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Networks and Public Policies in the Global South: The Chilean Case and the Future of the Developmental Network State

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Abstract Recently, there has been considerable excitement about the economic potential of the "developmental network state"—decentralized government policies that successfully accelerated growth in several high- and medium-income countries. The question remains whether such a strategy could be successful in less-developed nations whose scientific and technological resources were relatively limited. This paper analyzes the trajectory of Chile, a Southern country which, despite adverse conditions, managed to produce something akin to an economic miracle during the last few decades. Our argument is that Chile's success was based on the developmental network state strategy. Moreover, we highlight the centrality to understanding the Chilean experience of the concept of "network failures"—a common phenomenon that occurs when domestic production would be best served by network forms of organization but for a variety of reasons, these networks either fail to materialize or fail to take hold (Schrank and Whitford 2011). Over and over again, we see that the logic behind the actions of the Chilean state was to provide resources that reduced the likelihood of network failures. We examine three case studies of successful export sectors: salmon; wine; and fruit and vegetables. The paper outlines some of the challenges faced by the Chilean model and assesses its long-term viability.

Keywords Developmental state · Network forms of organization · Industrial upgrading · Technology transfer · Innovation systems

Introduction

In the 2000's, there was considerable excitement about the economic potential of the "developmental network state"—government-led policies that successfully accelerated

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the growth of new firms, new industries, and new employment opportunities. Studies showed the success of such policies in countries as diverse as Ireland (Ó Riain 2004), Israel, Taiwan (Breznitz 2007), China, and India.[1] Block (2008) and Block and Keller (2011) extended the argument by attributing much of the technological dynamism of the US economy in the last few decades to a decentralized developmental state. But all of these "success stories"—even the ones, such as Ireland, that appear to have been fleeting (Ó Riain 2011)—were nations with considerable advantages. They either had already reached a relatively high level of economic development (Ireland, Israel, Taiwan, and the USA) or their very large size and considerable past investments in science and technology gave them a unique advantage (China and India).

The question remains whether such a strategy could be successful in other developing nations whose scientific and technological resources were relatively limited. Not surprisingly, the evidence amassed to date on the prospects for the developmental network state in middle income nations is at best ambiguous. A number of countries have pursued a version of the Irish model that relies heavily on attracting very large amounts of foreign investment with the idea that indigenous firms can carve out a growing economic role by initially providing inputs to the foreign firms. Among the nations that have pursued this path, the Czech Republic and Malaysia stand out for their success in attracting foreign direct investment, and they have had some successes in nurturing local firms and economic clusters that might continue to have some dynamism even if foreign direct investment were to slow down (Best 2007; Rugraff 2009).

The question, however, is whether this strategy has greater applicability and could be extended to a range of middle-income countries. Hence, the pressing question is the viability of a version of the developmental network strategy that would work in a different context than what has generally been documented. Are there examples of medium income countries with limited science resources that have been successful in using the developmental network state strategy?

In this paper, we analyze the trajectory of Chile, a Southern country which, despite adverse conditions, managed to produce significant economic growth during the last few decades. Thirty years ago, Chile was experiencing a serious crisis. In 1982, the GDP shrank by 14%; in 1983, the financial system collapsed and unemployment engulfed over 30% of the work force (Silva 1996: 305). But new policies succeeded in turning the situation around. Between 1984 and 1998, GDP growth averaged 7.7% annually (Goldberg and Palladini 2008: 1). This performance was significantly better than that of other Latin American countries, as shown below (Fig. 1)

In addition, income poverty decreased by more than half, from 40% of the population in 1987 to 17% in 1998. Life expectancy and infant mortality rates have achieved OECD-comparable levels (Goldberg and Palladini 2008: 1). Since 2000, the national unemployment rate has generally been below 10% (World Bank 2011). In short, the data indicate not only that over the last two decades the Chilean economy grew significantly, but also that this growth directly contributed to considerable improvements in the well being of the population.

[1] See also Kim (2010), OECD (2011), and Weiss (2011). While these sources used different terminology, they are describing some of the same policy tools that are addressed in the literature on developmental network states.

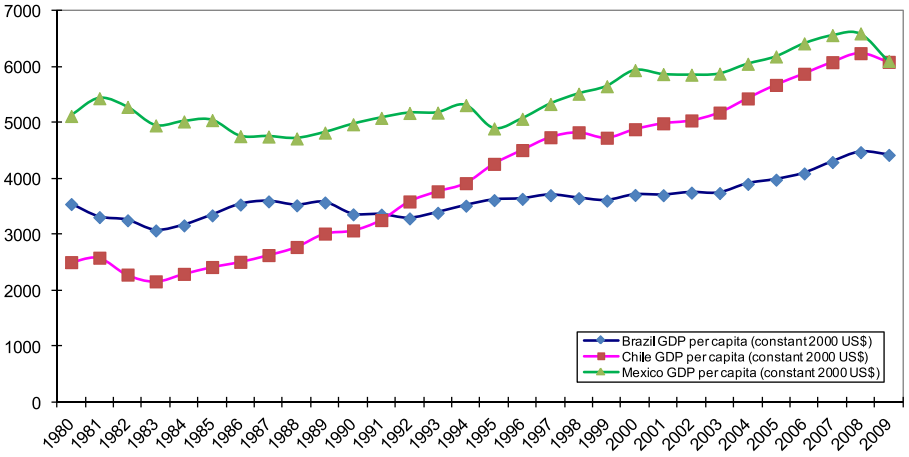


Fig. 1 Gross domestic product per capita in selected South American countries (World Bank 2011)

We argue that Chile's success hinged on its ability to significantly diversify its exports during the last few decades. In turn, export diversification relied on a developmental network state strategy that made intelligent use of the country's natural resources and relatively stable political institutions in order to become a major exporter of high value-added, agro-industrial products. This export success originated from strategic efforts by the state to test and adapt foreign technologies to suit the particularities of the Chilean physical and business environment, create widespread linkages among suppliers, producers, and distributors and help to disseminate technical knowledge.

To be sure, Chile had several distinct advantages that some other middle income nations do not have. First, Chile has had strong foreign exchange earnings from its copper mines that facilitated its development strategy. Second, Chile had a strong and legitimate central government with relative modest rates of corruption (Kurtz 2009). This helped to create the context for effective state-led development. Finally, in the aftermath of the disastrous experience with the Pinochet dictatorship, Chilean society had achieved a significant degree of consensus as political groups on both the left and the right saw the advantages of collaboration.

