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THE REPUBLIC OF CHILE

PUBLIC EXPENDITURE REVIEW

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Macroeconomics and Fiscal Management Global Practice
Bolivia, Chile, Ecuador, Peru and Venezuela Country Management Unit
Latin America and the Caribbean Region

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Chile Government Fiscal Year

January 1 – December 31

Currency Equivalentents

(Exchange Rate Effective as of November 30, 2016)

Currency Unit = Chilean Peso (CLP)

US\$1.00 = 674.30

ABBREVIATIONS AND ACRONYMS

AUGE	<i>Acceso Universal con Garantías Explícitas</i>
BOOST	World Bank Budget Database based on official data
CAB	Cyclical Adjusted Fiscal Balance
CASEN	National Socio-Economic Characterization Survey
CE	<i>Conectividad para la Educación</i>
CENABAST	<i>Centro Nacional de Abastecimiento</i>
CEPAL	<i>Comisión Económica para América Latina y el Caribe</i>
CLP	Chilean Peso
CNIC	<i>Consejo Nacional de Innovación y Competitividad</i>
CONYCID	<i>Comisión Nacional de Investigación Científica y Tecnológica</i>
CORFO	<i>Corporación de Fomento a la Producción de Chile</i>
CMO	Commodity Market Outlook
CNIC	National Council for Competitiveness and Innovation
COFOG	UN Classification of the Functions of Government
COPD	Chronic Obstructive Pulmonary Disease
DEA	Data Envelopment Analysis
DIPRES	<i>Dirección de Presupuestos de Chile</i>
DRG	Diagnosis-Related Groups
EAG	Education at a Glance
ECI	Economic Complexity Index
ENI	<i>Escuela Nacional de Inteligencia</i>
ENLACES	<i>Evaluación Nacional de Logro Académico en Centros Escolares</i>
FIC	<i>Fondo de Innovación y Competitividad</i>
FIE	<i>Fondo de Inversión Estratégica</i>
FNDR	<i>Fondo Nacional de Desarrollo Regional</i>
FONASA	<i>Fondo Nacional de Salud</i>
FONDAP	<i>Fondo de Financiamiento para Centros de Investigación en Áreas Prioritarias</i>
FONDECYT	<i>Fondo Nacional de Desarrollo Científico y Tecnológico</i>
FONDEF	<i>Fondo de Fomento al Desarrollo Científico y Tecnológico</i>
GCI	Global Competitiveness Index
GDP	Gross Domestic Product
GEM	Global Entrepreneurship Monitor
GERD	Gross Expenditure in Research and Development
GES	<i>Garantías Explícitas en Salud</i>

GGE	General Government Expenditure
GGHE	General Government Health Expenditure
GoC	Government of Chile
GP	Global Practice
HHI	Herfindahl-Hirschmann Index
HRST	Human Resources for Science and Technology
IADB	Inter-American Development Bank
ICT	Information and Communications Technology
I&E	Innovation & Entrepreneurship
IMF	International Monetary Fund
ISAPRE	<i>Institución de Salud Previsional</i>
ISO	International Organization for Standardization
IT	Information Technology
IVE	Index of Vulnerability
IWF	<i>Iluminación Wi-Fi</i>
JUNAEB	<i>Junta Nacional de Auxilio Escolar y Becas</i>
KPI	Key Performance Indicators
LAC	Latin America and the Caribbean
LOS	Length of Stay
MCPA	<i>Me Conecto para Aprender</i>
M&E	Monitoring and Evaluation
MINECON	<i>Ministerio de Economía, Fomento y Turismo de Chile</i>
MINEDUC	<i>Ministerio de Educación de Chile</i>
MLE	<i>Modalidad Libre Elección</i>
MoE	Ministry of Education
MTD	<i>Mi Taller Digital</i>
NHS	National Health Service
NQI	National Quality Infrastructure
NSLP	National School Lunch Program
OECD	Organization for Economic Co-Operation and Development
PAE	<i>Programa de Alimentación Escolar</i>
PAHO	Pan American Health Organization
PER	Public Expenditure Review
PISA	Programme for International Student Assessment
PNAE	<i>Programa Nacional de Alimentação Escolar</i>
PPP	Purchasing Power Parity
PYLL	Potential Years of Life Lost
R&D	Research and Development
SBP	School Breakfast Program
SEG	Socioeconomic Groups
SEP	<i>Subvención Escolar Preferencial</i>
SERCOTEC	<i>Servicio de Cooperación Técnica</i>
SERVIU	Services of Housing and Urbanization
SIEF	Strategic Impact Evaluation Fund
SIGFE	<i>Sistema de Información para la Gestión Financiera del Estado</i>
SIMCE-TIC	<i>Sistema Nacional de Evaluación del Ministerio de Chile – Tecnologías de la Información y Comunicación</i>
SINIM	<i>Sistema Nacional de Información Municipal</i>
SME	Small and Medium Enterprise
SNSS	National Health Services System
S&P	Standard and Poor's

