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Chile's Export Diversification since 1960: A Free Market *Miracle or Mirage?*

Amir Lebdioui 

ABSTRACT

Conventional wisdom has proclaimed Chile's recent economic development a 'free market miracle'. In an examination of Chile's export diversification experience, this article departs from that view. By analysing the dynamics underlying the emergence of the salmon, fruit, forestry and wine sectors in Chile's export basket since the 1960s, the study sheds light on the crucial role of industrial policy in the process of capability accumulation that shapes new industries. The article undertakes a qualitative historical analysis of the scope and nature of policy interventions in each of the four sectors and conducts a quantitative policy evaluation using the difference-in-difference method. It finds that public institutions are essential in overcoming market failures inhibiting the emergence of new industries. Specifically, it shows that the government has a key role to play as a catalyst of human capital accumulation, as a venture capitalist, in trade promotion, and in ensuring 'national' sector reputation through a strong regulatory and quality control role. By elaborating on the dynamic process of structural transformation and capability accumulation, this article contributes to theoretical debates on the role of vertical policies in the emergence of new competitive sectors, and debates relating to static versus dynamic approaches to comparative advantage.

INTRODUCTION

Several mineral resource rich countries have fallen into commodity dependence by failing to diversify.¹ In contrast, Chile, despite the continuing significance of copper (accounting for more than half of total exports for the

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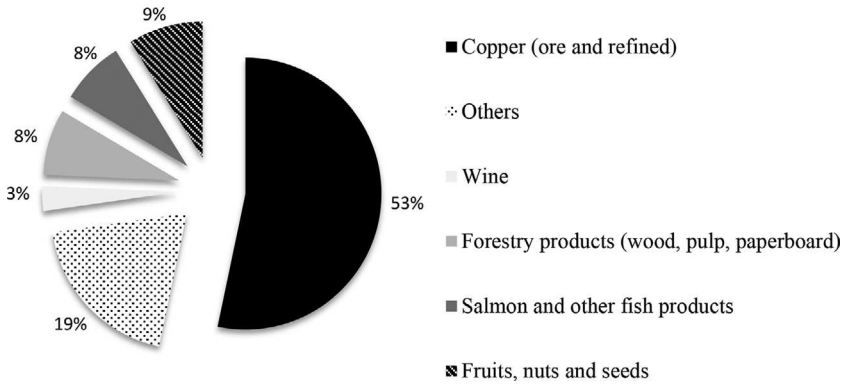
1. In its commodity dependence report, UNCTAD (2019) shows that more than half of all countries and two thirds of developing countries are commodity dependent (which means that commodities account for more than 60 per cent of their total merchandise exports in value terms). In addition, 63 out of the 72 most extractive-dependent countries have increased their dependence on extractive resources over the past 15 years (Roe and Dodd, 2018).

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Figure 1. Composition of Chile's Export Basket, 2017



Source: Author's compilation based on data provided by UN Comtrade database (<https://comtrade.un.org/> accessed 18 July 2019)

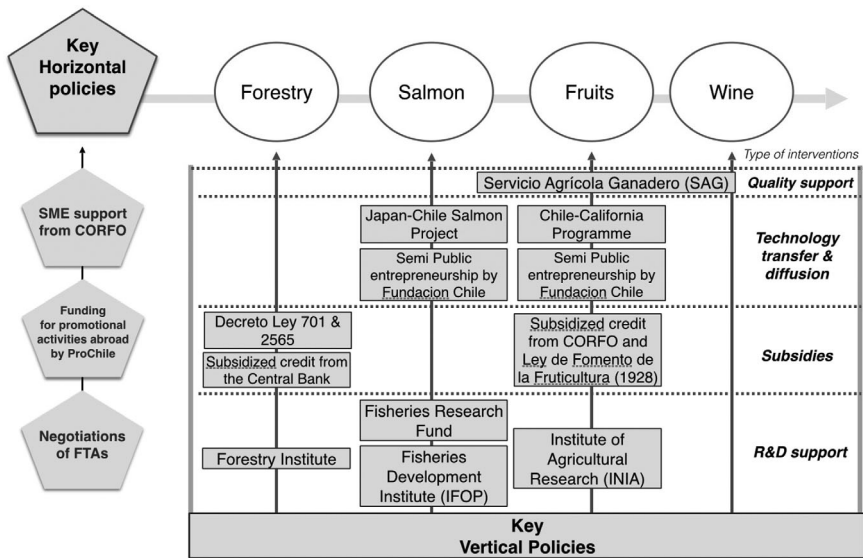
past decade), has managed to diversify into other sectors and acquire new competitive advantages. Chile's largest exported products, after copper, are salmon, fresh fruit, forestry products (such as wood, pulp and paper) and wine. These four sectors, which together now constitute the bulk of Chile's non-copper-related exports (as shown in Figure 1), have experienced tremendous annual growth rates of their exports, ranging from 8 per cent to 21 per cent per year between 1990 and 2007.

This article examines whether the emergence of new products in Chile's export basket has been the result of sector-neutral horizontal policies alone or also of vertical policies targeting the accumulation of capabilities in those sectors. Analysing these factors greatly enhances our understanding of how resource-dependent developing countries can identify emerging market niches to transform their economic structures according to both their 'static' and 'dynamic' comparative advantages.

One of the most common and enduring myths associated with recent economic development history portrays Chile as a free market 'miracle', a term coined by American economist Milton Friedman (1982). This dominant view maintains that the successful emergence of new competitive sectors in Chile's export basket are the result of four decades of commitment to economic openness and free market policies and attributes Chile's growth to the liberalization process during its military regime (1973–90), the impact of which was felt from the 1990s onwards. Neoliberal advocates argue that horizontal policies suffice to promote productive transformation and that policies should be confined to areas of comparative advantages: 'We do not believe in the state to have a role except to be neutral. . . . That is the policy in Chile and it has been successful'.²

2. Interview with the director of a think-tank based in Santiago, Chile, 26 July 2017.

Figure 2. Key Policy Interventions behind the Emergence of Chile's Non-mining Sectors



Source: Author's elaboration based on fieldwork and secondary data

This article shows that Chile has managed to diversify and develop new competitive sectors by being proactive. Relatively little scholarly attention has been given to the innovative policy interventions that have taken place in Chile. By examining the targeted policies pursued by the Chilean government since the 1970s, this study evidences the extent to which successive Chilean governments have adopted industrial policy 'in disguise' in order to send market signals towards new productive structures where private entrepreneurship had been suboptimal. Although it is important to understand the historical evolution of state interventions in Chile in order to understand vertical policies in their context, space constraints mean that this article focuses on the four key sectors that have emerged in Chile's export basket and does not include a broader review of the history of industrial policy in Chile from the 1950s onward.³ Figure 2 summarizes the different forms of industrial policies that contributed to the development of the salmon, fruit, forestry and wine sectors.

The article proceeds as follows. The next section outlines the theoretical debates on the scope for government intervention in the diversification process. Should governments in resource-rich countries target sectors

3. For an extensive historical review of industrial policy in Chile since the 1950s, see Agosin et al. (2010) and Bravo-Ortega and Eterovic (2015). For an analysis of state interventions in the copper sector in Chile, see Bravo-Ortega and Muñoz (2015), Lebdioui (2019), Meller and Parodi (2017) and Urzua (2012), amongst others.

for diversification or not? The scope for state intervention to stimulate productive diversification has been a notable source of academic disagreement. I then present a sector-level analysis of the salmon, fruit, forestry and wine sectors. This is followed by a policy evaluation of targeted policies using a difference-in-difference method. The final section discusses the research findings before outlining the theoretical implications of this study.

THEORETICAL FRAMEWORK

‘Enabling Environment’ through Horizontal Policies

The ‘conventional’ argument that governments should not target sectors because they lack the capacity and knowledge to anticipate how these sectors will grow, leads to the policy advice that governments can only focus on ensuring an enabling environment by investing resource rents in general capabilities such as health, general education and infrastructure. They should, for instance, focus on fostering a business-friendly climate ensuring general access to credit and property rights (Gylfason, 2011). Collier (2011) argues that focusing public investment on urban infrastructure, good public financial management and education enables an environment in which firms can succeed in any given industry, with the implicit idea that the market decides which sectors will grow. This line of argument also emphasizes that policy interventions still entail choosing favourites, which makes them prone to government failure and capture by lobbies. In contrast, ‘horizontal’ policy interventions for activities such as research and development (R&D) and technical training appear to be less subject to political economy pressures and government failure (Tordo et al., 2013). Nabli et al. (2008) also attribute the insufficient diversification of resource-rich countries in the Middle East and North Africa to the persistence of vertical industrial policies that favour well-entrenched groups.

Targeting Sectors: Within or beyond ‘Comparative Advantage’?

