Commission on Growth and Development

WORKING PAPER NO.31

Chilean Growth Through East Asian Eyes

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About the Series

The Commission on Growth and Development led by Nobel Laureate Mike Spence was established in April 2006 as a response to two insights. First, poverty cannot be reduced in isolation from economic growth—an observation that has been overlooked in the thinking and strategies of many practitioners. Second, there is growing awareness that knowledge about economic growth is much less definitive than commonly thought. Consequently, the Commission's mandate is to "take stock of the state of theoretical and empirical knowledge on economic growth with a view to drawing implications for policy for the current and next generation of policy makers."

To help explore the state of knowledge, the Commission invited leading academics and policy makers from developing and industrialized countries to explore and discuss economic issues it thought relevant for growth and development, including controversial ideas. Thematic papers assessed knowledge and highlighted ongoing debates in areas such as monetary and fiscal policies, climate change, and equity and growth. Additionally, 25 country case studies were commissioned to explore the dynamics of growth and change in the context of specific countries.

Working papers in this series were presented and reviewed at Commission workshops, which were held in 2007–08 in Washington, D.C., New York City, and New Haven, Connecticut. Each paper benefited from comments by workshop participants, including academics, policy makers, development practitioners, representatives of bilateral and multilateral institutions, and Commission members.

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Abstract

Chile could well have space to increase its growth potential by 2 percentage points of GDP per year.

To do this, it would need to pay more attention to new sources of growth in natural resources, manufacturing, and services. In an increasingly globalized world, first-mover advantages have become more numerous and larger. Chile risks losing out, as a few recent high-profile cases suggest.

Chile's total factor productivity (TFP) growth can be raised by driving within-firm technological change closer to the global best-practice frontier more rapidly, especially in manufacturing. This would encourage the diversification of exports and boost Chile's supply response to global demand changes.

Chile confronts obstacles in its processes of innovation, human capital accumulation, and investment. To overcome them, deep institutional changes are needed to develop a national innovation system, stronger and more equitable educational achievement, more flexible labor markets, and focused public investments that crowd in private business.

Such an inclusive growth strategy is likely to yield better social outcomes than a strategy that attempts to confront social inequities head-on through more equitable access to public services without paying adequate attention to the demand for labor and generation of income.

The Chilean political system is not well structured to deliver on the range of micro reforms that is required and legislative changes proposed by the government have become bogged down. In its place, tentative moves to improve the system have been advanced, such as the establishment of the National Innovation Council (NIC) and a series of laws on education reform. But these steps might be too limited to have a significant impact and run the risk of further damaging the reputation for successful public intervention. They may also waste resources.

By contrast, East Asian economies seem to be reforming faster and more successfully on the micro fronts. They have also achieved more rapid human and physical capital accumulation. The East Asian process is one of a pre-announced coherent and significant package that is implemented through incremental change each year. That requires constant fine-tuning and adjustment as implementation weaknesses become apparent. It builds on a vision, quantitative goals, and a partnership with the private sector. Scrupulous attention to detail boosts confidence in government's ability to deliver. But the benefits to aggregate growth have come at a cost in terms of elite capture of benefits.

Chile has been much more successful in avoiding elite capture, although the top 8 percent with the right education and the best jobs still benefit disproportionately. But this social order may also come at a cost in terms of difficulties in formulating an adequate micro reform program. A geographic

focus to reform might offer Chile some options for limiting further elite capture of its reform benefits.

It may be time for Chile to consider smart rebalancing of its famed sector-neutrality if it is to be successful in implementing a far-ranging micro reform package. Singapore, which has recently embraced casinos as part of its tourism development strategy, after a half-century of adamant opposition to gambling, shows that taboos in public policy can be overcome when carefully planned.

Chile could also try a new policy towards innovation, but it would need to be bolder in terms of the institutional design to maximize the chances of success.

A mindset change is needed from "get the policies right and growth will follow" to "focus on high growth and the policies will emerge." Given public expectations of continued improvement in living standards, average growth performance compared to global leaders may not be good enough. Worse yet, the social consensus that has been maintained over the past decades may begin to erode and inequalities become more pronounced. A bolder approach may in fact offer lower-risk policy choices.

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Introduction

Chile was a stellar growth performer from 1985 to 1997, averaging almost 6.5 percent per capita per year. Since then, growth rates have come down significantly and, according to estimates of the Central Bank of Chile, so has the estimated potential growth rate of the economy. The current consensus of Chile's potential GDP per capita growth rate is around 3.8 percent.[2]

What is unusual about the Chilean experience is that it has all the preconditions for rapid growth that traditional economics would suggest. For example, the quality of public policy is typically described as the best in Latin America (figure 1) and among the best in the world. Chile ranks high in global competitiveness indices.[3] It has strong scores in the World Bank's Doing Business Index,[4] low corporate tax rates[5] and secure property rights. It is open. Its macroeconomic policies and institutions are widely considered to be among the best. Its central government bureaucracy has an excellent reputation for its economic depth. Finance, trade, capital markets, and governance reforms have been deep. There is a high degree of consensus building in the reform process, so that Chile has earned a well-deserved reputation for predictability and sustainability.[6]

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[2] Presentation by Klaus Schmidt-Hebbel to Growth Commission Workshop, April 12–14, 2007.

[3] Chile is the highest ranked emerging country in the *Global Competitiveness Report*, 2006.

[4] Chile ranks 28th in *Doing Business*, the second highest emerging market economy.

[5] Chile ranks 3rd out of 30 countries in the PriceWaterhouseCoopers survey.

[6] Volatility in GDP growth has declined sharply since the 1980s.

Figure 1: The Quality of Public Policies in Latin America

	Stability	Adaptability	Enforcement and implementation	Coordination and coherence	Public regardness	Efficiency	Policy Index
Argentina	2.3	1.8	1.7	1.7	2.1	1.5	1.9
Bolivia	2.5	2.1	1.9	2.2	2.1	1.7	2.1
Brazil	2.7	3.0	2.2	2.6	2.2	1.9	2.4
Chile	3.0	3.4	3.0	3.0	3.0	2.9	3.0
Colombia	2.7	2.8	2.2	2.1	2.1	1.9	2.3
Costa Rica	2.3	3.0	2.4	2.3	2.5	2.1	2.4
Ecuador	2.2	1.9	1.8	1.8	1.8	1.6	1.8
El Salvador	2.6	2.7	2.2	2.2	2.2	2.1	2.3
Mexico	2.5	2.8	2.2	2.2	2.2	2.2	2.3
Nicaragua	2.3	2.0	1.8	1.6	1.8	1.8	1.9
Peru	2.2	2.3	2.1	2.0	2.2	1.7	2.1
Uruguay	2.5	3.0	2.3	2.1	2.2	1.9	2.3

Source: Stein and Tommasi (2006).

Note: The key features of public policies are classified using cluster analysis such that dark grey represents a "high" value of that particular variable, light grey is "medium," and white is "low."

Why then has Chile's growth performance since 2000 declined in comparison with the previous decade? Is Chile simply suffering an inevitable slowdown in growth as it moves through middle-income status?[7] Should one worry if growth stays in the range of 3 to 5 percent per capita? How does Chile's growth strategy differ from that of other countries or economies that have successfully made the transition from middle-income to rich country status?

There seems to be a consensus among external commentators, including the OECD, the IMF, and the World Bank, that one of the major challenges facing Chile is to lift its growth potential. That said, there is less of a consensus on the specifics of policy reform, the critical mass of reforms, and the urgency of reform. Public policy has to date concentrated on macro stability, neutral and predictable sectoral policies, and strong institutional underpinnings and this has delivered substantial economic rewards. Some wonder, however, if this stance is sufficient to help Chile overcome the pressures of greater globalization and domestic concerns with equity and social issues.

This paper contrasts Chile's approach with strategies pursued in East Asian high-growth countries. East Asian examples are used for three reasons: (i) many of the successful transitions from middle to high income levels have actually occurred in East Asia, starting with Japan, and continuing with the Republic of Korea, Singapore, and Taiwan, China; (ii) several other East Asian countries (Malaysia, Thailand) are now wrestling with an identical set of issues, including rising domestic inequality; and (iii) East Asia is widely seen as having heterodox growth policies, and so offers the most vivid contrast with Chile.

[7] Gill and Kharas (2007) describe the middle-income trap.

The choice of an East Asian lens does not mean that Chile should emulate East Asia. Nor does it mean that Chile should ignore lessons from other countries, such as Denmark, Finland, and Ireland, which have also had successful middle to high income transitions, and which are endowed with ample natural resources, like Chile. But it is worth understanding and considering Chilean growth through East Asian eyes so as to be clear on what the differences really are.

Much has been written on Chile and its growth is well-studied.[8] From that review, a few central points emerge. First, Chile's recent growth record is seen as solid, but not spectacular. Some analysts have argued that Chile's growth in the 1986-97 period, the so-called "golden years" should be viewed as aberrant, a one-off response of the economy as it shifted to higher income levels following major reforms. From this perspective, the decline in growth in recent years should be interpreted as a return to a longer-term sustainable trend, not as a secular decline. Others think differently, worrying that reform momentum has petered out after a decade of successful macroeconomic and structural reforms. This leads to the second point. There does not appear to be a strong social consensus at the moment on the agenda for the next generation of reforms. The lack of consensus is seen in three areas: (i) debate over the magnitude of the problem ("can much more to be done to foster growth?"); (ii) debate over the focus of change ("should priority be to increase economic growth or reduce social inequalities?") and (iii) debate over the driver of change ("what should be the role of the public sector and can it execute major policy change?").

In this paper, we make comparisons between Chile and East Asia along two dimensions. First, we assess Chile's growth and compare its strategy with that in fast-growing East Asian countries. Second, we compare the policy-making process and the nature of the debates in Chile with those in East Asia.

Chile's Growth Compared to East Asia

The OECD (2005) concludes that the "…overarching policy challenge (for Chile) is to lift the economy's growth potential." But how much faster can Chile grow, given that it is now a mature economy? Table 1 shows the growth performance of a number of countries that have recently made the transition from middle income to high income levels.

[8] See *Cuadernos de Economia* 43(127), 2006, for a selection of recent studies.

Table 1: GDP Per Capita (1990, International Geary-Khamis Dollars)

Country	Year	GDP	Growth next 10 years
Chile	2003	10,950	3.8?
Denmark	1965	10,953	1.9
Finland	1973	11,085	2.4
Spain	1988	11,046	2.4
Ireland	1989	10,880	6.3
Portugal	1990–1991	11,065	2.6
Japan	1972–1973	11,084	2.7
Singapore	1986	10,900	6.1
Taiwan, China	1991–1992	10,863	4.6
Korea, Rep. of	1994	10,959	4.6

Sources: Maddison, "World Population, GDP and Per Capita GDP, 1–2003 AD (Last update: August 2007), at: http://www.ggdc.net/maddison/; World Development Indicators; Penn World Tables, at: http://pwt.econ.upenn.edu/php_site/pwt62/pwt62_form.php.

The table shows that, at current potential, Chile falls in the middle range of recent experiences. Countries like Denmark and Finland actually grew quite slowly from the time when they were at Chilean income levels (although Finland grew rapidly thereafter). Chile is growing faster than Japan did at comparable income levels, and only slightly slower than Taiwan (China) and Korea (although the Korean data include growth through the unusual period of the East Asian crisis, so the figure might be biased down). Singapore and Ireland stand out as countries that grew very rapidly to become rich.

This crude comparison suggests that Chile may have some room for improvement in its growth, by around 2 percentage points if it were to become a top global performer. Global conditions are more favorable today than in the 1980s or 1990s so Chile could do even better than other countries in the past. Real interest rates are low and global demand is high with robust growth in trade, FDI, and international capital flows. Commodity prices are at all time highs and opportunities to leverage global demand are unprecedented. So perhaps Chile should strive to be more ambitious.