SSAF	<i>Subsidio Semilla de Asignación Flexible</i>
STEAM	Science, Technology, Engineering, Arts, and Math
STI	Science, Technology and Innovation
TEI	<i>Tabletas para la Educación Inicial</i>
TFP	Total Factor Productivity
TTO	Tech Transfer Office
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNESCO	United Nations Educational, Scientific, and Cultural Organization
USD	United States Dollar
USDc/Lb	U.S. dollar cents per pound
WEO	World Economic Outlook
WHO	World Health Organization
YEMPC	<i>Yo Elijo mi PC</i>

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REPUBLIC OF CHILE

PUBLIC EXPENDITURE REVIEW (P158618)

TABLE OF CONTENTS

Table of Contents

Executive Summary	1
Introduction.....	1
Chapter 1. Macro-Fiscal Context.....	2
Chapter 2. Health	4
Chapter 3. Education.....	4
Chapter 4. Innovation and Entrepreneurship	8
Appendix A.1.....	21
Appendix B: Definition of Peer Countries.....	30
Appendix C: BOOST Databases and Budget Classification	32

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Executive Summary

This Public Expenditure Review was prepared by the World Bank upon request from the Ministry of Finance of Chile. It identifies measures to improve the efficiency of public spending in a relatively narrow set of programs and functions in health, education and innovation/entrepreneurship. In health, the report recommends specific measures to improve the procurement of drugs and enhancing hospital efficiency. In education, efficiency gains can be achieved within government programs for school feeding, laptop distribution and text books. In terms of innovation and entrepreneurship programs, there is scope for further rationalization and consolidation of programs and processes, especially at the design stage. If implemented, these measures could result in cost savings of CLP284 billion (US\$422 million), equivalent to 0.2 percent of GDP or about three quarters of the fiscal adjustment targeted for 2016.

Introduction

1. The objective of the Chile Public Expenditure Review is to improve the efficiency of public spending with a view of informing the budget preparation process in the next years.

The Government of Chile (GoC) has requested the World Bank to undertake a Public Expenditure Review (PER) on the basis of a Reimbursable Advisory Service. World Bank PERs generally evaluate multiple dimensions of public spending including the effectiveness, equity and efficiency of public spending as well as fiscal sustainability. The Chile PER, however, has a strong emphasis on how to improve the technical, and to some extent, allocative efficiency of public spending within the sectors of analysis.¹

2. The report reviews public spending of the Ministry of Health, the Ministry of Education and the Ministry of Economy, Investment and Tourism. These ministries account for about 40 percent of central government public spending (9.4 percent of GDP).² As agreed with the GoC, the PER focuses on a relatively narrow set of programs and functions within these three ministries or sectors. In the case of education, the report focuses mainly on three programs accounting for about 10 percent of public education spending (0.5 percent of GDP). In the case of health, the analysis focuses largely on public spending within hospitals which account for about 46 percent of public health spending (2.0 percent of GDP). In the case of the Ministry of Economy, the focus is exclusively on spending programs supporting innovation and entrepreneurship which is about 40 percent of total spending of the Ministry of Economy, Investment and Tourism (0.1 percent of GDP). In sum, the PER effectively analyzes the efficiency of 11.1 percent of central government spending (2.6 percent of GDP) (see Appendix Table A.13 for details).

