Chile and the Middle-Income Trap, 1875-1939:
Ideas and Institutions Matter in Explaining a Failure

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Cristián Larroulet

Universidad del Desarrollo

clarroulet@udd.cl

Juan Pablo Couyoumdjian

Universidad del Desarrollo

jpc@udd.cl

Diego Díaz

Universidad del Desarrollo

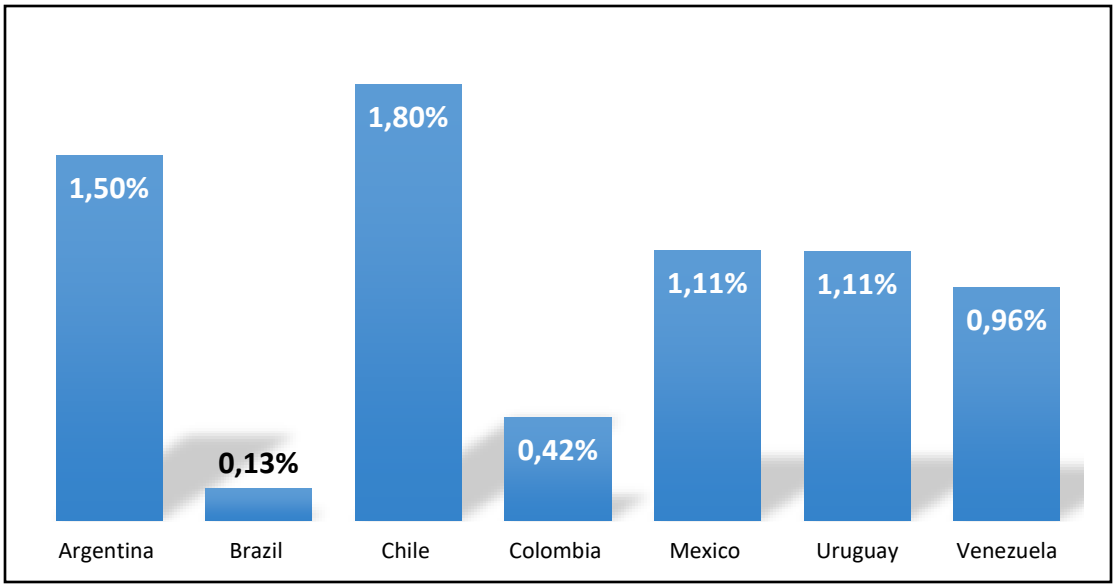
diegodiaz@udd.cl

1. Introduction

Economic development is explained by the accumulation of resources, the efficiency with which they are used, and new productive innovations (Barro, 1997). We also know that for this to happen efficient markets, free trade, private property, the rule of law, and macroeconomic stability are required, as well as formal institutions providing legal certainty and others that enable the development of human creativity (Easterly, 2002; Baumol, 2002; Acemoglu, Johnson & Robinson, 2005). For these conditions to exist ideas and culture, formal and informal institutions, and leaders promoting and implementing them are required (North, 2005; Mokyr, 2016). The experience from the last three centuries confirms the above. Especially between 1500 and 1700, a transformation occurred in Europe whereby –under the leadership of scholars such as Bacon and Newton– a culture promoting creativity, entrepreneurship, and innovation was spawned, one which enabled the accelerated technological progress that characterised the Industrial Revolution. These ideas led to the creation of capitalist institutions supportive of entrepreneurship and eventually to a novel process of rapid economic growth (Mokyr, 2010).

The process described above occurred firstly in Europe and then in the United States and Canada. During the twentieth century, several Asian countries entered this exclusive club of developed countries, with Japan and South Korea being the best-known examples in this sense. Latin America in general has not been able to join this club, despite its enormous resources. If development is measured in terms of income per capita, only three Latin American countries have reached an income level close to that of the richest countries in any period in their history: Chile, at the end of the nineteenth century, and Argentina and Uruguay at the beginning of the twentieth century. Regarding the Chilean case, Figure 1 shows that this country led Latin American growth during the nineteenth century. This process was explained by the effects of ideas, institutions, and entrepreneurs (Couyoumdjian & Larroulet, 2017).

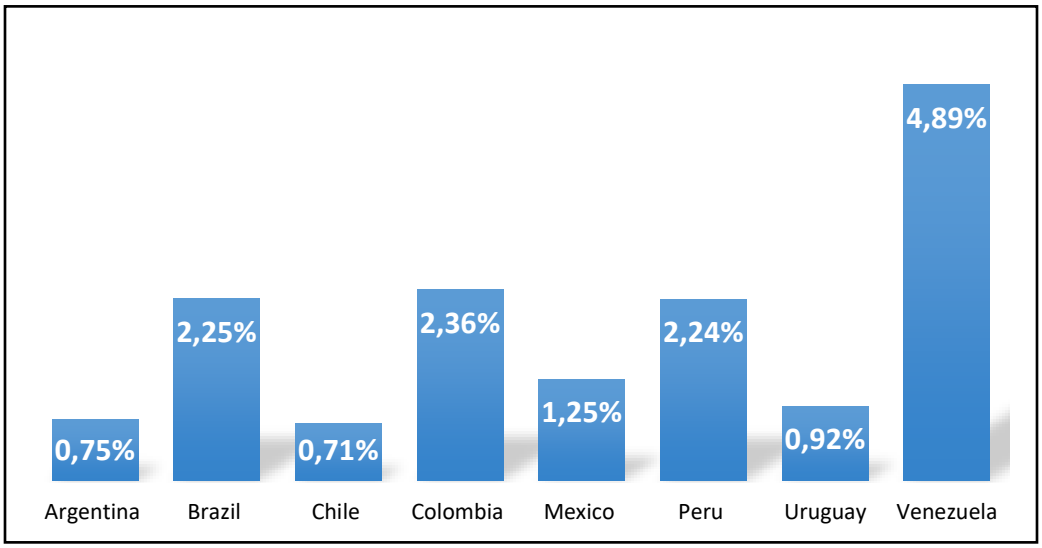
Figure 1: Average annual growth rates, 1820-1910
(per capita GDP)



Source: Maddison (2013).

Nevertheless, Chile's average annual growth rate decreased during the twentieth century, and between 1910 and 1960 it was one of the countries exhibiting the lowest growth in Latin America (see Figure 2).

Figure 2: Average annual growth rates, 1910-1960
(per capita GDP)



Source: Maddison (2013).

What factors explain the above? As a renowned Chilean intellectual and political leader of the time, Enrique MacIver, asked, “What curbs the mighty flight that the Republic had taken, and that had led the most backward of the Spanish colonies to the level of the principal Hispanic-American nations?” (Mac-Iver, 1900, p. 13). In other words, how did Chile change from being “the honourable exception in South America,” as the Argentine intellectual Juan Bautista Alberdi described it in the mid-nineteenth century (quoted by Collier, 1993, p.1), to a country characterised by its “economic inferiority?” (Encina, 1912). How did this phenomenon of relative economic stagnation and deterioration with respect to the United States and other countries –as a result of which in the mid-twentieth century another scholar described Chile as a case of “frustrated development” (Pinto, 1958)– happen?

We propose to study these questions focusing on the period during which this change occurred, i.e., between the end of the nineteenth and the first decades of the twentieth centuries. This is a subject that has been addressed in the literature from an exploratory perspective by, for example, Lüders (1998) and Prados de la Escosura (2007), and from a different perspective –within the context of a neoclassical growth model– by Fuentes (2011).

This paper will address these questions by pursuing three complementary approaches, in three consecutive sections. First, we review the literature dealing with the so-called "middle-income trap", mainly emphasising its institutional elements. Second, we examine the most relevant features associated with the middle-income trap occurring in Chile between 1875 and 1939; this will be based on a narrative approach (Alston, 2008). This is a very long period, and our narrative will suggest that the lagged and cumulative effect of several events taking place during these years may have had a very significant global effect.

Finally, we complement this narrative with a quantitative analysis based on the synthetic control method (SCM: Abadie & Gardeazabal, 2003; Abadie, Diamond & Hainmueller, 2015). This method consists of synthesising a counterfactual unit representing Chile based on a group of control countries and subsequently comparing this unit with what actually happened in the country. We pursue an exploratory strategy in this sense, focusing on some particularly significant events, and analysing the prevailing ideas, leaderships, and

institutions that could explain the change of course undertaken by the Chilean economy. Our results show that the likeliest date for the structural change in the Chilean economy is 1939. As it happens, this is a year for which we have an event which constitutes a unique "treatment" under the SCM: an earthquake in Chillán in 1939, which led to the creation that same year of the *Corporación de Fomento de la Producción* (CORFO) that instituted a process of economic planning in the country. The formation of CORFO is actually a process that had been taking place gradually over time, as evidenced by the founding in the country of different government credit and production development institutions, but which was triggered by the earthquake, and the election of the centre-left *Frente Popular* that was victorious in the 1938 Presidential elections (Ibáñez, 2013; Ortega et al., 1999).