Nevertheless, our argument is that even with these advantages, Chile would not have had the success it did if it had not pursued the developmental network state strategy. Moreover, we will highlight the centrality to understanding the Chilean experience of the concept of "network failures"—a common phenomenon that occurs when production and distribution of economic goods would be best served by network forms of organization but for a variety of reasons, these networks either fail to materialize or fail to become entrenched (Schrank and Whitford 2011). Over and over again, we see that the logic behind the actions of the Chilean state was to provide resources that reduced the likelihood of network failures.

The paper proceeds as follows. To better understand the novelty of Chile's approach, we briefly recapitulate the global context in which developing countries have to operate nowadays, arguing that the free-market ideology underpinning the governance of the world economy is a major impediment to standard development policies. Subsequently, we argue that in this new environment, firms from developing

countries are experiencing similar levels of uncertainty to that of firms from advanced developed countries. In turn, we hypothesize that the chief role of government policies becomes that of acting to generate and maintain network forms of organization. We then start delving into the Chilean story, underlining its historical and political background, outlining its policy history, and presenting three case studies of successful, internationally competitive export sectors: salmon; wine; and fruit and vegetable exports. In the final section, we outline some of the challenges faced by the Chilean model and discuss its applicability to other medium- and low-income countries.

Challenges to Development

Prior to the 1980s, most of the countries that were successful in their attempt to generate development pursued a capital accumulation strategy based on protectionism and economic nationalism, which aimed at building domestic industries sheltered from potentially destructive competition from abroad. This was the case in a large number of instances, beginning with Germany and Russia in the nineteenth century (Gerschenkron 1962) and continuing with the entire East Asian region after World War Two (Johnson 1982; Wade 1990; Evans 1995). This strategy was largely based on copying or reverse-engineering products already invented in the developed areas of the world (Block 2008).

Today, however, this strategy is no longer available. Echoing shifts in ideology generated by a decade-long recession in the West, a new development paradigm embraced by Western-dominated international lending institutions took shape in the 1980s. It posited that the establishment of free markets was the key ingredient to unlocking development potential in the Global South. Liberalization was expected to generate markets with undistorted price signals, which in turn were sure to generate competitiveness and growth. From necessary ingredients to growth, therefore, protectionism and state intervention became the very things that needed to be avoided.

This new paradigm, commonly called the Washington Consensus,[2] was institutionalized through the World Trade Organization, established in 1995, that set new rules for global trade. The WTO regime made export subsidies illegal and made it difficult for nations to place restrictions on imports, eliminating some of the most widely used tools of developmental states (Rodrik 2004; Gallagher 2005). Furthermore, the WTO's Treaty Regarding Intellectual Property severely restricted the ability of developing nations to transfer technology through reverse engineering or simple copying. This eliminated another key catch up strategy used by developing nations (Wade 2003). In a global context in which transnational corporations are less likely to share their technical knowledge to firms from developing countries (Lall 2004), these features constitute a major blow to historically validated strategies for development. One widely noted consequence has been a sharp drop in economic output and other development indicators for a large number of developing countries (Rodrik 2006; Nayyar 2008; Heller et al. 2009; Kohli 2009). Given the conditions imposed by the

[2] The term was originally coined by Williamson (1990) without the ideological connotation that it has since acquired.

Washington Consensus, which seemed to strip the governments in the developing world of many of their standard policy tools, many wondered whether states could still play a role in stimulating development. Subsequent scholarship, however, answered in the affirmative. It showed that globalization had created barriers but also opportunities for developmental states, although the structure and strategies of the new developmental efforts changed radically into something called a developmental network state (DNS).

The DNS literature has grown out of careful research documenting the role of the state in recent cases of rapid technological upgrading, including Ireland (Ó Riain 2004; Breznitz 2010); Israel (Breznitz 2007; Maman and Rosenhek 2011), Taiwan and Singapore (Ó Riain 2004), and USA (Block 2008; Block and Keller 2009). The main structural feature of the DNS is its high degree of decentralization. The DNS is best viewed as a loose network of agencies that are multiply embedded in professional associations, global and local capital, and various social groups (Ó Riain 2004). A DNS is thus not housed in one place, and it does not have a unified budget (Block 2008). Moreover, since these agencies retain a significant dose of autonomy, they can resist political pressures to support firms regardless of their performance (Ó Riain 2004).

In terms of strategy, the DNS attempts to generate industrial upgrading by building local networks of learning where technologists, businesspeople, and government officials interact and generate innovation. The DNS creates these networks through a variety of strategies, including investment in research and development (R&D), investment in technical education, creating and supporting industry associations, and working directly with firms (Ó Riain 2004). These strategies are vastly different from that of "classic" developmental states like postwar Japan and Korea because the main objective is not to imitate already proven technologies, but to generate product innovations that do not yet exist (Block 2008). Hence, the attempt is not to identify a handful of "national champions" and help them conquer already established markets, but to create communities of innovative firms and institutions so that innovation can bubble up from below (Ó Riain 2011). There are, of course, significant differences among the various countries pursuing a DNS strategy—for example, Ireland created public-private networks around foreign firms, whereas Israel and the USA tended to build their developmental states around domestic infrastructures of public R&D (Breznitz 2007; Ó Riain 2011). Nonetheless, a general strategy was clearly discernible among all these cases.

A legitimate question, however, is whether the success of the DNS is replicable to a wider set of middle-income countries. It could be argued that the DNS has been documented in countries that already possessed sophisticated science and technology infrastructures, which may not be found elsewhere. In addition, the focus on generating industrial innovation seems misplaced in the case of most middle-income countries, which are neither expected nor likely to push technological frontiers. Our answer is that if we step back and consider the internal mechanisms of the DNS, there is no reason why these mechanisms cannot be applied in industrial sectors that are less technologically intensive and where the goal is to produce existing goods or services at globally competitive prices. Moreover, we argue that DNS-type strategies may in fact be a solution for the economy-wide coordination problems created by the Washington Consensus policies.

To reiterate, in the current global context developing nations have no sure way to insulate their firms from the uncertainty of competing in a global economy with many sophisticated competitors that are able to move quickly into new market niches. The development task remains facilitating the emergence of new domestic firms that can produce certain goods and services at prices that are internationally competitive (Viotti 2002; Rodrik 2004; Mathews 2006). The problem becomes managing uncertainty and coming up with the innovative institutional arrangements that are likely to produce industrial upgrading. In other words, the situation of firms from most developing countries today has come to resemble the situation of their counterparts from developed countries.