¹ *Technical efficiency* refers to maintaining the same output with a reduced input or, conversely, increasing outputs with the same level of input. *Allocative efficiency* refers to reallocations of public spending between spending areas with a view to improving the quality of spending.

² In this PER, ‘public expenditures or spending’ refer to Central Government Expenditures. See Appendix A for an overview of the data.

3. **The choice of sectors included in the PER is related to a combination of budget size and recent spending growth.** The education and health sectors are relevant due to the government's ambition to improving the quality of public service delivery and they account for relatively large shares of public spending (4.8 and 4.2 percent of GDP, respectively). Public spending on innovation and entrepreneurship is limited in size, but it is rising fast and therefore merits closer scrutiny. It was the main factor behind the rapid increase in the budget of the Ministry of Economy, Investment and Tourism, exceeding 15 percent in real terms in 2014 and 2015.

4. **In light of its objective and scope the Chile PER therefore differs from a traditional World Bank PER.** To sum up, these differences include: (1) a strong emphasis on the objective of efficiency; (2) the inclusion of relatively few sectors in the analysis, and; (3) a strong focus on analyzing specific sub-programs within each sector. The relatively narrow and deep focus of the analysis sets it aside from other PERs which would typically have a more comprehensive, but less detail-oriented coverage.

5. **In this report, Chile's public spending dynamics and performance is compared with other relevant countries using an international benchmarking exercise.** A database created for this PER contains indicators on public spending and outcomes across a wide range of sectors using World Bank, OECD, and IMF indicators. Chile's performance is compared with OECD, regional and structural peers. Pre-defined regional peers include Colombia, Mexico and Peru (The Pacific Alliance). Structural peers are a sub-set of OECD countries with similar characteristics and include: Australia, Canada and Norway (see Appendix B for details).

Macro-Fiscal Context

6. **The Chilean economy is in the midst of a challenging rebalancing process, though it has been more resilient than its peers.** The global economic slowdown and the associated end of the commodity supercycle had a negative impact on Chile - the world's largest producer of copper. The combination of lower copper prices and higher costs has affected mining profitability and reduced investment. Lower terms of trade have also passed through the broader economy cutting household incomes and slowing private consumption. As a result, the Chilean economy expanded by 2.1 percent in 2015 – below the 20 year average of 4.1 percent, but well above the 0.7 percent contraction estimated for LAC.

7. **The authorities continue to adhere to a sound macroeconomic policy framework.** Chile's flexible exchange rate has been the first line of defense against the terms of trade shock stemming from lower oil prices and softer external demand. The pass-through effect of the exchange rate depreciation to domestic prices contributed to an acceleration in inflation exceeding the Central Bank's target range (of 2-4 percent). In an effort to reign-in inflation the monetary authorities increased interest rates in late 2015. The Central Bank's policy dilemma of tightening monetary policy in the midst of a slowdown, has been made easier by well-anchored inflation expectations.

8. **Going forward, fiscal policy would need to take a more active role in the adjustment, especially through an expenditure consolidation.** The fiscal deficit was allowed to increase

within the parameters set by the Fiscal Rule (which targets the structural fiscal deficit). The associated moderate fiscal impulse was aimed at smoothing the transition of the economy to a situation of lower growth potential in the context of less favorable external conditions over the medium term. But moving ahead, the expenditure side of fiscal policy would need to play an active role in the adjustment as a major revenue-enhancing tax reform has already been enacted in 2014. The authorities aim to gradually reduce the structural fiscal deficit by approximately 0.25 percent of GDP per year between 2016 and 2018, measured with structural parameters comparable year to year. Policy actions required to achieve this target have been already taken and are focused on containing growth of public spending. The government has already announced spending cuts by over half a billion dollars or 0.2 percent of GDP in the budget for 2016.