In contrast to this conventional argument, there has been a growing academic acknowledgement in the past decade or so that best-performing economies featured a proactive role of the state in developing productive capabilities and that markets cannot decide alone (World Bank, 2008). In addition, not all public goods provisions benefit the whole economy, so governments are ‘doomed to choose’ (Hausmann and Rodrik, 2006). While ‘horizontal’ policies play an important role in diversification, ‘vertical’ policies that target sectors are likely to be needed to bring down costs of production in the new traded sectors, to spur efficiency and encourage new entrants (Gelb, 2010). Nevertheless, Rodrik (2004) argues that the inability of governments to pick

winners needs to be weighed against the ability to cut losses once mistakes are made. In that sense, the contribution of the developmental state literature has been of particular importance to debates on the role of industrial policy in the economic development process, particularly by explaining the rapid growth of a number of Southeast Asian countries in the post-war period.⁴

The developmental state literature has essentially offered a heterodox theoretical approach to growth, grounded in comparative historical analysis. This approach has challenged received wisdom (that focused primarily on market forces) about the appropriate policies and institutions for achieving rapid economic growth by emphasizing the role of government intervention and industrial policy as well as the significance of strong states and particular social coalitions featuring some degrees of autonomy of the state from rent-seeking private interests (Haggard, 2018). One of the key arguments of this approach is that the market conditions of developed and developing countries differ, which reframes the role of industrial policy in developing countries, where substantial market imperfections are more likely to persist in hindering industrial activities, technology transfer and adoption, innovation and learning by doing. One of the important questions that arises from the recognition of active government intervention in targeting sectors is whether government intervention should be limited to, or should defy, 'comparative advantage' (see the debate between Justin Lin and Ha-Joon Chang, 2009).

Even new approaches in the neoclassical tradition, such as the 'Growth Identification and Facilitation' (GIF) approach in Lin and Treichel (2014), recognize the key role of the state in targeting sectors. However, the GIF approach maintains, as do Hausmann and Klinger (2007) and Rodrik (2004), that state intervention should target industries that are in line with the country's comparative advantages and follow the market rather than take the lead. According to this argument, governments fail when states try to reshape the production structure beyond the boundaries of comparative advantage (Lin and Treichel, 2014). This is reminiscent of Hausmann and Klinger's (2007) theory of product-relatedness, also termed 'product space', according to which countries are more likely to achieve economic progress when the upgrade of their product base targets closely related products. The GIF and similar approaches are problematic because they assume that comparative advantages are somehow given or natural; they neglect the dynamics

4. The concept of the developmental state has been championed by several scholars, including Amsden (1989), Chang (1994), Evans (1995), Johnson (1982) and Wade (1990). It is also worth noting that some of the underlying ideas of the developmental state approach are rooted in older theoretical contributions on 'economic backwardness', which also maintained that because the industrialization of late developers differed fundamentally from the process in first movers, the state would play a quite different role in the growth process, substituting for the weakness of private institutions (Haggard, 2018). For broader reviews of the developmental state approach and debates, see Haggard (*ibid.*), Henderson (1993), Leftwich (1995), Moon and Prasad (1997), Önis (1991), Routley (2012) and Woo-Cumings (1999).

behind the creation of comparative advantage, and the role of the state in technological upgrading, learning and capability building.⁵

One can distinguish two broad theoretical approaches to comparative advantage in the context of diversification in natural resource rich economies. On the one hand, static neoclassical approaches to comparative advantage are path dependent upon established capabilities and are generally unfavourable to the promotion of activities where skills and technology are lacking. On the other hand, dynamic approaches to comparative advantage, which are in line with evolutionary economics and neo-Schumpeterian perspectives, acknowledge the role of policy for technological upgrading, learning by doing and capability accumulation (Chang, 2013; Cimoli et al., 2009; Katz, 1984; Lall, 1992; Lee, 2013; Nelson and Winter, 1982; Pietrobelli and Staritz, 2018). These latter approaches view innovation as dependent upon the generation of feasible new capabilities, and feature a wider scope for the role of the state, which is seen as responsible for shaping productive transformation by promoting productive capabilities. Such an approach thus argues that innovations can be explained or predicted, whereas neoclassical economics considers them to be exogenous. Hence, in order to catch up, developing countries must create new value-generating activities as opposed to statically maximizing rents from existing income streams.

Looking at oil exporters, Cherif and Hasanov (2014: 4–5) argue that ‘the standard policy advice — implementing structural reforms, improving institutions and business environment, creating infrastructure and reducing regulations — while necessary, will not be sufficient because of fundamental market failures stemming from Dutch disease’. To overcome these barriers, the authors note that governments have gone beyond comparative advantage sectors and targeted high value-added industries with large spillovers and productivity gains, often through state-led venture capitalism and public–private collaboration.

This study contributes to these debates on the role of state and market forces in the diversification process, as well as to the vast literature on the developmental state, by analysing the case of Chile’s economic diversification since 1960. It examines the key role of vertical policies and the process of capability accumulation in terms of the emergence of new sectors and areas of comparative advantage outside the copper sector.

The Case of Chile and the Dominant Neoliberal Narrative

The case of Chile is particularly relevant. Chile has long been held up as an almost-textbook example of the success of ‘letting the market work’. There

5. As emphasized by Chang (2013), many countries have industrialized successfully by developing capabilities and learning by doing in sectors in which they did not have comparative advantage (such as the automobile industry in Japan).

is broad agreement among mainstream economists that Chile has largely succeeded in promoting strong and stable growth because it has embraced free market policies. Milton Friedman (1982) described Chile's success as a 'free market miracle', while the *Financial Times* (2014) stated that Chile has 'been a laboratory for free market economics for 30 years' and quoted the British historian Niall Ferguson who argued that Chile used to be the region's 'most intelligent country' (ibid.).

Chile is often viewed by admirers and critics alike as the quintessential neoliberal model of development in Latin America as it was the first country in the region to embrace neoliberalism after the 1973 coup against Allende's socialist government. Richard (1997: 139) even claims that 'Chile's adherence to the classical economic development doctrine based on liberalization and free trade has been so complete and so successful in generating high rates of export-led growth that the country's recent economic record has been favourably compared by some to the performance of the four "Asian tigers"'. While Chile has been one of Latin America's fastest-growing economies in recent decades, we must also acknowledge that its growth has owed much to high copper prices. Indeed, Chile's growth slowed between 2014 and 2017 due to declining copper prices, which negatively affected private investment and exports. In 2017, Chile's GDP growth dropped to 1.5 per cent, which meant the country ranked only 24th out of 34 Latin American and Caribbean economies (World Bank, 2019).

The underlying limitations of Chile's growth have been addressed by several scholars. While neoclassical narratives have dominated most accounts of Chile's economic development, several dissenting Chilean economists and economic historians (Manuel Agosin, Claudio Bravo-Ortega, Ricardo Ffrench-Davis, Gabriel Palma, Andres Solimano and José Miguel Amuhada, amongst others) have produced seminal works that critically assess the limits of the neoliberal model and shed light on underlying dynamics of industrial policy and market forces in Chile. Some of these scholars explain how free market policies resulted in the financial and balance-of-payments crisis before the 1982 debt crisis (see Ahumada, 2019; Ffrench-Davis, 2002; Solimano, 2012). Others highlight instances in which the military regime fell far short of genuinely adopting a free market economic philosophy and was actually involved heavily in subsidizing the structural transformation of the Chilean economy (see Agosin et al., 2010; Bravo-Ortega and Eterovic, 2015; Collins and Lear, 1996; Ffrench-Davis and Sáez, 1995).

In order to better understand Chile's development, it is thus important to first differentiate the 'good, the bad and the ugly', before analysing the underlying causes for each of those elements. In this context, this article examines the policy mechanisms underlying one of Chile's major developmental achievements by focusing on how Chile managed to diversify into new sectors and activities and move away from the copper sector. Indeed, despite the continuing significance of copper (accounting for

more than half of Chile's total exports in the past decade) and the fact that the country's diversification was confined to primary commodities (rather than high-tech manufactured goods), Chile's horizontal diversification towards new globally competitive sectors and activities should not be minimized. In addition, most of the activities within those agro-industrial sectors involve relatively high degrees of skills and technology (such as cold storage system managements, bio-vaccines, modern cultivation techniques, etc.).

In that perspective, in addition to locating Chile within the wider context of debates about industrial policy and the role of the state, this article also joins the scholarly works that seek to debunk the myth of Chile's neoliberal solutions and to contribute towards building a different narrative of Chile's economic development. Specifically, its contribution lies in the systematic review of the nature and scope of different policy interventions across all the major sectors that have emerged in Chile's export basket since 1960. Different policy interventions are subsequently assessed according to their vertical nature and scope, whether they constitute the provision of public goods (R&D support, quality control services, export promotion assistance) or direct market interventions (subsidies, state-sponsored venture capitalism, etc.).

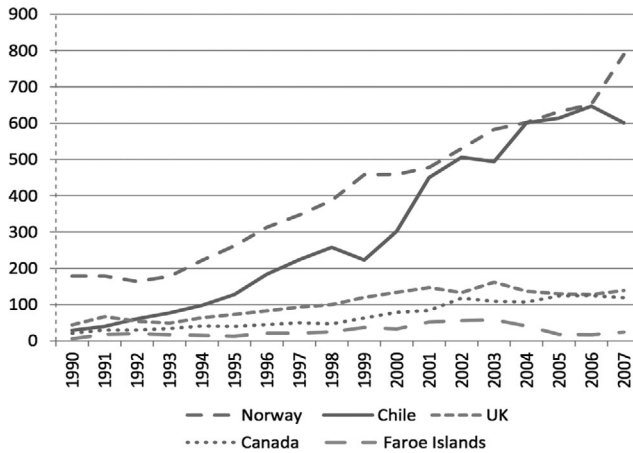
SECTOR ANALYSIS

The different sectors selected for analysis in this section include the salmon, fruit, wine and forestry sectors. The role of vertical policies and the process of capability accumulation is discussed to explain the emergence of each sector in Chile's export basket since the 1960s.