The Commission on Growth and Development[9] has been looking at the determinants of economic growth in developing countries. The Commission has recognized that growth policies are nuanced and country specific. From its review of country experiences and recent academic work on growth, the Commission feels that sustained growth successes have some common characteristics:

[9] The Commission on Growth and Development is an independent body, chaired by Professor A. Michael Spence. See www.growthcommission.org

- adaptable growth strategies, based on an understanding of the nonlinear dynamics of growth and changes in the micro underpinnings of production structures as countries grow richer
- pragmatic approaches to the role of government in development and the policy-making process

Micro Efficiency and Chilean Growth

The proximate cause of Chile's recent fall in potential growth has been a fall in its total factor productivity growth (TFP). It was an acceleration of TFP growth to over 4 percent annually that led to growth acceleration in the 1985–97 period, and it has been the halving of TFP growth to less than 2 percent annually that has led to the current slowdown. TFP growth, in turn, has been largely attributed to structural reforms in Chile. Hence, it seems natural to look at the micro underpinnings that might lie behind the swings in TFP growth.

During the process of development, aggregate growth can occur through moving the work force from low productivity to higher productivity sectors, and/or by increasing the productivity of each sector through general advances in organization and management.[10] In most countries, there is substantial heterogeneity of firm productivity and substantial reallocation of factors between firms in a continued process of "creative destruction"—the exit of poor performing firms and the expansion of more productive firms. This process, along with within-firm innovation to boost productivity, drives aggregate productivity growth. Hsieh and Klenow (2007) give a sense of the magnitude of this effect. They argue that if capital and labor are reallocated between plants to equalize marginal products to the same degree as in the United States, manufacturing TFP would rise 25-40 percent in China and 50–60 percent in India. Such plant level productivity differentials persist absent policy change and hence narrowing them can be considered a long-term source of growth.[11]

Consistent with this view, Bergoeing and Repetto (2006) calculate that much of the gain in Chilean TFP in the 1970s and 1980s was due to precisely these types of reallocations, including the displacement of less productive firms by new, higher productivity firms. Chilean firms benefited from a long period of macroeconomic stabilization, openness, and fiscal adjustment. The Chilean country risk premium fell by about 500 basis points during the "golden years," giving firms greater access to credit. Trade opening resulted in reduced distortions across sectors.

Only in the 1990s, with the consolidation of the reforms, did "unbounded, *within-plant* efficiency gains driven by technology adoption and innovation occur" (emphasis added). The adoption of better technologies and production

[10] Caselli (2005) argues within-industry efficiency differences explain most cross-country differences in efficiency.

[11] In the United Kingdom, for example, the productivity difference between the 90th/10th percentile firms was 4.8, while the TFP differential was 2.1 between 1980–92 (Haskel and Slaughter, 1999).

processes by both incumbents and new firms was facilitated by the reform of financial markets and the traded goods markets, but this process does not appear to have progressed as far in Chile as in other countries.

In Chile, it is services that appear to lead in productivity growth. Retail trade (2.7 percent) and financial services (1.4 percent) have shown solid productivity gains, but manufacturing productivity growth has been especially weak. Several studies show it to be negative.[12] There is some evidence that low or negative manufacturing productivity growth stems from firms' lack of flexibility in adjusting to changing business cycle conditions. Caballero, Engel, and Micco (2004), for instance, measure the relative ease with which firms adjust their levels of employment (either up or down) to productivity shocks across countries and argue that differences can account for roughly a percentage point in growth.[13] Specifically for Chile, they argue that small firms suffered slower sales growth than large firms during downturns. At the same time, they were unable to adjust their labor force so their productivity fell more during downturns. The parameter values suggest that almost 0.5 percentage points might be shaved off potential annual growth due to inflexibility of resource allocation.

How does this compare to East Asia? Although there has been a debate about the relative contribution of TFP and factor accumulation to East Asian growth, recent evidence suggests that technical progress has been a central factor. Technical efficiency (a move towards the frontier) is ascribed a more important role than technological progress (a move of the production function frontier) in modern East Asian growth.[14]

Chile's pattern of high productivity growth in services is exactly the opposite of East Asia where productivity gains in manufacturing have led economic growth. Some may ask whether it matters which sector leads. It does. When there is a positive productivity shock in manufacturing, the additional output can be exported usually with minimal impact on prices. Highly elastic global demand implies that the benefit from the productivity shock can be extended over a greater volume of factor inputs. That is why the East Asian discussion of whether technology or factor inputs drive growth is not the right question. In East Asia the two have gone hand-in-hand. Technology advances have been leveraged through greater factor accumulation.

Services, on the other hand, tend to be nontradable. In that case, positive productivity shocks and higher output can lead to lower prices. The effect on factor accumulation is consequently dampened and so the overall impact on aggregate growth from a positive productivity shock is reduced.

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[12] Vergara and Rivero (2006).

[13] Using a dynamic labor demand specification they estimate the effects of job security using a sample of 60 countries for 1980-98. They find that increasing job security significantly lowers the speed of adjustment to shocks in a third and reduces productivity growth by almost 1 percent (for countries with strong rule of law, Chile among them).

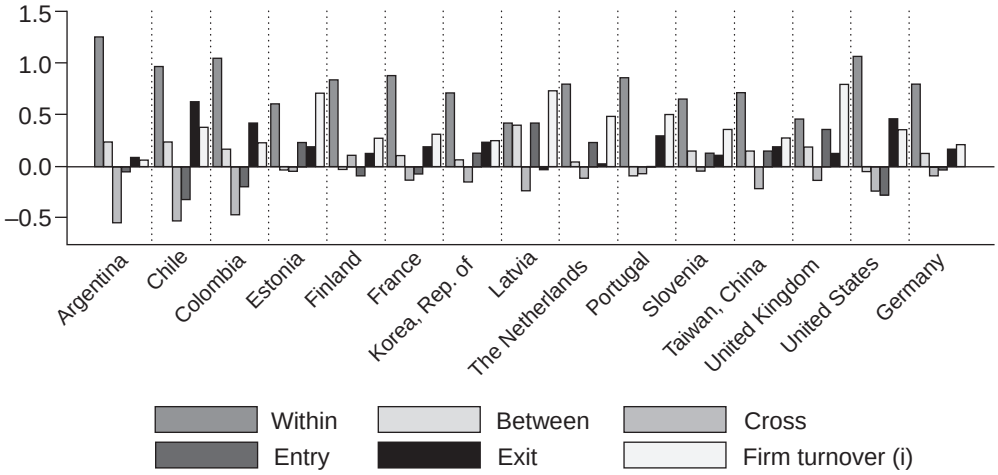
[14] Han et al. (2003); Hsieh (1999); Kim (2002).

Why has manufacturing TFP growth in Chile been so low? Foster, Haltiwanger, and Krizan (1998) (FHK) have developed a methodology for decomposing aggregate productivity growth between two points in time. They first look at changes in productivity in firms that survive between the two periods, and attribute the productivity growth in this aggregate to three items: (i) productivity growth in each individual firm; (ii) productivity growth stemming from a shift of resources towards more productive firms; and (iii) a cross-product term that reflects the expansion of market share for firms increasing their productivity most rapidly. There are two other terms in the FHK decomposition: (iv) productivity changes when new firms come into the sector; and (v) productivity changes when old firms exit the sector.

This decomposition has been applied to manufacturing firms in Chile by Bartelsman et al. (2005). It is reproduced in figure 2 along with comparisons with other countries. It shows that during 1985–99 Chile enjoyed strong productivity growth because individual firms increased their productivity and because some low productivity firms were forced out of production. On the other hand, new entrants in Chilean manufacturing often came in at lower than average productivity, and firms with improving productivity actually lost market share (the cross-product term). These two elements served to reduce the gains in aggregate Chilean productivity growth.

Figure 2: FHK Decomposition Shares—Manufacturing

Labor Productivity—Five-Year Differencing, Real Gross Output



Argentina: 1995–2001. Chile: 1985–1999. Colombia: 1987–1998. Estonia: 2000–2001. Finland: 2000–2002. France: 1990–1995. Germany: 2000–2002. Republic of Korea: 1998 & 1993. Latvia: 2001–2002. The Netherlands: 1992–2001. Portugal: 1991–1994. Slovenia: 1997–2001. Taiwan, China: 1986, 1991, & 1996. United Kingdom: 2000–2001. United States: 1992 & 1997. Excluding Brazil and Venezuela.

Source: Bartelsman et. al. (2006).

The implication is that productivity gains in Chile have come about through downsizing and restructuring rather than through expansion of the firms that improve productivity most rapidly. That is, technology gains in Chile are not translating into more rapid factor accumulation as in East Asia. Chilean firms do appear to be pushing out the technological frontier (within firm productivity growth), but resources are not flowing rapidly enough into these efficient firms. There are limits to downsizing and shutting down inefficient firms, so it is not surprising that Chile's productivity expansion has petered out over time.

Catching Up to Domestic and Foreign Production Frontiers

What pressures are firms responding to when they seek to innovate? Is it a coincidence that in economies that are major exporters, like Taiwan (China) and Korea, new entrants appear to have higher than average productivity, while new entrants in Chile have lower than average productivity? Is it domestic or external competition that forces low productivity firms to exit and ensures that firms that raise their productivity levels can survive?

To answer these kinds of questions, it is useful to divide total factor productivity growth into two components: (i) growth of the frontier (or best practice) within a sector; and (ii) catch-up growth whereby the firm approaches the frontier technology level.[15] The frontier, in turn, can be further subdivided into a domestic and an international frontier.

Gustavo Crespi (2006), using a ENIA[16] data set for Chile containing almost 20,000 observations on firms and their productivity levels between 1992–97, shows that indeed there is wide variation in productivity levels among Chilean manufacturing firms (figure 3), with the vast majority of firms falling well below global best practice. The figure shows that Chilean manufacturing productivity levels were less than 40 percent of global best practice towards the end of the 1990s, so considerable scope exists for catching up to global best practice. There is a rising trend (catch-up) after 1995, but the pace is modest—about one percentage point per year. This seems to be associated with a rise in the fraction of Chilean firms that can be considered as best practice. In some sectors, Chilean firms are much closer to international standards, even in terms of average productivity levels. Cement, tobacco, paper, copper, and wine stand out (see the Annex for additional information on regression results).

What are the characteristics of a Chilean "best-practice" plant? The research suggests that being multinational or an importer of raw materials, licensing one's technology, and having a strong human capital base are all characteristic of best practice plants. There is also evidence that being large and outsourcing selected activities are significant, but the effect of these latter two variables is small.