9. **Chile, along with other countries in the region, has initiated measures to support the adjustment.** They consisted of tax measures in the 2014 reform amounting to 3 percent of GDP. On the expenditure side, an initial adjustment consisted of a reduction of CLP380 billion (US\$540 million) or 0.2 percent of GDP on the approved budget for 2016. Other countries in the region are undergoing similar adjustments. In Colombia, expenditure reductions are achieved through a hiring freeze, reduced transfers and investments. In Mexico, spending adjustments tend to be tilted towards the reduction of capital expenditure in view of rigidities in much of the current expenditure (pensions, wages and salaries, social transfers).

10. **In the near term, the required fiscal consolidation of around 0.25 percent of GDP per year to reach a structural balance deficit of 0.8 percent of GDP by 2018 can be met through a combination of revenue and expenditure measures.** While the bulk of additional revenues from the 2014 tax reform will be used to finance additional public spending a part of it would be used to contribute towards meeting the fiscal target and to compensate for lower copper prices. The remainder would have to come from expenditure consolidation.

11. **In the longer term, a significant reduction in the annual growth of spending may be required.** Medium-term fiscal projections prepared for this PER shed important light on the evolution of future public spending growth. It makes a series of plausible assumptions for the future trajectory of copper prices and trend GDP growth, along with a structural balance target of zero percent by 2021. The projections suggest a rather tight scenario for the expansion of public expenditure of just 1.9 percent per year in 2019-21 compared to increases of 4.8 percent over the previous decade. Higher spending growth can only be attained by raising tax revenues, relaxing the fiscal deficit target or improving productivity growth.

12. **This PER aims to identify public spending efficiency saving measures to support the required macro-fiscal adjustment process.** Improved spending efficiency is a natural first step towards the goal of reducing public expenditures as it aims to maintaining the level and quality of public services largely unchanged. As such, efficiency measures would be expected to encounter relatively less political and public opposition compared to direct spending cuts that may impact public service delivery negative. The subsequent sections, identify a series of efficiency-enhancing measures across different sectors and programs and estimates their potential fiscal impact.

Health

13. **The analysis of the health sector is divided into five parts:** First, an assessment of Chile's health expenditures and performance on key health indicators in comparison to international benchmarks. Second, a review of efficiency-improving reforms implemented by other OECD countries, particularly following the 2008 global financial crisis. Third, an analysis of the relative efficiency of the 29 public integrated service delivery networks and determinants of efficiency at the regional level. Fourth, an analysis of the levels, trends and cost drivers of public spending in the health sector. Fifth, identifying opportunities for short and medium term efficiency gains and estimating the value of potential cost savings.

14. **Chile's public health expenditure has increased significantly over the past decade, driven in part by the introduction of guarantees for a defined health benefit package.** As the second largest budget category, health accounted for 18.3 percent of total public spending in 2015, compared to 13.6 percent in 2005. Real public spending on health increased by 10.5 percent per year during 2000-15, making it the third fastest growing budget category. By 2015, total health spending had reached CLP6.6 trillion or US\$10.1 billion. Relative to GDP, this represents an increase from 2.5 percent in 2005 to 4.2 percent in 2015.

15. **Public expenditure and total expenditure on health in Chile are lower than in OECD and Chile's health outcomes also lag behind.** On average, OECD governments spend about 7 percent of GDP on health versus about 4 percent in Chile. Private health spending in Chile is larger than in most OECD countries and regional peers: half of Chile's total health expenditure comes from private sources, with almost one-third of total health spending from out-of-the-pocket expenditures. Although there have been substantial improvements in health outcomes in recent decades, Chile's health outcomes lag behind the OECD in several dimensions. Chile has low utilization levels, as indicated by a low rate of physicians and consultations per capita; low screening and survival rates for certain cancers; and long wait times for selected types of surgery. International benchmarking also reveal an overuse of Caesarian sections, for which Chile has the third highest rate in the OECD.

