

# Productive development policy for Chile: an alternative to stagnation

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## Abstract

Since 1998, Chile has been experiencing a significant slowdown in its economic growth. The Chilean economy's recent poor performance is attributable to a halt in productive and export diversification around the beginning of the twenty-first century. State interventions have been horizontal, eschewing those to support specific industries. Intermediate interventions have focused on promoting activities (such as new exports and technologies) that form only a small part of the Chilean economy, leaving a wide margin for market forces to select companies and sectors. In terms of vertical policies, support for green hydrogen is proposed, as this is an emerging industry in which Chile has clear comparative advantages. The article also argues for exchange rate policies that mitigate sharp fluctuations in the real exchange rate and ensure a stable and competitive exchange rate for new exporters.

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## Keywords

Economic growth, productivity, production diversification, export diversification, industrial policy, technological innovations, renewable energy sources, monetary policy, foreign exchange rates, development policy, Chile

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## I. Introduction

In small, open economies (such as Chile's), aggregate growth is inexorably linked to export growth. However, export growth is not possible without diversification, especially in an economy with the characteristics of Chile's, whose exports of copper account for almost 30% of world exports of the metal.

The clearest driver of growth is investment. Looking deeper into its causes, it is not difficult to link volumes of investment to increases in exports and, in particular, to diversification beyond the country's traditional export good, which cannot grow faster than demand for it, or, in the case of Chile, without resulting in a fall in its price.

The boom that followed the recovery from the financial crisis of 1982–1985 was largely a result of sustained export diversification. A process that had begun toward the end of the military dictatorship became more pronounced and a series of new exports emerged, including some 3,000 categories of manufactured goods.

The stagnation that followed the Asian and Russian crises in 1999, which has continued to this day, is tied to the lack of emergence of new exports. In fact, some items, such as manufactured goods, declined sharply. From the early 2000s, the economy experienced positive disruption from a large rise in the real price of copper, which lasted until the global financial crisis of 2007–2008. After a short-lived drop in copper prices, starting in 2009, rises continued until the end of 2013, mainly owing to high Chinese demand for the metal. The boom cycle seemed to come to an end in 2014.<sup>2</sup>

The clear improvement in the terms of trade since the beginning of the 2000s caused the Chilean economy to suffer considerably from what is known as the Dutch disease, characterized by marked appreciation of the currency. This is perhaps the cause of the stagnation of non-copper exports, the decline of some key exports and the limited appearance of new products.

This article proposes a set of policies to revive export growth and diversification. It stresses that the need to combat global warming presents Chile with unique opportunities for productive diversification, which must be supported by industrial policy for the coming decades. The article also addresses measures relating to the exchange rate, to make it a more effective instrument of productive development policy.

The article is structured as follows. Section II discusses the relationship in the context of Chile between GDP growth and export growth, focusing on export diversification. Section III explains the links between diversification and export complexity on one hand, and growth on the other. Section IV outlines the productive development policy proposals; the aim is for the proposals to consider the country's political economy environment and eschew extreme measures that would be difficult to implement successfully. Section V looks at how exchange-rate policy can support productive transformation, without abandoning the floating exchange rate that has been in place since 1999. Section VI provides some conclusions.

## II. Aggregate growth and export growth

Chile is at a crossroads. Since 2010, the country has been governed by a variety of coalitions, but no strategy has yet been found to improve on the meagre growth seen in its economy over more than two decades. This article postulates that the explanation for the gradual slowdown in growth is exhaustion of the productive development policies that boosted growth substantially after the recovery from the financial and economic crisis of 1982–1985 and, in particular, after the return to democracy in 1990.

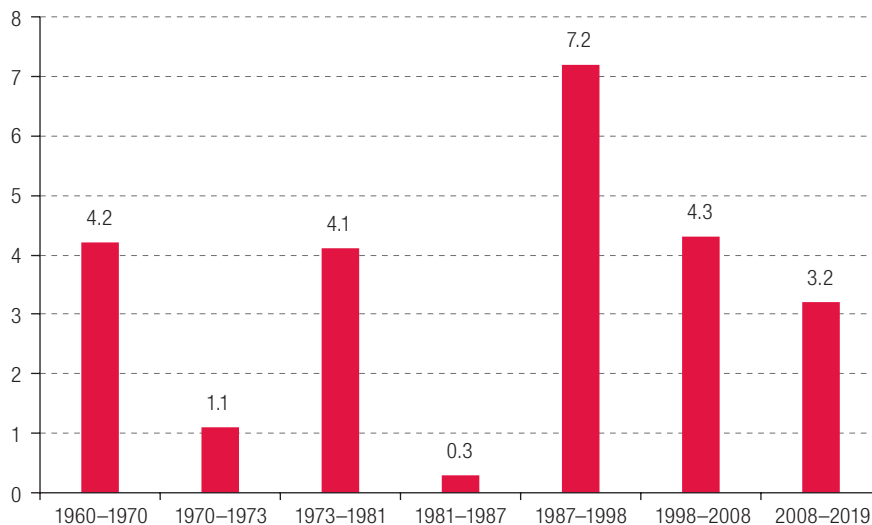
<sup>2</sup> Given the huge demand for copper in the transition to e-mobility, copper prices are likely to resume their uptrend as more and more conventional vehicles are replaced with electric vehicles.

It is time to rethink productive development policy (once called “industrial policy”) to make it stronger and more aligned with the objective reality of the Chilean economy in the global situation it must face.