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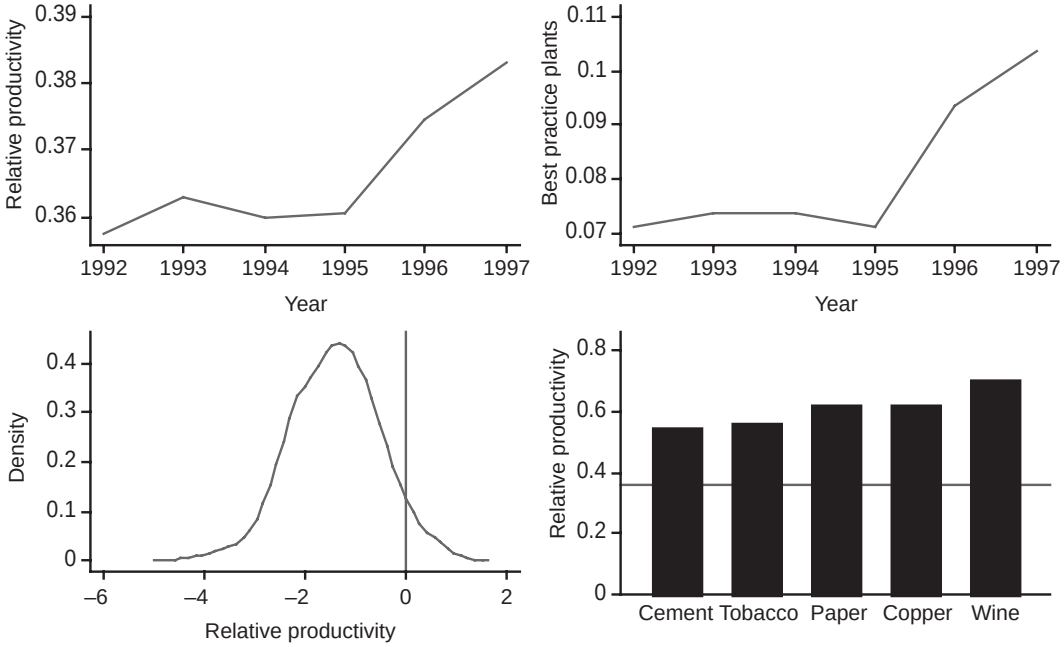
[15] Bartelsman, Haskel, and Martin (2006).

[16] The Annual National Industrial Survey (*Encuesta Nacional Industrial Annual*; ENIA) is carried out by the National Institute of Statistics of Chile (INE).

Figure 3: Productivity Levels in Chilean Manufacturing: Benchmarking against "Best Practice"



Source: Alvarez and Crespi (2007).

Productivity growth in Chile appears to be better explained by catch-up to the domestic frontier by less well-performing firms rather than by catch-up to the global frontier by best-practice firms, according to regression results based on the ENIA data set covering around 19,500 observations between 1992 and 1997. The regressions also show that when there are a lot of plants in a sector (and hence presumably significant competition), the speed with which the domestic frontier is approached is more rapid. On the other hand, the global frontier is a stronger pull in a few sectors where plants are larger and more concentrated, and where there is significant investment in new machinery.

Fundamentally, these results are consistent with the notion that productivity growth in Chilean manufacturing has come about largely through competition-induced improvements in domestic firms, with a more modest role being played by absorbing new technologies from abroad. Although the precise analysis done here for Chile has not been repeated for East Asian countries, it is generally believed that much of their productivity growth has come about by absorbing foreign technology and catching up to global best practices. So an important question for public policy in Chile could be to ask why this difference exists and what public policy can do to foster greater catch-up to global best practice.

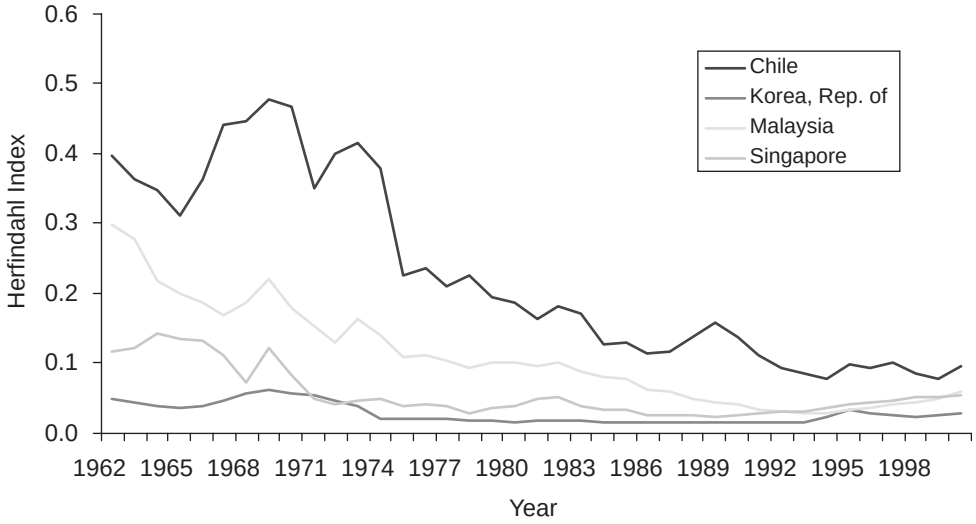
The Role of Exports

In the literature, the global production frontier is especially important for exporters. In fact, it is often presumed that those who develop or acquire frontier technology become successful exporters.

Chile is open, and has become increasingly integrated with the global economy through free trade agreements (FTAs) with Canada (1996), Mexico (1998), and Central America (1999). It reduced tariffs gradually from 100 percent in 1974 to 11 percent in 1991 and perhaps 2 percent today. But compared to middle-income countries that have been able to maintain rapid growth, Chile's non-commodity exports/GDP ratio is still low and faces obstacles in rising swiftly since it has suffered from some real exchange appreciation as a result of the copper boom. Despite the best efforts of government in establishing a copper stabilization fund and sterilizing foreign exchange inflows, the outcome has still been an increase in unit labor costs in manufacturing.

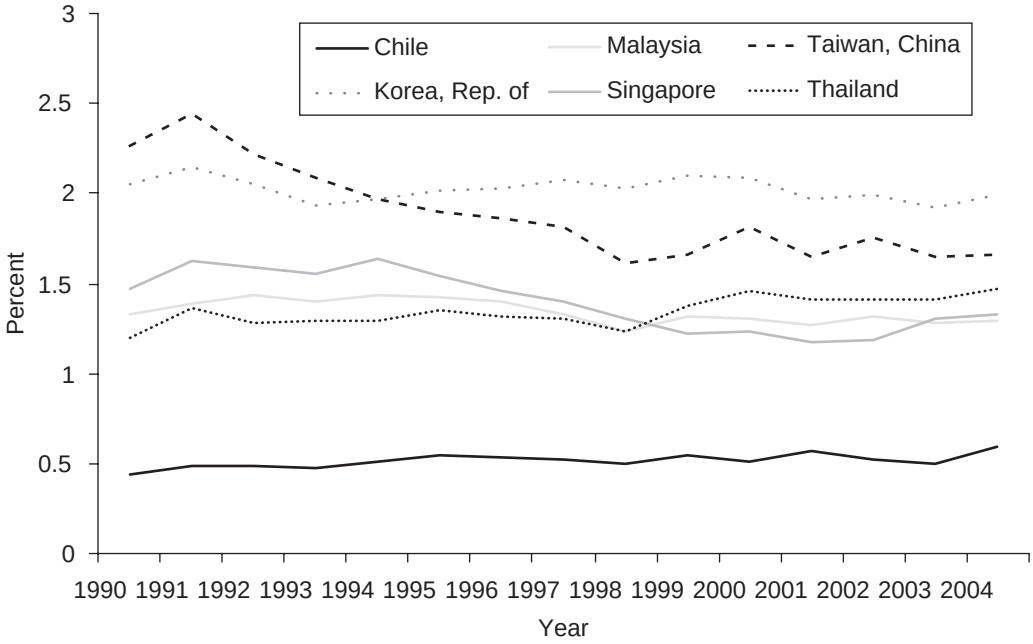
Furthermore, Chile's exports are quite concentrated, and the rapid move towards diversification of exports came to a halt by 1995, just before the slowdown in Chilean growth (figure 4). Chile is renowned for excellence in a set number of export products that have expanded rapidly, including high-quality wines, premium agricultural products, and a variety of marine products, but despite this, Chilean exports today remain much less diversified than for some East Asian countries. Fast-growing countries also have a high world market share in their exports, but Chilean manufactured exports have a lower world market share on average than do Asian exporters (figure 5). Globally, countries that do not constantly diversify their exports have tended to have lower average growth (figure 6).

Figure 4: Export Diversification



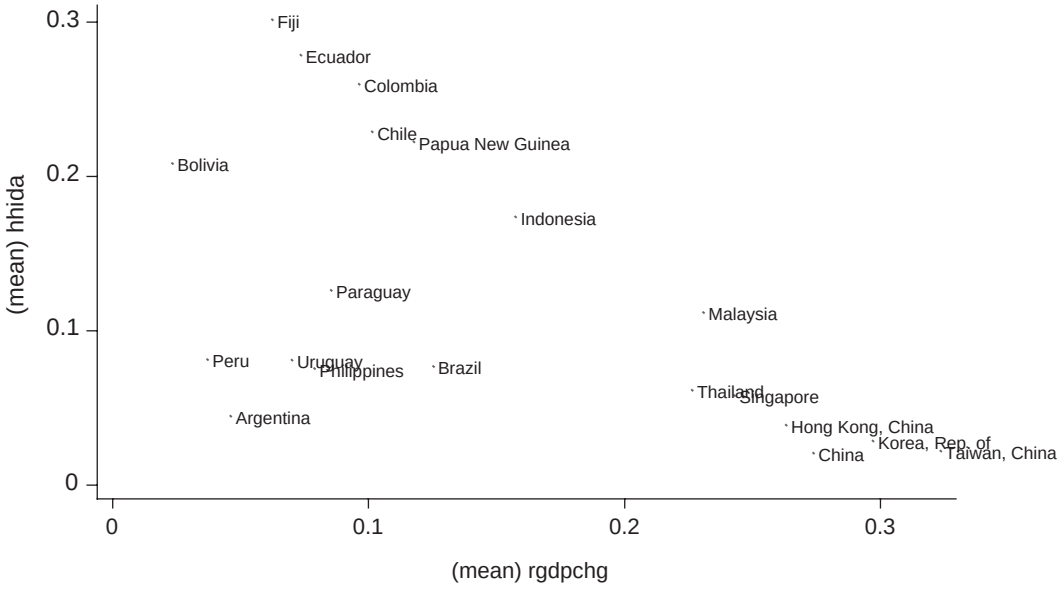
Source: Calculations based on Feenstra et al. (2005) data.

Figure 5: World Market Export Shares, 1990–2004



Source: Comtrade, 3-digit calculations.

Figure 6: Export Concentration and Per Capita Income, 1961–2000



Source: Calculations based on data from Feenstra et al. (2005) and Penn World Table 6.1 (http://pwt.econ.upenn.edu/php_site/pwt61_form.php).

Taking these facts together, it would seem that Chilean manufacturers have not been able to leverage global demand to scale up production as rapidly as other countries. The issue is not that high market share is required for a small country like Chile, but that high market share is the outcome of a process

whereby new technologies/processes can be exploited to generate growth. The question, then, is whether Chile can find an ever-increasing set of products in which it excels and whether existing economic incentives are sufficient for this process of export discovery to take place.

There remains a considerable debate in the literature as to whether export growth is fuelled by an intensification of existing products or whether the extensive margin, finding new products, is more important. Overall, it seems that both are likely to be important, with the predominant effect for middle-income countries coming from the intensive margin.

Amurgo-Pacheco and Pierola (2007) (APP) provide a good example of recent empirical work in this area.[17] They look at trade between developed and developing countries (including Chile) at the 6-digit level, meaning they have about 5,000 products. They find that for Chile, in common with most other middle-income countries, the intensive margin accounted for about 85 percent of export growth between 1990–2005. The expansion of existing products into new geographic areas was the next most important factor (10 percent), whereas the development of new products themselves was the least significant.[18]

In their formal model, APP estimate a gravity model to analyze the determinants of exports for a number of different countries.[19] Exports are a function of the partner country GDP (representing demand), the distance to the market, a dummy variable for whether the importing country is developed, and further dummies for parts and component trade and for the existence of a FTA between the partner countries. The results confirm typical findings in the literature: exports rise in response to higher GDP in partner countries; when distances are smaller between countries; when trade is with a developed, mature economy; when the sector is parts and components that have become the most dynamic portion of international trade in recent times; and when transaction costs decline with the signing of a FTA.