16. **International experience suggests that health reforms that produce short-term efficiency gains may generate negative consequences in the future.** A review of international literature revealed that in response to the 2008 crisis, OECD countries enacted health expenditure reductions in four primary areas: pharmaceuticals, personnel, hospitals, and across-the-board cuts. However, many of these policy reforms are likely to generate negative consequences in the longer term. Policies that reduce the amount the government pays for healthcare or increase the amount users pay for health care will generally achieve quick expenditure reductions. But in the longer term, salary freezes, for example, generally reduce the quality and availability of the health workforce, possibly resulting in shortages. Other efficiency-improving reforms require substantial time to take effect and are unlikely to reduce spending rapidly. Various pharmaceutical purchasing reforms may have the greatest potential for short-term savings with minimal long-term negative effects. This suggests that great care must be taken when identifying efficiency measures.

17. **Across the 29 regional networks, there is a relatively high level of efficiency in Chile's publicly funded health system.** On average, Chile's health care system could reduce premature

mortality from treatable causes of death by 8-13 percent if all regions operated efficiently. Efficiency scores at the regional level are positively associated with investments in primary care, as measured by the role GPs play in the system relative to specialist physicians, and negatively associated with both longer than expected length of stays in hospital and a higher proportion of spending on private services through MLE.

18. **Rising public spending on health care has been mainly driven by an increase in drug expenditures and payments for contracting of physicians engaged in dual practice.** Drug expenditures have grown substantially in the last ten years, with the three highest shares of total public drug expenditures observed in urban areas. The proportion of total spending on labor has slightly decreased in the last ten years, but the share of labor expenditures for contracts for private physician services has increased considerably, as well as the share of honoraria paid to physicians.

19. **Collectively, the various analyses point to four areas of focus consistent with the experience of other OECD countries in achieving efficiency gains: (1) drugs and medical equipment; (2) productivity and efficiency in hospital care; (3) primary health care; and (4) health human resources.** Recommendations were developed primarily to generate savings in the short term in these four areas. However, medium and long-term recommendations are also incorporated if efficiency gains over time are to be sustained. First, significant efficiency gains and savings can be obtained through better structured and more centralized procurement of drugs for public sector health services. A key goal would be to reduce the volume of direct procurement of drugs and medical equipment by hospitals and municipalities in the short term, leading to price decreases of at least 25 percent. In addition, the implementation of more advanced procurement mechanisms such as multi-year framework agreements and other methods could increase the effectiveness of centralized procurement and drive drug prices further down.

20. **Major savings can be derived from improvements in the clinical efficiency and effectiveness as well as in the management of hospital care services.** Key reforms include implementing a DRG-based payment system for sixty-two acute care hospitals; reducing low value and inappropriate care; strict financial monitoring of public hospitals; increased use of day surgeries; and reducing avoidable hospitalizations and readmission rates. In the realm of primary health care, remuneration of primary health care workers should be revised to incentivize productivity gains; the amount of direct procurement of drugs should be reduced by defining targets, which are enforced through contracts between the Ministry and municipalities; and innovations in population health management should be incentivized through an innovation fund to reduce avoidable hospital admissions. Finally, the primary recommendation for health human resources is to work with the medical college of physicians of Chile to avoid excessive dual practice by physicians, which have been one of the key drivers of hospital debts since 2013.

21. **Specific reforms should be accompanied by complementary efforts to improve the context for implementing these reforms and ensuring they are sustainable over the longer term.** Targets for efficiency gains should be set by region, supported by a new inter-ministerial task force responsible for providing guidance, support, and monitoring the implementation of regional efficiency plans. The health sector should be permitted to keep some of the efficiency savings to create an innovation fund supporting the implementation of regional efficiency plans. Primary health care should be strengthened, possibly entailing a shift to allocate a greater portion

of resources to the primary health care sector. Population risk factors, such as smoking, should be addressed through effective campaigns or interventions. Clinical efficiency and effectiveness should remain an area of focus. Finally, sufficient resources should be provided to sustain the transformation of CENABAST into a high-performing procurement agency for pharmaceutical and other medical products.