The Salmon Industry

Having started from scratch in the 1980s, Chile's salmon industry is now the country's second largest export sector, after copper. By 2004 the salmon industry employed, directly and indirectly, around 550,000 people (Katz, 2006; SalmonChile, 2009). Furthermore, as shown in Figure 3, Chile is now the second largest salmon exporter in the world, behind Norway. While some accounts focus on the growth of the Chilean salmon sector from the mid-1980s onwards when Chile adopted an open trade policy, Hosono (2016) argues that it is important to look at the domestic capability building that took place long before, which enables us to understand how the industry accumulated the knowledge necessary for its foundation. In this regard, the role of the Chilean government was crucial in several ways from the late 1960s onwards, through bilateral scientific and technical cooperation programmes such as the Japan–Chile Salmon Project, as well as proactive

Figure 3. Export Volume of Salmon Industries by Country ('000 Tonnes)



Source: Iizuka et al. (2016)

intervention from public and semi-public agencies such as Fundación Chile,⁶ Production Development Corporation of Chile (CORFO), Chile's National Fisheries Service (SERNAP), its Fisheries Development Institute (IFOP) and its Agricultural and Livestock Service (SAG).

The Japan–Chile Salmon Project, which operated between 1969 and 1989, was built on mutual interests of the Chilean and Japanese governments. The government of Chile had identified the salmon sector as a way to alleviate the poverty faced by fishermen in southern regions of Chile, while the Japan Fisheries Association was looking for an alternative source of salmon in the North Pacific Ocean, because of restrictions imposed on fishing by the United States and the Soviet Union (Hosono, 2016; Mendez and Munita, 1989). Since the Japan–Chile Salmon Project fell under the auspices of public institutions, the technologies that were transferred, adapted or developed were considered to be public goods and were made freely available (Hosono, 2016). Figure 4 shows how technology was introduced and adapted to enable Chile to attain a new comparative advantage. Fundación Chile and the Japan–Chile Salmon Project played a key role in addressing the investment gap required for knowledge accumulation (*ibid.*).

Prior to 1980, foreign companies had attempted, unsuccessfully, to develop and cultivate the salmon industry in Chile. The American company Domsea Farms and a Japanese firm invested in salmon farming during the 1970s, but their production levels and return rates were low. In 1981,

6. Fundación Chile is a semi-public/semi-private foundation created in 1976 as part of the settlement for the Allende government's expropriation of the Chilean Telephone Corporation, owned by IT&T. While the government does not appoint Fundación Chile's managers, it has a large influence in the designation of its president and board of directors.

Figure 4. Contributions to the Development of Technologies for Processing, Fish Disease Control and Feed Production

		Contribution by the Japan-Chile Salmon Project	Contribution by Salmones Antártica / Fundación Chile	Contribution by the private sector
Processing technology			Salmones Antártica constructed the most advanced processing plants and introduced pioneering technology in 1989–1990	
Fish disease control		R&D on bacteria kidney disease control with the most advanced laboratory equipment, and pioneering contributions in the mid-1980s		
Food production	General	Conducted pioneering research on feed production using fish meal produced in Chile	Salmones Antártica/ Fundación Chile boosted food production towards commercial sea-cage farming of salmon in the mid-1980s	
	Crumbles	Conducted research on the production of feed suitable for young juveniles that have absorbed their yolk sacs; built production equipment and ensured a stable supply		
	Expansion pellets			Norwegian firms introduced expansion pellets into Chile through investments and the sale of equipment in the 1990s

Source: Hosono (2016)

Fundación Chile stepped in to acquire Domsea Farms, transfer technology from Norway to Chile and experiment with the farming of various salmonid species under different conditions in order to identify ways to make salmon farming commercially viable. Salmones Antártica, the company created by Fundación Chile, reached production levels of around 1,000 tonnes by 1988 and transmitted a clear message to potential entrepreneurs that the salmon industry was indeed profitable (ibid.). The experience of that company was

then 'copied' by nascent firms, which increased in number from around four companies in 1980 to 219 in 1997 (Iizuka and Gebreeyesus, 2017). Fundación Chile played a key role in the diffusion of knowledge, experience and technology, thereby attracting a large number of entrepreneurs. The company offered consulting services (for instance on how to obtain a mariculture licence, how to produce wooden fish cages, etc.) to entrepreneurs, most of whom initially had little knowledge about salmon (Hosono, 2016).

Although Fundación Chile sold *Salmones Antártica* in 1988, it is still involved today in several supporting activities around the salmon-farming ecosystem, such as the production of vaccines, bio-testing and quality control labs. As a result, Chile is exporting not only salmon but also products related to the health of salmon. Fundación Chile also set up *SalmonChile*, an industrial association for the salmon sector in Chile (Mendez and Munita, 1989).

Addressing Market Failures in Technological Diffusion

One of the obstacles that had impeded the growth of the salmon sector in Chile before Fundación Chile intervened can be traced back to a collective action problem, which led to a 'first mover disadvantage'. This implies that after a company had entered into this new activity, investing in R&D in the cultivation of salmonid species, learning how to adapt salmon technology to Chilean conditions, identifying suitable cultivation areas and developing a business model, other firms could then move into the field and copy the business model without bearing the same costs or undergoing the same trial and error process. A corollary of this is that, when investments in technological development are motivated by ambitions to gain a competitive edge in the market, private investors may seek to prevent imitators from entering the industry and may restrict diffusion of the relevant technology and knowledge. This misalignment of private interests with the social desirability of technology diffusion and emulation can be treated as a market failure.

This market failure was effectively addressed by Fundación Chile. Through its role as a venture capitalist combined with its not-for-profit mandate, Fundación Chile shared its knowledge with the wider public, which enabled entrepreneurs to copy its model and to emulate its success with *Salmon Antártica*, without having to bear the high costs of investments in R&D. Beyond solely solving a market failure, this intervention enabled the state to send a signal to entrepreneurs. The President of Fundación Chile, Patricio Meller, explained:

Fundación Chile's development of a firm producing salmon was not easy and it took us eight years. We studied why previous firms had failed and solved the issue by taking all risk and bearing the cost of investing in R&D. The high risks of setting up new industries can be identified as a market failure and can be alleviated by government intervention. Fundación Chile proved that salmon cultivation was a profitable activity and used its firm as a show-case

to convince Chilean entrepreneurs to get into the salmon farming business. Hence, it was a clear intervention in the market as well as public goods provision and production.⁷

R&D and Human Capital Accumulation

Natural conditions were favourable for salmon farming in Chile but the human capital and technology were lacking. Along with the risk of investing in a new sector, addressing these gaps would involve high costs for private entrepreneurs because training specialized professionals and developing R&D to sustain the industry takes time (Hosono, 2016). In order to reduce the level of risk and cost to private entrepreneurs, the challenge lay in the reduction of entry barriers, notably by ensuring the availability of specialized human capital and providing incentives for technology development and diffusion.

Salmon cultivation in Chile is a knowledge-intensive activity founded upon extensive R&D in the area of aquaculture improvements, fish packing, storage and other aspects of the business (Maggi, 2006). When it comes to R&D, the role of government funding between 1987 and 2008 was key, and reached a cumulative total of the equivalent of US\$ 70 million in the salmon sector, as shown in Table 1. Government funding in aquaculture was channelled through various grants set up by public agencies, some of which had a sector focus such as the Fisheries Research Fund. Other important funding sources have included organizations with a more 'horizontal' mandate such as CORFO and the National Commission for Scientific and Technological Research.

When it comes to human capital development, the government has invested significant resources to train specialized professionals and technicians needed by the salmon farming industry, by establishing new university programmes and technical centres. From the 1990s onwards, Chilean universities, such as the Universidad Los Lagos and University of Austral, started to provide programmes in marine sciences, biochemistry, pathology and issues related to aquaculture production and aquaculture business administration. These two universities have supplied most of the Chilean labour market with professionals in these fields (UNCTAD, 2006). Alongside public research institutions, the Salmon Technology Institute (INTESAL), a private institute created in 1995 by SalmonChile (the Salmon and Trout Producers' Association), also contributed to developing the human capital and technical skills needed for the salmon farming industry. In 2002 alone, it trained 2,060 workers (ibid.). INTESAL also contributed to the development and diffusion of food safety and quality control technologies in the salmon industry, using funding from the above-mentioned public funds.