Although all the coefficients are highly significant,[20] as is common in gravity model estimations using the level of exports, the findings are interesting in that they also show a significant difference in the coefficients for Chile and East Asian countries (table 2). APP show two separate impacts: (i) the impact on the growth of existing exports, and (ii) the change in the probability of exporting a new product.

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[17] Other recent studies include Brenton, Newfarmer, and Walkenhurst (forthcoming); Amiti and Freund (2007); Pham and Martin (2007).

[18] The degree of disaggregation obviously affects this finding. Even "intensive margin" growth can signify considerable innovation and a move up in the value chain.

[19] The key innovation is the use of zero observations when no trade is observed between countries in a particular product. This requires use of a Tobit estimation procedure.

[20] The standard errors are not reported here for convenience, but can be found in the cited work.

Table 2: Determinants of Export Growth, 1990–2005

	GDP-dest	Distance	Developed	Parts	FTA
Elasticities of marginal impact on existing exports					
Chile	0.156	−0.447	0.13	0.119	0.133
Indonesia	0.203	−0.391	0.345	0.256	0.256
Malaysia	0.191	−0.363	0.375	0.385	0.128
Thailand	0.19	−0.324	0.52	0.306	0.411
Marginal change in the probability of exporting new goods					
Chile	0.011	−0.033	0.01	0.009	0.011
Indonesia	0.033	−0.064	0.06	0.045	0.045
Malaysia	0.032	−0.061	0.067	0.071	0.022
Thailand	0.038	−0.064	0.109	0.064	0.087

Source: Amurgo-Pacheco and Pierola (2007).

Column one, table 2 shows the impact on each country's exports from a one percent increase in partner country GDP. The coefficient for Chile is much smaller than the corresponding coefficient for other countries. Column two shows that Chile's exports are more adversely affected by distance to markets than in comparator countries (perhaps because of higher transport costs). Columns 3–5 show coefficients on a range of dummy variables included in the regression: trade with developed countries, parts and components trade, and trade with an FTA partner. In all cases, the coefficient for Chile's exports is smaller than that for other countries. The lower panel of table 2 replays the story, but this time looking to see what factors affect the probability of exporting new products. The pattern is the same. Chile's propensity to export new items is lower than that of the East Asian comparators.

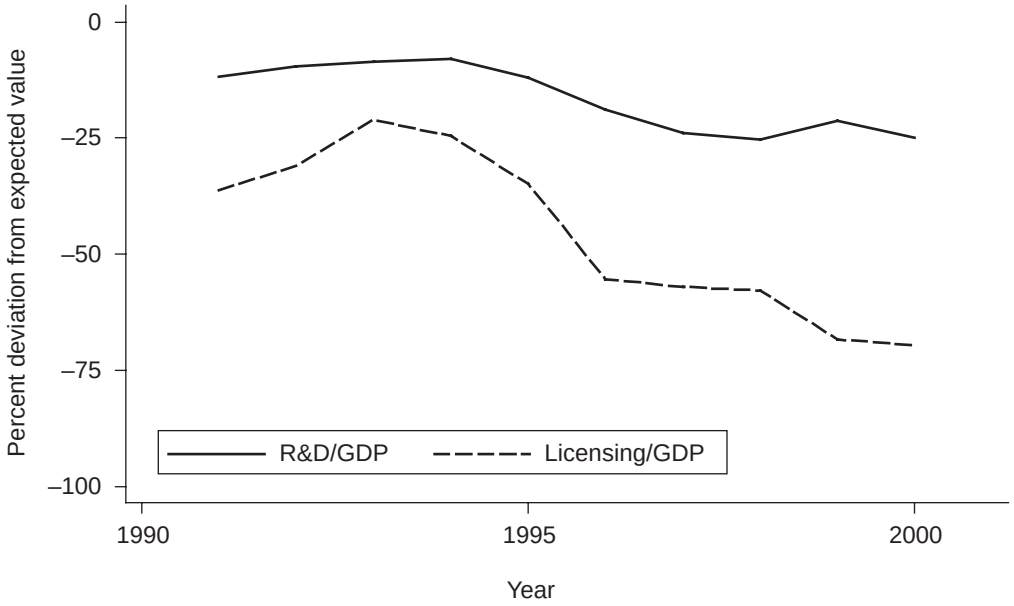
Chile's lower coefficients suggest that the country's supply response differentiates it from East Asian economies and results in lower export growth when international conditions improve. A poor supply response could be the result of the structure of exports, or of a limited ability to innovate and upgrade technology. In either case, Chile could do much better. The public policy question becomes one of promoting an environment in which global best-practice firms become successful exporters.

Innovation by Firms and the Accumulation of Technological Capacity

It is tempting to blame Chile's apparent lack of technological accumulation on its limited investment in acquiring new technologies. In figure 7, two common measures of innovation effort are plotted for Chile—research and development expenditures (R&D) and technology licensing fees.[21]

[21] Of course, there might be other measures of innovation effort where Chile does better, so the figure should be treated as no more than illustrative.

Figure 7: Innovation Inputs in Chile (Adjusted for Income Level)



Source: Authors' calculations.

One would expect these indicators to rise with income levels, and so the data is plotted in terms of deviations from expected levels, given Chile's income. The figure suggests a significant shortfall in knowledge effort, in both R&D and licensing. What is more, it appears as if this shortfall is growing worse over time. This has been long recognized in Chile, and the government has called for an increase in the R&D/GDP effort in Chile to 1.5 percent (almost a tripling) by 2010. But what is unclear—yet critical for public policy—is how to achieve this increase, whether by a more deregulated neutral business climate, which might naturally encourage firms to spend more on innovation, or by a specific intervention in the national innovation system.

In comparison to East Asia, and certainly Korea, Chile has a rudimentary national innovation system. Most R&D research in Chile is financed by the public sector; in Korea, the private sector accounts for three-quarters of R&D spending and more than half of this is through the largest corporations.[22] There are close links between firms, research institutes, and the government in Korea. In Chile, there is said to be little cooperation or coordination between universities and firms, although recently passed legislature provides a tax credit for firm-sponsored university research. Also, there are few research workers—only 2.2 researchers out of 1,000 economically active persons. These are concentrated in the public sector, rather than in firms, and this potentially reduces the commercial returns to R&D, which also appear lower in Chile than in the OECD.

[22] The debate in Korea has shifted to a view that too much R&D spending is undertaken by the private sector, causing a lack of investment in basic research and an exposure of spending to business cycles, causing excess volatility.

In an effort to improve on this situation, Chile has formed a new National Innovation Council (NIC) to advise the government on budget allocations for innovation. The NIC will take a longer-term view on what promising future sectors are worth investing in and can promote an arms-length approach to decisions on subsidies to firms, but it still falls short of a national system that can achieve systemic change in Chile's move towards a knowledge economy. Most importantly, the largest enterprises do not yet seem to be fully committed to the NIC. If this observation is accurate, it might lead the NIC to shift its focus on small and medium enterprises—an approach that is valuable for bridging the technology divide within Chile, but might be unlikely to yield significant technological advancement.

The problem for the NIC is that the larger question of the role for public policy in innovation does not yet seem to be settled and views within the country are quite contradictory between those who argue for more rapid deregulation and proponents of a more interventionist, publicly driven innovation system. To shed light on this debate, it is useful to compare Chile with East Asian countries in a more formal fashion.

One approach is to use a modeling framework, such as the one developed by Klenow and Rodriguez-Clare (KRC) (2004). The fundamental insight of KRC is that productivity must be viewed as a joint outcome of accumulation decisions in three areas of a standard production function—human capital, physical capital, and knowledge—precisely because the rate of return to accumulation of any one factor depends on the level of accumulation of the other factors. In the KRC model, the return to knowledge goes up when there is more physical and human capital per worker. This insight suggests that measures of knowledge accumulation, such as R&D, cannot be looked at in isolation, but have to viewed in conjunction with investment and education. If accumulation is speeded up in those areas, then the KRC model predicts that R&D would expand as well.

The KRC model was applied to Chile and four East Asian countries for which data are readily available.[23] The model relates levels of output per worker to levels of physical capital, human capital, and technology and uses actual data on investment, human capital formation, and innovation effort to derive two key parameters that differ across countries: (i) an implicit "tax" on innovation effort and (ii) an implicit tax on general capital accumulation (the "costs of doing business"). These parameters are interpreted as the focus of public policy.

The model parameters are not estimated econometrically, but are simulated to yield the closest fit with the actual observed pace of innovation effort, physical capital investment, and human capital formation. They are sensitive to the calibration procedure and so should not be interpreted as actual tax levels. Instead, it is more useful to simply look at the differences in the parameters across countries. These are shown in table 3, which also shows the change over

[23] The model details are not reproduced here but are available upon request. The full procedure is described in a background paper by W. Maloney (World Bank, 2007, unpublished).

time in the main variables of interest—output per worker, capital stock per unit of output, and skills per worker.

The first column in table 3 shows how output per worker (labor productivity) has evolved in each of the last four decades, expressed as a ratio of productivity in the United States. Chile has shown steady signs of catch-up over the past four decades, accelerating in the 1990s to reach a level of just over half that in the United States (0.54). The four East Asian countries shown have also had labor productivity catch-up, and at a much faster pace. Chile has fallen further behind East Asia in its labor productivity in each of the last four decades. As Korea, Taiwan (China), and Hong Kong (China) were already at higher income levels in the 1990s, Chile should have been catching up to them rather than falling behind.

The reasons for Chile's falling relative labor productivity are also clear. They are predominantly to do with lower rates of accumulation of physical and human capital. Chile has the lowest capital/output ratio of any of the economies shown, comparable to that of Taiwan, China. But whereas Taiwan, China—along with the other Asian economies—has increased its capital output ratio over time, Chile's has fallen.

Table 3: Implicit Tax on Accumulation and Innovation

Country	Decade	Y/L (US=1.0)	K/Y	HK	Tax accumulation (%)	Tax on Innovation (%)
Chile	60s	0.37	1.65	5.21	−18	176
	70s	0.39	1.36	5.78	4	100
	80s	0.42	1.18	6.67	15	85
	90s	0.54	1.21	7.23	14	67
Hong Kong, China	60s	0.23	1.57	5.76	−1	65
	70s	0.40	1.47	6.86	6	−9
	80s	0.71	1.56	8.41	0	−81
	90s	1.15	1.76	9.27	−13	−616
Taiwan, China	60s	0.14	0.55	4.53	61	−64
	70s	0.27	0.85	6.32	43	−50
	80s	0.52	1.10	7.69	24	−63
	90s	0.81	1.19	8.29	22	−69
Korea, Rep. of	60s	0.15	0.84	4.95	46	8
	70s	0.26	1.17	6.36	25	94
	80s	0.47	1.76	8.70	−13	368
	90s	0.77	2.28	10.43	−47	698
Malaysia	60s	0.20	0.85	3.34	41	−33
	70s	0.26	1.00	4.40	30	−12
	80s	0.39	1.38	5.47	4	37
	90s	0.59	1.57	6.42	−9	25

Source: Author calculations based on Klenow and Rodriguez-Clare (2004) and Maloney and Rodriguez-Clare (2007).

Note: Income adjusted for mining rents. Returns to education based on country-specific estimates.

The same pattern holds for human capital. Chile has increased the average years of education of its labor force by 2 years over four decades, but in the East Asian countries, the expansion has been much faster, ranging from 3.1 years in Malaysia to 5.4 years in Korea.

It is these processes of physical and human capital accumulation that appear to differentiate Chile from East Asian economies. In East Asia, the model parameters (low or negative implied tax on capital accumulation) suggest that governments are finding ways to implicitly subsidize capital accumulation, perhaps through the banking system. This might be socially efficient if knowledge is embedded in physical capital and if there are externalities to knowledge generation within an economy. But this cannot explain all the differences between Chile and East Asia. In fact, like East Asia, Chile also has a rather low "tax" on physical capital accumulation.