Our work will not only be important to gain a deeper insight into the causes underlying Chile's relative economic divergence during the twentieth century, but also in terms of the recommendations on the most appropriate economic policies and institutions for developing countries facing similar problems.[1] Many countries in the world face the middle-income trap and the case-study we present offers important lessons as to the role of ideas and leaders in order to overcome internal and external crises through greater state capacity and the implementation of institutions and economic policies favourable to growth. This paper shows how a country that was one of the leaders in terms of economic growth missed an opportunity to become a developed nation. Failures are important learning episodes as to the role of ideas and institutions in the process of development.

2. Factors accounting for the middle-income trap: A review

The "middle-income trap" is a phenomenon characterising many developing countries which, after a high-growth period during which they converge to developed countries, get stuck at middle-income per capita levels (Gill & Kharas, 2007). This is an important problem because it is generally assumed that countries undergoing accelerated development have been able to establish the institutions conducive to the promotion of investment, human capital, and innovation that will allow them to further this growth process over the long-run (obviously, at lower rates given a decreasing marginal productivity of capital). However, convergence does not always occur, and what is more,

[1] Along this line, see, for example, Foxley (2012).

many times the countries falling into the “trap” see their per capita income fall in relation to that of developed countries (for which the usual reference is the United States).

This phenomenon also has a geographic dimension: Latin America is said to be the main region of the world characterised by this phenomenon. In fact, Japan, South Korea, and Taiwan are the only countries that, after the Second World War, have been able to overcome poverty and the middle-income trap and attain the status of developed countries. Nevertheless, three Latin American countries (Argentina, Uruguay, and Chile) were among the 20 countries with the highest income in the world in 1913; today they are far from this privileged position.

The literature dealing with the middle-income trap phenomenon has been widespread over the last decades (Hausmann, Rodríguez & Wagner, 2006; Agénor & Canuto, 2012; Eichengreen, Park & Shin, 2013; Aiyar, et al., 2013). The existing evidence indicates that the middle-income trap can be explained by institutional factors such as a weak rule of law, the excessive size of government and its poorly designed regulations. Likewise, demographic factors, a lack of infrastructure, low investment levels, scarce trade diversification, and exchange market distortions are also associated with growth slowdowns in middle-income countries (Dollar & Kraay, 2003; Glawe & Wagner, 2016). Other factors such as social conflicts, coups d’état, and wars also increase the likelihood of growth decelerations.

On this latter point, an interesting research area links the impacts of unfavourable external shocks with countries’ growth, and argues that such growth is more affected in societies with major social conflicts and low institutional capacity to resolve them (Rodrik, 1999). Thus, the lack of any of the following is considered a drawback preventing effective management of social conflicts in a country: democratic institutions; an effective, independent judiciary; and an honest bureaucracy.

Other important factors include the institutional arrangements made by countries to prevent them from falling under the influence of interest groups that hinder growth by obstructing market competition and innovation, whether by capturing the state or promoting monopolistic structures in order to protect their rents (Olson, 1982). In this respect, the existence of states that have a weak capacity to create and manage institutions promoting growth is crucial. Again, the comparison between Latin America and Southeast Asia is impressive. It has been argued that a state’s lack of capacity to ensure

an institutional environment favourable to investment and productivity explains, at least in part, the fact that production by a Latin American worker in relation to a worker in Southeast Asia fell from 1.7 in 1960 to only 0.45 in 2005. Likewise, both political and economic inequalities restrict state capacity in terms of the establishment of a professional bureaucracy, the protection of property rights, effective contract enforcement, and the ability to raise resources to finance the provision of public goods (Cárdenas, 2010). Weak states also generate conditions favourable to corruption and social conflicts which, as we have already seen, increase the probability of stagnation.

The Schumpeterian process of “creative destruction” has an impact on the middle-income trap because technological changes always bring about losers and winners, and if the former have more political power, the growth process may be halted by a slowdown of reforms and the preservation of or return to extractive institutions. In addition, there is a technological break point that can condemn countries to remain at a middle-income level (Lee, 2013).

In all, the literature suggests that countries that manage to avoid the “trap” are usually those that have institutions promoting productivity, sound macroeconomic management, human capital investment, and a strong export orientation. They also have institutions that reduce the probability of events such as wars and social conflicts and that foster the adoption of technological changes.

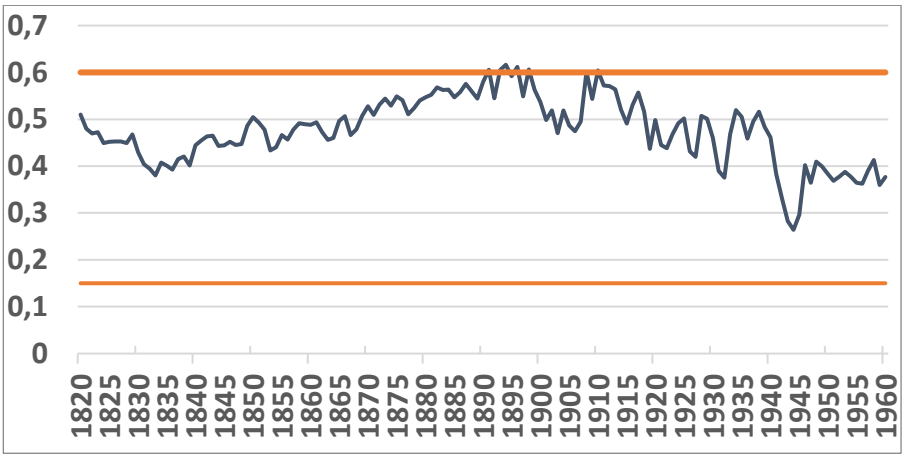
3. Chile already experienced the middle-income trap

Practically all the factors shown by the evidence to be relevant in explaining the middle-income trap were present in Chile by the end of the nineteenth century and the beginning of the twentieth century. In addition, during that period, which can be circumscribed to the years 1875 to 1939, income per capita reached or even exceeded the relative middle-income level.

According to Im and Rosenblatt (2013) a middle-income country is one that has an income per capita ranging from 15% to 60% of U.S. income per capita. Here we follow this approach and apply this band at every moment in time, and find that Chile was only able to

move beyond this range temporarily during some years between 1890 and 1910.[2] In relative terms, the increase occurred thanks to an average 1.8% growth rate between 1820 and 1910; however, it dropped to only 0.7% between 1910 and 1960, as a result of which the country lost its relative position. Thus, after reaching an income per capita representing 60.4% of U.S. income per capita in 1910, there was a drop to 37.7% in 1960 (Figure 3). The latter is relevant and indicates that, during the period under review, the relative development process of the Chilean economy actually came to a halt.[3]

Figure 3: Income per capita: Chile relative to the United States



Source: Maddison (2013).
Note: The horizontal lines represent the middle-income band.

Looking for evidence of the middle-income trap phenomenon Eichengreen et al. (2013) identified growth rate slowdown episodes, defining them as such if they satisfied the following conditions:[4]

$$g_{t,t-n} \geq 0.035 \qquad (1)$$

$$g_{t,t-n} - g_{t,t+n} \geq 0.02 \qquad (2)$$

[2] Based on Maddison's (2013) data from 1820 to 2010, Chile's income per capita exceeded 60% of that of the United States only in 1891, 1893, 1894, 1896, 1898, 1908, and 1910.
[3] As noted, this does not mean that the Chilean economy did not experience any growth during this period.
[4] Eichengreen et al. (2013) included a third condition $y_t \geq Y'$, with $Y' = 10000$, in 2005 PPP dollars. This condition is incorporated to exclude poor countries with serious economic problems and to focus on middle-income countries. For our analysis, we ignored this condition for the period under study, in which Chile was not a poor country but a middle-income country in relative terms.

Where y_t is the actual gross domestic product per capita, $g_{t,t-n}$ and $g_{t,t+n}$ are the average growth rates between years t and $t-n$ and between years t and $t+n$, respectively. Following Hausmann et al. (2005) and Eichengreen et al. (2013), we set $n = 7$.

We follow the same definition in order to determine when Chile underwent these types of economic deceleration episodes; we found that these occurred in 5 periods between 1820 and 1960. The periods were 1881-1884, 1928-1929, 1938-1940, and the years 1910 and 1912. Table 1 shows the growth rates before and after each of the Eichengreen-like deceleration episodes.