7. Interview with Patricio Meller, then-president of Fundación Chile, 13 July 2017.

Table 1. Research in the Salmon Sector Financed by Government Funding (1987–2008)

Thematic Areas	Number of Projects	Value (in Chilean pesos, '000s)	Share of funding
Pathology and phytosanitary management	77	12,140,701	28.9%
Genetics and reproduction	38	7,752,516	18.4%
Nutrition and food	29	6,327,948	15.1%
Environment and clean production	33	3,842,839	9.1%
Technology centres	5	3,736,752	8.9%
Engineering and technology	44	3,489,769	8.3%
Cultivation and production	14	1,573,375	3.7%
Training and transfer of technology	18	1,026,484	2.4%
Processing and quality control	13	877,022	2.1%
Recreational fishery	10	829,549	2.0%
Administration and regulation	4	346,458	0.8%
Small-scale aquaculture	1	46,874	0.1%
Biology and ecology	1	43,043	0.1%
Total	287	42,033,330	100.0%

Source: Bravo (2009)

Regulatory Role: Ensuring Sustainability of the 'Commons'

State interventions taking the shape of public goods provision were also key in addressing other market failures in the salmon industry and ensuring production sustainability. Natural resource based industries need to balance their exploitation activities with the environment's pace of regeneration in order to avoid environmental catastrophe (Iizuka and Zanlungo, 2016). This is reflected by the Chilean salmon sector, which has been affected by a 'tragedy of the commons' — a problem in which every individual has an incentive to consume a resource at the expense of all other individuals. Over-exploitation of fishing waters resulted in sanitary and environmental deterioration leading to Infectious Salmon Anemia (ISA) virus contamination in 2007. As a result, Chilean Atlantic salmon production decreased by 65 per cent between 2007 and 2010, while the number of workers fell by 40 per cent. This crisis highlighted the absence of adequate regulatory mechanisms for monitoring environmental impact (Iizuka and Katz, 2010): policy efforts were needed to intervene and create changes in existing institutions surrounding the salmon farming industry to ensure sustainability. Regulatory institutions have been set up, notably through the implementation of the Aquaculture Law in 2010. In order to reduce the systemic risk of new diseases in the future, the National Fisheries Service (SERNAP) also required salmon farming firms to group their cultivation centres into *barrios*, or production zones, according to geographical location, and obliged firms operating in cultivation centres within the same *barrio* to synchronize their production calendar, providing for a three-month resting period, to facilitate sanitary controls aimed at minimizing navigation time, often instrumental in transmitting pathogens (Iizuka and Zanlungo, 2016).

The Chilean case thus demonstrates how natural resource based activities need to be supported not only by advanced production technology, but also by scientific knowledge of the local environment in order to establish appropriate local regulatory institutions to manage the use of common resources (Iizuka and Zanlungo, 2016; Katz, 2006). Such a local regulatory role can be seen as an input that has public goods characteristics and thus will be under-provided by the market.

The Fruit Sector

In the 1960s, Chile's fruit exports were mostly limited to grapes and apples. Today, the country exports more than 20 types of fruit and has become the largest fruit exporter in Latin America. One of Chile's advantages lies in the fact that it is located deep in the southern hemisphere and consequently experiences seasons at opposite times of year from the northern hemisphere, where the largest consumer markets are located. However, this seemingly clear natural advantage determined by geographic location has not developed organically through market forces alone. Rather, the most important catalysts for the production of new fruits in Chile can be traced back to several vertical interventions. The University of Chile and the Institute of Agricultural Research (INIA) set up technical training programmes to address the human capital shortage inhibiting the growth of the fruit sector; a fruit development plan was put into action in the late 1960s by CORFO, the national production development corporation (Bravo-Ortega and Eterovic, 2015); and Fundación Chile invested in R&D in the 1980s to promote the production and export of berries.

The Chile–California Programme and its Underlying Governmental Vision

Given that the absence of adequate human capital was for a long time the main obstacle to the development of the Chilean fruit sector, the promotion of targeted and specific skills was key to its emergence and export orientation (Agosin and Bravo-Ortega, 2009). The most important example of this is the Chile–California Programme, an exchange programme established in 1965 between the Universidad de Chile and the University of California and funded by the Ford Foundation. The programme entailed sending more than 80 Chilean graduate students to study agricultural economics in California in order to learn how to cultivate and export fresh fruits. The Ford Foundation spent US\$ 9.75 million to fund this programme over a period of 10 years (equivalent to US\$ 200 million today). This appears to have been an extremely successful and impactful grant considering the growth of the sector during the following decades (Bravo-Ortega and Eterovic, 2015).

This successful intervention may have been financed by a private charitable foundation but it remains a vertical intervention nonetheless, as it contributed to providing what could be seen as a public good that oriented market forces towards the growth of a specific industry in Chile. In addition, while the Chile–California programme is very often credited to the Ford Foundation instead of being considered a governmental initiative, a closer examination of the context in which it emerged suggests that the story is more complex and that the design and scope of the programme was guided by public agencies.

An examination of the archives of the State of California reveals that the origins and design of this programme were clearly governmental. Between 1963 and 1978, the governments of Chile and California undertook three programmes of development assistance and cooperation, spurred by the two regions' striking similarities in physical geography and natural resources (Bauer and Catalán, 2017). In 1963, a Californian task force initiated the first technical cooperation programme with Chile, following President Kennedy's suggestion, and 'responding directly to the wishes of the Chilean Government' in the definition of core areas for cooperation, such as agriculture, education, water resources, highway transportation, planning and budgeting (California State Archives, 2000: para. 3). Since the exchange programme between Chile and the University of California was signed just two years after the Californian task force had first met with Chilean policy makers, it seems likely that the governmental cooperation programme influenced the establishment of the university exchange programme between Chile and California.

It is important to understand the context of the Chile–California Programme as well as the context of the Ford Foundation's involvement. In the aftermath of John F. Kennedy's election, the agenda of international cooperation through the US Agency for International Development (USAID) increasingly emphasized the role of university exchanges and the development of technical skills in Latin America as a motor for economic development (USAID, 1962). Private foundations such as the Rockefeller and Ford Foundations aligned their thinking with USAID and re-oriented their focus towards technical training and modernization of universities overseas (Fuenzalida, 1984). When Governor Reagan discontinued the technical cooperation programme with Chile in 1967, only the agricultural element of the programme was to remain active, although federal funding for that programme was also discontinued. The agreement between the Universidad de Chile and the University of California clearly stated that the two universities should be responsible for formulating the specific programmes and should present joint proposals to foundations or government agencies if there was a need for external funding (*ibid.*: 96). Consequently, while the Ford Foundation provided funding for the proposal, the design of the programme and the decision to target the fruit sector are to be credited to Chilean policy makers and public education institutions.

Tinsman (2013) analyses the historical roots of the programme and provides a detailed account of the emergence of the fruit sector from the 19th century onwards, which sheds light on the important role played by the government. As Chile's nitrate industry suffered from the invention of synthetic nitrate during World War I, Adolfo Ibáñez, Chile's Minister of Economic Development at the time, proposed that fruit exports could replace nitrate as Chile's primary source of wealth and identified international demand for fruits in the USA and Europe (*ibid.*: 30). The government thus played a major role in the identification of Chile's potential competitive advantage in fruit production. In addition, well before the Chile–California programme, Chilean policy makers looked to the USA not only as a future market but also as a model for building their fruit industry (*ibid.*: 30). In 1922, Arturo Alessandri, the President of the National Agricultural Society (who was also a sitting senator) led a state-financed commission to tour California, after which he compiled a report in which he admired and praised the strong government role in developing agriculture in California:

Alessandri identified the mysterious force at work in California not as the market's invisible hand but as the enormous presence of the U.S. Ministry of Agriculture, which he praised as 'one of the largest, most complete and admirable [ministries of agriculture] in the world'. By contrast, he bemoaned, 'How enormous has been the wealth lost by Chile for lack of a [national] policy that should have been unceasing and tenacious in its promotion of production!' Alessandri reassured his audience that Chile had every potential to reproduce California's success since it possessed an almost identical climate and fruit-growing tradition. But this would be possible only with significant state involvement. (*ibid.*: 32)

The role of state planning was particularly emphasized in Alessandri's report: 'All of this [California's agricultural development] is owing to the fact that [in California] the orchard plantations obey a scientific agricultural plan, via which each region is planted only with those trees that are best adapted to the conditions of climate and soil, in other words, those that are capable of producing the most dollars per hectare' (Alessandri, 1923, cited in Tinsman, 2013: 32).

A critical historical perspective on the development of the fruit industry thus shows that the vision underlying the Chile–California programme was clearly governmental.⁸ In addition, it is important to point out that it was part of a broader set of policy interventions towards developing the Chilean fruit sector, as explained in the next section.

8. Tinsman (2013: 47) notes: 'Chicago and California philosophies overlapped on the imperative of making agriculture more efficient and promoting exports, but they had dichotomous visions of the state'. While most Chileans who studied in California during the 1960s and 1970s had prepared for careers in the public sector, following the government-directed National Fruit Development Plan, Chileans studying in Chicago learned about the disasters of state-led projects and the need to minimize government involvement in economic life (*ibid.*).

*Earlier State Involvement and Planning*⁹

In 1927, Adolfo Ibáñez produced a report recommending the development of the fruit sector. According to Tinsman (2013), the Chilean state took several actions following this report. A Ministry of Agriculture had already been created in 1925, including a special Fruit Tree and Vineyard Service tasked with 'promoting and developing fruit plantations, in technical form and the creation of markets' (ibid.: 33). Three years later, the government passed the Law for Fruit Development (*Ley de Fomento de la Fruticultura*), which allocated 10 million Chilean pesos for five years to subsidize new vineyards and orchards as well as canning and packing facilities. In 1938, the University of Chile established the School of Agronomy, which included a special course for fruit cultivation.

In 1939, CORFO began providing special credits to fruit growers. It was also charged with drafting an earlier national agricultural development plan wherein fruit exports were central. This plan, which aimed to increase total fruit production fivefold within 15 years, was expected to use funding worth US\$ 18 million from both public and private sources to pay for credit incentives, technical support, infrastructure and commercialization of fruits abroad; in practice the most impactful parts of the plan used credit from CORFO and the Chilean Central Bank (ibid.: 38). The national fruit development plan was accompanied by the Chile–California programme; at the same time, the Inter-American Development Bank supplemented Ford Foundation funds with US\$ 4 million to build a new agricultural and forestry campus at the University of Chile (ibid.: 42)

As a result of these public policies, the amount of land planted with orchards and table grape vineyards expanded almost fourfold and fruit exports grew ninefold between 1930 and 1975 (from 4,500 to 38,300 metric tonnes), when the military began dismantling agrarian reform programmes (CEPAL, 1990; Tinsman, 2013). Fruit exports increased almost 10-fold under the military regime, 'but the exponential growth in the 1980s was partly afforded by fruit trees and vineyards that were planted in the late 1960s and early 1970s but took three to seven years to mature' (Tinsman, 2013: 39).¹⁰

Vertical Interventions and Public Entrepreneurship

Other interventions also played a part in Chile's fruit sector. Fundación Chile — which was able to catalyse the salmon sector in the 1980s — also

9. The role of agrarian reforms on fruit sector development and productivity is also important but cannot be fully discussed in this article due to length considerations. For a detailed account of agrarian reforms, see Tinsman (2013).