It is here that development strategies intersect with the transition to networked forms of economic organization that has been intensively studied in developed countries. Research has shown that, when confronted with high levels of uncertainty and turbulent markets, firms from developed countries are more likely to structure productive arrangements around network forms of organization. Contingency theorists noted quite some time ago that the more uncertain the environment, the more decentralized organizational processes (Lawrence and Lorsch 1967), and scholars associated with the resource dependence approach have long stressed the complex interdependencies that develop among firms (Pfeffer and Salancik 1979). Economic sociologists took these insights and broke new ground by documenting, in great detail, the contemporary advance of the network organizational form, which they characterized as complex interdependencies between firms engaged in "reciprocal, preferential, mutually supportive actions" (Powell 1990: 303). Network forms of organization involve close interdependencies among firms, leading to the fragmentation of production into cross-form specialist teams and to cross-company knowledge sharing and problem solving (Podolny and Page 1998; Smith-Doerr and Powell 2005). An important finding in this literature has been that network governance is best suited "for the production or distribution of goods and services characterized by volatile demand conditions, complex interdependencies on the supply side, or rapid technological changes" (Whitford and Schrank 2011: 9). The reason network arrangements are more efficient in uncertain markets is their capacity to solve complex problems and their ability to dissipate risk. In the developed world, the highly volatile market of advanced technology increasingly depends on regional agglomerations of firms, suppliers, university research centers, and knowledge-sharing institutions, agglomerations otherwise known as "industrial clusters" (Saxenian 1996; Porter 1998).

The fact that network forms of governance are well suited for uncertain markets is thus relatively undisputed. However, networks do not always spring up where they are needed. We are becoming increasingly aware that networks, too, can fail—or fail to emerge at all. An emerging strand of the literature focuses on "network failure" (Schrank and Whitford 2011; Whitford and Schrank 2011) and identifies opportunism and lack of competence as the two most likely sources of network breakdown. Opportunistic behavior kills networks because it erodes trust, which is a quintessential resource for any network. But even when other parties are trustworthy, it is often difficult for firms to find network partners who have the competencies and skills that are complementary to their own. The central point that Whitford and Schrank make, however, is that network failures, like market failures, can be corrected through public policy. Where network failures based on opportunism prevail, the state can

initiate trust-building policies such as trade associations and dispute resolution procedures; in the case of ignorance-induced network failures, states may try to invest in training or programs that more rapidly transfer knowledge from universities and government laboratories to private firms (Whitford and Schrank 2011).

If the above description of public policies aimed at dealing with network failures sounds familiar, it should—these are exactly the kinds of policies that Developmental Network States are eminently capable of delivering. As shown in previous paragraphs, many typical DNS strategies—including support for trade and professional associations, investment in education and R&D, and public-private partnerships—are also listed by Whitford and Schrank as particularly useful in countering network failure. It follows, then, that the DNS is potentially a successful antidote to network failure.

What does all this mean for contemporary development? If developing economies are pervaded by at least the same level of uncertainty as developed ones, it follows that they, too, will benefit from extensive firm networks. These networks are required so that the risks associated with adopting new technologies can be spread among network actors and knowledge can be pooled to benefit all the network members. In addition, in developing countries network failures are likely to be more pervasive since both social capital and technical competency are usually in short supply, requiring in turn more network-building efforts initiated by the state. It also follows that the kind of state that would be particularly successful at creating and maintaining networks would be a Developmental Network State.

This is where the example of Chile becomes crucial. The infrastructural, educational, and research capacities of this Southern country are rather modest. And yet, as documented in the introductory section of this paper, between the mid-1980s and through today it has boasted one of the highest development rates in the world. How do we make sense of this puzzle? We argue that the key to the Chilean situation was the successful attempt of the Chilean state—which largely fits the description of a DNS—to implement a network-building strategy that relied heavily on domestic firms with a view of generating new export opportunities. The Chilean DNS channeled funds from internal sources and created local industrial clusters linking producers, suppliers, and supportive state institutions, but instead of electronics or computers like some of its contemporaries, Chile's export success was in highly profitable agro-industrial exports. Chile, thus, fits the description of a middle-income country that successfully uses a DNS to generate an export boom in non-high technology sectors of the economy.

Natural Resource Upgrading—Chile and Beyond

Chile's historical trajectory changed from a postwar development agenda characterized by import-substitution industrialization to one of the world's earliest shifts to neoliberalism under the military dictatorship of Augusto Pinochet in the 1970s. But the market fundamentalist approach gradually morphed into a new development strategy fully supported by the state, a strategy which in turn generated sustained economic growth over the next few decades.

As with many of its South American neighbors, Chile inherited specific sociopolitical legacies including high levels of social inequality along class and ethnic

lines, an economy specializing in exports of natural resources (notably copper), and a political system that often alternates periods of democracy with periods of authoritarianism. In the postwar period, Chilean economic policies entered a phase of import-substitution industrialization (ISI), a strategy based on restricting imports of manufactured products and state-financed construction of domestic industries. With its heavy reliance on copper exports—constituting about 75% of the total value of exports—Chile was especially vulnerable to shifts in world prices and thus an ideal candidate for a turn towards ISI.

After several decades of dominance, the ISI phase reached an abrupt end in 1973, when a military junta led by General Augusto Pinochet organized a coup that toppled Salvador Allende from power and led to the emergence of an authoritarian regime that lasted 17 years. The coup had occurred in the context of an acute economic depression following a long decline in productivity and economic growth. After a brief period of experimentation with gradualist measures, the regime turned to a group of University of Chicago-trained economists—the now-famous "Chicago boys"—to devise a radical shift in policy. Predictably, the US-trained experts concluded that the major reason behind the crisis had been the state's heavy-handed control of the economy, which had led to inefficient productive structures. The reforms attempted to reduce the country's fiscal deficit and stimulate growth by "purging" the economy of government interventions. The policies included stabilization programs aimed at cutting deficit along with the thorough liberalization of capital markets, prices, and trade (Silva 1996). By 1974, the average tariff fell from 105 to 57% and a variety of other protectionist barriers had been lifted (Kurtz 2001: 4). In addition, neoliberal reformers purported to solve the productivity crisis by letting "unviable" industries collapse rather than continuing to subsidize them beginning in 1975 (Kurtz 2001).