The big difference between Chile and East Asia lies in the estimate of the implicit tax on innovation. The model tries to generate much higher innovation efforts in Chile, other things equal, than what actually occurred. The only way it can approximate the actual low level of innovation is by assuming a high implicit tax. The level of this tax does fall somewhat over time, but even in the 1990s, it remains at very high levels. By contrast, East Asian economies have a much lower "innovation tax" than Chile, and most have had periods when the "tax" is negative. That is, the model can only explain the innovation effort in these countries by assuming that there is some kind of government subsidy.

The one exception to this pattern is Korea. This may seem unusual given Korea's reputation as an economy that has been in the forefront of the shift towards a knowledge economy. It is well known that Korea has the highest level of broadband subscribers (per 100 inhabitants) of any OECD country, with a ratio that is almost double that in the United States. Korea also has several important government research institutes and spends around 0.7 percent of GDP in public R&D. On the face of it, Korea has an impressive array of public support mechanisms for knowledge generation.

What the model illustrates is that much of Korea's knowledge generation is in fact being embedded in high rates of physical and human capital formation. Korea has built its knowledge economy around four pillars: (i) an economic and institutional incentive regime that ensures effective resource allocation; (ii) an educated and skilled labor force that can adapt and use knowledge; (iii) an effective innovation system of firms, research centers, universities, and consultants that keeps on top of global trends; and (iv) a modern and adequate information infrastructure. Each of these is given high priority and the interaction between the four pillars is central to Korea's knowledge enhancement strategy.

The policy point is that there are several ways of developing a knowledge strategy, and that it is premature to conclude that public subsidization of R&D is the best way forward for Chile. Much of Korea's success has been associated

with providing incentives for broad physical and human capital accumulation (pillars (i), (ii), and (iv) of the strategy outlined above). But in doing this, Korea has not remained passive in terms of public policy. It used its instruments to achieve a far more rapid accumulation of physical and human capital than would be expected, and it structured incentives so that this capital accumulation would generate embedded knowledge. The other East Asian countries have also had comprehensive approaches with rapid accumulation of physical capital, human capital, and technology going along hand-in-hand. It does appear true that innovation is unexpectedly high in these countries, and so might well have received public subsidies, but the broader point is that East Asian countries have accumulated knowledge in a comprehensive way, embedding it in new capital stock and skilled engineers as well as through R&D. Chile, on the other hand, appears to be caught in a no-man's land. It has neither used instruments to subsidize innovation directly, nor has it provided broad-based incentives to raise the rate of physical and human capital investment. No wonder that the pace of absorption of new knowledge in Chile has lagged behind East Asia.

A Quality Labor Force

The comparisons above demonstrate that one area where Chile has lagged behind East Asia is in human capital accumulation. The raw data on the rate of advancement of average years of education has already been mentioned. But the gap between Chile and East Asia becomes even wider when measures of the quality of education and its distribution are included. This is all the more significant as recent research suggests that what matters most for growth is quality-adjusted education, not just average years of education in the labor force.

New data from international test scores permit a disaggregation of the effects of quality, distribution, and education levels. Student scores can be taken as a proxy for the quality of education across countries, while the variance in student scores, or the shares scoring below 400 points and above 600 points, can be used as proxies for the distribution of education. Such a database has been constructed and used by Hanushek and Wößmann (2007) to disentangle the educational variables of most significance for economic growth.Hanushek and Wößmann argue that for most developing countries, which are in the process of catching-up and assimilating technology from abroad, the key variable is the existence of a large labor force with "basic literacy," or those who can readily take instruction on a factory floor in a formal job setting. He defines "basic literacy" as a score of 400 on the standardized tests. Accordingly, countries with large shares of workers scoring below this threshold should have low rates of economic growth.

Conversely, Hanushek and Wößmann argue that as income levels rise, more growth comes from new innovations and the ability to absorb more complex technologies from abroad, which in turn requires a group of more highly skilled workers. These "rocket scientists" are defined as those who score more than 600

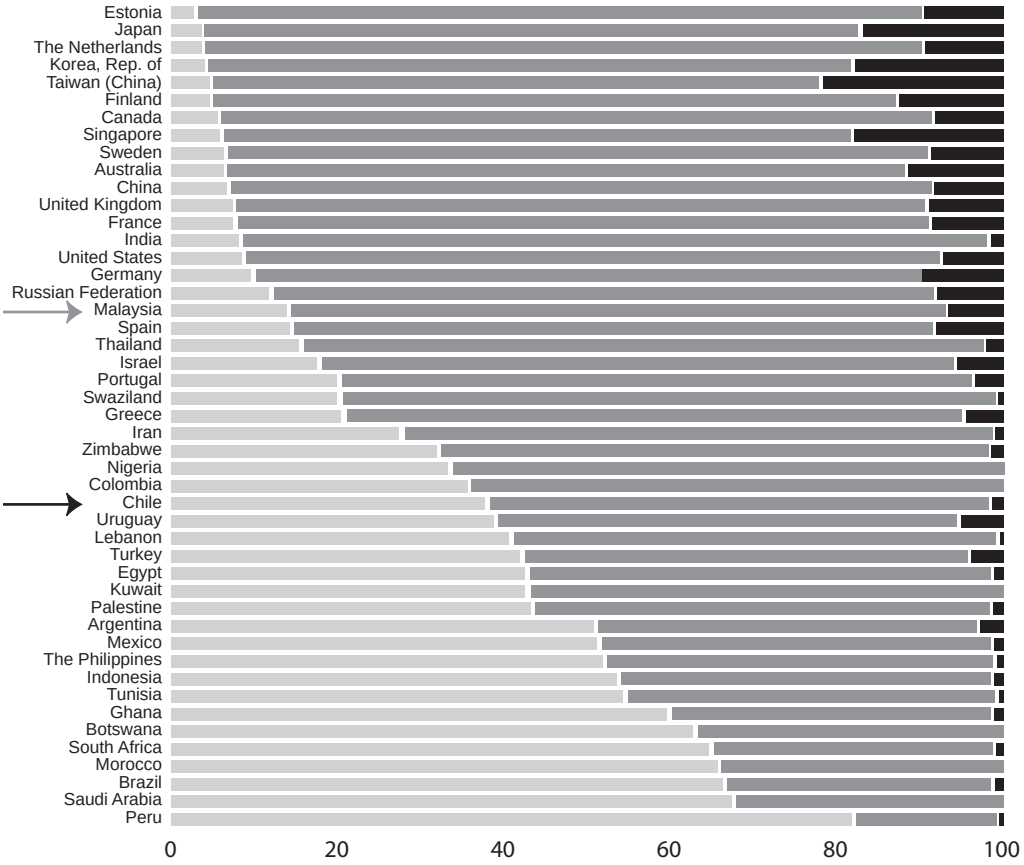
points on test scores. They are loosely interpreted as the share of potential knowledge workers in the economy.

When these variables are included in a standard cross-country growth regression, Hanushek and Wößmann find that the quality-adjusted education variables dominate the standard "years of education" variable, suggesting that quantity, quality, and distribution of education operate together as drivers of growth.

Despite the misgivings that many have towards cross-country regressions, the results appear to be quite robust. What is more, the intuition that quality operates in two distinct ways in modern economies—through assimilation and use of existing knowledge by a mass, literate workforce, and through expansion of the number of knowledge workers—is powerful.

The implications for Chile are profound. Given its income level, Chile is not an outlier in terms of average years of schooling, but it does suffer badly in terms of education quality and distribution. Figure 8 shows the cross-country comparisons of the distribution and quality of students' knowledge.

Figure 8: Percentage of Students below 400 ("Illiterate"), between 400 and 600, and above 600



Source: Hanushek and Wößmann (2007).

Table 4: TIMSS 2003

Country	Math score of eight-grade students	Science score of eight-grade students
Chile	387	413
Singapore	605	578
Korea, Rep. of	589	558
Hong Kong, China	586	556
Taiwan, China	585	571
Malaysia	508	510
Indonesia	411	420
Philippines	378	377
Average	466	473

Source: TIMSS.

Note: In total, 45 countries participated, and Chile ranks 39th in the math score and 37th in the science score.

Chile scores poorly on both counts. Over 37 percent of the student body appears to be "illiterate" while only about 2 percent would qualify as having potential knowledge-worker qualifications.

In Korea, Taiwan (China), and Singapore these figures are around 5 percent illiterate and 20 percent future knowledge workers. For Malaysia, they are about 13 percent illiterate and 8 percent knowledge-quality.

Quality of labor figures have also been calculated by Altinok and Murseli (forthcoming) for 105 countries. Here too Chile has a quality level that is 20 percent lower than Malaysia's and 30 percent lower than the high-income East Asian countries. Selected raw data from the 2003 Trends in International Mathematics and Science Study (TIMSS) test are shown in table 4 to illustrate the size of the quality gap between Chilean and East Asian students.

The data for Chilean students' test scores are all the more disappointing as Chile has the world's second largest private education program,[24] partially funded through government provided vouchers, with the precise goal of raising education quality through competition and choice. There have been successes: the last 10 years has seen fast progress in coverage and enrollment, but issues of quality and equity have arisen. There are now significant differences in test scores by socioeconomic status and between children attending public and private schools.[25] The trend does not appear to be good. Test scores have been relatively stagnant since 1997, with a slight improvement as shown by 2006 data

[24] Only the Netherlands has more private schools, but in that country the private school sector is nonprofit.

[25] In the PISA 2006, only Bulgaria and Argentina had higher standard errors in science test scores among their students.

from the OECD's Programme for International Student Assessment (PISA).[26] Closing the gap has become a political imperative.

At one level, it would appear that competition is succeeding. Since 1990, 1,600 schools have closed while 2,300 new schools have opened. Ninety percent of teachers have degrees in education. Substantially more money is going into education through higher tuition and larger voucher payments from government. Yet, despite these changes, the private school sector remains very heterogeneous. Money has gone into teacher salaries, bus transport, and facilities but has not yet translated into better learning outcomes.[27] The proliferation of small schools diffuses accountability. It does appear that franchise schools outperform others, but the speed with which they are gaining market share is slow.

In contrast to East Asia, where schools are publicly run, it is hard for Chilean authorities to drive quality improvements through the system. There is a dearth of information on where money is spent, so crucial links between inputs and outcomes cannot be easily tested. For example, the plan to reduce the student/computer ratio from 30/1 to 10/1 over 3 years is commendable, but the cost-benefit cannot be easily compared with other options for spending money on education. Parents do not seem to make choices based on curricula or past test scores, but on school infrastructure, raising questions about whether complete autonomy for schools on how they use public voucher funds is the best approach. Similarly it is not easy to evaluate whether for-profit or nonprofit private schools do better, although it is true generally the private outperform the public schools.

There is an effort to change the General Law on Education to remove some of the anomalies from the system. For example, primary schools might be assigned students to avoid selection becoming a force for inequality. A new Superintendencia will monitor and evaluate testing, which is now regularly conducted in the fourth, eight, and tenth grades. It is also important that Chile remains active in future international tests such the OECD-administered PISA and TIMSS.

Beyond these statistics on schooling, tertiary education has also lagged behind. Several analysts believe that the stock of workers with tertiary education is critical to technological upgrading and that there are economy-wide spillovers from this. Data on wages in Chile reinforce the sense that there is a shortage of university graduates with the right skills. The average wage premium for a

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[26] It is common to hear in Chile that the lack of progress on test scores is because of expansion of enrollment to include more children from poor families who perform worse on average. Homogenous populations will on average have smaller standard errors, as seen in comparing the United States and Chile with East Asia.