Many policy reforms were proposed and implemented by the governments that followed the military dictatorship. Despite the efforts made over more than 30 years, productive development policy has never been one of the Chilean economic authorities’ core concerns. Projects have not been assigned sufficient resources and have not been maintained after each change of government. In order to succeed, industrial policies must be State policies and not depend on who is in government.<sup>3</sup> In Chile, since the return to democracy, each new government has made radical policy changes instead of building on existing successes, resulting in this lack of continuity.<sup>4</sup>

The economy returned to its 1981 GDP level only in 1987. After the “golden age” of the Chilean economy (1987–1998), when an annual growth rate of 7.2% was attained, the economy gradually slowed, taking growth to even weaker levels than those recorded during the military government (see figure 1). One factor that contributed to the exceptional growth in 1987–1998 was significant diversification of the export basket, adding new goods such as salmon, wine, fresh fruit, paper and pulp, wood products and even many manufactured goods.<sup>5</sup>

**Figure 1**  
Chile: real GDP growth rates, annual averages, 1960–2019  
(Percentages, chained prices of the prior year, base year 2018)



**Source:** Prepared by the author, on the basis of data from Central Bank of Chile.

The sustained slowdown in growth largely explains why criticism of the market economy has intensified and demands for redistribution have proliferated. The Central Bank of Chile and the Ministry of Finance report a gradual but sustained slowdown in the potential (i.e., long-term) growth of the

<sup>3</sup> According to Breznitz (2007, p. 148), Ireland has been persistent in its productive development policies, which have been supported by both liberal-reformist and conservative governments. Breznitz calls these policies “neoliberal interventionism”, because they combine an adherence to the market with a large role for government in attracting foreign investment in high-tech sectors.

<sup>4</sup> This is especially true in the case of the National Council for Competitiveness Innovation (CNIC), created in the closing months of the government of President Lagos, whose direction was radically changed during the first government of President Piñera, and in the case of the High Technology Investment Promotion and Attraction Programme, also created during the government of President Lagos, which, despite being successful on a small scale, was transferred from the Production Development Corporation (CORFO) to InvestChile (a Ministry of Economic Affairs entity aimed at attracting, regulating and recording foreign direct investment), and left without resources.

<sup>5</sup> This phenomenon is described very well in the individual papers published in Meller and Sáez (1995).

economy, attributable to a decline in investment and no expansion of total factor productivity (TFP). The two phenomena are related. Investment will not pick up in a small economy whose tradable sector is still dominated by copper. Nor are increases in TFP going to be achieved if the economy does not move into new, higher productivity sectors. The halt of the productive and export diversification process that began in 2000 is one of the main causes of Chile's stagnation.

In contrast to more recent trends, the rapid growth of the economy in the 1987–1998 period coincided with substantial productive and export diversification. From the mid-1980s to the end of the 1990s, non-mining exports at constant prices grew at a rate of 11.5% (author's calculations based on data from Central Bank of Chile).<sup>6</sup> In 1997, they accounted for almost two thirds of total exports. Likewise, Agosin and Bravo-Ortega (2009) established that the sharp increase in exports up to 2000 was largely a result of the “discovery” (in the sense employed by Hausmann and Rodrik, 2003) of new export products. According to Agosin and Bravo-Ortega (2009), a good is considered an “export discovery” when, defined at the four-digit level of the Standard International Trade Classification (SITC) in the United Nations International Trade Statistics Database (UN Comtrade), it exceeds US\$ 1 million exported (at 2000 prices) in any year of the 1962–2000 period and remains at least at that level throughout the remainder of the period after its discovery. The work of Agosin and Bravo-Ortega (2009) shows that the bulk of export discoveries occurred in the 1985–2000 period, following the trade liberalizations of the 1970s and the recovery from the severe financial and economic crisis of 1982–1983.<sup>7</sup> The study estimates that, by 2000, more than one third of Chilean non-mining exports were of products that were not exported before 1980.<sup>8</sup>

The good performance of non-copper exports was largely a result of economic policies that gave them a boost, even during the dominance of the “neoliberal” policies of the military dictatorship. For example, the subsidy for afforestation and reforestation established at the beginning of the military government (Decree Law No. 701 of 1974) ultimately led to sharp increases in exports of wood, paper and pulp. The investments made by the non-profit corporation Fundación Chile in salmon farming, supported by the Japan International Cooperation Agency (JICA) in the late 1970s, resulted in a marked growth in farmed salmon exports from in the mid-1980s.<sup>9</sup> The marked depreciation of the Chilean peso in real terms after the 1982 crisis (which lasted for most of the rest of the 1980s and the 1990s, although with a tendency toward appreciation in the latter decade) also contributed to boosting investments in new potentially exportable products, which bore fruit a few years later. The “simplified drawback”, which was in place between 1985 and 2003 and consisted of a 10% subsidy for exports of less than US\$ 20 million for an entire tariff heading, also contributed (Agosin, Larraín and Grau, 2009). This subsidy was granted in exchange for the rebate of customs duties on imported inputs and the benefit disappeared automatically when the tariff item exceeded US\$ 20 million.

Although new exports continued to grow until 2008, their pace of growth slowed and they gradually accounted for a smaller and smaller proportion of total exports, mainly owing to a copper price boom. In the decade from 2008 to 2018, non-copper exports as a whole have been stagnant. In terms of volume, copper exports, in real terms, grew at a rate of 0.7% per year, while non-copper exports increased at a rate of 1.6%. Between 2008 and 2018, prices of exports other than copper remained steady. Figure 2 shows values at constant 2013 prices of copper exports and other products for the 2008–2018 period.

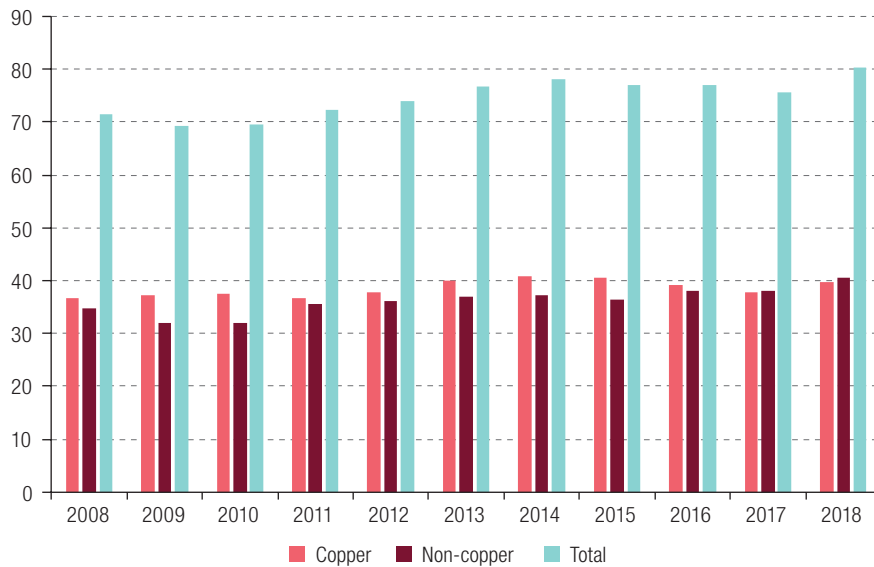
<sup>6</sup> All actual export figures have been calculated on the basis of export values deflated by their own international price indices.