Table 1: Average annual growth rates

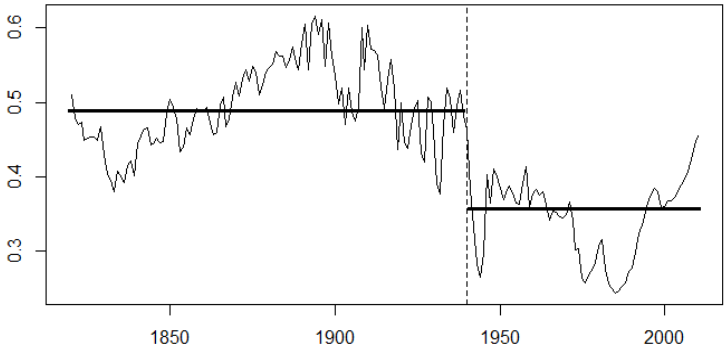
YEAR	$g_{t,t-7}$	$g_{t,t+7}$	$Income\ per\ capita\ Chile/USA$
1881	4.13%	0.49%	55.2%
1882	4.15%	-0.28%	56.8%
1883	4.40%	0.65%	56.3%
1884	5.03%	1.67%	56.3%
1910	4.95%	-0.37%	60.4%
1912	3.97%	-2.53%	57.1%
1928	4.99%	-2.65%	50.7%
1929	5.18%	-2.73%	50.1%
1938	5.19%	1.35%	51.6%
1939	8.04%	2.23%	48.3%
1940	5.42%	0.02%	46.2%

As seen in Table 1, the deceleration periods from the end of the nineteenth century to the beginning of the twentieth century occurred when Chile was about to attain income levels close to what Im and Rosenblatt (2013) defined as a high-income level. Subsequently, from the 1920s, deceleration episodes became more intense, with an increasing difference between the $g_{t,t-7}$ and $g_{t,t+7}$ growth rates. This brought about greater divergence with respect to the U.S. income per capita, as shown in Figure 3.

On the other hand, statistical structural change tests (Chow and Bai Perron tests) for the relative income per capita series between Chile and the United States show a structural

break in 1940[5] (Figure 4). This is an indicator of crucial changes in the Chilean economy around 1940.

Figure 4: Relative income and structural change



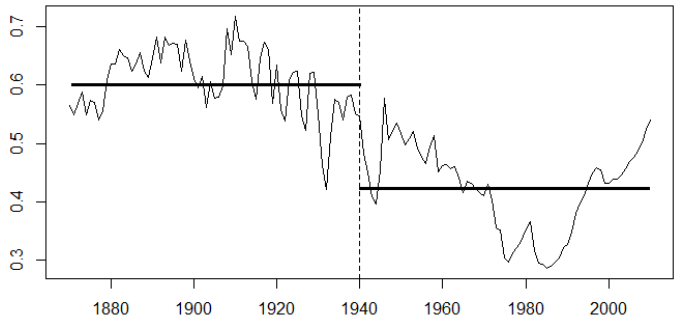
Note: The vertical line marks the year of the structural break according to a Chow's test. The curve indicates the relative income per capita between Chile and the United States, while horizontal lines indicate mean values before and after the 1940 break.

To show that the structural change is not caused by specific characteristics of the United States series but is rather an actual divergence from the developed world trend, we repeated the exercise using the relative income between Chile and the simple average of Western Offshoots and Western Europe 12 from Maddison for the entire period for which data are available: 1870-2010.[6] The results, shown in Figure 5, also indicate a structural change in 1940.

[5] A Chow's test is carried out by adjusting the series to a linear model, and after this the F statistic is determined. As this reached a maximum value in 1940 (see Figures 13 and 14 in the Appendix), the break was determined to have occurred at that time. In other words, the series underwent a change in its mean value in 1940, going from 49.5% to 34.3%.

[6] Western offshoots include the United States, Canada, Australia, and New Zealand, a group of countries undergoing much faster growth than Europe and the rest of the world during the last two centuries. Western Europe is formed by the 12 countries with the highest growth in Western Europe: Austria, Belgium, Denmark, Finland, France, Germany, Italy, the Netherlands, Norway, Sweden, Switzerland, and England.

Figure 5: Relative income and structural change



Note: The vertical line marks the year of the structural break according to a Chow's test. The curve indicates the relative income per capita between Chile and the average income between Western Offshoots and Western Europe 12, while horizontal lines indicate mean values before and after the 1940 break.

A Bai Perron test, following Bai & Perron (1998), determines the years of optimal breaks in the series. Applying this test to our relative income series we also find a break in 1940, independently of the number of structural breaks identified.

Figure 6: Break date from Bai Perron's test

	Year of optimal structural break					RSS
$m = 1$				1940		1.59
$m = 2$		1968		1940		0.57
$m = 3$		1968	1912	1940		0.44
$m = 4$		1968	1912	1940	1971	0.34
$m = 5$	1848	1978	1912	1940	1971	0.33

Note: The years show the optimal break dates according to the Bai Perron's test applied to the relative income per capita between Chile and the United States. The value of m indicates the number of breaks, while the RSS shows the residual sum of squares of the model.

Our analysis thus suggests that due to a growth slowdown Chile suffered a middle-income trap. Several of the factors that today we known to be determinants of this phenomenon were also present. This is what we examine next.

a. Moving to a closed economy

According to historians, till the mid-nineteenth century, Chile was characterised by “certain consensuses” about national economic policy (Bernedo, Camus, & Couyoumdjian, 2014, p. 53). This started to weaken due to several factors, including the effects of economic crises. In the second half of the nineteenth century, one of the most significant such shocks was the crisis occurring in the 1870s, which was a global crisis that started in Europe and was concurrent with another one in the United States, rapidly extending to Latin America. In Chile, a substantial fall in copper and silver prices had important economic effects, such that in 1878 the exports of silver were 52% of what they had been in 1874. This situation subsequently extended to the agricultural sector, with exports in 1878 being only 23% of those in 1874. Not surprisingly, it then propagated to the rest of the domestic economy, although the War of the Pacific moderated this process to a certain extent.

The social consequences of this crisis were enormous, as reflected by the newspaper “*El Independiente*”, which in August 1877 reported that “that men, women, and children walked the streets, all bearing the stamp of hunger on their face” (quoted by Sater, 1979, p. 78). The political environment in the country showed widespread divisions and strong demands for greater protection of national industry and a shift towards a closed economy. As mentioned by Sater, at that time the press echoed the call for protectionism: “In the name of justice, we request the protection of work, protection for our national factories” (id, p. 91). This perspective can be contrasted with the events occurring during the previous two decades, when in his famous work comparing the Chilean customs legislation with that of France, Great Britain, and the United States, the French professor Jean-Gustave Courcelle-Seneuil (1856) wrote that the former was more liberal and he described it as “excelling that of the other three countries from an economic point of view and, also from the point of view of commercial relations and the simplicity of procedures” (1856, p. 45).

Protectionist ideas were increasingly advanced in the country, and thus in 1897 a new customs reform, promoted by the Chilean Manufacturers’ Association (*Sociedad de Fomento Fabril* – SOFOFA), was implemented. This reform raised customs duties on many products while reducing import tariffs on machinery and raw materials, thereby increasing effective protection of domestic industry. As a consequence of the impact of the First World War and the crisis due to the emergence of synthetic nitrate, a new protectionist step was taken in 1916, when a new tariff increase was approved. In 1921,

under the government of Arturo Alessandri, import tariffs were raised once again by an average 50% and by 100% for so-called luxury goods. This process continued, with an even stronger emphasis, after the 1929 crisis, which had a deep impact in the country and led to the growing emergence of nationalist, socialist, and populist ideas. The trend was deepened to the point that protectionism virtually became a state policy. Thus, in 1938 SOFOFA published a document called "*El Concepto de Industria Nacional y la Protección del Estado*", arguing that "trade or import license protection must be established *a-priori* and as steadfast economic doctrine on every occasion a domestic industry is to be protected" (Boletín de la Sociedad de Fomento Fabril December 1938, quoted by Ibáñez, 2013, p. 222).

In brief, the ideas and institutions contrary to free trade were progressively advanced from the end of the nineteenth century, and consolidated as a result of the 1929 crisis. In this sense, a substantial portion of the deterioration of the Chilean economy during the twentieth century is accounted for by closed-economy policies which make it more difficult for countries to increase their economic efficiency and overcome the middle-income trap. (Edwards, 2009).

b. Macroeconomic balance

Another distinctive feature of the period was the macroeconomic deterioration of the state in contrast to the rigor with which the public finances were managed during the previous period, such that, "until 1858 there was a balance between tax revenue and expenditure, with the exception of some years, but from then on deficits … became constant features of the public sector's funding" (Bernedo, Camus, & Couyoumdjian, 2014, p. 55). Indeed, between 1880 and 1913, governments always had fiscal deficits, except for 1894.

This was compounded by the monetary instability reflected in the debates about paper money and the gold standard spanning several decades. But the crucial monetary problem was more fundamentally related to the financing of fiscal deficits resulting from wars, the expansion of the state's investments, and the need to save banks in face of international crises. A good presentation of these problems is that of the Valparaiso Chamber of Commerce in 1907, who argued that "the people does not want a single paper peso more; it wants, it desires, a healthy and effective currency, an unchangeable measure of value" (quoted by Collier & Sater, 1996, p. 169).