22. Collectively, the expected efficiency gains of these recommended reforms could amount to CLP170 billion or 255 million USD, representing 0.11 percent of GDP. Expenditure reductions from short-term reforms to drug and medical equipment procurement are estimated to save CLP68.7 billion (or around 102 million USD). The majority of these savings will result from reducing direct procurement and implementing targeted, multi-year framework contracts. A total of CLP103.1 billion (or 153 million USD) in savings is expected from improving clinical efficiencies and operational effectiveness, including accelerating the implementation of day surgery and reducing: avoidable hospitalizations, Caesarean sections, hospital readmissions, and the length of stay for key conditions and procedures. Table ES.1 at the end of this Executive Summary provides a detailed breakdown of these results. The gross efficiency gains for next fiscal year should be reduced by the amount invested in the innovation fund to deduct the net fiscal gains. Moderation in wage increases in the hospital sector will be key to realize expected efficiency gains.

Education

23. The analysis of education spending is primarily focused on identifying potential efficiency gains within selected spending programs as opposed to analyzing broad spending categories. Specifically, this includes: (1) a program providing computers to 7th grade students in public schools (*Me Conecto para Aprender*); (2) a program providing school lunches in public schools at the primary and secondary level (*Programa Alimentación Escolar*), and; (3) a program providing educational text books. Nonetheless, the education sector analysis also reviews broad sector spending patterns and trends and assesses school level efficiency at the general level.

24. The programs evaluated were jointly selected by the Ministry of Education, the Ministry of Finance and the World Bank team. Their selection was due to a number of factors. First, they are programs which are not affected by any of the deep and wide reaching educational reforms currently under way in Chile. Second, their share of the education budget is sufficiently sizeable to give rise to potential efficiency gains that are of fiscal importance. Third, there is increasing evidence suggesting potential for improving the spending efficiency within these programs. The analysis quantifies the potential size of such efficiency gains (whenever possible) and identifies the mechanisms through which they can be achieved.

25. The analysis of potential efficiency gains carefully incorporates the ongoing reforms initiative in the education sector in Chile. The Government of Chile recognizes the importance of reducing inequality and has put in place a series of ambitious reforms to promote the equality of opportunities for all. One key principle in the education sector is the transformation of the role of the state towards a guarantor of rights. This implies that proposals to achieve efficiency gains in the education sector, as a part of the process of fiscal consolidation, would need to be consistent with this overall policy direction of the Government.

26. **Public education spending has been increasing substantially over the past decade.** As the largest sector in the budget, it accounts for 20.5 percent of total public spending in 2015 compared to 17.2 percent in 2005. Relative to GDP, this represents an increase from 3.2 to 4.8 percent over this period. Real public spending on education increased by 9.1 percent per year in 2000-15 making the fourth fastest growing budget category. By 2015, total education spending amounted to CLP7.5 trillion or US\$11 billion. Further spending increase are expected in the medium term on account of the expected increase in revenues to be generated by the tax reform of 2014.

27. **A number of interesting insights can be gained from benchmarking Chile's education spending and outcomes with peers.** Education spending accounts for a relatively large portion of total spending (20 percent) compared to OECD (13 percent) and regional peers (15 percent). Public spending levels (4.5 percent of GDP) are gradually approaching OECD levels (5.5 percent of GDP), although they remain lower. Ongoing education sector reforms are expected to close the remaining gap. Public spending on education spending heavily favors recurrent expenditures over capital investment. In terms of education outcomes, while Chile performs favorably in regional terms while lagging behind OECD countries and structural peers.