<sup>7</sup> Agosin and Bravo-Ortega (2009), table 2, p. 58.

<sup>8</sup> This hypothesis tallies with the analysis conducted more than a decade earlier by Amin Gutiérrez de Piñeres and Ferrantino (1997).

<sup>9</sup> Agosin, Larraín and Grau (2009) and Agosin (1999). See also Achurra (1995) and Hosono, Iizuka and Katz (2016).

**Figure 2**  
Chile: volume of exports, 2008–2018  
(Billions of dollars at constant 2013 prices)



**Source:** Prepared by the author, on the basis of figures from Central Bank of Chile.

**Note:** Each export category is deflated by its own price index. Non-copper export figures are aggregates of exports at constant prices of all components of that category.

If the country is to return to a growth rate of 5% or more, non-copper exports will have to grow much faster than GDP. Since Chilean copper exports account for almost 30% of world exports of the metal, they will not grow at a rate above 3% (based on unitary income elasticity of copper demand and considering that the world economy will not grow much more than that figure in the medium term). In addition, Chile is depleting its known high-grade deposits, meaning that growth in world demand puts a ceiling on foreseeable growth in Chilean exports of the metal. Therefore, exports of other goods and services will have to grow at a much faster rate.

Part of the inequality in income distribution in Chile seems to be caused by the low density of high-productivity jobs and the predominance of unskilled and informal jobs. Only a few sectors are at the world's production possibility frontier and are capable of generating high wages. A recent article showed that countries that produce a more diversified and complex basket of goods (in the sense of including more knowledge) tend to have lower levels of inequality than others such as Chile, which can produce very few goods competitively and whose productive and export basket is concentrated in low-complexity goods (Hartmann and others, 2017).

### III. Some analytical considerations

The Chilean experience shows that, in a small and open economy, with almost all productive sectors located within the world production possibility frontier, fast growth is related to new goods being added to the productive and export basket.

Several studies on developing countries support the hypothesis that, controlling for other variables that influence growth, initial export diversification is a good predictor of future economic growth. In one study (Agosin, 2009), a theoretical model is outlined and an empirical growth model is estimated with a sample for 124 developing countries over the 1980–2003 period. The regressions performed indicate

that a diversification index (unity minus the Herfindahl-Hirschman index applied to exports from the UN Comtrade database disaggregated at the three-digit level of SITC) was positively correlated with growth, after controlling for other variables that could affect it. Hesse (2008) reaches similar conclusions using a Theil index of export concentration. Using panel data for developing countries, Hesse finds that the Theil index at its extensive margin is negatively correlated with growth in these countries.

Other studies have expanded on the idea that what matters is not only production diversification and export diversification, but also promoting more technologically sophisticated exports. These authors — at the Center for International Development of the Kennedy School of Government of Harvard University — put emphasis on diversification into more complex products. The studies define an index of economic complexity for countries based on disaggregated export data and conclude that initial export complexity is positively correlated with subsequent growth, even after including various controls (see, for example, Hausmann and Rodrik (2006), Hausmann, Hwang and Rodrik (2007), Hausmann and Klinger (2006), Klinger and Lederman (2006) and Hausmann and Hidalgo (2011)).

Obviously, complexity goes hand in hand with diversification, but the role of exports with a higher technological content is also emphasized. The way the Harvard researchers' studies determine whether a country has a more complex export basket is related to the type of goods: if they are typical of those exported by countries with higher per capita income, the economic complexity index will be higher than if the country exports goods linked to those exported by lower-income countries. For example, of 128 countries for which economic complexity index calculations were performed, ordered from highest to lowest, in 2017 Chile was in sixty-sixth place, while in terms of per capita GDP it was in forty-first place.<sup>10</sup>

It is therefore important to ask why exports and particularly their diversification or complexity are key determinants of growth in developing countries. There are three reasons why exports are critical. First, the vast majority of countries do not produce capital goods. Therefore, investment unavoidably requires exports. Second, domestic markets tend to be small and production for the domestic market promptly runs into demand problems. This is why import substitution did not achieve the objective of boosting the economies of many small countries. Third, as Cherif and Hasanov (2019) stress, the act of exporting forces firms to improve their productivity and innovate to remain competitive, which they are not compelled to do in protected domestic markets. These authors suggest that companies' inability (or reluctance) to export manufactured goods, rather than high tariffs, are behind the slow economic growth of many countries such as those in Latin America. The successful Asian economies (the Republic of Korea, Singapore and Taiwan Province of China) seem to have been quite protectionist, but at the same time compelled their companies to export and thus continuously modernize.

The literature linked to Hausmann, Rodrik and their co-authors and the work of Cherif and Hasanov (2019) both emphasize that industrial policies should aim for innovation and increased complexity, not just diversification. However, in the case of countries such as Chile, which still depend on a limited number of export goods and are also far from the world's major markets, diversification on its own appears to be a good first step, as suggested by Benavente (2016). Nor is it advisable for countries that do not meet all the prerequisites for success in advanced manufacturing to embark on production of complex goods without considering the likelihood of achieving the desired results. Brazil's unsuccessful experience with its information and communications technology policy, in which considerable government resources were spent with negligible results, is a lesson for other countries considering a leap towards creating new sectors that are too far removed from their existing comparative advantages.<sup>11</sup>

<sup>10</sup> See Atlas of Economic Complexity, Harvard University [online] <https://atlas.cid.harvard.edu/>.