10. Although between 1974 and 1986, during the military regime, the state spent more than US\$ 27 million on expanding fruit irrigation systems (Tinsman, 2013: 49).

pioneered the cultivation of berries in the south of Chile. Fundación Chile identified which fruits are produced in similar climatic conditions to those in Chile and in 1980 it created a firm called Berries la Union, which became the largest exporter of blueberries in Chile.¹¹ Although this firm later went bankrupt, after Fundación Chile exited the business, its demonstration effect was very important, showing entrepreneurs that the cultivation of berries in Chile was possible. Chile's blueberry exports reached US\$ 380 million in 2011 (Retamales et al., 2014). Thus this investment, through what could be considered public entrepreneurship, resulted in the introduction and development of a new product as well as new transversal technologies and capabilities, including cold-storage systems, which are required to ensure product quality.

A government agency, SAG, was set up to control the export quality of fruits produced in Chile. SAG played a key role in the performance of the entire fruit sector: it was responsible for disseminating information on phytosanitary standards in importing countries so that individual producers could comply with these standards and request technical assistance where necessary. Chilean exports were also supported by ProChile, the government's export promotion agency, as well as diplomatic activities in the negotiation of free trade agreements (FTAs). Such FTAs can be seen as providing a public good (albeit for specific sectors), and have been considered by most executives of Chilean exporting companies as an important factor in stimulating the export of Chilean fruits (Agosin and Bravo-Ortega, 2009; Meller and Zenteno, 2013).

In addition to Fundación Chile's mandate, the Chilean government also set up institutions to promote technological upgrading in the fruit and agriculture sector more broadly. It created the Institute of Agricultural Research (INIA) as well as a technology transfer programme (GTT), with the purpose of creating synergies between agricultural producers and research institutes to facilitate the adoption and dissemination of foreign knowledge and technologies by local farmers (Grosse, 2009: 180). CORFO has also financed cold-storage and fumigation facilities required for fruit exports.¹²

The Forestry Industry

One of the areas that the Chilean government has targeted most explicitly is the forestry sector, through a mix of policy interventions including laws, incentives, subsidized credit lines and other tools to attract private investments in the sector. According to Agosin et al. (2010: 7), 'the military government made a strategic bet on a non-existent but potentially profitable

11. Interview with a manager of Fundación Chile, 18 July 2017.

12. Between 1967 and 1972, it built five refrigerated facilities, accounting for 70 per cent of all cold-storage capacity in the country in 1972 (Tinsman, 2013).

sector. It had long been known that radiata pine grew faster in certain parts of Chile than practically anywhere else in the world. The authorities in effect solved a coordination problem that made this sector take off'. In 1965 the Chilean government created the Forestry Institute, a technological research institute attached to the Ministry of Agriculture and the country's first institution responsible for conducting R&D in the forestry sector, specifically in areas of forestry economics and wood-related technologies.

Subsidized Credits and Incentives for Reforestation

The Chilean authorities have successfully targeted the forestry sector through several tools and legal interventions. One of them was Decreto Ley 701, a law passed in 1974 to recognize the importance and necessity for the domestic economy of developing the forestry sector. This law granted cash subsidies amounting to 75 per cent of the costs of planting and the initial management of forests.¹³ The Central Bank also provided incentives and subsidized credit lines for investments in the forestry sector (managed through public and private banks) between 1974 and 1979. This subsidized credit was effectively used by specialist professionals, most of whom had recently graduated from two Chilean universities that offered forestry engineering programmes, for the planting and replanting of trees for commercial exploitation, including wood and pulp exports (Rossi, 1995).

Measures were also taken to ban the exploitation of forest trees younger than 18 years old, as well as the export of raw wood and debarked logs. Rossi (ibid.: 117) highlights the Central Bank's requirement for quality certification, rendering wood export a very difficult task. As a result, the market for raw wood became less export oriented and turned towards the internal market. This measure benefited the domestic cellulose and paper industries, which took advantage of low raw material prices. Rossi (1995) argues that this discouraged investments in plantation or forestation. Nevertheless, it would seem that those impediments were effectively counterbalanced by financial incentives offered by Decreto Ley 701 and the Central Bank for further plantations. The Central Bank thus played a key role in artificially controlling market prices in a way that benefited domestic value addition and the growth of industries around the forestry sector.

*Debt–Equity Swap Programme*¹⁴

Another intervention, which is less vertical in its design but benefited the forestry sector in particular, was a programme of debt–equity swaps

13. For more information on Decreto Ley 701, see: www.leychile.cl/Navegar?idNorma=6294
14. The impact of the debt–equity swap programme for the forestry sector was pointed out to me by Manuel Agosin during a fieldwork interview.

introduced in 1985.¹⁵ This programme acted as an important subsidy for investing by buying debt, as it involved the sale of a bank's loan at a discount rate. While the programme did not explicitly target any specific sector, the Central Bank's approval of all debt–equity swap arrangements stipulated and ensured that proposed investments would generate foreign exchange and create wealth (Bridges, 1987).

The biggest debt–equity swap by far was carried out by the New Zealand company, Carter Holt Harvey, which in 1986 bought US\$ 160 million of Chilean debt, which it then converted into pesos and invested in the forestry industry (*ibid.*). The programme also attracted investments from other leading New Zealand producers of wood fibre and forestry-based products such as New Fletcher Challenge (Shirley, 1988). The programme thus benefited the forestry sector in particular. Given that the Central Bank had to oversee and approve proposed investments involving debt–equity swaps, it is reasonable to suspect that the forestry sector was seen as a priority area with potential to generate foreign exchange. The Central Bank had already been giving incentives and subsidized credits for forestry plantations before 1985, so the fact that the largest investors selected and approved for the debt–equity swap programme by the Central Bank were also in the forestry sector is perhaps not a coincidence. In addition, the sequencing of those policies and investments appears to be very timely. While the Central Bank's subsidies targeted radiata pine plantation development, promoting availability of raw material, the later investments as part of the debt–equity swap stimulated the industrial processes needed to transform the developing forestry sector through value-added wood products such as fibreboard.

Impact of Policy Interventions

The different policy tools that were used to promote the forestry sector were extremely successful. Public expenditures through subsidies and grants in the 20 years of application of Decreto Ley 701 amounted to US\$ 135 million. Meanwhile, total private investments in the forestry sector in the same period reached US\$ 4 billion and total forestry exports rose from US\$ 127 million in 1974 (the year of enactment of Decreto Ley 701) to US\$ 1.5 billion in 1994, when the terms of the law ended (Rossi, 1995). Today, exports of wood and paper products are worth about US\$ 5 billion, which accounts for some

15. The debt–equity swap programme was introduced by the Central Bank in 1985 as a way to reduce external debt while attracting investments. The buyer of the loan converts the earnings into the debtor's currency and invests it in that country. In other words, the debt holder gets an equity position in exchange for cancellation of the debt. Thanks to the debt–equity swap programme, Chile's total external debt declined by about US\$ 740 million between 1985 and 1988, while its GNP grew by 43 per cent in that period (Cole, 1992: 69).

9 per cent of Chilean exports.¹⁶ While it appears that the main motivation was the exploitation of the country's natural resource endowment, it is important to note that Chile's considerable forestry endowment, with more than 1.5 million hectares of plantations and an abundance of radiata pine, was man-made.

It is interesting to note that, as the state gradually abandoned wood production and the management of forestry plantations, the development of more sophisticated and value-added products slowed (Agosin et al., 2010: 7). For instance, wood furniture exports, which increased almost 50-fold from US\$ 500,000 in 1985 to US\$ 23.3 million in 1994 (Rossi, 1995), have since been stagnating.¹⁷

The Wine Sector

Wine has been produced in Chile for over two centuries, but its emergence in the country's export basket happened only recently. Between 1938 and 1973, wine production was restricted by the government, heavily taxed and mostly aimed at domestic consumption (Grosse, 2009). However, according to statistics generated by the United Nations' international trade statistics database, Chile's wine exports had generated revenue of nearly US\$ 2 billion by 2016.¹⁸

In the late 1970s, growing investments from foreign firms, particularly the Spanish firm Miguel Torres which was looking for ideal climatic conditions, played a key role in the introduction of new methods of production that were non-existent in Chile, such as the use of stainless steel containers imported from the USA, as well as modern grinding and pressing machinery (Meller and Zenteno, 2013). The success of Miguel Torres was followed by increasing foreign investments and joint ventures from the 1980s onwards, enabling Chilean producers to access foreign markets and international distribution channels while learning how to adapt their production to the demand of foreign consumer markets (ibid.: 150). The import of foreign technology was thus a crucial factor in the development of wine exports (Agosin and Bravo-Ortega, 2012). According to recent statistics from the UN Comtrade database, this process enabled Chile to go from being a minor participant in the international wine business to becoming the fourth largest exporter of wine in the world today.¹⁹

While the climatic conditions for cultivating grapes and producing wine had existed for centuries, the export orientation and upgrading came from the introduction of new skills and technology, and support from public

16. UN Comtrade database for 2018. See: <https://comtrade.un.org/data/>

17. See: <https://comtrade.un.org/data/>

18. See: <https://comtrade.un.org/pb/downloads/2016/Vol12016.pdf>

19. See: <https://comtrade.un.org/data/>

agencies (such as CORFO, ProChile and SAG) and government policy (Grosse, 2009: 180). In fact, foreign investments in the wine sector came after the interventions to develop Chile's fruit sector, including grapes, which represented a major part of the fruit industry at the time. The foreign direct investment (FDI) inflow that contributed to developing Chile's wine sector may have been partly motivated by the existing quality and supply of grapes, and could consequently be linked to the successful interventions leading the development of the fruit industry, described above. I have not been able to find data confirming the Chile–California Programme's effect on wine grape and table grape cultivation, but the agro-science skills developed through that programme would also have been applicable to the cultivation of grapes.