28. **The findings of the efficiency analysis suggest that schools are on average efficient at optimizing the allocation of resources, but there is still room to obtain efficiency gains.** This finding is consistent with the international evidence that Chile's public education spending is relatively efficient. Results from a stochastic frontier analysis reveal substantial disparities in measurable learning outcomes at the 8th grade in public schools and subsidized private schools. Math and reading scores between the best and worst performing schools (top 10 percent vs. bottom 10 percent) exceed 30 percent. Differences in pupil self-esteem and motivation are somewhat lower at 20 percent. However, most of these differences can be explained by the combination of educational inputs and socioeconomic characteristics at each school. Schools that achieve better results in reading have more resources, better quality of infrastructure, better quality of teachers and lower pupil-teacher ratios. Comparable results are found for math skills and self-esteem. These results take into account the variation in the socioeconomic background of the students which also play a substantial role.

29. **In the case of the school feeding program, there is scope for short and medium term efficiency gains of up to CLP87.2 billion (or 130 million of USD) which represents a quarter of the program budget.** Table ES.1 at the end of this Executive Summary highlights the detailed results. In the short term, efficiency gains can be achieved by improving the monitoring of beneficiaries of school feeding rations and by introducing an on-demand modality for beneficiaries from the third income quintile requiring them to opt-in to the program. In the medium term, additional budget resources could be saved by allowing richer students to pay for rations and expanding the new monitoring system to all the schools. Overall, these measures have a positive or negligible impact on equity and are consistent with government policy of universalization.

30. **In the case of the ICT program, there is scope for efficiency gains of CLP25.4 billion (or 37 million USD), more than a third of program costs.** A change of technology towards tablets instead of laptops could lead to cost savings amounting to CLP14 billion while maintaining

universal benefits. Offering free hardware to only the poorest students, who are the ones least likely to have a computer at home, could also lead to savings of similar magnitude (CLP19 billion), although this proposal may run counter to the principle of universal benefits. Combining these two proposals, i.e. offering tablets only to the poorest students could lead to savings amounting CLP 25.4 billion.

31. **A review of the procurement processes of three major education programs was also undertaken.** The three programs (*PAE*, *Enlaces* and *Textos Escolares*) represent about three quarters of the procurement executed by the Ministry of Education. Procurement of goods and services, in turn, account for about 10 percent of total education expenditure, while the remainder is transfers. Among the three programs, the school feeding program (*PAE*) accounts for the bulk of spending (about 70 percent). The report proposes adjustments to the procurement rules for selected programs, though the impact of these measures have not been quantified.

32. **Improvements in procurement under the school feeding program stand the best chances of producing efficiency savings given the relative size of the program.** The report identifies the following specific recommendations for this program: (1) emphasize product performance monitoring and de-emphasize process monitoring; (2) improve monitoring of rations; (3) allow suppliers the option of preparing meals in industrial kitchens; (4) simplify and reduce procedures to submit and evaluate bids, and; (5) simplify the process for contract award.

33. **Recommendations were also made for the laptop and textbook programs, which are relatively smaller in budget size.** For the laptop program, there were three recommendations: (1) use total cost of ownership (hardware cost and support) as the metric when investing in computer equipment; (2) consolidate support of computer equipment, and; (3) explore leasing options. Finally, two recommendations were made for the textbook program: (1) consider electronic publishing for selected items, and (2) consider a two-stage strategy for copyrights and printing services.

Innovation and Entrepreneurship

1. **The GoC is determined to improve the effectiveness and efficiency of a small albeit rapidly increasing budget in support of innovation and entrepreneurship.** It may be too early to assess the impact of this spending, but there are concerns about the existence of some relatively small innovation and entrepreneurship (I&E) programs that may have either little or no impact on economic development.