<sup>11</sup> Brazil's failed efforts to build an information and communications technology industry, for both software and hardware, are described in Crespi, Fernández-Arias and Stein (2014), pp. 16–18. The same text discusses the more successful experience of Embraer, although this company only became internationally competitive after being privatized, following a long period as an Air Force company. One lesson from Embraer is that one must keep in mind the need not only to establish a final assembly company, but also to foster the emergence of competitive parts and inputs companies that enable the firm that assembles the final product to operate.

Furthermore, achieving greater complexity in production and exports partly depends on the density of a country's internationally competitive sectors. Assuming that there is a random element to the success of innovations, the more diverse its exports are, the greater the chances of successful innovation. In the case of Chile, where only a handful of products are exportable, success in innovation is limited.

In a recent study, Agosin and Retamal (2021) model the growth of an economy as the addition of new production functions to existing ones. For a production function to be integrated into a country's production, there must be a pioneer who "discovers" its parameters. This involves copying technologies that are already in use in other economies, which entails a variety of costs. Shortly after a technology is introduced, other producers ("copycats") can use it without incurring the costs of its discovery. In fact, the scaling up of production and exports is contingent on the emergence of these copycats. However, for the technology to be used, public investment is needed in infrastructure in a broader sense of the word (not only physical infrastructure but also public regulations, an adequate institutional framework, training of human resources in specific skills, and even the availability of credit).

In the model, growth occurs not as a result of producing more of the same (it is even assumed that the traditional sector does not grow) but rather by adding new productive sectors. The particularity of these sectors is that they require not only unskilled labour but also skilled labour, which is supposed to arise from on-the-job learning. Therefore, production by these sectors has a spillover effect: it creates skilled labour that can be used by other sectors.

The model has no analytical solution, since it is open to the introduction of new sectors. But it is possible to simulate it, giving the parameters reasonable values and making sure that it converges to feasible solutions. The model has three economic policy variables, which in reality represent a stylized view of industrial policy: (i) investment subsidies that aim to promote new production functions; (ii) the corporate income tax rates for different parties (in the traditional sector and, in the modern sector, for pioneers and copycats); and (iii) the options for deciding which infrastructure projects to invest in, given that each project does not benefit one sector alone but a family of sectors that use the same non-tradable inputs (for example, infrastructure that enables production of computer monitors can also be used by producers of television sets and other electronic goods).

The results obtained from the simulations are of considerable interest. Because the model includes an equation that represents the necessary budgetary equilibrium, a larger subsidy for investment to promote new production functions takes resources away from infrastructure spending. The policies that maximize the growth rate consist of partially subsidizing investment of pioneers and investing in sectors that are intensive in skilled labour, precisely because of the spillover effect from these sectors on other sectors with potential that are intensive in skilled labour.

The model includes a simulation that accounts for learning by doing. The simulation yields a path of GDP over a 50-year period that is quite similar to those followed by the per capita GDPs of the Republic of Korea and Taiwan Province of China. Without learning by doing, the path of GDP is very similar to that of Chile's per capita GDP.

In short, what these new studies indicate is that there are several components of a successful industrial policy. First, as Cherif and Hasanov (2019) emphasize, policies should steer producers toward international markets. Second, they must broaden the range of products produced by a country, because, as Hausmann and Rodrik (2003) state in their seminal work, there is a spillover effect that discourages investment in information, since it benefits those who have not made the investment. Third, any new sector requires a supply of its essential non-tradable inputs (what Agosin and Retamal call "infrastructure"). In this area, it is fundamental that the steps taken by the State are well thought-out.



## IV. Modern productive development policies for Chile

It has become customary to classify productive development policy instruments according to two dimensions: (i) whether they are horizontal in nature (which is to say that they could support any sector with a market failure that the policy seeks to correct) or vertical (aimed at fostering the emergence of a specific industry or strengthening one) and; (ii) whether they are implemented through market interventions (in other words, altering relative prices) or through provision of public goods. Under this classification, policies can be divided into four categories: (1a) horizontal policies implemented through market interventions; (1b) horizontal policies implemented through provision of public goods (for example, a relatively stable and competitive exchange rate for new exports); (2a) vertical policies implemented through market interventions; and (2b) vertical policies implemented through provision of public goods. We will not look at examples that have already been studied (in particular, in the work of the Inter-American Development Bank (IDB) edited by Crespi, Fernández-Arias and Stein, 2014), but we will use this classification to discuss policies that can help Chile out of its stagnation.

Chile has in fact implemented some productive development policies and they contributed to export diversification. Thus, new export sectors have appeared, including fresh fruit (increasingly varied), farmed salmon (which has become a large industry, exporting more than US\$ 6 billion), forestry, pulp and paper (with exports of US\$ 7 billion) and wine (with exports of US\$ 2 billion). State agencies have been involved in the emergence and consolidation of these sectors and have taken on different roles. The specific policies that contributed to these successes are described in the work by Meller and Sáez (1995), Agosin (2009 and 2011) and Agosin, Larrain and Grau (2009).

The various dimensions of industrial policy for the future are summarized in table 1, using the classification of Crespi, Fernández-Arias and Stein (2014), but adding a third dimension: intermediate policies that are between horizontal and vertical ones, which exclude some industries and support others, without indicating in principle which specific sectors will benefit from the incentives included in the policy.

**Table 1**  
Productive development policies that show potential for Chile

	Horizontal (H)	Vertical (V)	Intermediate
Provision of public goods (P)	Competitive and stable exchange rate  Strengthen and improve free trade agreements	Support venture capital  Convert the Production Development Corporation (CORFO) into a development bank  Support human capital for emerging industries  Public-private coordination	
Market intervention (M)		Capitalize on potential comparative advantages: green hydrogen, lithium, green mining	Temporary subsidies for new exports  Incentives for investment in new technologies

**Source:** Prepared by the author.

Some of the main features of the policies listed in table 1 are described below. Because it is especially important, the question of the exchange rate will be addressed toward the end of this article.

In addition to the exchange rate question, the other policy that appears in the top left cell (HP policies) refers to increased participation in the global market through multilateral agreements within the framework of the World Trade Organization (WTO), multilateral treaties — such as the Comprehensive



and Progressive Agreement for Trans-Pacific Partnership (CPTPP)— or bilateral treaties. Notably, Chile has not entered into agreements with some countries in South-East Asia and those agreements it has signed with other countries (such as India) are quite restrictive. Access to markets is extremely important for countries such as Chile that need to export in order to grow. Strengthening and modernizing existing agreements and signing new agreements with countries that are key markets are therefore vital government contributions to productive development policies.