After the War of the Pacific and due to a significant increase in tax revenue thanks to the acquisition of the nitrate industry, tax expenditures increased: by a factor of 2.8 between 1880-1884 and 1910-1914. The country also underwent a sort of "Dutch disease," with the real exchange rate falling by 30% between 1876-1897 and 1910-1914, leading to a decline in the competitiveness of the tradable sector.[7]

The corollary was the progressive loss of monetary discipline with the ensuing increase in the prices of goods and services. Macroeconomic instability was reflected in the fact that, between 1891 and 1924, the country had more than 90 Ministers of Finance. This prevented the development of long-term policies and the capacity of the state to implement macroeconomic policies at complex times such as during the First World War with the emergence of synthetic nitrate. As a result of this macroeconomic deterioration, the Government hired Edwin W. Kemmerer, Professor of Economics at Princeton University, to provide assistance in fiscal and monetary matters. This led to the creation of the Central Bank in 1925. However, the Great Depression in 1929, once more resulted in the deterioration of the main macroeconomic indicators in the country.

In the end, during the period under examination the appreciation of the importance of macroeconomic stability started to lose relevance in favour of an enthusiasm for the industrialisation process, "regardless of salary levels and the value of the currency" ("Boletín de la Sociedad de Fomento Fabril", December 1938, quoted by Ibáñez, 2013, p. 223).

c. Interest groups

The period under study is also remarkable for the growing role of interest groups seeking to influence governments to obtain protection, reduce competition, and produce regulations that benefit them. As we now know, interest groups reduce the efficiency and income of the societies where they operate (Olson, 1982).

As noted by Sater (1976, p. 333), in late nineteenth century Chile "free trade might be attractive to intellectuals but not to a Congress that represented the economic interests of the oligarchy." The SOFOFA, founded in 1883, was among the groups exerting the biggest influence. Through Parliament, it managed to obtain protection for its sectors. One example of this was what happened in 1893, when a lower import duty was established for

[7] Preliminary evidence in this sense is presented in Jeftanovic (1992).

raw sugar and a higher one for refined sugar, thereby protecting the domestic sugar refining industry (Bernedo, Camus, & Couyoumdjian, 2014 p. 69). Another example of the capture of the state was in the railway industry, where pressures were exerted for trains to travel long routes that had no economic justification and for the preservation of low, unprofitable, rates (Ibáñez, 2013). Something similar occurred in the agricultural sector, which after a very promissory export-oriented period during a large part of the nineteenth century was impacted by a fall in the real exchange rate, by increasing international competition, and also by the negative impact of protectionism on export activities, that generating strong incentives for monopolistic and protectionist behaviours. As remarked by Collier & Sater, "The poor divided the land into increasingly smaller plots while the rich increased their possessions, whether through purchases or marriage … Once landlords took possession of the domestic market, they had few incentives to produce" (Collier & Sater, 1996, p. 148).

It is interesting to note that the capture of the State did not only occur in Santiago, but also extended throughout the national territory. An evidence of this was the arrival of German entrepreneurs in Llanquihue and their establishment of "political support networks seeking to instrumentalise bureaucratic and parliamentary officials, expecting them to represent their interests on a national scale" (Muñoz, 2016, p. 255).

In a broader sense, the struggle for the capture of nitrate rents was a serious economic and political problem; in the end, the tax revenues generated by the nitrate industry were increasingly used to increase spending and reduce taxes, weakening the nation's public finances.

The interest group influence phenomenon moved forward to the point that it became a public policy through a corporativist ideology and materialised in institutions such as the National Economy Council (*Consejo de Economía Nacional*), created during the government of President Carlos Ibáñez del Campo, and comprising different economic groups. But its most influential manifestation was the creation of CORFO in 1939. Indeed, it has even been argued that "CORFO's offices were the actual seat of government since 1939" (Ibáñez, 2013, p. 220).

d. Conflicts and Disasters

As seen in the previous section, one of the factors having the greatest bearing on countries falling into the middle-income trap are conflicts, whether created by wars with

other nations, civil wars, or social problems resulting from economic or political crises. Chile's situation during the period under study confirms the above. Between 1879 and 1929 the country faced a war with Peru and Bolivia (1879-1883), a tremendous civil war (1891), and the effects of the First World War (1914-1918) which was especially important due to the emergence of synthetic nitrate, which affected a key source of government funding. In addition, it faced the strong effects of the 1929 crisis. After President Ibáñez's first term in office, important changes occurred, marked by significant social upheaval and political instability, with several coups taking place in 1932, one even leading to a short-lived "Socialist Republic".

Natural disasters are also relevant among the factors affecting Chile. In fact, the country is a leader in this area due to its geological conditions, and was struck by several seismic events during the period under study. The most relevant were the 1906 earthquake, which destroyed Valparaíso and caused 2,300 deaths, and the Chillán earthquake in 1939, with 24,000 deaths.

These types of disasters put a significant pressure on the state and its capacity to address them. If there is no capacity to face them due to institutional deficits, a public finance imbalance, corruption, or a lack of social capital, crises arise and growth is hindered. The literature shows that the state's lack of capacity to design and implement sound public policies is very relevant (Besley & Persson, 2011).

e. Technological Changes

Since the end of the nineteenth century, if not before, strong economic changes were experienced due to the new technologies arising at the time. Among the most remarkable changes were the development of the railway, steam engines with their ensuing impact on the development of means of transport, and electrical power. The emergence of synthetic nitrate is also worth mentioning. These events generated losers and winners, mounting tensions between those who wanted to adopt these changes and those who, because they could be damaged by them, used their influences to oppose them.

While at the beginning of the period private efforts to incorporate these innovations were quite remarkable, the adoption of some of these innovations was delayed especially due to the influence of interest groups (e.g., Ibáñez, 2013, pp. 149-150). The incorporation of technological changes such as electrical power justified a certain developmental ideology, linking the incorporation of these new technologies with the need for industrialising the

country at any cost and transforming this process into a quasi-ideology (Harnecker et al., 1936). This was a new argument for the establishment of the state's entrepreneurial role, which was especially strong from 1939 when CORFO was created.[8]

f. Poverty and Inequality

Despite the economic growth attained at the beginning of the twentieth century, the country had not attained an equivalent situation in social terms. In fact, concerning health, progress was slow and there was a painful sanitary situation which had transformed the country into a large hospital. (Sagredo, 2014; Gazmuri, 2012; Vial, 1981). As a result, at the beginning of the twentieth century, life expectancy at birth in Chile was only 30 years. This is an evidence of a significant state failure. Indeed, as stated by Collier and Sater, "In some cities, the benefits of electricity came even before the Municipality was able to supply water" (1996, 160). The installation of electrical lighting in Santiago was started in 1886 and water began to be supplied after 1900; 20 years after this drinking water was still very limited in supply. The condition of the sewerage system was even worse. As a result, illnesses expanded very easily, and child mortality reached 33% and 40% of general mortality.

Social deprivation extended to housing and social security. Something similar happened with education. In this respect, it is interesting to contrast educational coverage between Chile and the United States in 1900. In Chile, primary education coverage reached 35% versus 106.6% in the United States; in secondary education, Chile attained 4.2% and the United States 10.6%; and in tertiary education Chile reached a 0.3% coverage rate and the United States 2.3% (Larroulet & Gorosabel, 2015). As Sagredo has correctly concluded, "Despite the progress made, at the beginning of the 1930s there was a critical view of the so-called *Estado Docente*, i.e., the public educational system implemented during the Republic. This was mainly because, with all its virtues, it was a highly unequal system providing quality education to urban elites, which did not pay for the privilege they received, but rather it was the entire population that paid the cost through taxes" (2014, p. 222).

The difficult social situation was compounded at the end of the First World War and as a result of the 1929 global crisis. It is thus possible to argue that there was a problem in terms of the state's capacity to meet its role as an efficient supplier of public goods,

[8] For more details, see Ibáñez (1983).

especially in the areas of health and education. Undoubtedly, this contributed to the climate of social upheaval which started with growing intensity since the end of the nineteenth century and implied coups d'état and political instabilities such as in 1924 and 1932. Clearly, as evidenced by the literature, the existing differences in social conditions and opportunities and the ensuing income distribution also affected the social climate in the country during the period (Hodgson, 2015; Barro, 2000).

The narrative analysis presented in this section shows that the same elements that have been shown to be determinants of countries falling into the middle-income trap were present in Chile during the period under examination. This is consistent with the situation described in Figure 3, showing a change in Chile's relative growth trend at the end of the nineteenth century and the beginning of the twentieth century. This is a transitional period which has been examined in the Chilean economic history before. Lüders (1998) and Fuentes (2011) find that the Great Depression represents a key structural change in this respect; Ellsworth (1945) even uses the expression "an economy in transition", to refer to the period after the Great Depression. But as the statistical analysis we present next shows, this change may have occurred later, with the Chillán earthquake and the establishment of CORFO, which is when the Chilean economy stated diverging from the rest of the world. From that moment, Chile directly entered into an era of economic planning (*planificacionismo*), which will include several dimensions of national life (Ibáñez, 2013).