The Role of Government

Although the export orientation of the wine sector was FDI-led, the government played a key role from the 1980s onwards in intensifying the sector's export performance. The government established several measures to subsidize export-oriented production across sectors, notably through CORFO, which set up a supplier development programme that helped small producers adapt the quality of their products to international standards. ProChile financed nearly half of total costs related to promotional activities of the Chilean wine sector abroad, including trade fairs, travel costs and marketing brochures and equipment. Nevertheless, it is worth noting that most of these interventions were horizontal. Neither ProChile nor CORFO singled out the wine sector and the support they offered was available to all industries (Grosse, 2009: 180).

According to Meller and Zenteno (2013), Chilean wine producers acknowledged the existence of certain 'public goods' as essential for increasing their exports, such as the negotiation of phytosanitary agreements, the protection of the environment carried out by the SAG, the promotion of business associations, and the establishment of free trade agreements. Just as the government responded to the tragedy of the commons leading to salmon diseases, it also stepped in to avoid negative externalities in the wine sector when some producers were found to be using chemicals which could damage the image and branding of the Chilean wine industry as a whole. This view of the Chilean state's role in preserving the value of the national brand through regulation is supported by the analysis by Iizuka and Katz (2010) of the regulatory role of the state.

POLICY EVALUATION USING A DIFFERENCE-IN-DIFFERENCE METHOD

While this article argues that government interventions played a key role, a counter-argument would claim that these interventions targeted sectors in line with Chile's comparative advantages, that is, sectors which were already

likely to emerge as successful export industries. Preliminary assessments which consider state interventions to be successful would then be based on a selection bias. The question should thus not be whether successful sectors today have benefited from government interventions, but rather whether they would have been successful without government interventions (Bravo-Ortega and Eterovic, 2015).

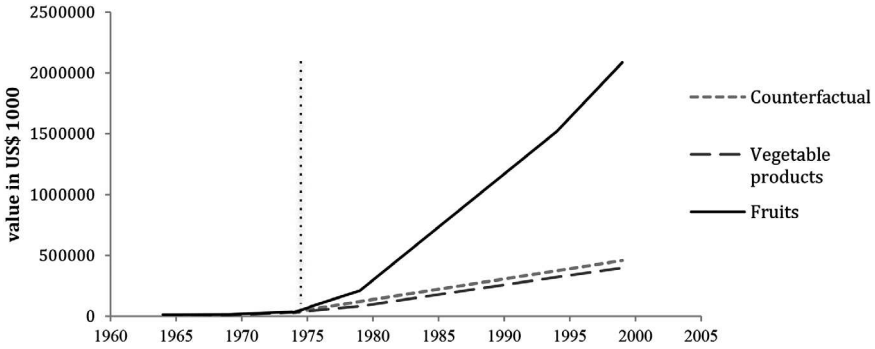
The fact that only a few sectors (such as wine) have emerged as major exports without benefiting from vertical interventions suggests that there is little evidence to support the counter-argument that free market forces, alone, are behind Chile's diversification outcomes. Since it is difficult to build an exact counterfactual to test the two arguments, it may be useful to conduct an impact evaluation of Chile's vertical interventions by using a difference-in-difference estimation (DiD). The use of this method has been widespread in studying the impact of policies on a certain outcome in a natural experiment using observational and longitudinal data (Angrist and Pischke, 2008).

To this end, I looked at the effect of vertical policies on different sectors by using the value of exports as the outcome variable. While several factors can impact a sector's level of exports, including other policies that might have been implemented at the same time as the ones being evaluated, I reduced the level of bias by choosing control groups that are sub-sectors within the same industry but that did not benefit from vertical interventions to the same extent as the treated group, in order to plot a trend before and after the intervention (t_0). I conducted two comparisons: the first compares the fruit sector with vegetable exports as the control group because the fruit and vegetable sectors benefit from similar conditions and are affected by similar natural factors. Hence, there would be no reason to believe that one sector would perform better than the other without differences in accumulation of capital investments, human capital and technological upgrading. The selection of the wine sector as control group would have perhaps provided different results but because the wine sector directly relates to grape cultivation, the externalities from interventions in the fruit sector towards the wine sector might be high. The vegetable export sector thus constitutes a more appropriate control group. The second comparison is that of the salmon industry with other fish exports. Appendix Tables A1 and A2 show the export data used for the DiD policy evaluation.

Fruits and Vegetables

Using Standard International Trade Classification (SITC4) data, I singled out fruit products (code 057 and 058) and vegetable products (code 054, 056 and 292). The fruit sector has been the subject of several interventions from the late 1920s to the 1980s, but the major interventions started in 1965 with the Chile-California programme and subsequently Fundación

Figure 5. Evolution of Chilean Exports of Fruits and Vegetable Products, 1964–1999 (US\$ '000s)



Sources: Author’s calculations based on data supplied by the Center for International Data (2018) and UN Comtrade database (<https://comtrade.un.org/> accessed 18 July 2019)

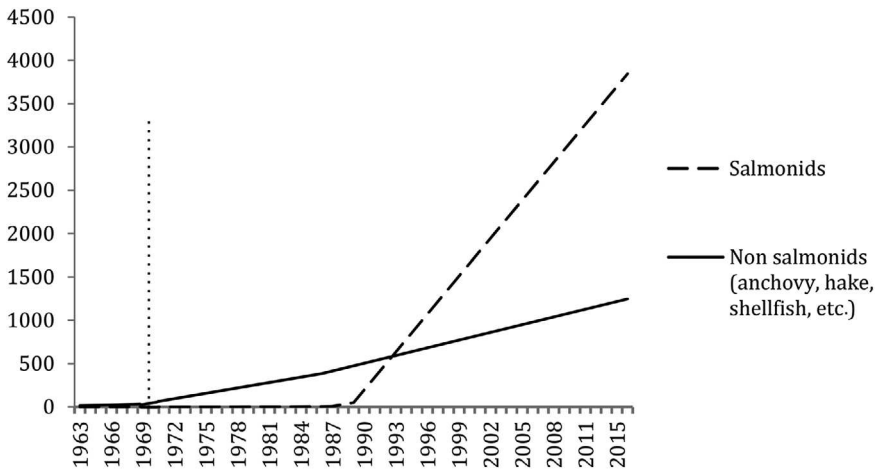
Chile’s intervention in 1980. The earliest available data point is 1964, not allowing for comparison before treatment in Figure 5. Nevertheless, the vertical dotted line in Figure 5 represents the year 1974 which could be used as an alternative t0. There is in fact a solid basis for assuming that the interventions would not have had any effect on the treated group (fruit sector) before 1974 due to time lags (implementation of the cooperation programme, the duration of full academic courses and exchange programmes, translating newly acquired capabilities into practice), as well as the years needed for fruit trees and vineyards planted in the late 1960s to mature.

It is not surprising, then, that both the treated and non-treated groups had very similar growth rates between 1964 and 1974. The fruit sector experienced an annual growth rate of 11 per cent while the rate for vegetables was 10 per cent. Consequently, it is highly plausible that fruit exports would have experienced a similar growth trend to vegetable exports if there had been no intervention during the period 1965–80. Between 1974 and 2000, the vegetable sector continued to grow steadily with a 10.6 per cent annual growth rate. If the fruit sector had grown at the same rate as pre-1974, it would have reached an export level of around US\$ 480 million in 1999 (the counterfactual line in Figure 5): in fact, fruit exports actually exceeded US\$ 2 billion. According to this DiD estimation, today’s fruit exports are more than four times higher than they would have been without the vertical intervention. In other words, 80 per cent of current fruit exports can be attributed to the clearly successful interventions in the fruit sector.

Salmonids and Other Fish Exports (Anchovy, Hake and Shellfish)

One of the issues faced in this DiD estimation was the lack of disaggregation of the product classifications for specific fish species in both the Standard

Figure 6. Evolution of Chile's Exports of Salmon Products and other Fishery Exports, 1963–2016, Using DiD Method (US\$ millions)



Source: Author's calculations based on data provided by Achurra (1995); Center for International Data (2018); SalmonChile (2003, 2009, 2018); UNCTAD (2006); UN Comtrade database (<https://comtrade.un.org/> accessed 18 July 2019)

International Trade Classification and the Harmonized System. I thus relied on different sources, such as SalmonChile, the Chilean Customs Authorities and UNCTAD, to gather and cross-check data on Chile's salmon exports. I then systematically deducted that number from overall fish exports.