Despite the regime's expectations, the neoliberal reforms failed to solve Chile's economic problems. The major economic crisis in the early 1980s led to the abandonment of the dogmatic neoliberal agenda pursued throughout the previous decade. The "Chicago Boys" were cast aside and a new development agenda rose to the surface, although the complete transition to a post-neoliberal approach would take place only after the fall of the authoritarian regime. Thus, between 1984 and 1990 the government seemed as committed to neoliberalism as ever. In reality, however, the official discourse was being changed in subtle ways to allow a greater role for the state. Chilean policymakers often described the resulting paradigm as "pragmatic neoliberalism" (see Silva 1996)—a fitting description of the tension between the official discourse still dominated by a neoliberal ideology and the "back stage" where state interventionism was increasingly dominant.

In a similar manner to other countries where neoliberal ideologies prevail, the way in which Chilean policymakers solved the tension was the market failure argument: since markets often fail, the state has the duty to intervene to correct these failures (Agosin et al. 2009). This, however, did not mean a return to the ISI agenda. The new development discourse viewed state interventions mainly as a tool to ensure the smooth operation of markets. State-enforced protectionism, state ownership of companies, and direct interventions into private companies' decision-making, all chief elements of the ISI agenda, were completely foreign to the new development paradigm. The new policy regime favored state efforts aimed at stimulating entrepreneurship, raising the technological level of existing industries, and export promotion, with the

least possible amount of direct intervention into companies' affairs. A mere 6 years after the dawn of the new developmental agenda, the fall of the military regime in 1990 following free elections contributed to the further erosion of neoliberal ideas. During the 1990s, an expansive set of policies were enacted, leaving a distinct imprint on Chile's developmental trajectory. It was only during this period, dominated politically by the center-left alliance known as the Concertación, that a fully mature DNS came into existence. Although many of the state agencies in charge of the new development strategy had been functioning for quite some time, we argue that only after 1990 did these disparate programs and policies coalesce into the recognizable pattern of the DNS.

The Chilean approach to generate industrial upgrading was based on sustained state support for domestic firms to make them competitive in agro-export world markets. This state support took the distinctive form of a DNS-type strategy. A decentralized network of loosely coupled state agencies have been adapting foreign technology for domestic companies, offering massive support for domestic entrepreneurs—including the formation of industrial clusters, creating industry and trade associations, and actively promoting exports through fiscal incentives and free trade agreements. We review each of these efforts below.

The Chilean state has been very successful in adapting foreign technology to Chilean soil and then getting domestic firms to commercialize the results. A key state agency in this regard has been Fundación Chile (FC). A private non-profit organization created in 1976 by the Chilean government and the IT&T Corporation, FC's main purpose is to carry out research devoted to technology transfer. The agency has played an essential role in the economic growth of the last two decades because it provided vital support for the early stages of technology adoption. FC has its own labs that carry out independent research. Typically, the first stage of the production cycle begins when the company's experts identify the opportunity to introduce an existing technology, product, or service, to the Chilean business environment. Next, extensive research is conducted to establish the feasibility, costs, and possible impact of introducing a new product to the local market. While not looking down on original research, most of the FC's efforts have been directed toward adapting technologies and products already well established in the world markets. After the new technologies were shown to have viability, FC subsequently acted as a broker between various private firms with a view of lifting commercially viable projects off the ground[3] (Agosin et al. 2009). In other words, the FC acted as a developmental state agency to minimize the network failures induced by firms' lack of expertise in potentially viable sectors.[4]

Once the new technologies were adopted, the Chilean state agencies acted to support the fledgling exporters. Chile's developmental state has been extraordinarily successful in its support for domestic firms. The government spends between $400

[3] FC's experience was replicated elsewhere in South America. For example, Mexico's successful blueberry export program can be traced back to the efforts of one Mexican grower, together with specialists from the University of Chapingo, to develop locally viable varieties (Chollett 2009). In Argentina, several state institutions created detailed mappings of microclimates so as to help the local agro-exporters (McDermott 2007).

[4] Although the FC is formally a non-profit, private organization, several factors qualify it in practice as virtually a state agency. The government is usually instrumental in choosing the members of its board of directors and the president, and the government also owns an important share of FC's capital (Agosin et al. 2009).

and $600 million annually on private sector support programs, including loan and credit guarantees, matching funds for competitively selected projects, and tax rebates (Tan 2009: 4). This substantial support for entrepreneurship did not originate in one place: there are currently 22 state institutions and more than a hundred individual programs aimed at promoting new businesses, either directly or indirectly (Romani et al. 2009: 59). But the Chilean state has done more than simply promote private sector initiatives. It has effectively created a culture of entrepreneurship (Schurman 1996).

When it comes to entrepreneurship support, Chile's premier development agency is Corporación de Fomento de la Producción de Chile, Production Development Corporation (CORFO). Founded in 1939, CORFO's mission changed with the times. During the ISI era, the agency was involved in developing new industrial ventures, and after the nationalization initiated by the Allende regime, CORFO directly managed an important share of the resulting portfolio of state-owned enterprises. Under Pinochet, CORFO's role was completely reversed—it was now supposed to manage and overview the privatization process initiated by the regime. In the 1990s, CORFO's mission again changed, this time in order to serve the new types of industrial policies emanating from post-Pinochet governments.

The new role of CORFO was to support companies, but do so in a way that would limit corruption and ineffective spending. To this end, CORFO instituted several changes. First, it decided to stop providing loans directly to companies; instead, it began acting as an intermediary, negotiating lines of credit with banks and then offering these to companies on a competitive basis. This was clearly a DNS-type policy because no particular companies were being favored. Second, the agency began to support associations of small and medium sized enterprises, requiring member firms to co-finance a part of the costs. CORFO also began systematically evaluating the efficiency of its programs (Nelson 2007). Thanks to these programs, Chile boasts one of the highest rates of small and medium companies (SME) with access to credit in the world: 70% of micro enterprises and 93% of small enterprises had a bank loan in 2004. These figures were higher than the similar percent in the USA (Agosin et al. 2009: 19).[5] Thus, CORFO contributed to a vibrant entrepreneurial culture dominated by small enterprises, which are rapidly becoming known as the main vector for technological innovation elsewhere in the developed world (Block and Keller 2009).

The Chilean state has done more than simply support individual companies. It has also been instrumental in generating industrial clusters linking individual producers or farmers, processing facilities, and exporting firms, thus preventing network failures that originate from both opportunism and lack of skills. The main vehicle for achieving this result has been Proyectos Asociativos de Fomento or Group Development Projects (PROFO). This highly successful program's main goal is to create groups of small and medium sized companies that work together toward solving collective problems such as access to technology and access to markets. It finances a share of expenses—diminishing over time—for training, market research and other joint actions. A manager hired by the members oversees the administration of resources.