In the cell in the third column, first row, of table 1 (VP policies), there are several policies which Chile is lacking. One is support for venture capital. State participation in promoting venture capital can take several forms: some State agencies (such as BancoEstado, the Production Development Corporation (CORFO) or a potential new development bank) may invest in such companies together with private investors, public regulation may support new companies being floated, or the profits from the sale of companies created by venture capital firms may be exempt from capital gains taxes. Also, facilitating initial public offerings (IPOs), which is how venture capitalists most commonly divest successful firms, could give the industry a substantial boost.

Perhaps the most important task for the State in pursuing new activities to diversify the production and export apparatus is establishing a development bank, potentially by transforming CORFO, whose current role is that of an administrator of around 150 development programmes, which are difficult to assess in terms of effectiveness. Chile needs a development bank to financially support new activities that will lead it to become a developed country. One of the problems faced by entrepreneurs is the scarcity of capital for investment in fixed capital. A development bank can attract long-term capital at preferential rates for investments that are well aligned with the country's long-term goals.

It is not necessary for the development bank to interact with end users of its financing facilities: it can function as a second-tier bank, using commercial banks as a conduit for resources to reach users. This removes the need for the development bank to undertake due diligence for each loan and reduces the temptation to use resources for other purposes. The most successful development bank in the world and the largest in Europe is the German government's KfW. Except in the event of a crisis, KfW acts as a second-tier bank (see Moslener, Thiemann and Volberding, 2018).<sup>12</sup> In its financial activities, CORFO has already been acting increasingly as a second-tier bank (Jiménez, 2009).

In several developed and developing countries, development banking plays a pivotal role between the public sector units that formulate development policy and the financial sector. Since a development bank is an entity that is financed largely by placing bonds with State guarantees on national and international financial markets, it must remain solvent and aim to obtain and retain the best possible credit rating, without this affecting it being less profitable than private banks, because a portion of its loans are at below-market rates and its goal is social returns and not private profits.

In this same cell is education at the university and technical levels, focused on the needs of new industries. Training in new technical and professional skills must be aligned with the development policy vision and the specific industries it aims to promote.

Lastly, this cell includes the role of the State of coordinating its own agencies, as well as coordinating the public sector and private companies. This function includes removing bureaucratic hurdles, coordinating different public agencies, drafting regulations, designing proposed legislation as necessary and acting as a forum where the private sector, universities and the public sector can coordinate their actions.<sup>13</sup>

<sup>12</sup> This work is part of an interesting set of recent studies on development banking in various countries edited by Griffith-Jones and Ocampo (2018).

<sup>13</sup> Devlin and Moguillansky (2012) provide examples of such institutions that have worked well in other countries and draw conclusions for Latin American countries.

In the cell in the fourth column, second row, are some sectors that already appear to be of great importance for the future: green hydrogen, lithium and decarbonization of mining. All are aligned with the commitments made by the country under the Paris Agreement to address global warming. If the mining sector does not make the transition to green mining, in the medium term Chile will not be able to export mining products because they will be subject to high carbon footprint taxes in importing countries.

Given that solar power and wind power in Chile are among the cheapest in the world, the country could become one of the main exporters of hydrogen extracted through technologies that make use of green energy (Ministry of Energy of Chile, 2020). Green hydrogen fulfils two functions: it contributes to decarbonization of the national economy and diversifies exports with a new product that will be in demand worldwide. Studies indicate that Chile is already internationally competitive in green ammonia and that within a few years it will be competitive in green fuels. Development of this industry would be of prime importance for the economic future of the country. It is estimated that, by 2040, green hydrogen could become an industry that could rival today's mining industry.

To realize this potential, government action is required in the following areas to overcome the coordination problem: (i) ensuring a supply of specific human capital for this new industry, estimated at some 500,000 skilled workers, including technicians and professionals; (ii) committing to maintaining rules of the game that are conducive to business; (iii) developing regulations for green hydrogen that meet international standards and facilitate international certifications for producers; and (iv) adapting ports for transporting the fuel to foreign markets and performing other work on infrastructure to supply domestic users (such as mining). The investments required are likely to be greater than those either the State or the domestic private sector is in a position to make.

The projections for lithium are also particularly good, both in terms of exports and in terms of production of components for global e-mobility value chains.

In this study, we will examine two policies that could be said to be intermediate or hybrid that could be designed and implemented relatively quickly, as they have precedents in previous policies. One such policy these are possible policies, not past policies as indicated in this sentence, please reword was previously abandoned and the second is still in place through InvestChile, but has been left without any financing.

These policies are distinguished firstly by the fact that authorities select the characteristics of the sectors that they wish to support, but leave it to market forces to determine which specific sectors are developed. And secondly by the fact that public support is either strictly temporary or ends automatically.

One intermediate policy could be a 5% subsidy for new exports, defined as those for which the entire export category accounts for less than US\$ 50 million. Once exports reach the threshold, all the companies that export goods in the category cease to receive the subsidy. It could be argued that WTO has prohibited subsidies; however, the Agreement on Subsidies and Countervailing Measures contains a *de minimis* clause for developing countries. This means that for the importing country to take action against the exporter, the subsidized exports must exceed 2% of imports of the good into the importing country. It is unlikely that a small subsidy for an entire tariff heading, which would automatically disappear when exports exceed US\$ 50 million, would result in retaliation against Chile.<sup>14</sup>

<sup>14</sup> A reader who is familiar with the history of trade policy over the last 40 years will realize that this proposal is connected to the "simplified drawback" that was in place until 2003, when Chile classified it as a subsidy and notified the WTO that it would be suspended. This version does not link the subsidy to a refund of customs duties on imported inputs and is easier to operate. Agosin, Larraín and Grau (2009) show that the "simplified drawback" was highly effective in supporting manufacturing exports.