[27] Chile is not alone in this. The 2006 PISA reports "across the OECD area, as a whole, learning outcomes have generally remained flat, while expenditure on education in OECD countries rose by an average of 39 percent between 1995 and 2004" (http://www.oecd.org/document/2/0,,en_32252351_32236191_39718850_1_1_1_1,00).

university graduate is said to have soared to 300 percent, with engineers and geologists commanding even larger premiums. Some software firms are reported to have bypassed Chile because of a lack of qualified labor, prompting the Chilean Economic Development Agency (Corporación de Fomento de la Producción de Chile; CORFO) to try to provide its own programs for English language training. But this can at best be a "band-aid," not a solution to the structural problems in education.

Many countries send their students abroad to get the requisite skills and the United States is the principal destination worldwide for foreign students. In fact, it may be more important to establish long-term relationships with countries near the technological frontier than to simply develop higher education domestically. Building international networks can provide access to new knowledge, and access to research and production partners later on. The successful development of software and computing industries in Ireland, Taiwan (China), and India were all seeded by returning nationals who learned the ropes in the United States and could use their understanding of both cultures to enhance opportunities in their home countries.

A similar story may be told about the long-standing linkages, dating from the 1960s, between the University of Chile and the University of California, Davis. Growing such ties is probably a bottom-up process, heavily dependent in the first place on having nationals study abroad. To date, Chile is quite backward in this respect (table 5).

Table 5: Foreign Students (FS) Studying in the United States, Per Capita and Per Student Studying at the Tertiary Level

	FS/cap	FS/Tertiary
Brazil	38	191
Chile	96	224
Colombia	152	564
Mexico	134	609
Canada	881	1,546
Australia	137	121
New Zealand	226	263
China	47	316
India	71	644
Korea, Rep. of	1,230	1,382
Malaysia	221	764
Vietnam	56	559
Taiwan, China	1,217	1,368

Source: Institute of international education, Open Doors, 2007 for Foreign Students; World Bank, World Development Indicators for population and number of tertiary students

Measured in per capita terms, Chile, as well as the three other countries of Latin America, has perhaps one tenth the number of the students studying abroad as Korea or Taiwan, China and perhaps half as many as Australia and New Zealand. Standardizing on the share of the population that actually studies at the tertiary level, to a degree a correction for level of development, Chile slips below Vietnam, Malaysia, India, and even China. Students from these countries must overcome obstacles of culture, language, and physical distance that are substantially greater than those facing Chilean students. The gaps are huge. The propensity of a Chilean university student to study in the United States is one-sixth that of her counterpart in Korea or Taiwan, China.

A more highly skilled labor force is clearly valuable for growth because of the higher human capital it represents. It can also be valuable if it changes the dynamics of labor flexibility. In general, more highly skilled workers are better able to self-insure against employment shocks, and are more willing to change jobs (and find it easier to move) when economic conditions change.

For organized labor, there is an eternal tension between the need to adopt new technologies to raise worker productivity in the long term, and protecting the short-term livelihood of workers. Nonetheless, estimates suggest that leaning too far toward the latter can lead to large costs. Parente and Prescott (2000), for instance, show through simulations that the historical resistance by guilds and organized labor to the adoption of new technologies could be the critical contributor to current income disparities among countries.

Does Chile suffer from excessive labor inflexibility? Table 6 suggests that along measures of overall labor market rigidity, statutory restrictions on firing, and actual costs of firing, Chile is clearly more rigid than the United States, Canada, Australia, or Singapore.

Table 6: Barriers to Reallocating Workers

	Employment rigidity	Difficulty of firing	Firing costs
United States	0	0	0
Australia	3	10	4
Canada	4	0	28
Chile	24	20	52
Malaysia	10	10	88
China	24	40	91
Korea, Rep. of	34	30	91
India	41	70	56
Finland	48	40	26
Singapore	0	0	4
Taiwan, China	56	30	91

Source: Doing Business Indicators 2007: The rigidity of employment index is an average of difficulty of hiring index, rigidity of hours, and difficulty of firing. The difficulty of firing index is a mix of 8 components capturing statutory limitations to termination. Firing costs capture the financial costs of separation.

However, Chile is not as far out of line with other Latin American countries or Korea, Taiwan (China), or Finland. A similar middle ground for Chile was found by Caballero, Engel, and Micco (2004) in a study estimating labor adjustment coefficients. Labor market inflexibility does not stand out as an insuperable obstacle for achieving superior growth, although World Bank Investment Climate Surveys suggest that Chilean firms are more likely to complain that lack of a skilled workforce is a major obstacle to growth than their East Asian counterparts.

Despite these aggregate numbers, labor market rigidity in Chile is clearly an issue for female employment. Chile stands out as having very low levels of female labor force participation While there is a near virtual gender parity at all education levels and an equitable legal framework, Chile's female labor participation rate of 35.1 percent is the lowest in South America, and significantly below the LAC regional average of 40.7 percent and the upper-middle-income country average of 50 percent. East Asia and the Pacific have an average rate of 43.8 percent. If Chile could raise its female labor force participation rate to the OECD average, it would add 6 percent to the aggregate labor force, a fairly significant potential contribution to growth.

Unfortunately, this is unlikely to happen on current trends. Since 1980, female labor force participation has only increased by 0.25 percentage points per year. It could be growing at ten times that rate. The constraints are well-studied: part-time work regulations, "over 19" regulations,[28] and other elements of labor law inflexibility seem to perpetuate the problem. Unfortunately, this issue appears to hurt the very people that public regulations are designed to protect—the poor. Figure 9 shows female labor force by quintile. The lowest participation rates are in the poorest quintiles. The figure also shows the very high female participation rate in the top quintile, a sure demonstration that Chile's low aggregate female labor force participation rate is probably not a cultural phenomenon.

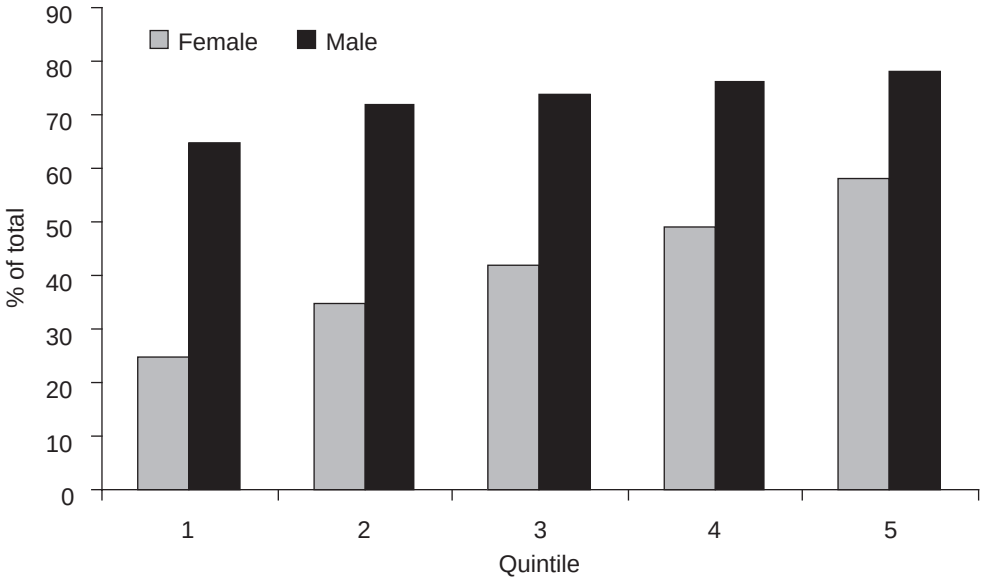
The real question is why seemingly benign changes in the labor law have proven to be so hard to achieve. We return to this below.

Investment in Public Goods and Infrastructure

Compared to East Asia, Chile has very low levels of public investment, especially in infrastructure. The data are hard to compare directly because Chile has used a model of concessions to build infrastructure with private rather than public financing, but this cannot explain the whole story. Public investment in Chile is limited to about 2.1 percent of GDP. In Malaysia, Korea, and Thailand, a range of 5–10 percent of GDP for public investment is more common. What is more, only half of public investment in Chile, or US$1 billion per year, goes into productive infrastructure (plus maybe an additional US$800 million in concessions).

[28] Special regulations apply when firms employ more than 19 women.

Figure 9: Female and Male Labor Force Participation in Chile (% of total)



Source: 200 CEPAL con base en tabul aciones de en cuestas de hogares, circa 2000.

Perhaps as a consequence, logistics costs in Chile are thought to be high, around 16 percent of GDP compared with 10 percent of GDP in the OECD on average. Chile has the same logistics costs as China, a vast country, and is ranked 32nd out of 150 countries in the World Bank's Logistics Performance Index.

One reason often cited for Chile's low level of investment is the mixed experience with government execution of public projects. Several analysts talk about the weakness of public institutions outside of the main macroeconomic ministries. As one example, there appear to be problems even with maintaining the existing stock of infrastructure. In most advanced economies, such issues have long been sorted out.

Separating the planning, execution, and auditing functions in infrastructure is one institutional mechanism for getting more accountability into the process. In many ways, this is what East Asian countries have done. For example, in Malaysia's current "corridor" development policy the government has set the overall strategic direction and policy regime but left actual execution of much of the program to the private sector, including foreign investors.

Although the argument that infrastructure could be increased is viewed with some sympathy among public policy makers in Chile, there are still questions about the macroeconomic absorptive capacity and about the identification of specific projects.

The macro constraint is driven by Chile's restrictive fiscal rule to run a modest surplus in public finances. This fiscal rule has been credited with bringing down the volatility of growth and with helping smooth large fluctuations in spending associated with commodity revenues. It has been universally acclaimed as optimal by academic studies (looking at the tradeoff

between growth and volatility) (IMF, 2007). Furthermore, it does not seem probable that the fiscal rule is the binding constraint on public investment at the current time. Government spending has increased considerably recently, yet infrastructure spending has oscillated in a stop-and-go fashion.

A more compelling reason seems to be broad discomfort with the pipeline of adequate infrastructure projects. Infrastructure is not planned in Chile as part of a comprehensive approach to competitiveness, as in Finland for example, nor does it adequately deal with two elements of market failure: coordination problems and externalities. Tourism in the south of Chile is one example where a coordinated approach is required. Infrastructure without promotion of private sector development for facilities in a coordinated tourism development plan would be unsuccessful. Conversely, private development of tourist facilities cannot be contemplated without infrastructure being in place.

A different example is in overcoming externalities. Industries like mining and water both compete for water. In the short term, mining may be more profitable and able to pay higher water fees, but these profits do not incorporate the fact that mining is exhaustible. Without better water technology and environmental management, sustainable industries like salmon farming can also suffer.

In East Asia, these kinds of coordination and externality issues are resolved through an extensive process of consultation with the private sector and the prioritization of specific sectors in national development plans. Consider the case of tourism development in Singapore. Singapore recently set itself the goal of doubling tourist arrivals within 10 years, as part of its strategic direction. It recognized that to do this it needed a major attraction that would differentiate Singapore from competing destinations in the region. It decided on an integrated resorts approach, combining casinos and family entertainment. The concept initially was viewed with considerable skepticism because Singapore has a long tradition of banning all gambling (except horse racing and lottery) in light of its perceived social dangers.

Yet this long-standing taboo has been completely overturned. The need for a new source of growth and the lure of high profits and job creation was enough to persuade public policy makers of the merits of the idea. The public, including interest groups, such as the church, were invited to submit their views to the government. The media, which is implicitly censored by the government, was given a degree of freedom to debate the matter. Business groups responded enthusiastically to the government's request for concept proposals and spent sizeable sums to develop exciting and iconic concepts, with proposals to make multi-billion dollar investments.

What swayed the decision was an extensive communication campaign promoting the benefits of jobs along with strict safeguards through regulations on Singaporean entry to the casinos and on the licensing of the operators. Controls to ensure no money laundering were developed. With confidence that

criminal elements would be kept at bay and that local social problems would be handled administratively, Singaporeans overwhelmingly supported the project, so much so that the government decided on licensing two resorts.