[5] As in the case of technology adoption, extensive support for entrepreneurship seems to have become entrenched in other parts of Latin America. For example, the Argentinean state of Mendoza has developed more than 75 different programs and policies specifically aimed at supporting local entrepreneurs (McDermott 2007).

The first PROFOs began in 1992 and already by 1997 the program had contributed to the creation of 29 groups with 250 participating companies (Benavente and Crespi 2003: 5). Early studies showed that many of the PROFOS (firm clusters) that had been active for 20 to 30 months were becoming financially independent and that they were gaining market share in both Chilean and international markets (Spencer and Gomez 2001). Companies that participated in the program saw their annual sales increase by 12.9%, on average, between 1996 and 1999 (Goldberg and Palladini 2008: 18). External organizations such as the Institute of Development Studies in the UK and the United Nations have referred to PROFO as one of the most successful programs of its kind in South America (Spencer and Gomez 2001) .[6]

Finally, the Chilean government has been very active in its export promotion efforts. The National Agency for Export Promotion (PROCHILE) was founded in 1974 and its main mission is to promote Chilean exports abroad and to facilitate the entry of Chilean products to international markets. It was a key agency in the development of all the recent export successes, including salmon, wine, and fruit and vegetable exports. The agency's Export Promotion Fund provided co-financing for groups of firms in two categories of projects: those aimed at raising the quality of Chilean exports to satisfy international standards and projects aimed at developing new products (Perez-Aleman 2005).[7] In addition, the Chilean state has facilitated exports by signing a large number of free trade agreements (FTA) with practically all the countries that import goods from Chile, becoming one of the countries with the most FTAs signed in the world (Agosin and Bravo-Ortega 2009).

In what follows, we exemplify the role of the Chilean state in generating export diversification and growth using three brief case studies: the salmon industry, wine production, and fruit and vegetable exports. We emphasize these sectors not only because they have experienced explosive export growth, but also because the Chilean state played an important role in their development. The charts below demonstrate the growth of salmon, wine, and fruit exports over time:

The charts show the rapid growth of these sectors, which closely dovetails with the chronology of the DNS that we previously outlined, as the major takeoff in all of the three sectors took place only after 1990. This growth is manifest not only when looking at absolute export values (Fig. 2) but also when we examine the shares of these sectors in total non-copper exports (Fig. 3).[8] We do not want to suggest that

[6] Again, there is substantial evidence to suggest that the emergence of publicly supported industrial clusters was not a Chilean peculiarity. In the Dominican Republic, exporters of organic bananas were required by the government to form industry associations, which in turn has helped Dominican firms to acquire necessary export certifications, maintain product quality, and increasing output (Raynolds 2008). The recent wine export boom registered in Mendoza, Argentina, is also attributable to programs jointly developed and managed by partnerships between the regional government and more than 50 nongovernmental organizations (McDermott 2007).

[7] In a now familiar pattern, Chilean export promotion programs were not singular in the South American context. In fact, PROCHILE itself had been modeled after Proexport, its successful Colombian counterpart (Kurtz and Brooks 2008). Extensive state-sponsored promotion efforts were also observed in Argentina (McDermott 2007), Brazil (Arbix and Martin 2009), Dominican Republic (Raynolds 2008), and Costa Rica (Schrank and Kurtz 2005).

[8] We chose to report shares in non-copper exports because, as we document in the concluding section, copper exports have been growing rapidly in recent years due to an increase in world prices. Depicting our sectors' share of non-copper exports makes it possible to see that Chilean agroindustrial products would provide continued export strength even in the event of falling copper prices.

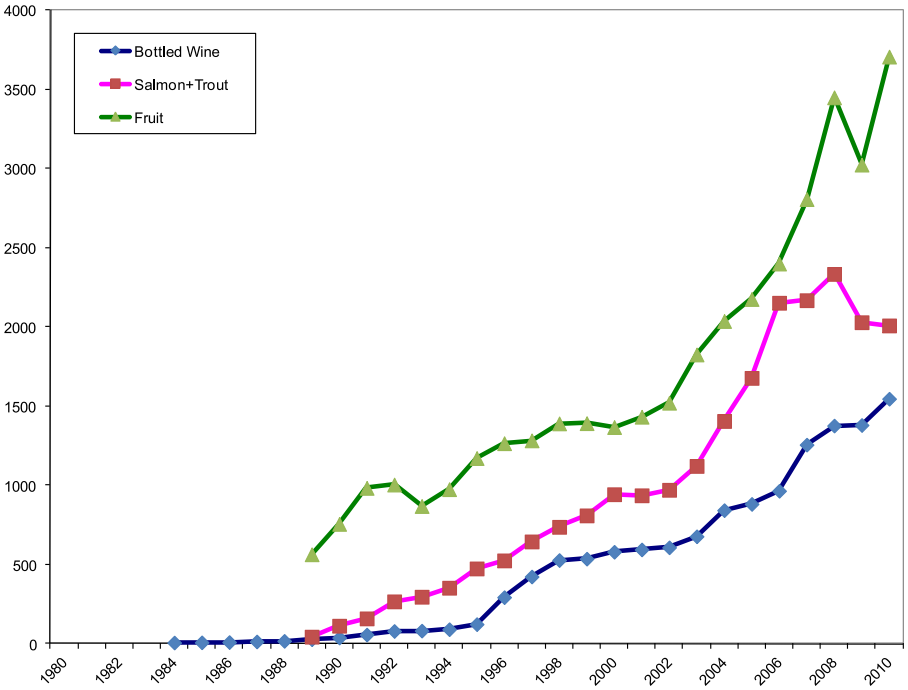
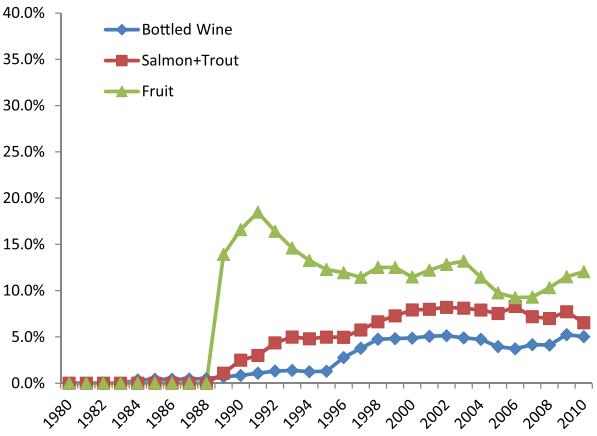


Fig. 2 Exports of goods in selected sectors, 1980–2010 (million dollars FOB) (Central Bank of Chile 2011)

Chile's economic growth was entirely the result of the growth of these exports. There were a number of other export innovations that this paper does not discuss—for example, the remarkable growth of pork meat processing. Nonetheless, the kinds of industrial policies that helped our chosen sectors to grow were present in these other sectors, as well (Agosin and Bravo-Ortega 2009).

