with abundant Natural Resources endowments. We have summarized the future work in the following points:

4.1. *Genuine savings*

In order to quantify sustainable development, mainstream measures such as GDP have become older and not suitable to account for wealth, in a comprehensive view. Facing these challenges, since the 1990s, there is a constant work on green and sustainable national accounts. One of the most spread of these measures is Genuine Savings (Hereafter, GS), which account for net savings, natural resources depletion, environmental damage (using CO2 emission as proxy), human capital formation and total factor productivity gains. There are some advances regarding two of the countries of our study; in the case of Sweden, GS estimations are available since 1850 and in the case of Chile, since 1900.[135,136] Giving the new data elaborated by the authors of this article, we expect to have GS estimations for our six countries at the end of the project. These new measures are going to show us how much of the natural resources depletion have become in useful investments (fixed capital and human capital).

4.2. Trade and Market Integration

In the case of trade and market integration our work will focus on the composition of exports baskets, and how their evolution (or path dependence) could be one of the reasons behind the divergence between Andean and Nordic countries. This last point is related to the old theory, but totally "alive", about the evolution of the terms of trade (and its volatility) in the long run and its impact on growth. Although the Super Cycle has challenged this hypothesis, the downward trend in oil prices and commodities after the Great Recession have meant a revival of these ideas. Lastly, another key factor which explains the existence of different patterns between countries is their access to distant markets. In that sense, those countries specialising in natural resource exports which were closer to the UK could benefit more in the long run.[137]

4.3. The knowledge gap

The knowledge gap hypothesis will be explored through the comparison of more country cases and by looking beyond the mining sectors of Chile and Norway. The idea is to analyse if the relationship between learning, knowledge accumulation and technical innovation might contribute to explain the diverging paths of the two regions.

4.4. The fiscal contract

Our future work will also compare and analyse the structure of tax revenues in these six economies. The literature has signalled that where the public sector enjoys a boom of revenues from expanding commodity exports, incentives to develop fiscal capacity might be lower.[138] This could in turn affect the emergence of a "fiscal contract" between state and citizens, where tax revenue (and specially direct taxes) would make governments more prone to provide valued public goods in exchange.[139] Taking advantage of previous work, we will therefore seek to establish the levels of fiscal dependency from natural resources across these economies, and how it might have affected tax transitions.[124] Did the Nordic countries have lower levels of dependency and, therefore, higher incentives to look for alternative ways of raising revenue? Or were modern taxes more feasible on other grounds?

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Abbreviations

The following abbreviations are used in this manuscript:

MDPI	Multidisciplinary Digital Publishing Institute
DOAJ	Directory of open access journals
TLA	Three letter acronym
LD	linear dichroism

Appendix A

Appendix A.1

Sources: Finland from (Flora, Kraus, & Pfenning, 1987) Flora (1983) with GDP from Hjerpe (1996) (Hjerpe & (Kopi-jyvä), 1996), OECD Statistics since 1965. Norway from Statistics Norway (1948) until 1946, Flora (1983), OECD Statistics since 1965, with GDP from Grytten (2004). Sweden from Henrekson and Stenkula (2015). Bolivia from (José Alejandro Peres-Cajías, 2014), since 2011 from CEPALSTAT. Chile from (Díaz et al., 2010)Díaz, Lüders and Wagner (2016), since 1990 from CEPALSTAT. Peru from (Portocarrero S., Beltrán B., & Romero P., 1992), since 1990 from CEPALSTAT.

Notes: total revenue for Latin American countries, tax revenue for Scandinavia. Central Government in Latin America, General Government in Scandinavia.

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