The other policy already mentioned is the High Technology Investment Promotion and Attraction Programme, which ran from 2001 to 2010, when the first Government of President Piñera withdrew its funding. That programme succeeded in attracting around a hundred companies. Its main incentive was a subsidy for hiring skilled labour (US\$ 25,000 per worker) and a US\$ 5,000 subsidy for each unskilled worker. The subsidy was granted on a one-time basis and the companies undertook to remain in Chile for ten years. It is estimated that the programme generated some US\$ 2 billion in service exports (see Agosin and Price, 2009).

Lastly, a competitive and stable real exchange rate is the broadest, cheapest and probably the most powerful instrument of productive development policy. This is the subject of the following section.

## V. Adjustments to exchange-rate policy

The question of exchange-rate policy has been left for the end of this article. It is fundamentally a horizontal policy, implemented by providing public goods. The exchange-rate regime is determined by the central bank's choice of monetary policy. In the case of Chile, the correlate of the floating exchange rate that has been in place since late 1999 is the inflation targeting regime, whereby the interest rate is used to maintain the inflation rate within the Central Bank's target range (set for more than two decades between 2% and 4%). However, because the level of the real exchange rate and its volatility have an enormous impact on economic growth, and thus on the profitability of tradables sectors — particularly new exports that are close to becoming profitable— productive development considerations should be taken into account when formulating the framework for a floating rate. Therefore, having an exchange rate that favours export diversification does not necessarily entail abandoning a floating exchange rate, which has been a vital tool in maintaining price stability in Chile since it was adopted in late 1999. In a recent article, Guzmán, Ocampo and Stiglitz (2018) put forward a thorough argument on the importance of a competitive and stable exchange rate for growth.

There are two reasons to consider the foreign-exchange market different from goods and services markets. First, unlike prices of individual goods, the exchange rate affects the entire economy. To achieve productive diversification, it is important for the real exchange rate not to be too uncertain and for it to be at a level that stimulates new exports.

Second, the level and volatility of the real exchange rate can be influenced by economic policy measures. However, this article is not arguing for frequent foreign-exchange intervention by the Central Bank. It is more important to have an impact on the fundamentals of the real exchange rate, which is to say that part of copper revenues that now pass through the foreign-exchange market can be saved and short-term, liquid capital movements unrelated to internal macroeconomic equilibrium can be discouraged when necessary.

Exchange-rate volatility, both real and nominal, has been high in Chile, particularly since the adoption of a floating rate and in comparison with other emerging economies. These assertions are tested in this article using econometric tests outlined later, which are available to any person seeking further information. With the real exchange rate as a first-order integrated series, the monthly real exchange rate figures reveal that there are two structural breaks in the series from January 1986 to July 2019. The first occurred in April 1991 and the second in May 2000. The latter break came at almost the same time as adoption of the floating exchange-rate regime.

In this article, the relative level of volatility in the periods from April 1991 to May 2000 and June 2000 to July 2019 is estimated in three different ways. The first is to estimate the standard deviation of the moving average of the logarithm of the real exchange rate in 12-month windows. The second is to estimate, through a generalized autoregressive conditional heteroskedasticity (GARCH) model, the

predicted conditional variances in the multilateral real exchange rate for the two periods. The third is to estimate the first indicator for a representative group of emerging economies and compare the volatility of Chile's real exchange rate with its emerging peers.<sup>15</sup>

The result of the first two methods for estimating the volatility of the real exchange rate is that it was more volatile in the second period, when a floating-rate regime had already been adopted. The third method indicates that, in the 1990s, Chile was in a group of countries with relatively low real exchange-rate volatility and from 2000 onward in a group with high real exchange-rate volatility.<sup>16</sup>

Fluctuations were caused by external shocks, both financial and real, that affected the economy, and by agents' overreactions, which are characteristic of asset markets. Firstly, fluctuations in the price of copper are important, as its prominence in exports means that when copper prices rise, there is a real appreciation of the Chilean peso (decrease in the value of foreign currency) and depreciation, naturally, when copper prices fall.

Secondly, there tend to be large inflows of capital, resulting in net inflows that are difficult for the domestic economy to absorb when international markets are very liquid and risk-tolerant; these flows generally come to a sudden stop when international markets become illiquid, when interest rates in core countries rise or when the fundamentals of recipient countries worsen following booms. These sudden stops, in the Case of Chile — and in many emerging economies — have come after booms that have resulted in appreciation of the peso in terms of the real exchange rate, thus pushing up the cost of imports and the current account deficit, leading to rises in asset prices (real estate and shares) that far outstrip what is suggested by the assets' long-term fundamentals.<sup>17</sup>

Regarding copper prices, the cyclically adjusted fiscal balance rule the authorities have followed is aligned with the rule for economic activity: saving the difference between the long-term price and the observed price and spending it when the difference is negative.

The means of calculating the long-term price is crucial for managing copper price booms and busts. Since the rule was established, the long-term price estimated by a committee of experts mandated by the Minister of Finance has tended to follow the observed price very closely, but with a lag. As a result, during booms the long-term price estimates are too high and the fiscal savings tend to be too small. The opposite occurs during downturns. In other words, the treasury does not save enough when prices are high and does not spend enough when they are low. This was perhaps why the Economic and Social Stabilization Fund (FEES), the Chilean sovereign wealth fund, did not accumulate enough resources during the commodity super-cycle, which could well have been used to alleviate the macroeconomic consequences of the price decline since mid-2013. This is also one of the reasons why the exchange rate tends to appreciate excessively during copper booms and depreciate sharply during copper price declines.

There is another long-term argument for changing the fiscal rule with respect to its copper component, relating to the intergenerational distribution of the benefits of a non-renewable resource. To avoid unfairly disadvantaging future generations by consuming copper revenues in the present, all the net revenues of the treasury from profits of the National Copper Corporation of Chile (CODELCO)

<sup>15</sup> Data for the emerging economies that served as comparators were obtained from the Bank for International Settlements, but are available from 1994 onwards. Therefore, we compare Chile's real exchange-rate volatility with that of these countries for the periods from January 1994 to May 2000 and from June 2000 to July 2019.

<sup>16</sup> A full description of the tests performed and their empirical results are available from the author for interested readers.