Fig. 3 Exports of goods in selected sectors, 1980–2010 (percent of total non-copper export value) (Central Bank of Chile 2011)



Case Study I—Salmon Farming

The story of the Chilean salmon farming sector is nothing short of spectacular. In 1980, there were only two commercial farming operations producing 70 t/year. By 1995, production exceeded 100,000 t (Barton 1997: 314) and Chile had become the second-largest salmon producer in the world after Norway (Perez-Aleman 2005). The value of Chile's fishery exports grew from US$50.5 million, representing 3% of the country's export earnings in 1975, to US$1.2 billion, or 13% of exports in 1995 (Schurman 1996: 88). The corresponding figure for 2008 was US$2.5 billion (Agosin et al. 2009: 29).

Natural conditions were an important factor in the spread of the industry. Chile's extremely long coastline with pristine waters, much of which is away from human settlements, offers very good conditions for salmon farming. A close look at the evolution of the industry, however, reveals that the Chilean state was involved in every step, from helping to create the industry in the 1970s to supporting it to overcome some major recent hurdles. The beginning of the industry is indissolubly linked to the efforts of Fundación Chile. One of FC's subdivisions, Salmones Antartica, was directly responsible for the industry's takeoff. In the early 1980s, FC broke new ground when it began to transfer a set of key technologies from Scotland and Norway, the industry's world leaders, to Chile. Some techniques, such as the floating net pen, were imported directly without modifications. Other techniques were altered to conform to Chile's environment. For example, instead of rearing the smolts (juvenile salmon) in open rivers, FC opted for rearing them in tanks (Perez-Aleman 2005).

Subsequently, FC contributed to the salmon industry's takeoff in several distinct ways. First, it acted as a consultant to Chilean companies interested in entering the market. In 1980, there were only three private firms active in the market; by 1985, the number of firms had increased to 36. Many of the new firms were established by professionals and experts who had previously worked in the public research program (Perez-Aleman 2005: 16). Second, FC's decision to sell Salmones Antartica to Nippon Suisan, a Japanese company, for a handsome profit, demonstrated the potential of the industry, leading to a "crowding in" effect and subsequently to the boom in production documented above. In the next phase which took place in the 1980s, many new firms—especially small and family enterprises—joined the industry. In addition, the establishment of salmon farming generated the expansion of adjacent industries, including suppliers of intermediate inputs, service firms, salmon food producers, and pharmaceutical companies (Katz 2006).

The role of the Chilean state, however, did not stop with the establishment of the industry. If the industry was to achieve international competitiveness, several milestones had to be reached. The most pressing concern was the capacity of the Chilean producers to deliver a product that met international quality standards. In 1986, 17 firms formed the Association of Salmon and Trout Producers (APTSC), which currently enlists 42 members accounting for 85% of Chile's salmon production (Perez-Aleman 2005: 17). One of APTSC's most pressing concerns was to develop a code of standards and an inspection system to evaluate each stage of the production and processing of salmon. Once the system was in place, the Association was able to grant its certification seal only to firms that met the standards. The Chilean state

supported APTSC's attempts by financing the implementation of quality certification. In addition, the state body charged with fisheries regulation—SERNAPESCA—adopted the code developed by the APTSC, making it mandatory for any firm operating in Chile (Perez-Aleman 2005).

Another hurdle that had to be passed was ensuring the health of the salmon population. One of the most difficult aspects of salmon production is its extreme sensitivity to water impurities and pathogens. In order to keep salmon populations healthy, the ATPSC set up the Salmon Technology Institute (INTESAL) in 1993. The main mission of the Institute is to improve production practices and reduce disease by making sure that the Association members benefit from the latest disease management and sustainable production techniques. Notably, CORFO contributed 45% of the funds used to establish the Institute.

These measures, however, were not sufficient to avoid a crisis in 2008–2009 that centered on the rapid spread of a virus called Infectious Salmon Anemia (ISA) that devastated the fish population, reduced foreign demand for Chilean salmon, and led to many layoffs in the industry. There is reason to believe that this crisis resulted from too rapid growth of salmon production in Chile and insufficient attention to the environmental and sanitary consequences of expanded aquaculture (Iizuka and Katz 2010). Even before the crisis, it appears that Chilean production relied heavily on the use of antibiotics rather than improved sanitation (Barton 1997). While the data (Fig. 2) suggest that the industry recovered from the ISA crisis, the Chilean industry's future depends on the ability of the Chilean state to make dramatic improvements both in its regulatory oversight and its knowledge of the complex environmental challenges associated with aquaculture.

Nevertheless, the history of Chilean salmon production remains impressive and shows what a DNS can do to alleviate network failures in a developing country. State support for the salmon industry came from at least three separate state agencies, and it successfully overcame both knowledge- and opportunism-induced network failures. Through FC's efforts, domestic firms learned that salmon production was feasible in Chile and acquired the specific information and tools required to start production. Because of involvement by CORFO, trade associations and technical institutes facilitated knowledge transfer and created a sense of trust between firms located in various parts of the production cluster. And because of PROCHILE's export promotion, domestic firms successfully connected to world markets.

Case Study II—Wine Production

Wine is a more unequivocal Chilean success story. Unlike salmon, it has been produced and consumed in Chile for centuries, but until recently most of the wine produced in the country was consumed locally. There had been some attempts to create a more international profile before the World War II, with some of the wealthier families trying to imitate French chateaux by taking up viticulture. By the 1970s, however, most of the wine production was still geared toward domestic consumption.

In the 1990s, however, a dramatic change was afoot. Production had grown both in terms of the surface area cultivated (from 12,386 ha in 1982–1983 to 49,214 ha in 1990—Kurtz 2001: 16) and in terms of yields—from 52% of the US level to 76% in 1999 (Kurtz 2001: 17). More importantly, however, Chilean wine had become a

global presence. Export volume expanded from 178,400 t in 1984 to 512,879 t in 1996 (Kurtz 2001: 16). Chilean wine was now being exported to such sophisticated markets as the European Union, where 38% of the total exports are now headed, and the USA with 17%. Only 7% of the Chilean exports end up in Latin America (Agosin and Bravo-Ortega 2009: 14). By the mid-2000s, Chile had become the world's fifth largest exporter of wine (Benavente 2006: 225). Even more impressive is the fact that foreign investors did not drive the export growth—with a single exception, foreign companies arrived at the scene long after the market was solidly expanding (Agosin and Bravo-Ortega 2009). Among the largest 16 Chilean wine exporters, none are fully owned by foreign companies and only one is partially foreign-owned. Together, these 16 companies collect 60% of the revenue from wine exports (Gwynne 2006: 388).