4. An analysis with the synthetic control method

The synthetic control method (SCM) developed by Abadie & Gardeazabal (2003) (see also Abadie, Diamond & Hainmueller 2010), allows researchers to assess the effect of an intervention in a single treated unit (city, region, country, etc.) by making a synthetic control from a donor pool, which is a group of untreated units. This is useful in many cases since, because of their differences with the treated unit, a single unit is usually not an effective control by itself.

In a country panel setup, for the synthetic control to represent the behaviour of a country in a variable of interest after the treatment it is necessary that it resembles the country's behaviour before the treatment. Recently, several articles have appeared that utilize the

SCM for studying the impact of policy changes in comparative case studies; these include Abadie, Diamond & Hainmueller (2014), Acemoglu et al. (2016), Billmeier & Nannicini (2013) and Grier & Maynard (2016). The method has also been used in different contexts in economics and political science, ranging from an assessment of the impact of terrorism on long term growth (Abadie & Gardeazabal, 2003), to an assessment of the economic impact of a powerful earthquake (DuPont et al, 2015).

Assuming we observe a panel of J+1 countries during T periods of time, and only one country receives the intervention in some $T_0 < T$, which stays in place until T, the effect of the treatment for country i in period t can be defined as:

$$\tau_{it} = Y_{it}^{I} - Y_{it}^{N} \qquad (3)$$

Where Y_{it}^{I} is the observed value of the outcome variable (in our case gross domestic product or income per capita), while Y_{it}^{N} is the value if the intervention had never taken place. Let $i = 0$ be the country affected by the treatment. It follows that $Y_{0t}^{I} = Y_{0t}^{obs}$, where Y_{0t}^{obs} is the observed value of the outcome variable, and that $\tau_{0t} = Y_{0t}^{I} - Y_{0t}^{N}$, with the value of Y_{0t}^{N} being unobserved.

Note that we assume the treatment has no effect before its implementation, in other words, $Y_{it}^{I} = Y_{it}^{N}$ for every $t < T_0$. In case of having anticipation effects, we could simply redefine T_0 as some other $t < T_0$.

The SCM determines an estimator of Y_{it}^{N} with the following lineal structure:

$$Y_{it}^{N} = \sum_{i=1}^{J} w_i Y_{it}^{obs} \qquad (4)$$

The value of the outcome variable, Y_{it}^{N}, is a lineal combination of the control countries, with weight w_i for country i. The method doesn't allow for extrapolation outside the convex hull of the control countries, or in mathematical terms, weights are required to be positive and sum to one. This is an attractive feature of the model because it allows to make explicit the relative contribution of each available control unit.

For estimating the parameters, let Y_1 be a vector of $T_0 x 1$ values of the outcome variable for the treated country, and let Y_0 be a matrix of $T_0 x J$ with the same variable for each of the J countries in the donor pool. The weights on the model are chosen with a data driven procedure so that the distance between the synthetic control and the treated unit is minimized. In mathematical terms, the problem can be expressed as:

$$W^* = argmin_w \sqrt{(Y_1 - Y_0 W)'(Y_{1-} Y_0 W)} \qquad (5)$$

The weights can also be estimating by minimizing the distance between a set of covariates, as in Abadie (2010). However, in our case it is not possible to form a balanced panel with the necessary variables for the period in question.

In a different note, condition (4) can only hold exactly if Y_0 belongs to the convex hull of $[(Y_1), \ldots (Y_J)]$. However, this does not hold in the data, and the condition will only hold approximately, producing a better fit when the unit falls close to the convex hull of the donor pool. In case the synthetic control falls too far from the convex hull, a poor fit will be obtained, and it will not possible to infer many things from the model.

A limitation of the SCM is that it does not allow accounting for the significance of the results using standard inferential techniques, as these methods rely on large randomized samples, and several treated units. But the SCM only requires a relative small sample and a single treated unit, and because it provides a systematic way to choose comparison units, placebo tests can be made to make quantitative inference. This consists in applying the SCM to every country in the donor pool and compare the values of the outcome variable between each one and their synthetic control.

4. Implementation and Results

As we already explained, by the end of the nineteenth century and the beginning of the twentieth century Chile underwent a transitional period in its GDP per capita growth process. A number of events occurred in this period –across a number of dimensions– that marked the development of the national economy. These suggest several possibilities for a treatment date under the SCM.

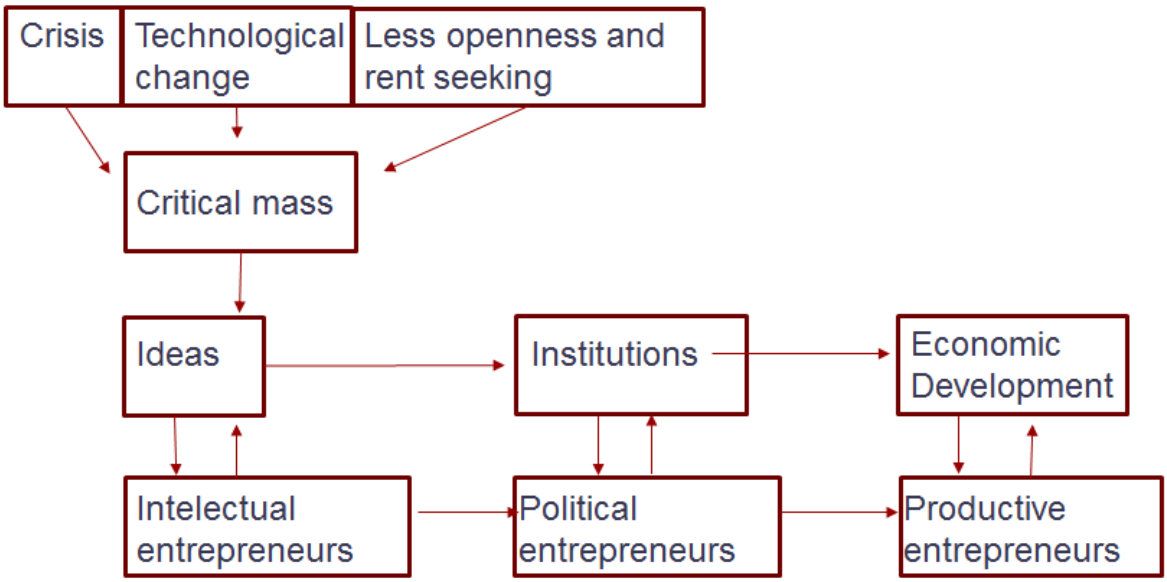
Changes in Ideas and Institutions

We have described the multiple events faced by the Chilean society and the Chilean economy during the period under study, but it is important to examine how these events accumulated such that the country's ideas and institutions started to evolve. This will involve an examination of the intellectual and political entrepreneurs who materialised these changes.

Our hypothesis is that, when societies undergo the aforementioned events –economic crises, social conflicts, wars, natural disasters, technological changes– they close their economies and change their policies yielding to corporate and ideological and interest groups, and if this occurs with a high-enough intensity, a “critical mass” is generated to introduce new ideas and institutions affecting the development process. The main stakeholders in this process are, first, intellectual entrepreneurs, leading changes in ideas, then political entrepreneurs, leading institutional reforms, and finally productive entrepreneurs, who adjust their behaviour to the new reality, thus becoming unproductive entrepreneurs and leaders of the rent-seeking process (Baumol, Litan & Schramm, 2007; Rajan & Zingales, 2003). In this way, countries fall into the middle-income trap.

But this typically occurs gradually, i.e., these ideas and these institutional changes only start affecting societies a sufficient number of adopters of ideas and institutions contrary to the factors explaining the growth accumulate. Figure 6, below, illustrates this argument.

Figure 6



Next, we will describe and apply our model to the case of Chile during the period under study.

a. Ideas

Chile's political and economic success since the last decades of the first half of the nineteenth century was mainly based on conservative ideas establishing order and authority as the main political axes, although this started to evolve gradually towards the predominance of liberal ideas. Later, at the beginning of the twentieth century, a group of scholars following different currents of ideas strongly criticised the overall situation in the country; these included, Francisco A Encina ("*Nuestra Inferioridad Económica*", 1912), Enrique MacIver ("*Discurso sobre la Crisis Moral de la República*", 1900), Nicolás Palacios ("*Raza Chilena*", 1904), Luis Emilio Recabarren, and Alberto Edwards ("*La Fronda Aristocrática*", 1928). This reflected a was deep criticism of the state's performance and its public policies, especially because of its inability to "legislate in a more effective way concerning the social question" (Collier, 2009, p. 83).