The resorts formed a package of measures designed to improve Singapore as a tourist destination, along with the Singapore Flyer, the Formula One (F1) Grand Prix, and a rejuvenated Orchard Road. Good infrastructure upgrading was planned to accommodate the new arrivals. Most observers believe that the volume of new hotel rooms and hotel rates will expand at double-digit levels for the next several years. The government was able to solve both coordination issues and externalities through its planning process. Public investment will leverage private investment many times over.

Some of this may be starting in Chile. There are seven new major tourist projects being planned, and each region has been undergoing a process of consultation to identify current constraints, gaps in public services, and new strategies with regional cofinancing. Although the process is still very new and has yet to be tested at the national level to see if it can overcome other obstacles and contribute significantly to growth at the aggregate level, the approach holds promise.

In a globalizing world, average performance, whether in productivity or infrastructure logistics, is just not enough and regional comparisons may provide a false sense of security. On the World Bank's recently released Logistics Performance Index[29] Chile is ranked 32nd out of 150 countries worldwide. Further infrastructure investments, especially those connected to diversification of the economy, may entail high long-term gains. Usually these would need to be linked to improvements in human capital, deregulation, and strong domestic competition.

Chile's Policy Making Compared to East Asia

The Primacy of Growth

Most observers seem to believe that the challenge for Chile today is to design and implement a package of far-reaching microeconomic reforms. In contrast to the macro reforms successfully undertaken heretofore, micro reforms are seen to be more difficult: their effect can take time to capture, their implementation cuts across ministerial responsibilities, and aspects of reform affect perceptions of the political and social compact that has governed Chile in past decades.

Some have questioned whether Chile's political system, with a nonrenewable four-year term for government, is a constraint in achieving the kind of long-term push required for such things as civil service reform, labor market reform, education reform, or innovation reform—all examples of what

[29] http://www.worldbank.org/lpi.

the diagnosis above suggests is needed in Chile. Whereas there have been legitimate attempts at fixing some aspects of educational reform and other areas of institutionality, these have in the views of outsiders not achieved the intended goals of freeing up resources to achieve greater efficiency. Reforms in labor markets, innovation policies that provide linkages to global best practice, effective venture capital risk-taking, and better skills training for workers whose educational achievement fosters increased productivity are all areas in which East Asia has excelled and this has led their spectacular economic performance. What the East Asia experience also teaches us is that piecemeal or partial reforms are not successful. Comprehensive and far-reaching reforms, however, are politically more challenging and do run into vested interests that must be convinced that they will gain from the eventual, higher-level equilibrium.

Can Chile come up with a forceful package of micro reforms with enough critical mass to help propel the economy on to a more dynamic track, possibly with higher growth, but at a minimum a more efficient growth path? A revised consensus around micro policy interventions will test Chile's orthodoxy and also its political ideology.

There is a glaring difference between Chile and East Asia in terms of the urgency of reforms and the prominence given to growth. In Chile, growth is seen as solid with good progress along most dimensions and the attention of policy makers is on slow-moving institutional changes in the public sector. With high levels of inequality, and a relatively progressive tax-and-spend fiscal policy, considerable focus has been placed on education and improved delivery of other social services. By contrast, in Malaysia, with about the same income level and similar recent growth performance, there is a palpable sense of urgency in the political debate about how to boost growth.

This is a long-standing preoccupation in East Asia. Most countries in the region have operated on the basis that distributional issues would only be resolved in an environment of rapid growth and whenever growth has slowed a broad-based discussion of measures to revitalize the economy has ensued.

Malaysia and other East Asian countries typically have had medium-term plans in which growth targets have been outlined along with measures to achieve them. Midterm reviews track economic performance and make midcourse corrections in policy. In Chile, there is no such planning. Growth is the outcome of a set of policies that are developed to approximate neutrality as closely as possible. In fact, it would not be too much of a caricature to say that in Chile the approach is to "get the policies right and growth will follow," while in East Asia it is "keep a focus on growth and the policies will emerge." In the first case, there is a presumption that government failures are far greater than market failures and that government's role is to minimize distortions. In the latter case, there is a desire to experiment with active government policies and revise them as and when failures occur.

It is clear that the political environment dictates the choice of strategy. It may not be feasible for Chile to emulate East Asia nor for East Asia to emulate Chile. But in East Asia there is an accountability of government to deliver growth. It may be worth asking if this can be introduced into the Chilean system. It would require two changes.

First, the coalition for growth has to be broadened across political parties. To some degree, one could argue for an effort to depoliticize the push towards growth. The current political divide, especially in Congress, impedes the initiation and implementation of new policy ideas. To a certain degree, the requirement for supermajorities for some policy changes can generate an incentive for consensus building across parties, but it can also act as a bottleneck to change.

Second, the coalition for growth must be broadened to include the business community. Large businesses appear skeptical of the government's ability to deliver growth. They worry that no one has the responsibility. When specific business opportunities present themselves, such as in meat or off-shoring, there is no champion to drive reform. And without a specific goal in mind, reform momentum can peter out. After the pension reform of the 1980s there was considerable momentum on capital markets, but this flagged despite a second round of reforms. Business has not rallied around the new initiative to foster innovation through the NIC.

The lack of trust between business and government has deep roots. There is a deep mistrust in the business community that the government is incapable in areas outside of macro, tax administration, toll collection, and a few others. Government's inability to deal effectively with education and energy supply, the deterioration in public investment evaluation, and the urban problems of Trans-Santiago reinforce this perception. Government worries that business has short-term goals in mind, often pushes for tax breaks that would be largely redistributional rather than transformational, and has the ability to sway public policy in their favor if not restricted by strict rules of the game. Both business and government are engaged in a delicate dance around wage bargaining and the appropriate role for the government to play in collective bargaining. With significant distrust about the long-term goals, even minor change and improvement becomes difficult to agree on. Any change can upset the informal rules of the game and alter the dynamics of larger changes.

In Chile, the Ministerio de Economia is responsible for developing the reform agenda. In East Asia, these responsibilities are normally given to agencies directly controlled by the top leadership. For example, the planning agencies in Malaysia and Singapore reside in the Prime Minister's Office. The Economic Planning Board in Korea was headed by a Deputy Prime Minister. Taiwan, China's Council for Economic Development is an advisory body reporting to the chief executive. In each East Asian case, the top political leadership has an explicit commitment to growth.

Public Private Partnerships

In East Asia, planning and extensive consultation with the private sector have been used to overcome the problems of myopia and externalities. One cost of this has perhaps been greater capture of the gains from growth by select elements of the business community and indeed, during the East Asian financial crisis, crony capitalism was much discussed. Clearly, striking the right balance between public partnership with the private sector and public capture by the private sector is critical to healthy long-term development. The balance in Chile has been tilted toward avoiding capture by applying strict rules of the game, while in East Asia the balance has been towards developing partnerships.

To illustrate the difference in approach, consider the ways in which Chile and Korea have developed programs for boosting innovation. In Chile, a newly established Innovation Commission[30] produced a National Innovation Strategy in January 2007, which has been endorsed by President Bachelet. The report sets out very ambitious benchmarks for Chile to become a knowledge economy. Within 15 years, it aims for Chile to reduce the export concentration of the top 25 exports to below 50 percent of total exports; to sharply increase tertiary education; and to raise R&D spending, especially by the private sector. The NIC has commissioned a report by the Boston Consulting Group and identified a number of key sectors it deems appropriate to support. Along with the Ministry of Planning (MIDEPLAN), it will advise on budget allocations for new public investment. The NIC does not have decision-making power.

In the Chilean context, the innovation strategy has broken ground in two areas: specific output and outcome targets have been endorsed by the top leadership, and specific sectors have been singled out for support. But as yet, the NIC does not appear to have received enthusiastic support from business, especially big business, and several business leaders appeared uninformed and uninterested in the approach. There is some concern that the efforts will become limited to selected tax breaks rather than significant public programs. No clarity has yet emerged on who will take responsibility for key components of the strategy. For example, development of a major off-shoring industry is said to require 40,000 English-speakers over the next 2–3 years. But Chile does not have an agency responsible for worker training, so CORFO is thinking about setting up its own program.

Contrast this with the Korean experience in moving to a knowledge economy. The Korean policy actually started with the private sector. Just prior to the East Asian financial crisis, the *Maeil Business Newspaper* (MBN) teamed up with Booz, Allen, and Hamilton to review the threats and opportunities facing the Korean economy and concluded that a major transition to a knowledge economy was needed. The MBN then hosted a series of national conventions and

[30] The Chilean Science and Technology Council (CONICYT) and CORFO are responsible for implementing Chile's innovation policies.

invited business, academia, and government leaders to share the results and to hasten the implementation of change. There emerged a broad consensus that the old Korean development model, focused largely on copying and reverse engineering, had become obsolete in a world where intangible assets have become dominant in the valuation of firms.

In January 2000, President Kim Dae-jung announced his intention for Korea to become an advanced, knowledge-based economy. Three months later, the country put into effect a three-year action plan for implementing the Knowledge Economy strategy. It consisted of 83 associated action plans in the five main areas of information infrastructure, human resource development, development of knowledge-based industry, science, and technology, as well as elimination of the digital divide. The plan was led by five working groups and involved 19 ministries and 17 research institutes, all to be tracked by the Ministry of Finance and Economy and reported on to the president by the private committee of the National Economic Advisory Council.[31]

The Korean Knowledge Economy plan enjoyed a strong buy-in from the country's business elite. The scale and pace of programs were tremendous. For example, MBN offered a million free Internet connections. A special Informatization Promotion Fund supported ICT training classes for housewives, the elderly, farmers, and other groups—many conducted in stadiums, no less. Nevertheless, the three-year timeframe for the plan was too short and many unfinished agendas remained. A new strategy—"Dynamic Korea: Nation on the Move"—was developed by the Roh government. That strategy emphasized the need to reduce polarization within society and to strengthen the elimination of the digital divide and the growing productivity gap between SMEs and large firms. Gaining support across administrations and allowing for fine-tuning is one of the hallmarks of success of the Korean Knowledge Economy plan.

The Korean story offers a case study of how a mix of supply side policies—such as the distribution of low-priced PCs to disadvantaged groups, building a high-speed Internet infrastructure, and support for venture startups and e-business—was coupled with demand-side policies including massive awareness and computer training programs and a new approach to public procurement. It also shows how the risk of capture was mitigated by macroeconomic policies aimed at further liberalization and the breakup and strengthened regulation of large conglomerates. Korea avoided a process of marginal and piecemeal reforms in putting together a major coordinated program. But despite strong efforts, coordination remained a challenge during implementation, and the role of the private sector, including the media, in crafting and implementing this program has been enormous, and largely instrumental for its success.

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[31] See "The Story of One Vision" at http://web.worldbank.org/WBSITE/EXTERNAL/WBI/WBIPROGRAMS/KFDLP/0,,contentMDK:21014147~menuPK:2500572~pagePK:64156158~piPK:64152884~theSitePK:461198,00.html.

A key institution for successful policy making was the Economic Planning Board (EPB) in Korea, which, for 3 decades provided the development vision, monitoring of implementation, and the budget for Korea's strategic plans.[32] It is interesting that the recently elected government in Seoul, set to take office in February 2008, has signaled its intention to resurrect an EPB-like super-ministry once again to help drive up Korea's growth.