In a similar manner to salmon farming, the rise of the Chilean wine industry benefited from excellent natural conditions. Chile's Central Valley, where most of the wine is produced, has cold and rainy winters and dry, hot summers—ideal conditions for growing high-quality grapes. In addition, Chile's positioning between the Pacific Ocean on one side and the Andes on the other gives the country a natural barrier against diseases. In the nineteenth century, Chile was the only winemaking country in the world whose vines had not been destroyed by phylloxera, a disease which nearly extinguished the European wine industry (Agosin and Bravo-Ortega 2009).

Of course, natural conditions can only partially explain the growth of the wine sector. They enabled the production of high-quality wine, but in a now familiar pattern, Chilean developmental agencies were also responsible for the export reorientation of the industry. This time around, however, the initial impetus did not come from the state. In the 1980s, traditional Chilean wines were produced from grapes of variable quality and while they suited the local tastes, they were often considered too tannic and too harsh by international standards. In the 1980s, two wineries—one domestic and one foreign-owned—introduced technological innovations that allowed an increase in quality. Viña Cánepa, a traditional Chilean winery, introduced the use of stainless steel vats instead of the wooden vats that had been previously used. In addition, Miguel Torres, a Spanish wine producer, began aging the wine in small oak barrels (220 l) in place of the large, 4,000-l oak barrels traditionally used by the Chilean producers (Agosin and Bravo-Ortega 2009: 16). These two improvements led to a considerable improvement in the quality of the wines and created a demonstration effect, luring more Chilean producers into export markets. After 1990, exports also took off because, with the end of Pinochet's dictatorship, consumer groups from developed economies stopped boycotting Chilean products (Gwynne 2006).

Once the industry took off, the Chilean state stepped in and contributed to the expansion of the sector in several ways. To produce wine of international levels of quality, one of the most important conditions was to ensure a reliable supply of grapes. This was not easy to achieve since most grapes produced for winemaking in Chile came from small growers. Thus, establishing an adequate cooperation between winemakers and grape growers was urgent. This is where CORFO's supplier development program (PDP) proved crucial. Winemakers have been intensively using the PDP to improve the quality of the grapes (Agosin and Bravo-Ortega 2009: 16). They transferred their constantly updating knowledge to their external suppliers. Business contracts detailed the handling procedures, irrigation pathways, and established

performance indicators such as yield per hectare. In its attempts to create a true export-oriented cluster, CORFO also supported the creation of industry-wide business associations. There are two major associations in Chile: Centers for Business Development (ChileVid), which is a consortium of small and medium wine producers, and the Chilean Wine Corporation (AVC), which includes the large winemakers. Both these industries associations were created with CORFO support.

Along with efforts to create a successful wine cluster, the Chilean state contributed to the burgeoning of wine exports by facilitating the establishment of links between Chilean companies and foreign markets. A major role was played in this regard by PROCHILE, the state agency created in 1974 to support emerging exporters. The agency financed almost a half of all funds spent to promote Chilean wines abroad, including travel, participation in fairs, and marketing costs (Benavente 2006: 235). In addition, PROCHILE facilitated the transfer of knowledge from more advanced markets by financing so called "technology capture tours" by Chilean oenologists and viticulturists to Australia, Europe, and the USA (Benavente 2006: 233).

Thus, the story of Chilean wine exports encapsulates a similar experience to that of the salmon industry previously detailed. It was the concerted action of several state agencies that transformed the Chilean wine industry from an obscure domestic sector to an international export success. Several government programs overcame network failure by helping to create communities of producers and small growers so that knowledge about production techniques, quality standards, and international markets could flow, resulting in a marked upgrading of quality and ultimately export success.

Case Study III—Fruit and Vegetables

Another area where Chilean firms have made great progress is in the export of fruit and vegetables. There are several products that merit attention, but in the context of this paper, we chose only two, namely tomato processing and blueberry exports. Both sectors have shown impressive growth rates and both confirm trends observed in the other sectors so far. Chilean state agencies were involved in all the important phases of these industries' growth.

From a paltry US$2 million in 1981, export sales of processed tomato products jumped to more than US$100 million in 1995, placing Chile in the fifth position on the list of the largest exporters of tomato paste in 1994 (Perez-Aleman 2000: 44). Similarly, the value of blueberry exports grew from US$200,000 in 1990 to US$95.3 million in 2005, making blueberries the fifth largest fruit export (Agosin and Bravo-Ortega 2009: 33). As a whole, fresh fruit production currently employs approximately 450,000 workers, or 7.1% of the workforce (Agosin and Bravo-Ortega 2009: 29).

Looking at the trajectory of these two industries, we find similar patterns to the other case studies discussed above. Eight of the nine largest tomato processing companies are Chilean-owned (Perez-Aleman 2005: 11), in a similar pattern to wine production. In the blueberry exporting market, we find a mixture of Chilean and multinational companies, similar to salmon farming. Both tomato processing and blueberry production, however, are similar with respect to the types of relationships between exporters and suppliers. Neither of the two markets is vertically integrated;

instead, a small handful of exporters collect the product from a large number of small suppliers. This characteristic was a byproduct of the agrarian reform enacted by President Eduardo Frei, which resulted in the emergence of a large number of small farmers (Perez-Aleman 2005). This situation was less likely to promote vertically integrated markets, and more likely, as it turned out, to generate dense industrial clusters linking a multitude of suppliers to several producers/exporters. In 1985, the tomato industry was dominated by two large firms working with 210 suppliers; by 1995, nine large exporters were connected to 5,000 small suppliers (Perez-Aleman 2005: 12). In fruit exports, 550 exporters purchase product from about 16,000 suppliers (Agosin and Bravo-Ortega 2009: 29).

The Chilean state was actively involved in both the takeoff and the subsequent growth of tomato and blueberry exports. The seeds of growth were planted as far back as the mid-1960s. The National Institute for Agrarian Research (INIA) was founded in 1964 to improve existing agricultural technologies. In 1967, CORFO launched an ambitious program for fruit development which included efforts to build a comprehensive irrigation system, market analysis, technology transfer, and phytosanitary inspections—all of which are essential to building export capacity (Kurtz 2001). With the coming of the Pinochet regime, however, these attempts were abandoned and had to wait more than a decade to be picked up again.