<sup>17</sup> These arguments are expanded on in Agosin and Huaita (2012) and Agosin, Díaz-Maureira and Karnani (2019). The studies contain an extensive bibliography of the literature on booms and sudden stops. Capital inflows are considered excessive when they exceed 5% of GDP or of some monetary aggregate and, in addition, are more than one standard deviation of the series of net capital inflows for the entire period under analysis. Sudden stops are defined as falls in net capital inflows of at least 5% of GDP that are more than one standard deviation of the changes in net inflows for the period under analysis.

and from taxes plus royalties on the income obtained by the private companies involved in the copper industry should be saved by the Government in its sovereign wealth fund.<sup>18</sup>

As mentioned above, the second variable affecting the real exchange rate is Chile's net capital flows. The most important variable that determines its behaviour is related to changes in international financial markets' appetite for liquidity, which tend to lead to substantial fluctuations in the nominal and real exchange rates. This is why it is advisable for the Central Bank to have the option to apply a small tax on capital flows,<sup>19</sup> which could be activated when capital flows are expanding and returned to zero when there is no need to discourage flows.

Two regimes can be distinguished, in terms of the variables that have affected the real exchange rate since 1986. The first ran from January 1986 to December 2004 and can be referred to as a regime of the real exchange rate being determined by the financial account. From 1986 to 1997, aggregate net capital inflows (the absolute value of the financial account balance over the entire period) were 117% of the quantity of money, measured as M3.<sup>20</sup> In the subsequent years through to the end of 2004, aggregate net inflows were just 8% of M3 over the entire period. Therefore, in the first stage there was strong appreciation of the real exchange rate (despite the existence of a target range for the nominal exchange rate) and in the second stage there was also a significant depreciation.

The second regime was marked by the copper cycle. Between 2004 and 2018, despite fluctuations in its real price, copper rose 47% in real terms. The real exchange rate first showed significant appreciation, which was only partially reversed from 2012 onward. These figures and their effects on the real exchange rate are shown in table 2 and figure 3.

**Table 2**  
Chile: real exchange rate, financial account and real copper price,  
aggregate changes in the periods 1986–1997, 1997–2004 and 2004–2018  
(Percentages)

Periods	Change in real exchange rate (1986=100)	Financial account/M3 (Percentages)	Change in the real price of copper in 2012 prices
1986–1997	-22.0	116.5	30.2
1997–2004	26.9	7.9	9.1
2004–2018	-8.1	19.9	65.4

**Source:** Prepared by the author, on the basis of data from Central Bank of Chile and Chilean Copper Commission (COCHILCO).

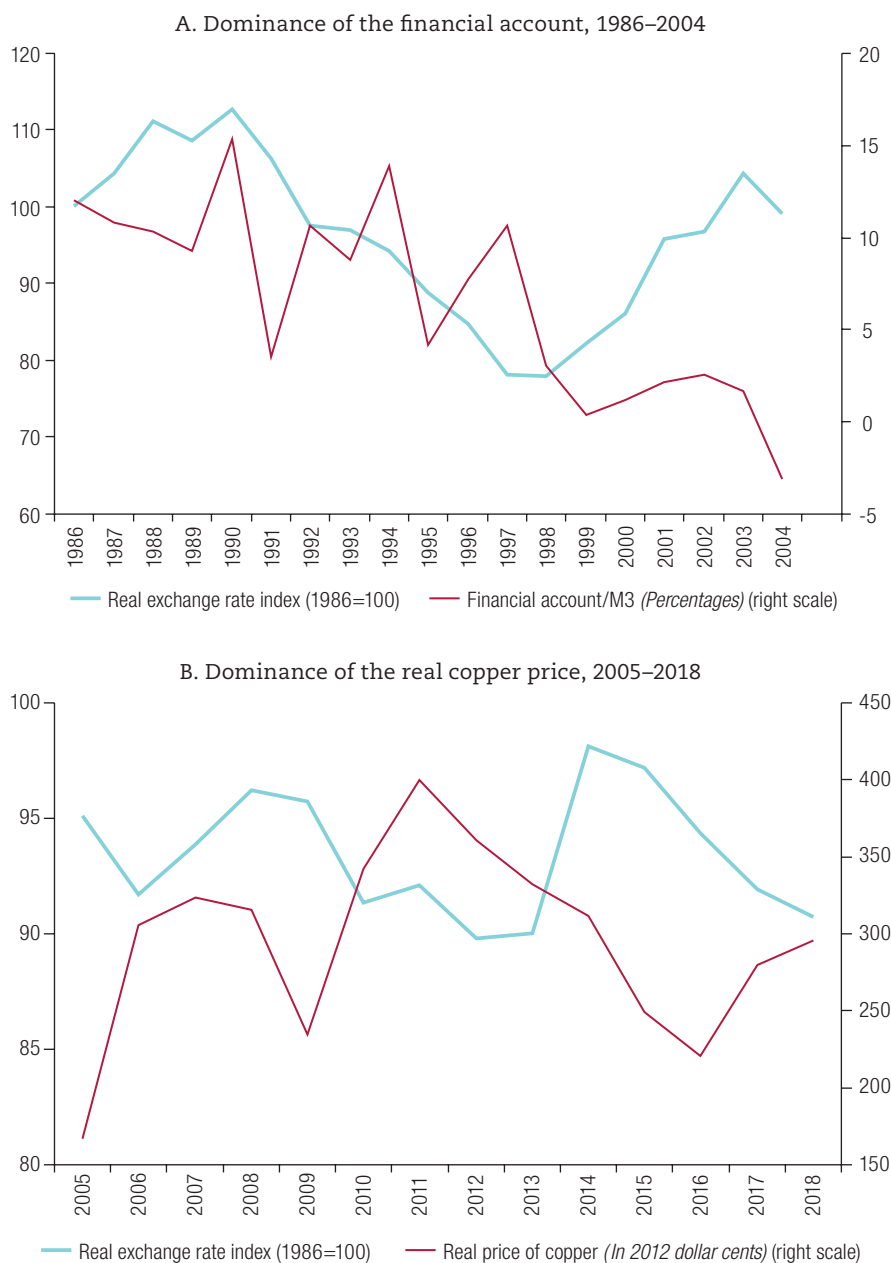
**Note:** An increase in the real exchange rate means depreciation; a decrease, appreciation. The real price of copper is equal to its nominal price deflated by the United States producer price index. The base for the United States producer price index is 2012.