The Korean approach towards private-public partnerships for growth is not unusual. In most East Asian countries it is institutionalized into their planning processes. In Malaysia, a top-down and bottom-up approach to planning has been adopted to synchronize national development goals and strategies with the aspirations of the people, including aspirations of the different communities and regions/states. At the top, the Cabinet decides on the broad development goals, strategies, and policies as well as on the overall level of public sector expenditure and its financing. At the bottom, the views of the common man as well as of the elites are sought through several dialogue mechanisms: with grassroots organizations (such as the JKKK or the Village Development & Security Committee), regular public-private sector meetings that continue annually with each budget document as well as the plan, and through specially convened consultative assemblies for issues of major importance such as the 20-year New Economic Policy covering 1970–90, the 10-year New Development Policy (1990–2000), and the National Vision Policy (2000–2020). The dialogues and the assemblies were invariably organized by and with the secretarial support of the Economic Planning Unit in Malaysia.[33]

Malaysia's National Development Planning Committee (NDPC) meets once a month and approves the draft plan and a consolidated list of public projects. The NDPC has an advisory committee comprising representatives of the public and private sectors as well as of employer associations and trade unions. This committee acts as a forum for an exchange of views as well as to brainstorm on plans, issues, and policies constraining the level and quality of growth of the economy.

The NDPC has set up four subcommittees to enable it to discharge its duties more effectively: (i) Standards & Costs, (ii) Estimates, (iii) Manpower Planning, and (iv) Budget. The Standards & Costs subcommittee draws up and sets guidelines for project designs and standards to optimize economies and cost. The Estimates subcommittee examines and appraises in detail capital expenditure estimates for their reliability and for phasing public sector development expenditure over the plan period. The Manpower Planning subcommittee examines and assesses the expected manpower, education, and training requirements based on the planned and anticipated development of the economy. And the Budget subcommittee looks at the public sector expenditure

[32] See Kim and Leipziger (1993) among others.

[33] See Salleh and Meyanathan (1993) among others.

allocation by activities, sectors, and states based on the outlined strategies, project viability, and other relevant considerations.

These examples suggest that there is a level of detailed planning and monitoring in East Asia that goes well beyond what is done in Chile. The detail, in conjunction with an extensive dialogue with the private sector, builds confidence that implementation will follow.

Lengthening Time Horizons, Strengthening Coordination, and Reducing Capture

The examples above point to the key challenges for Chile. How to lengthen the time horizon of the political process to take on long-term challenges such as improving the national innovation system? How to effectively coordinate across government ministries and between the public and private sectors? And how to avoid elite capture?

These are not easy challenges and Chile is experimenting with some fresh approaches, but these may be too cautious given the nature of the obstacles. It may be time to separate better ideology from practical policy making. The Chilean political economy model, while excellent for stability, continuity, and the status quo, is less useful for structural transformation.

There can be a persuasive argument made that Chile should aim for a doubling of income by 2020 and to that end should present a vision, quantitative goals, and a multi-year business plan for achieving them. This would require a number of micro reforms to make that possible. Piecemeal reforms or small steps that do not cause waves will be a waste of resources. Because of the policy interaction effects noted by Rodrik (2004), a program combining greater efficiency, higher investment in Chile's growth potential, and broader gains for the population at large would require an integrated set of actions, led by the presidency and implemented by all relevant organs of government.

It is important to emphasize that such approaches do not require substantial new public resources. East Asian countries have typically maintained small governments, although their spending is more heavily geared towards public investment that recurrent spending.

For Chile, a new way is needed, building on the country's favorable experiences and determination to use markets and to ensure accountability.

One idea would be to establish a new authority, like Fundación Chile, perhaps called Chile 2020, funded by a 10-year program to the tune of 0.5 percent of GDP annually to finance needed infrastructure investments in ecotourism and other areas. This would use the concept of autonomous, accountable agencies with a market orientation. The new authority would offer to match public infrastructure with private sector bidders who are willing to provide supporting investment. It could be modeled on the New York Port Authority, commercially staffed by non-bureaucrats, but with powers that the legislature would grant and

with a linkage to relevant ministries that would need to deliver on related aspects of project development.

This kind of activity would need to report to the president, for example, to ensure ministerial compliance and high-level political commitment. This project would have to be bipartisan and involve the business sector. The project evaluation aspect could be outsourced to external experts, such as the United Kingdom's Crown Agents, if there is concern over current independent expertise within Chile for such activity.[34] Financing would be expected from the domestic private sector or foreign investors. Special laws might need to be enacted that would grant waivers for firms operating in the designated zones. This would avoid a prolonged legislative process that might be needed to get change at the national level and preserve some first-mover advantages in the areas selected for public-private investment. A major media campaign to promote the economic benefits of the new approach would likely be needed. By limiting benefits to certain geographic areas, the scope for elite capture would be significantly reduced.

The present Chilean strategy of looking to first improve public institutions and then contemplate a more active role for the government seems to be too cautious and risks the country losing ground to international competitors. That can have a heavy cost that can persist into the future.

Risk Management and Policy Choices: Taking a Chance on Higher Growth

This paper acknowledges Chile's fantastic record on managing public sector risks. The fiscal rule, the copper stabilization fund, the establishment of off-shore assets to cover future pension fund liabilities, and the program to recapitalize and ensure solvency of the Central Bank are all testaments to prudent macroeconomic policy choices that serve to minimize risk and preserve the basis for sustained growth.

The question at hand is whether social discontent will rise, in part reflecting distributional concerns, and whether more rapid growth could help reduce this risk. In East Asia a central tenet of policy making for the past 40 years has been that rapid growth is the best insurance against social instability. This premise has led several East Asian countries to be less cautious with their public policy choices if the gains to growth seemed large. In a globalized world, this approach has served these countries well, despite episodic crises. East Asian economies are now firmly on track to build global competitiveness.

What opportunities could Chile seize if it felt that social risks should be mitigated through more rapid growth? A package of policy reforms and of reforms in policy-making processes would be desirable. On the policy front, provision of public infrastructure investment, a coherent national strategy for a shift to a knowledge economy, and building better skills could be the focus of

[34] There is a long-standing tradition in East Asia of using foreign expertise to fill perceived capacity gaps in the public sector.

reforms. There are some quick wins available—higher female labor force participation, more flexible part-time work, scholarships for students studying abroad, and regional development projects in Southern Chile are possible examples. But most of the changes are long term in nature. Improving the quality and distribution of schooling will not happen overnight, and the current system does not appear to provide the incentives (nor the instruments) for a significant shift in the right direction. Reforming the process for identifying and implementing public infrastructure investment requires institutional change. And efforts to spark innovation might not work if they are not placed within a comprehensive framework of accumulation.

On the policy-making front, it is imperative to find a new mechanism for public-private partnerships in a range of areas, and to rebuild trust between executive, legislative, and private sector bodies. Without such mechanisms, it will be difficult to make the kind of intertemporal commitment to reform that is needed for Chile to grow.

The overriding priority for public policy, then, is to recognize that macroeconomic stability is indispensable, but should not be seen to constitute a dynamic growth strategy. The reality is that most middle-income countries currently pursue prudent fiscal policies and try to limit inflation. Their major risks therefore are in the area of stagnation or slow growth. In order to deal with distributional issues as well as those negatively affected by competition, higher rates of growth are necessary. Chile can—in our view—do better in terms of growth, but would need far-reaching changes to implement a new and bolder growth strategy.

Annex

Figure A 1: Which Are the Best Chilean Plants?

Plant	(1)	(2)
Efecto Marginal	frontier	frontier
Multinacional	0.172***	0.0781***
	(0.0120)	(0.0088)
Capital Humano		0.0562***
		(0.0033)
Grande		0.0228***
		0.0032
Importadora		0.0728***
		(0.0047)
Licencia Tecnologica		0.0597***
		(0.0079)
Outsourcing		0.0198***
		(0.0039)
Observations	29,061	29,061

Source: Gustavo Crespi, presentation at CEPAL, September 2007.

Note: Results are based on Fixed Effects and are for the years 1992–97.

Figure A2: Regression Results (Fixed Effects)

Dependent variable is labor productivity growth	(1)	(2)	(3)	(4)
Distance to Domestic Frontier (-1)	0.734	0.720	0.724	0.726
	(0.061)***	(0.061)***	(0.061)***	(0.062)***
Distance to Global Frontier (-1)	0.233	0.280	0.278	0.267
	(0.060)***	(0.60)***	(0.060)***	(0.061)***
Change in DF (-1)	0.302	0.318	0.323	0.317
	(0.056)***	(0.055)***	(0.057)***	(0.0564)***
Change in GF (-1)	−0.090	−0.049	−0.047	−0.020
	(0.069)	(0.068)	(0.072)	(0.073)
FDI (-1)		0.004		0.004
		(0.007)		(0.007)
Real New Investment in Machinery (-1)		0.004	0.004	
		(0.001)***	(0.001)***	
Distance to DF * FDI (-1)			0.008	
			(0.024)	
Distance to GF * FDI (-1)			−0.002	
			(0.022)	
Distance to DF * Inv. in Machinery (-1)				−0.008
				(0.004)**
Distance to GF * Inv. in Machinery (-1)				0.012
				(0.004)***
Constant	−1.290	−2.604	−2.551	−2.492
	(0.024)***	(0.218)***	(0.220)***	(0.229)***
R2	0.485	0.489	0.488	0.489
Observations	19,524	19,524	19,524	19,524

Notes: All variables are in logs. The Fixed Effects models include year dummies as well as robust standard errors. Models 2–4 also include further firm-specific control variables (not shown here). Standard errors are in brackets; *** 1% significance level, ** 5% significance level, and * 10% significance level.

Source: Gustavo Crespi based on Chilean plant-level data from ENIA. The global frontier data is from Bartelsman et al. (2006), and its conversion to Chilean Pesos is based on PPP. The regression results cover the period 1992–97.

Technical Notes

Why the analysis matters?

Before the seminal paper by Bartelsman et al. (2006), the academic literature on convergence usually proceeded in two ways: (i) understand countries' convergence patterns in relation to the global frontier (often the United States), the so-called *macro method;* or (ii) investigate firm/industry-level convergence to the domestic frontier, the so-called *micro method*.

The problem in the *macro method* is that it assumes that all domestic firms in a country will eventually converge to the global frontier. It omits the prevalence of firm heterogeneity (Jovanovic 1982; Hopenhayn 1992; Tybout 2000; Melitz

2003) and the fact that usually only the best firms in a country might be able to absorb the global pool of knowledge and internalize it. Laggards are most likely so far from the global frontier that they will not be able to catch up.

The *micro method* allows differential effects of domestic firms' characteristics on firm-level productivity. However, for the best domestic firms, the domestic frontier might be the wrong benchmark since these firms might be closer to the global benchmark. In other words, the best firms are able to learn from international best practices but can't do so in the micro method setup.

Our Chile study, similar to Bartelsman et al. (2006), combines the macro and micro method. Drawing on the international productivity benchmarks by industry from Bartelsman et al. (2006), we are able to relate convergence patterns of heterogeneous Chilean firms not only to the domestic frontier but also to the global frontier.

What are the findings?

Both the domestic and global frontier matter for Chile's labor productivity convergence and catch up.

Overall, the domestic frontier exerts a stronger pull on Chilean firms than the global frontier (note not only the importance of the coefficient on distance but also the coefficient on growth of the domestic frontier).

Firms with new investments in machinery seem to catch up faster to the global frontier than the domestic frontier. The effect of FDI (as well as its interaction with the domestic and global frontier) is insignificant on firm labor productivity growth.

What are some of the implications?

The best domestic firms should be able to benchmark themselves against the global leaders in their industry and not the domestic frontier.

Investments in machinery allow Chilean firms to catch up faster to the global frontier. The result might indicate those Chilean firms are able to absorb global knowledge

The theoretical literature on exporting and heterogeneous firms (for example, Melitz, 2003) argues that due to fixed costs of exporting, only the most productive firms will enter the export market. It is likely that those firms that also catch up to the global frontier are exporting firms and the most productive firms in Chile.

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