At the end of the 1970s, INIA began an initiative aimed at testing the possibility of blueberry cultivation in Chile. Since blueberries are not traditionally consumed in Chile, the entire project has been from the beginning geared toward exports. INIA tested around twenty different varieties of berries, and the results indicated that blueberries were among the plant types that could grow successfully on Chilean soil. In addition, their hardier build made blueberries more likely to endure the long transport from Chile to the USA—the most important market for Chilean blueberries. Subsequently, INIA developed a series of production techniques, trained researchers, and provided technical assistance to potential growers (Agosin and Bravo-Ortega 2009). In the mid-1980s, Fundación Chile took over the torch. It used the research previously developed by INIA to establish a private commercial venture, Berries La Union, which was specifically designed to launch blueberry exports as a profitable activity. Although Berries La Union went bankrupt after FC exited the business, the demonstration effect it created drew many other companies to start blueberry export ventures (Agosin et al. 2009).

In a recurrent theme, the Chilean state also contributed to the creation of industrial clusters by helping to create links between suppliers and exporters. In tomato processing as well as blueberry production, the main difficulty is obtaining a reliable and high-quality source of agricultural products. This task was made harder, initially, by the fragmentation of the market. In tomato processing, CORFO deployed active efforts toward improving the quality of the primary product by aiding large exporters in their efforts to train suppliers (Perez-Aleman 2000). In blueberry exports, a major role was played by the Agriculture and Livestock Service (SAG). SAG disseminated information on best agricultural practices, ensured that Chilean products met the quality norms of receiving countries, and issued export certificates. PROCHILE, in turn, did its part by acquiring information on foreign standards, organizing information and "product discovery" missions, and offering information on global market trends (Perez-Aleman 2000).

Implications

In this paper, we have documented the Chilean developmental network state's ability to initiate and nurture extensive entrepreneurial networks which, in turn, were able to prevent network failures and generate growth in a way that fit the particularities of the Chilean context. But we also want to emphasize that this Chilean model is not without its problems. The focus on agro-industrial exports is obviously a problematic long term strategy. For one thing, other nations are bound to follow a similar path so that the rewards in export markets will be diminished. For another, as the case of salmon farming suggests, agro-industrial products can take a severe toll on the natural environment. Finally, wage levels for workers in these industries have been relatively low, so the multiplier effect of increased employment tends to be weaker than in the case of manufacturing.

But the point is that Chile is following the logic of upgrading to use the same techniques in industries beyond agriculture and aquaculture. In January 2007, a newly appointed Innovation Commission issued a National Innovation Strategy that purported to transform Chile into an advanced knowledge economy. The strategy aimed to reduce the export concentration of the top 25 exports to less that 50% of the total exports within 15 years. Another stated goal was to increase R&D spending, especially by the private sector, and tertiary education spending (Kharas et al. 2008). Another recent policy change was the Innovation Commission's decision to steer innovation subsidies towards nine clusters selected for special attention (Agosin et al. 2009).

Contemporary development scholarship has come to recognize the role of innovation and learning within the development process: "growth requires continuing social learning. The goal therefore is to create institutions that can learn to identify and mitigate different, successive constraints on growth, including of course such constraints as arise from defects in the current organization of the learning institutions themselves" (Sabel 2005: 6). If continued development rests on the capacity to innovate, then having extensive networks, with their proven ability to foster innovation, is a strong indication that the upward trend will continue.

To their merit, Chilean policymakers understand that if the country is to continue its growth, the Chilean government must apply its documented ability to foster networks to non-agroindustrial sectors. If seriously pursued, the previously mentioned National Innovation Strategy—whose main goal is to transform Chile into a true knowledge economy—might push the country in that direction. This could be achieved in sectors where Chilean industries are already strong. For example, building capacity in biotechnology would seem to be a natural corollary to Chile's existing strengths in advanced agro-industrial exports. And indeed, in 2004 the Chilean government issued a biotechnology strategy that attempted to do just that (Hernandez-Cuevas and Valenzuela 2004). Furthermore, Chilean policy is currently moving away from an emphasis on correcting market failures to a more vertical approach characterized by an emphasis on specific clusters of industries that have shown that they can obtain, or have the potential for obtaining, a comparative advantage (Agosin and Bravo-Ortega 2009). However, this approach can backfire if it replaces the current decentralized strategy with a more hierarchical and rigid industrial policy,

leading to a decline in innovative capacity, as recently documented by Ó Riain (2011) in the case of Ireland.

Another seeming challenge to Chile's future performance is that copper is making a comeback. Whereas during the 1990s copper accounted for around 35% of the total value of exports, by 2010 this proportion had climbed to 57% (Central Bank of Chile 2011). While this might seem to suggest that Chile is becoming more dependent on copper, in reality this trend is caused by the sharp rise in copper prices over the last half decade, which caused revenues from copper exports to increase significantly. In other words, copper's greater proportion in the value of exports is not caused by a decline in agro-industrial exports—in fact, as Fig. 2 demonstrates, these have been growing quite strongly. Moreover, the government is taking steps to ensure that the increase in copper revenues is not simply channeled into consumption, but that it serves as a basis for future growth. Revenues from copper royalties have been used to create a Fund for Innovation and Competitiveness, which funds some of the innovation strategies mentioned above (Fuentes 2009). In addition, some of the recent windfall in copper revenues has been channeled to carry out fiscal stimulus measures and support employment (Havro and Santiso 2011). Thus, the country does not appear to be in any danger of falling into a resource curse trap, and has been one of the few countries in the world to register a budget surplus during the last few years (de Mello 2008).

Nonetheless, it is far too early to tell if Chile will be successful in creating new industries outside of the agro-industrial examples we have examined. If Chile does succeed, it would be a shining example for many other developing countries. If it fails, it will become another example of a "growth spurt" that fizzles, showing the inadequacies of the current global development environment. For if Chile fails, that fact will underscore once again the hostile nature of the current global regime that has left developing countries without most of the tools traditionally used to generate development. Bereft of their traditional tools, governments must now try to create sophisticated industrial networks—a task daunting enough for many firms from developed countries—to even hope to generate industrial upgrading. And once the networks are created, the next task, perhaps even more daunting, is to compete on an equal footing against firms from developed countries, which often benefit from extensive support from their own governments. In short, whatever happens with Chile, there is still an urgent need for deep reforms of the global regime that make it easier for governments in the developing world to achieve higher standards of living for their people.

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