<sup>18</sup> This proposal is taken up by Atria and others (2013), pp. 333–348. In essence, this is the rule put forward by Hartwick (1977), known as Hartwick's rule. Norway is an example: since the 1990s, Norway has accumulated all oil profits in its sovereign wealth fund and spends only the return on the fund's investments. As a result of this policy, it has managed to accumulate 1.3 trillion dollars in its sovereign wealth fund, making the country almost independent from oil price swings, in addition to protecting its real effective exchange rate from the fluctuations it would experience in the absence of this policy.

<sup>19</sup> Unlike the reserve requirement for capital inflows employed in the 1990s, this proposal would tax all capital inflows and outflows, including foreign direct investment. The experience of the 1990s suggests that agents tend to disguise their capital as items that are exempt. The proposal is, in essence, the Tobin tax (1978 and 1996). It has been shown that a small tax on capital inflows and outflows affects only short-term capital movements and has minimal effects on long-term capital. For the case of the reserve requirement, this is demonstrated in Agosin and Ffrench-Davis (1996) and Frankel (1996).

<sup>20</sup> M3 (or "broad money", in IMF usage) is a better variable to express the relative value of capital movements than GDP, because it is a proxy for the size of the financial sector. It is defined as coins and banknotes in circulation, demand deposits, time deposits, savings deposits, plus other credit or investment instruments that are readily convertible into liquid money without loss of value (for a more precise definition, see Banco Central de Chile, Statistical Data Base (BDE) [online]: <https://www.bcentral.cl/en/web/banco-central/areas/statistics/monetary-and-financial-statistics/monetary-aggregates>).

**Figure 3**  
Chile: real exchange rate, net capital flows and real copper price, 1986–2018  
(Annual figures)



**Source:** Prepared by the author, on the basis of data from Central Bank of Chile and Chilean Copper Commission (COCHILCO).

**Note:** The real price of copper is that calculated by COCHILCO, deflating the nominal price by the United States producer price index, in dollar cents at 2012 prices.

Lastly, in order to moderate the fluctuations that occur in foreign exchange markets because agents have different expectations for the future exchange rate, it is proposed that the Central Bank have some additional tools available in its array of policies. First, the bank should periodically publish a report on exchange-market conditions, specifying the range of the equilibrium exchange rate (the one that would occur in the absence of speculative occurrences). The report should also discuss liquidity conditions on international capital markets, the variables that are affecting them, their possible future

trends and how they are expected to affect the equilibrium real exchange rate. This information would help foreign-exchange market agents not to overreact when making decisions regarding the future direction of the exchange rate.<sup>21</sup>

Some observers have argued that the foreign-exchange problem could be managed by deepening the foreign-exchange derivatives markets. However, these markets do not trade long-term instruments, which are what real investors would need. Derivatives are useful not for productive investors but for those who need to offload short-term risks (importers and exporters) and for counterparties who are willing to shoulder such risks.

## VI. Concluding remarks

It is clear that the Chilean economy, after growing at “Asian” rates over the 1987–1998 period, has been stagnating. In fact, the economic growth rate from 2013 to 2019 was just 2.0%, barely exceeding the population growth rate, which has been around 1.5% in recent years, owing to large immigration flows. For there to be a return to growth, it is essential to diversify production and, as the economy is small and open, this entails diversifying exports.

Policies have been proposed to develop green hydrogen, a commodity for which Chile has an obvious potential comparative advantage. Successful development requires the State to be able to coordinate the various public and private parties that must contribute. Likewise, use of the country’s large lithium deposits and implementation of a decisive policy to transition toward green mining, making use in part of green hydrogen to replace fuels based on hydrocarbons, can help Chile to boost its export growth and not miss out on comparative advantages in mining.

The article has argued for a limited set of productive development policies, including “intermediate” policies that are between horizontal and vertical ones. These policies would be adjusted to the current capacities of the State and rely on market forces to identify companies and sectors to be encouraged.

One of the intermediate policies that Chile already has in place that has been successful but has been left unfunded can be activated quickly. It would not be difficult to assign resources once again to the High Technology Investment Promotion and Attraction Programme. In addition, this programme should be open to joint ventures with domestic and foreign capital and to eligible purely domestic companies.

The second intermediate policy is a small subsidy for new exports, defined as those that, considering all exporting companies, total less than US\$ 50 million. The subsidy would end when exports of the subsidized tariff item reached that threshold.

Regarding the exchange rate, it is proposed that policy target its fundamentals and not necessarily abandon the floating exchange rate. This would entail fiscal policy moving closer to adopting Hartwick’s rule of saving a large portion of net copper revenues. It is also recommended that a small tax on capital inflows and outflows be considered, to be applied when conditions on international financial markets so require.

Of course, these recommendations are far removed from today’s pressing concerns. While the uncertainties that are affecting the world economy continue and while the circumstances of Chile in recent months continue to hamper economic activity, there will be no fresh rise in copper prices or a

<sup>21</sup> Exchange-market agents often act in a destabilizing manner. When a factor external to the exchange rate causes it to appreciate (or depreciate), some bet that the recent market trajectory will continue, while others expect the price to return to the mean. Nominal exchange rate movements are determined by which of these two groups of agents is dominant in the market. If it is the first group, the nominal exchange rate will move away from equilibrium; if it is the second group, the exchange rate will return to its equilibrium levels. See the development of a formal model with “speculative” and “fundamentalist” agents in De Grauwe and Grimaldi (2006).



boom in capital flows, the real exchange rate will remain depreciated and the risks will largely relate to a potential global recession, in which the key international variables that influence the Chilean economy (copper prices and international capital flows) will follow more unfavourable trends. Given this situation, now seems an opportune time for policymakers to anticipate new cycles in copper prices and capital movements and to commit to an exchange rate that favours non-copper exports, with less future volatility, without abandoning the prevailing exchange rate regime.

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