The cooperation scheme between the Chilean and Japanese governments started in 1969 while Fundación Chile's entry into the salmon industry took place in 1981. Consequently, the year 1969 is used as t_0 (Figure 6). It is not possible to estimate the similarity of growth trends between 1969 and 1986 because salmon exports were non-existent before the intervention. Just as in the case of fruit, the selection of other fish species within the same sector as a control group is motivated by the reduction of bias caused by natural factors and industry trends.

According to my calculations, the annual growth rate of non-salmonids exports reached about 7 per cent between 1969 and 2016 and around 4 per cent in the period 1986–2016. The annual growth rate of salmonid products from their emergence in the export basket in 1986 until 2016 was about 25 per cent. If salmonid exports had grown at the same pace as non-salmonid exports for the entire period (1969–2016), they would have reached US\$ 50.35 million in 2016. Instead, salmonid exports accounted for US\$ 3.844 billion in 2016. There are thus solid reasons to believe that the interventions in the salmon industry were very impactful and enabled it to grow well above the fish sector's average.

FINDINGS

The Role of the State

Several lessons on the role of policy interventions for export diversification can be drawn from this analysis of Chile's diversification since the 1960s. A number of elements, such as human capital accumulation, venture capital, R&D and environmental sustainability, that are crucial for a sector's development, are difficult to manage without policy interventions.

Human capital accumulation: This study has shed light on the role of investments in human capital to address shortages in the skills required for the development of new industries. Specialized human capital accumulation in Chile was promoted through technical training programmes and university programmes in fields related to the now export-oriented sectors, such as marine sciences, fruit and agricultural science, forestry engineering, etc. As I have demonstrated elsewhere (Lebdioui, forthcoming), when institutions for training specialized personnel are lacking, or when particular skills are not provided by the public sector, private firms either fail to grow due to the absence of skilled human capital or have to train the necessary personnel in-house, which leads to high non-recoverable costs if trained employees leave the company. Governments therefore have a key role to play in the creation of training programmes in anticipation of future and current skills needs.

Venture capital provision: While pioneers in an industry can gain significant sales advantages, a head start in learning and reputational advantage (Schumpeter, 1942), Boulding and Christen (2001) have found that they can in some circumstances incur even larger cost disadvantages. Firms that follow pioneers can have some cost advantages as they can learn from the mistakes and successes of their predecessors, reducing their own investment requirements as well as their risks, potentially leading to a free rider problem.²⁰ As a result, while technology diffusion and the presence of 'followers' can bring high social and economic returns for the sector as a whole, private investors are more reluctant to invest in a new industry if technologies that have been developed at their expense are likely to be copied or are not sufficiently protected by intellectual property control, as this would weaken confidence that sufficient profit would be generated to compensate for the risks and costs of R&D (Hosono, 2016; Rodrik, 2007). Private investors are

20. It may be easier for other firms to free ride when first movers adapt imported technology instead of developing their own: 'emulating' first movers thus might have smaller knowledge advantages than first movers that are genuine innovators. A discussion of the determinants that render industries prone to a first mover advantage or disadvantage is beyond the scope of this article.

thus likely to seek to prevent imitators from entering the field and to restrict diffusion of technology and knowledge through patents and other means. In other words, the private interests of innovators do not necessarily match the socially desirable outcome of technology diffusion and emulation.

In that context, the role of the semi-public agency Fundación Chile highlights the scope for vertical interventions to promote the diffusion of knowledge acquired through R&D and industrial trials, through what could be seen as semi-public, not-for-profit venture capitalism. Fundación Chile's role has included sending market signals in promising industries that would not develop through market forces alone. This type of intervention can be considered a mechanism to explore new products and promote infant industries.²¹ In this role, Fundación Chile faces a trade-off between profitable investments and risky ones that may be less profitable but that could have higher social returns (Agosin et al., 2010). In total, Fundación Chile has created around 70 firms since its establishment in 1981.²²

Trade promotion: Another aspect relevant to the development of Chilean exports is the government's role in opening up foreign markets for Chilean products. Such interventions involve diplomatic activities in the negotiation of FTAs, phytosanitary agreements for food exports, as well as the creation of export promotion agencies such as ProChile, which assist Chilean companies in their participation in trade fairs, etc. Trade promotion activities started in the 1980s, when few countries were willing to trade with Pinochet's military government. The state's trade promotion could be seen as provision of a 'public good' of a horizontal nature. However, it appears to have been very targeted as it focused on foodstuffs and benefited existing sectors, at the expense of some infant industries and manufacturing. Meller and Zenteno (2013) note that the negotiation of phytosanitary agreements with importing countries was a key element for the growth of certain exports, especially food-related products, which are particularly impacted by such standards.

Regulatory and quality control: The government also plays a crucial role in reducing negative externalities that can impact a whole industry's reputation and exports. The Chilean state had to ensure quality control of salmon, fruit and wine producers. In the case of the wine sector, for example, Bordeu (1995) shows that wine consumers tend to associate product quality with the

21. In the past decade, Fundación Chile's mandate has evolved towards solving market bottlenecks and coordinating prospective studies rather than creating firms. The decision to embrace sector neutrality by the first Piñera government (2010–14) deeply impacted Fundación Chile, whose budget was cut in half (Interview with former President of Fundación Chile, 13 July 2017).

22. Some of the commercial projects pioneered by Fundación Chile had no followers (such as furniture production), while others (such as berry cultivation) were not commercially successful but had several followers and consequently high returns for the Chilean economy as a whole (Agosin et al., 2010; Meller, 2017).

country of origin. Poor quality, or the use of chemicals, from a single wine exporter could hurt the branding of the Chilean wine industry as a whole. There is an asymmetry in this: while it is very easy for a few wine exporters to damage the sector's branding, it is difficult for a few firms to enhance the sector's reputation on their own. Indeed, if some firms invest in quality improvement and thereby increase the reputation of Chilean wines, other producers that have not raised their quality might attempt to charge higher prices, which would in turn damage the sector's standing. In contrast, if all producers improve their quality, there are large reputational increases for the country's branding that few firms on their own might be able to achieve. Hence, enhanced product quality control can have a considerable impact on increasing the value of a product, allowing the sector to target niche markets with higher prices (Meller and Zenteno, 2013). In Chile, the activities of public agencies such as SAG and the Chiquihue Foundation were key to upholding export quality standards in the salmon, fruit and wine sectors.

Correlation between Export Diversification and Industrial Policy

Interestingly, some of the most successful vertical policy instruments were used during the seemingly economically liberal military regime (1973–90), directly contradicting free market ideology. While the Pinochet administration was explicit in stating that the government avoided picking winners by 'letting the market choose' (thereby invoking the logic of the Chicago School), this article has outlined vertical policies involving the forestry, salmon and fruit sectors, that belied this claim of sector neutrality. The military regime provided government subsidies for credits in various sectors (the fruit and forestry sectors in particular) through organizations such as the Central Bank and CORFO; the latter also led public investments in agricultural infrastructure, such as irrigation, and sold off its cold-storage facilities and packing plants to private exporters at reduced rates (Tinsman, 2013).

Nevertheless, it would be misleading to think that industrial policy 'in disguise' was a consistent feature of Pinochet's economic policy. The military regime's shock therapy in the mid-1970s sent the country spiralling into a financial crisis within a few years. The regime eliminated price controls, unified the exchange rate, cut public expenditures by half, sold off several hundred state-owned firms, and dramatically reduced import tariffs from 90 per cent to 10 per cent within four years.

There was little room for the market to adjust gradually to the strong impact of this rapid liberalization, which led to a steep increase in non-traditional imports, particularly non-food consumer goods. As a result, per capita imports other than equipment and machinery grew by 115 per cent even though per capita GDP increased by barely 10 per cent in 1970–81. In that period, imports of equipment and machinery as a share of GDP were significantly below the level of 1970, which was insufficient to raise

productive investment and recover the growth rates of the 1960s (Ffrench-Davis, 2002). Ffrench Davis (*ibid.*) thus concludes that the expansion of imports (or import de-substitution) was much larger and stronger than export dynamism and specialization, with non-resource based exports ceasing to grow in 1980, generating a growing trade deficit. Pinochet's neoliberal policies were also followed by very volatile growth and Chile experienced two big recessions, in 1975 and 1982–83, with GDP declining by 13 per cent in 1975 and more than 16 per cent in 1982–83 (Solimano, 2012).²³

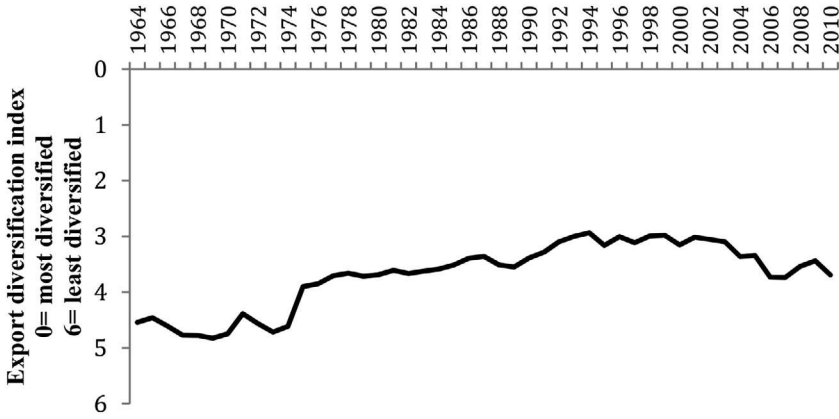
As a result, it is doubtful whether industrial policy was part of Pinochet's economic project from the start. Rather, based on the chronology and sequencing of liberal and industrial policies during the military regime, we can reasonably assume that some of the industrial policies emerged as a consequence of the realities of the crises that were created by the abrupt liberalization of the economy. Some of the push towards more interventionism might therefore have been driven by the limitations of neoliberal policies in promoting export diversification right after 1973.