Criticism came from approaches that promoted new ideas in two directions: nationalism and socialism. As Ibáñez has noted, both "nationalist trends in their struggle in favour of social protection and the strengthening of the economy and the Chilean identity, which led to statism, and socialist proposals, which later on took root firstly in intellectual segments and then in political segments" (2103, p. 190), were gaining momentum, fed by successive crises related to earthquakes, the discovery of a substitute for nitrate at the end of the First War World, the strength of new international ideologies such as the Bolshevik Revolution in 1917, and the end of democracy through coups d'état such as those of 1924 and 1932. These views became even more intensive as a consequence of the 1929 crisis, which affected the country very strongly, deepening the nationalist views and leading to the emergence "of a planning-based (*planificacionista*) ideology", fostering "development, protection, and entrepreneurial action, all of which that were a responsibility of the state" (id, 218). These ideas were driven "by a group of engineers advocating new conceptions of national development," that attributed a main entrepreneurial role to the state. A good summary of the new ideas has been made by Cristián Gazmuri who remarks that "the new opposing political models were socialism, fascism, and corporatism, which have in common the conviction that the state should have greater influence on society" (2012, p. 165).

b. Leaderships

Many leaders were influential during this period, but there is no doubt that two of them are remarkable. This is shown in Mario Góngora's important essay on the Chilean state. Here, when referring to "*El tiempo de los caudillos (1920-1932),*" he mentions Presidents Arturo Alessandri and Carlos Ibáñez del Campo as the most outstanding figures of this period (Góngora, 1981). Both were political rivals during more than two decades, but, as no one else, they promoted a moderate type of state socialism.

In addition to these political entrepreneurs, another less visible but still highly influential figure concerning the changes faced in this period is worth mentioning. He is an example of intellectual and political entrepreneur: Carlos Ibáñez's Minister of Finance during his first term in office (1927-1931), Pablo Ramírez. Patricio Silva labels him as one of the first "techno-politicians" in the country, "because he knew how to combine with relative success the skills of a technocrat and a politician in an attempt to transform the Chilean society" (2010, p. 74-75). Ramírez was relevant for his role in modernising the state, professionalising the state's management, and creating institutions to provide it with the capacity to implement a sound, active protection program for all national industries. In addition, by hiring young engineers, he formed a cadre of followers with a strong human capital through which his influence extended over decades.

In all, whether directly or indirectly, these leaders had a deep influence in the period under study with their ideas and their political and economic reforms. As Max Weber stated, individuals, historical forces, and institutions are all important and interact in a significant way.

c. Institutions

As we have described in another context new intellectual and political ideas and leaders drive policy and legislative changes (Couyoumdjian & Larroulet, 2017). This happened during the period under study, where the prevailing policies led to a reduction of the dynamism that the economy had shown during a large part of the nineteenth century. In 1925, a new Constitution was enacted. Among other matters, this new constitution, "included new constitutional guarantees of a social nature: it ensured the right to work, restricted property rights in case of social need, and extended the duties of the state in matters of health and education" (Sagredo, 2014, p. 224). This institutional modification implied that "the liberal conception, prevailing almost without counterweights until the initial

years of the twentieth century, would start to give way, from 1925, to another one in which the rights of the owners would almost disappear in face of the rights of the community" (Brahm, 1999).

The other fundamental institutional change concerned the role of the state. The latter became an important entrepreneur, and new state companies were created in different productive and service sectors. CORFO, created in 1939, is the culmination of a gradual process during which there was a change in prevailing ideas, and which was consolidated with the new government of the centre-left *Frente Popular*, elected in 1938. As explained by Oscar Muñoz and Ana María Arriagada, CORFO had "functions that no state agency had ever had before, such as the formulation of a national productive plan and the associated allocation of investment resources. This implied, on the one hand, that the state was assigned a function as coordinator of the interests of the different productive sectors, and on the other hand, a clear entrepreneurial function by being allowed to make direct public investments in activities different from traditional infrastructure projects" (quoted by Silva, 2010, p. 108).

There are two additional institutional changes that were decisive. On the one hand, the concept of macroeconomic responsibility weakened in face of the developmental priority of the time, and public finances deteriorated with the concurrent impact on the Central Bank, which became a paying agency. Bernedo, Camus, and Couyoumdjian present a synthesis of the consequences of this institutional deterioration, stating that "Since the election of Pedro Aguirre Cerda (1939), a long-term, difficult to control inflationary process whose multiple causes are complex to isolate and define, was reactivated in our country. The funding of the industrialisation policy, foreign trade disruptions as a result of the Second World War, fiscal indebtedness, uncontrolled monetary issues, the growth of the state apparatus, and the pressures exerted by workers' unions and associations to raise their remunerations are factors contributing to a rise in inflationary processes" (Bernedo, Camus & Couyoumdjian, 2013, p. 113).

The second change is directly related to the capture of the state by labour and entrepreneurial organisations. "Rent-seeking" was reflected in a vicious circle that progressively affected the dynamism of growth. The state was called upon to raise salaries, and it granted these raises to the corresponding company or productive sector in exchange for greater protection against competition, whether domestic or external. As mentioned by Arnold Harberger in his description of the Chilean domestic economy in

1956, “unions have a truly monopolistic power, probably much stronger than that exerted by any relevant union in the United States. Monopolies are also important in the world of business and are supported by the laws and rules regulating international trade" (2000, p. 415).

The institutional changes described above are the best explanation to understand why Chile reduced its “mighty flight” during the first half of the twentieth century. As explained by Edwards (2010), “If there is political, social, and economic stability, if there is an institutional system promoting learning and innovation, and if economic policies promote competition,” productivity and growth will thrive. Very little of this existed; as a result, Chile definitively fell into the middle-income trap.

d. Critical Mass

To complete the model described in the previous figure, we must consider the concept of “critical mass” in this historical process. This concept is applied in natural and social sciences to the threshold required for a status change and for this new status to be sustainable. In the social science, it refers to the situation in which a society undergoes a change in ideas once a citizen support threshold is overcome, or in which certain groups and organisations exert decisive influence on collective decisions (Schelling, 1978). The role of groups and organisations in societies is relevant to this phenomenon; their size, the intensity of their preferences, and their organisation refers to the "critical number” required to support an idea or social activity also matter (Olson, 1965).

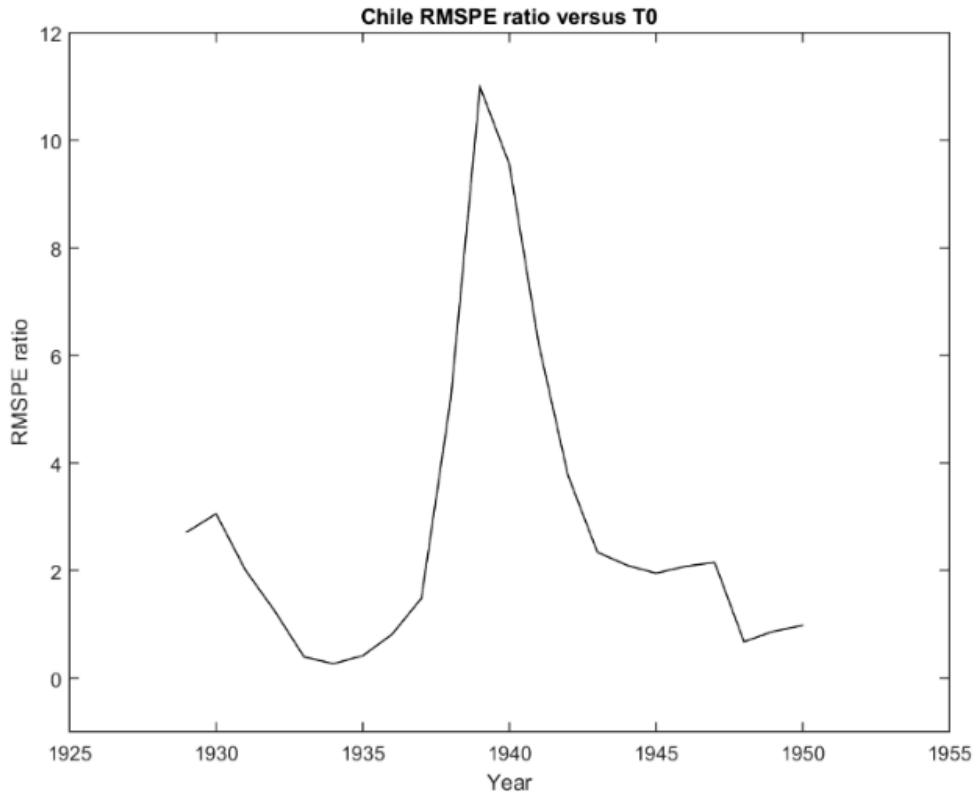
In our model, its application is related to the point in time when the “critical mass” is attained, which, in accordance with the synthetic control model, we find is 1939. As we will examine next, this was the year in which divergence between the “synthetic Chile” and the real Chile began. Let us recall that in this year three circumstances occurred: the new government of the *Frente Popular*, the Chillán earthquake, and the creation of CORFO. Does this mean that everything is accounted for by the events occurring in a single year? No, the determinants of the middle-income trap, and the changes in ideas, leaderships, and institutions we have discussed began to generate the “critical mass” diminishing the incentives for economic growth.

A SCM analysis

The exercise to be carried out based on the SCM methodology seeks to unravel when the Chilean economy started diverging from the rest of the world. For this, we will use a panel of 19 countries for which we have data on income per capita from 1900 to 1960 from Maddison (2013). The control group is a list of countries potentially similar to Chile, from South America, North America, Europe, and Oceania.

As noted, there are several possible events/dates that could have triggered the changes we are examining, and we determined a synthetic control per year taking the period from 1929 to 1949. In every case (for every year t) we took annual data on GDP per capita between 1900 to t-1 to form the synthetic control based on equation (3). Before we continue it is important to note that, as we explained before, on account of the data availability, in this work we will only consider the income (GDP) per capita series without modelling the determinants of GDP, which is an exercise that will remain pending for the future. For each year we calculated the root mean square prediction error (RMSPE), 5 years before and 5 years after the treatment. Figure 7 presents a plot of the ratio between these variables against the initial treatment year.

Figure 7: RMSPE-ratio



Note: The black line shows the root mean square error ratio between post- and pre-treatment periods when year T0, in which we consider that the treatment starts, is changed. For consistency with using the same number of periods in every iteration, we take the same number of periods for every synthetic control, going 5 years before, and 5 years after treatment.

The results show that the likelihood of s shock is highest in 1939. Table 2 presents the weights assigned by the SCM for this year.

When resolving the optimisation problem, we obtained a synthetic control consisting of 12.3% for New Zealand, 34.7% for Canada, 4.1% for Argentina, and 47.3% for Brazil. Figure 8 shows Chile's income per capita and its synthetic control for the entire period. As seen, the synthetic control follows the path followed by Chile very accurately until 1939, replicating the economic cycles in the previous decades. When the treatment is begun, an instant and dramatic effect is observed on the income per capita level. Only 5 years after

1939, the income difference is around $1000 GK dollars (hereafter US$), which is equivalent to a bit more than 30% of the income. Moreover, this difference is persistent over time until 1955, when it starts to increase even more.

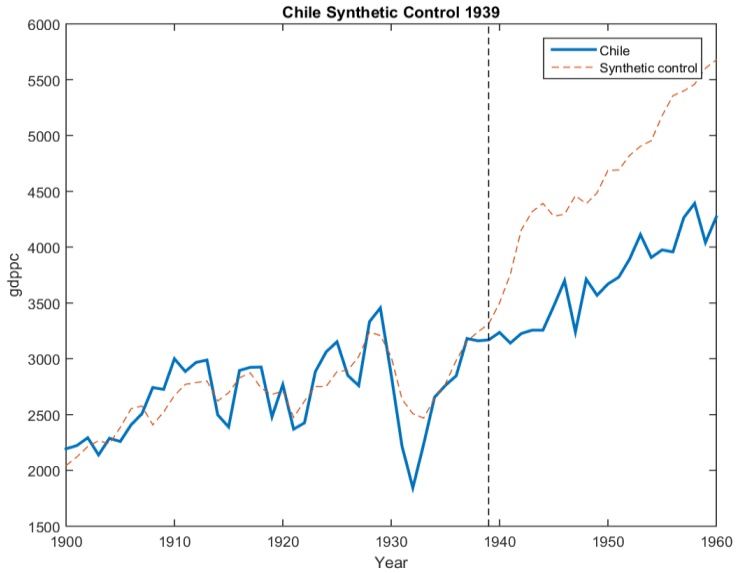
The root mean square prediction error (RMSPE) for the pre-treatment period is US$210.82, indicating that the difference in the average income between Chile and its synthetic control corresponds to this value before 1939. After the RMSPE treatment, it is US$1007.50, with the ratio between both RMSPEs being 4.78.

Table 2: Weights assigned by the SCM

	Weights
Denmark	0%
Norway	0%
Sweden	0%
United Kingdom	0%
Australia	1.6%
New Zealand	12.3%
Canada	34.7%
USA	0%
Argentina	4.1%
Brazil	47.3%
Peru	0%
Uruguay	0%
Finland	0%
Switzerland	0%
Ecuador	0%
Spain	0%
Venezuela	0%
Pre-RMSPE	210.82
Post-RMSPE	1007.50
RMSPE-ratio	4.78

Note: The RMSPE-ratio indicates the ratio between the mean error for the post-treatment period and the pre-treatment period.

Figure 8: Income per capita



Note: The continuous line indicates Chile's per capita income for the 1900-1960 period; the dotted line represents the synthetic control; the dotted vertical line indicates the treatment year.

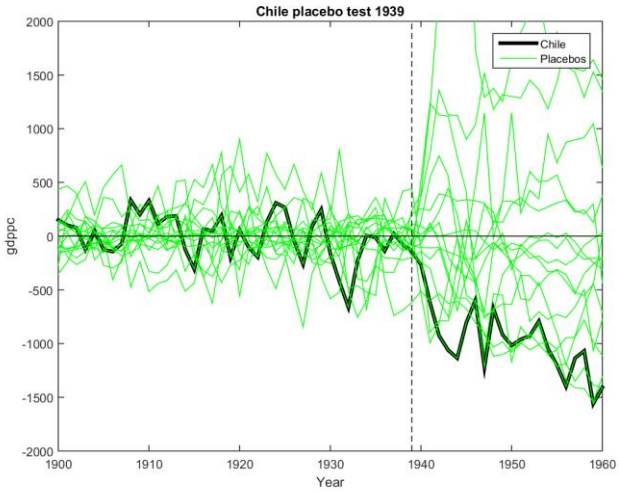
Placebo test

We replicated the synthetic control method applied to Chile for the 18 countries in the control group to study model robustness. In other words, we assumed that each country was affected by the treatment, and we developed a synthetic control using the same data as that for the 1900-1938 period. In this way, we estimated control deviations and the respective countries in the sample. The results are plotted in Figure 9.

As seen, Chile is the worst-performing country across the sample compared to its synthetic control, showing a negative and persistent difference throughout the post-treatment period.[9]

[9] Actually, Switzerland performs worse than Chile as compared with its synthetic control. However, this divergence is only temporary, becoming equal over an interval of 5 years. In addition, the pre-treatment RMSPE is 1750.5, and therefore it has the worst fit across the sample.

Figure 9: Placebo tests



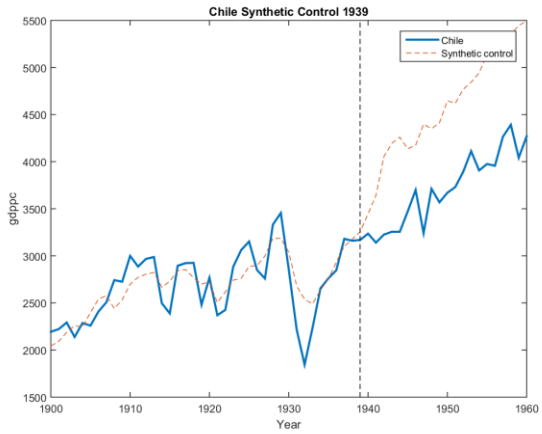
Note: The black line represents the income per capita difference between Chile and its synthetic control over the 1900-1960 period. The light-coloured lines represent placebo tests: the differences between the income per capita of the other countries and their respective synthetic controls. The plot only includes those countries whose RMSPEs over the 1900-1938 period are lower than $422 (twice that of Chile). New Zealand, the United Kingdom, USA, Switzerland, and Venezuela have been removed.

Jackknife Test

As an additional verification of test robustness, we considered the base model while removing the countries having the highest weights based on Table 1, i.e., Brazil and Canada. The results are shown in Figures 10 and 11. As seen, the results are not sensitive to the removal of any of these two countries. When Brazil is removed, the differences between Chile and its synthetic control remain very similar on average, although towards the end they start increasing even more, while when Canada is removed, the differences decrease, but not enough to change the analysis in any way whatsoever.[10]

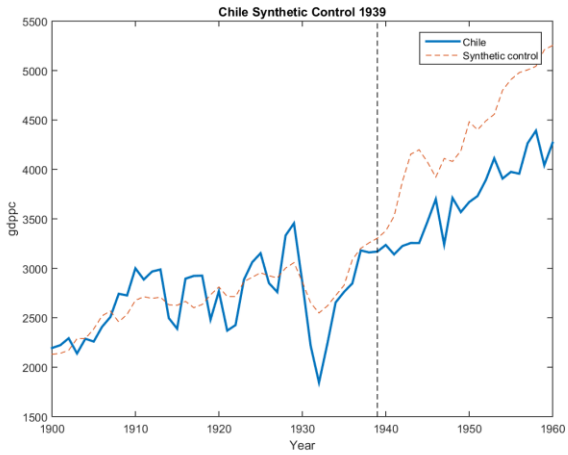
[10] Table 4, in the Appendix shows the values of the new weights assigned to both cases. The ratio between the pre- and post-treatment mean error is observed to be high in both cases, suggesting a significant divergence of the synthetic control after 1939.