Furthermore, the progressive abandonment of those vertical policy tools from the 1990s onwards (after the return to democracy) appears to be correlated to the country's decreasing export diversification. Since 1990, the new political economy has been rooted in neoliberal fundamentals, with a policy consensus that economic growth is based on ensuring macroeconomic stability (low inflation, low fiscal deficits, and moderate current account deficits) and an underlying view that industrial policy is unnecessary or unproductive (Solimano, 2012).

While long-term diversification in Chile shows positive trends (see Figure 7), with the emergence of industries such as salmon, forestry, fruits and wine, a shorter time horizon reveals that Chile's export basket has become less and less diversified since 2004. Varas (2012:16) notes that while policies implemented in the 1990s aimed at correcting market failures by fostering entrepreneurship and innovation, facilitating access to capital and lowering barriers to export markets, it appears that out of a total of 7,520 exporting companies in 2009, the 10 largest exporters accounted for nearly half of all export values, with eight of these firms operating in the mining sector while the other two operated in the forestry sector. Since both sectors had strongly benefited from clear state support and vertical policies since the 1970s, it is appropriate to ask whether the neoliberal policies implemented since the 1990s contributed to the goal of diversifying the Chilean economy. This trend could be at least partly explained by the five-fold increase in copper prices between 2003 and 2011 as well as China's economic boom,

23. Ffrench-Davis (2002) points out that even though significant trade liberalization was required after the effective protection of numerous import categories in 1973, the way in which trade liberalization was conducted was excessive, ill-timed, uncoordinated with exchange rate and capital account policies, and disregarded the challenge of completing underdeveloped factor markets.

Figure 7. Evolution of Export Diversification in Chile, 1964–2010



Source: Author’s compilation based on data provided by IMF (2018)

leading to a surge in commodity demand. Chile’s drop in diversification eventually translated into slower economic growth after 1998 and especially after 2014, following a decrease in copper prices, which shows that ‘adhering strictly to macroeconomic fundamentals is not enough to ensure steady high-end economic growth when sector-specific weaknesses are not addressed’ (Solimano, 2012: 51).

An important issue that could not be addressed in depth by this article relates to distributional consequences: who benefited from Chile’s successful export diversification and vertical interventions across different sectors? Despite its relative export diversification (which would be expected to reduce income inequalities by expanding employment opportunities for different segments of the population), and despite important reductions in poverty, it can be argued that Chile has retained a highly unequal income distribution due to the concentration of its economy on raw materials (Amsden, 2008; Kay, 2002). However, the distributional consequences of different policy interventions may have varied according to specific sectors, depending on the degree of firm concentration and labour intensity, land concentration, the exploitation of cheap peasant labour, as well as the historical reproduction of class-based inequalities in industrial and agricultural contexts, for example through systems of *haciendas* and *latifundias* (see Kay, 1997, 2002; Tinsman, 2013).²⁴

24. A hacienda, in the colonies of the Spanish Empire, is a large estate or plantation with a dwelling. Latifundias are extensive parcels of privately owned land that usually involve the exploitation of peasants or slaves.

CONCLUDING REMARKS

The findings of this research show that, in contrast to the *laissez-faire* narrative, the role of the Chilean state has been crucial in catalysing human capital accumulation, ensuring sustainability, and diffusing expertise and technology in non-copper related sectors, through different types of vertical policies and through various public institutions (including government agencies, the Central Bank, Fundación Chile and universities).

The opening up of the economy in the 1980s took advantage of the specialized human capital, knowledge and technological capabilities accumulated through vertical interventions prior to liberalization. While it can be argued that some sectors such as the wine industry could have developed through market forces alone, it is undeniable that other sectors would not have developed to the same extent without vertical interventions (in fact, it is likely that some would not have developed at all, given the policy-induced endowments for the forestry and salmon sectors). The comparative advantage that Chile developed in salmon, forestry and fruit production did not simply rely on natural factors; rather, it has mostly been *acquired* through technology upgrading, human capital accumulation, export quality control and financial incentives, through state interventions. For instance, while Chile had had a fishing industry for a century, and while salmon cultivation relies on several natural comparative advantages (such as temperature, the availability of adequate protected freshwater and seawater sites far from population centres, and different production periods between the southern and northern hemispheres), the salmon industry only took off and expanded after considerable policy interventions to develop the conditions allowing for its emergence (such as phytosanitary control of the import of eggs, investments in R&D, technology transfer, training programmes, etc.).

Referring back to the theoretical framework of this article, it is interesting to note that some of the most successful industries in Chile, such as salmon, are unlikely to have been found in Chile's 'open forest'²⁵ in 1980, as they were not related to copper mining or other exports in that period (which mostly consisted of forestry-related products and fruits) (Agosin et al., 2010). The government's decision to develop salmon production can thus be considered a strategic gamble on opening up a new area of the Chilean economy (*ibid.*). In addition, while the wine sector's technological upgrading was mostly the result of foreign investments and horizontal policies (unlike the other sectors analysed in this study), it is worth noting that those foreign investments targeted an industry in which Chile was already operating, and consequently did not promote a new product beyond Chile's existing productive structures. While it was a successful example of 'export

25. For the definition and application of this concept, see Hausmann and Klinger (2006).

discovery’, it was not a case of ‘product discovery’, as in the cases of the salmon or fruit sector.

It appears that the Chilean government had thus relied on several policy tools to effectively govern the market through what could be termed industrial policy ‘in disguise’, especially during the seemingly economically liberal military regime (1973–90). Since the return to democracy, economic policy has focused on natural comparative advantages, which attribute more importance to natural resource endowment than the potential for capabilities accumulation, learning by doing and incremental innovation in new industrial sectors. While focusing on sectors related to resource endowment is sensible, it should not prevent strategic gambles beyond a country’s comparative advantage.

There are two main elements underlying the focus on natural comparative advantage at the expense of acquired comparative advantage. First, such a focus is based on the idea preached by orthodox and ‘enlightenment economists’ that export orientation is more beneficial than import substitution, because exporting respects the law of comparative advantage. This leads to a static view of comparative advantage that is path dependent upon established capabilities, while neglecting dynamic and acquired comparative advantages. As a result, static approaches to comparative advantage have often considered agriculture and raw material processing as the developing world’s comparative advantage, as almost 90 per cent of third world exports derived from primary products in the 1960s (Amsden, 2008). While the developmental state rejected agriculture as the engine of export-led growth, Chile was the most successful country to target agriculture (*ibid.*). Interestingly, and quite importantly, it can be argued that even Chile’s comparative advantages in new primary sectors were dynamically acquired, as opposed to ‘revealed’ through free market forces thanks solely to natural endowment factors.

In terms of theoretical implications, it is clear that dynamic approaches to comparative advantage can greatly enhance our understanding of the key factors behind capability accumulation, industrial development and structural productive transformation in resource-rich countries. The role of industrial policy in guiding the export diversification process stems not only from the existence of systemic market failures but also from the non-self-directing nature of the diversification and resource-based development processes, and the recognition that the accumulation of capabilities is complex and dynamic according to a country’s institutional and structural characteristics.

APPENDIX: EXPORT DATA USED FOR THE DIFFERENCE-IN-DIFFERENCE POLICY EVALUATION

Table A1. Data on Chile's Fruit and Vegetable Exports (1964–2017)

Export Value (in US\$ '000s)	Products	SITC3 CODE	1964	1969	1974	1979	1994	1999	2009	2017
	Vegetable products	54; 56; 292	12503	8118	32099	83053	321629	397961	608720	762989
	Fruits	57; 58	13254	15159	36953	210445	1519098	2086220	3686767	5747827
Annual Growth Rate (%)	Products	1964–1974		1974–1999			1974–2017			
	Vegetable products	10.0%		10.6%			7.6%			
	Fruits	10.8%		17.5%			12.5%			

Source: Author's compilation based on data provided by UN Comtrade database (<https://comtrade.un.org/> accessed 18 July 2019)

Table A2. Data on Chile's Fish Exports (1963–2016)

Export Value (in US\$ millions)	Products	1963	1969	1986	1987	1989	1993	1998	2003	2007	2008	2013	2016
	Salmonids	0	0	5	8	50	291	714	1147	2243	2392	3517	3844
	Non salmonids (anchovy, hake, shellfish, etc.)	15	33.1	385	489	693	698	856	1013	1697	1608	1473	1246
	Total fishery exports	15	33.1	390	497	743	989	1570	2160	3940	4000	4990	5090
Annual Growth Rate (%)	Products	1969–2016			1969–1986			1986–2016					
	Non salmonids	7.1%			15.5%			4.0%					
	Salmonids	N/A			N/A			24.8%					

Sources: Author's calculations based on data from Achurra (1995); SalmonChile (2003, 2009, 2018); UNCTAD (2006); UN Comtrade database (<https://comtrade.un.org/> accessed 18 July 2019)

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