Figure 10: Jackknife test



Note: SCM with Brazil having been removed from the panel. The continuous line indicates Chile's income per capita between 1900-1950; the dotted line represents the synthetic control; the dotted vertical line indicates the treatment year.

Figure 11: Jackknife test

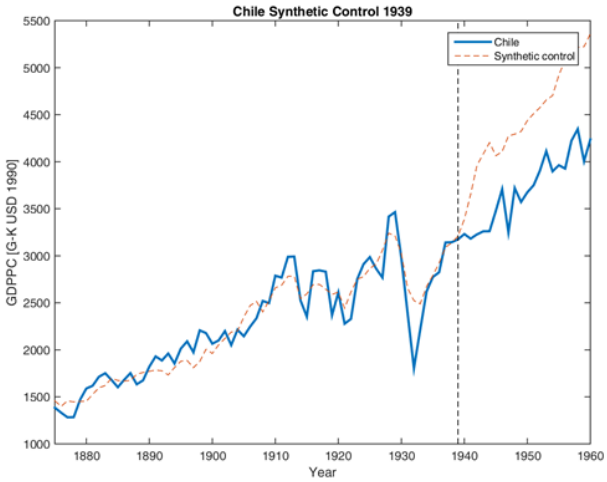


Note: SCM with Canada having been removed from the panel. The continuous line indicates Chile's income per capita between 1900-1950; the dotted line represents the synthetic control; the dotted vertical line indicates the treatment year.

1875-1939 Synthetic Control

As a final robustness test we took data from 1875 and once again applied the synthetic control method on our panel of countries.[11] We have argued that Chile was a transition economy from the end of the nineteenth century to the beginning of the twentieth century, and therefore, we made an effort for our counterfactual representation of Chile to also adjust to the 1875-1900 period. Figure 12 shows the path, and Table 3 shows the weights assigned by the SCM.

Figure 12: Income per capita



Note: The continuous line indicates Chile´s income per capita for the 1875-1960 period; the dotted line represents the synthetic control; the dotted vertical line indicates the treatment year.

[11]Ecuador had to be removed from the panel because it had no data on income per capita for the entire 1875-1900 period.

Table 3: Weights assigned by the SCM.

	Weights
Denmark	0%
Norway	0%
Sweden	0%
United Kingdom	0%
Australia	0%
New Zealand	3%
Canada	5%
USA	30%
Argentina	0%
Brazil	17%
Peru	44%
Uruguay	0%
Finland	0%
Switzerland	0%
Spain	0%
Venezuela	0%
Pre-RMSPE	174.21
Post-RMSPE	796.30
RMSPE-ratio	4.57

Note: The RMSPE-ratio indicates the ratio between the mean error for the post-treatment period and that for the pre-treatment period.

As shown in Figure 12, the behaviour of the synthetic control is very similar to that of the previous model when only the 1900-1938 period is used as pre-intervention period. The difference with respect to Chile's income per capita rapidly increases from 1939 and corresponds to US$796.3 on average, although it is somewhat lower than the figure shown by the base model (US$991.61). However, the average fit is also better, since the root mean square prediction error is US$174.21, lower than the previous US$184.41.

Once again, a placebo test was carried out for this representation, applying the SCM for the 18 countries in the panel as if they had been subject to treatment. Figure 12 (available upon request) shows the results.

5. Conclusions

In this paper we have studied the problem of why countries suffer from growth-slowdowns which lead them to diverge from developed countries. Moreover, we examine countries that previously had long-periods of growth thanks to favourable ideas institutions and leaders. Those are called in the modern literature, countries that suffered the middle-income trap. For this, we focus on the case of Chile.

We have argued that Chile went from being a high-growth economy during the nineteenth century to a transition economy that slowed its relative progress between the end of the nineteenth century and the beginning of the twentieth century. Subsequently, it moved away from developed countries. In brief, Chile fell into the middle-income trap. What are the factors underlying this phenomenon? Learning from failures is important. We confirmed the importance of ideas and institutions, now in the process of development failures. For example, the role of the state tends to debilitate macroeconomic balances, close the economy, encourage rent-seeking, and weaken the rule of law. We also learned about the importance of internal and external factors that facilitate the changes in ideas and institutions. Conflicts, disasters and other crises, in a context with weak state capacity, lead to accumulation of critical mass and a change of regime in terms of ideas and institutions.

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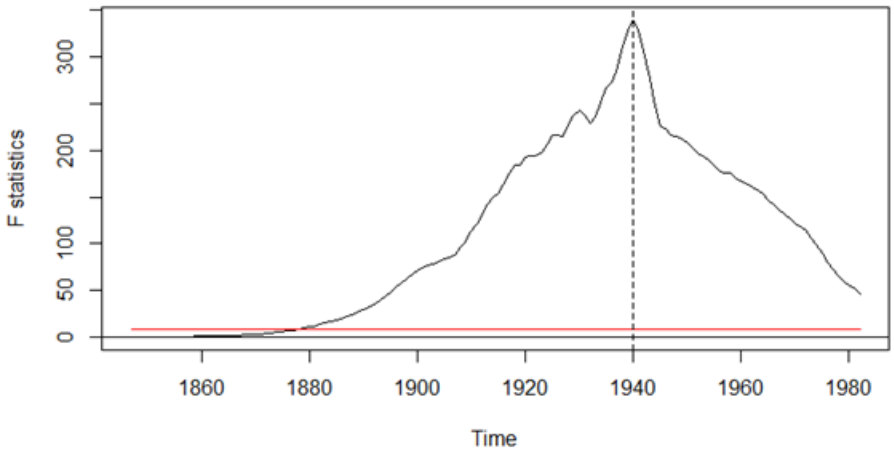
Appendix

Table 4: Weights assigned by the SCM under Jacknife

	Without Canada	Without Brazil	Complete Panel
Denmark	0.00%	0.00%	0.00%
Norway	0.00%	0.00%	0.00%
Sweden	0.00%	0.00%	0.00%
United Kingdom	0.00%	0.00%	0.00%
Australia	11.0%	1.50%	1.60%
New Zealand	18.7%	13.70%	12.30%
Canada	-	30.90%	34.70%
USA	9.50%	0.00%	0.00%
Argentina	6.10%	7.60%	4.10%
Brazil	0.00%	-	47.30%
Peru	0.00%	0.00%	0.00%
Uruguay	19.63%	0.00%	0.00%
Finland	0.00%	0.00%	0.00%
Switzerland	0.00%	0.00%	0.00%
Ecuador	54.80%	46.30%	0.00%
Spain	0.00%	0.00%	0.00%
Venezuela	0.00%	0.00%	0.00%
Pre-RMSPE	244.44	215.81	210.82
Post-RMSPE	728.70	926.08	1007.50
RMSPE-ratio	2.98	4.29	4.78

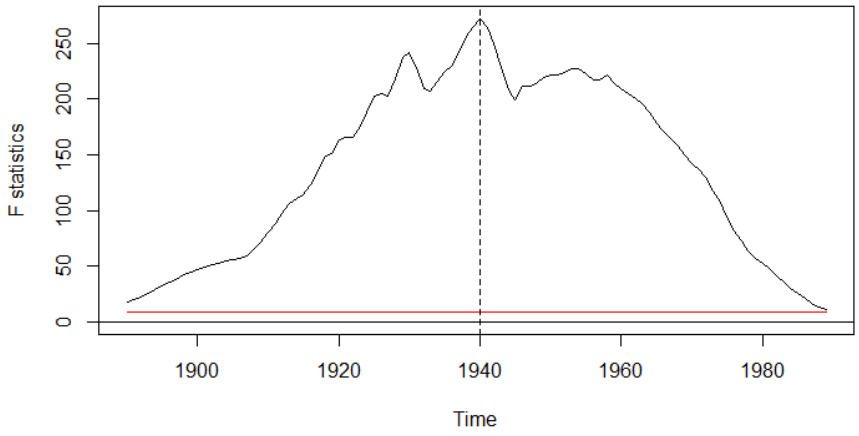
Note: The RMSPE-ratio indicates the ratio between the mean error for the post-treatment period and that for the pre-treatment period

Figure 13: Chow Test – Chile/United States



Note: The maximum value of the F statistic indicates the structural change period for the relative income series between Chile and the United States in the period from 1820 to 2010 with data from Maddison (2013). The red line indicates the critical value of the statistic for the adjusted model, in this case a constant.

Figure 14: Chow Test - Chile/Western Offshoots + Western Europe 12



Note: The maximum value of the F statistic indicates the structural change period for the relative income series between Chile and the sum of Western Offshoots and Western Europe over the period from 1870 to 2010, with data from Maddison (2013). The red line indicates the critical value of the statistic for the adjusted model, in this case a constant.