2. **The Ministry of Economy, Investment and Tourism has a small, but rapidly budget.** The Ministry accounted for 1.4 percent of public spending or 0.3 percent of GDP in 2015. The budget has increased by a real average rate of 15 percent in recent years. About 40 percent of the Ministry budget is devoted to innovation and entrepreneurship programs, which are also financed

through various non-budgetary public trust funds. The Science and Technology budget is implemented by a series of institutions, including CORFO and SERCOTEC.³

3. **Against this backdrop, the report analyzes the quality of the innovation and entrepreneurship portfolio of instruments of CORFO and SERCOTEC.** The analysis consists of two parts. The first part reviews the portfolio of existing instruments; evaluates the coherence of the policy mix in meeting the demand for innovation, reviews the allocation of resources across objectives and beneficiaries; evaluates the scale redundancies and examines opportunities for rationalization. The second part consists of an evaluation of the quality of the design, implementation and governance for a sample of 15 instruments – 12 from CORFO and 3 from SERCOTEC – that represent 37.6 percent of the non-investment and finance budget of these two institutions for innovation and entrepreneurship.

4. **Chile’s innovation and entrepreneurship policy mix is largely coherent with the main government policy objectives and the existing demand conditions.** On the one hand, the cluster analysis suggests that there are no overlaps across directorates and that there is a stark division of labor across CORFO’s three directorates and SERCOTEC. On the other hand, a more thorough evaluation of the existing policy mix needs more evidence on impact and also consideration of other instruments in institutions of the National System of Innovation, such as CONICYT. SERCOTEC recently rationalized its instruments and there are no clear overlaps across directorates in CORFO. However, there is some room for improvement of the policy mix and rationalizing some of the existing instruments.

5. **The quality of the policy mix has improved in recent years with the focus on later stages of growth, scalability and consolidation, but more re-balancing may be needed.** This opportunity is not only the case for CORFO but also, to some extent, for SERCOTEC. Also, while there has been a justified focus on expanding the entrepreneurial base, the data available suggest of relatively high entrepreneurial rates that justifies a shift of targeting from the quantity to the quality and growth potential of new entrepreneurs, and especially towards growth stages.

6. **Improving productivity requires a renewed effort on improving managerial practices for SMEs.** The analysis of the current portfolio still shows a gap in this area, which is being addressed with the launching of two new programs. More effort needs to be devoted to support and scale these centers over time in order to build managerial capabilities in Chilean firms. This is particularly important given the conditioning nature this capability has with inducing growth of business led R&D.

7. **There are areas that are not covered appropriately by the existing programs in CORFO.** Two areas stand out. First, there is no coverage of basic research related to innovation. While this may be the objective of CONICYT, this separation reflects a stereotypical distinction between basic and applied research and ignores the opportunities for innovation that are related to

³The *Corporación de Fomento de la Producción de Chile* (CORFO) is the main public institution supporting innovation, entrepreneurship and productive development in Chile. The *Servicio de Cooperación Técnica* (SERCOTEC) is a public institution that supports the development of entrepreneurs and micro enterprises in the country. Both institutions are implementing agencies under the umbrella of the Ministry of Economy.

a broad view of R&D in general. Second, the targeting of female entrepreneurs should be mainstreamed in other programs I&E programs.

8. **There is a high concentration of direct support instruments in matching grants and their justification in terms of the optimality in addressing a market failure is unclear.** Although CORFO has diversified the use of instruments in the last years, it is critical to continue piloting and testing alternative instruments, such as equity finance, loan guarantees, prizes and the expanded use of vouchers for innovation; as well as testing different co-financing schemes within matching grants.

9. **There are potential opportunities to enhance efficiency through further rationalization and consolidation within directorates of both institutions.** The government could reduce the number of small instruments with budgets too low to achieve stated objectives at scale and at reasonable implementation costs per beneficiary. There are also opportunities for programmatic consolidation within directorates at CORFO for instruments. The analysis suggests objective overlap and slight differences in terms of target beneficiaries. We have identified 6 cases where there may be opportunities for consolidating instruments into a reduced number to further achieve efficiency in their implementation.

10. **The quality of design, implementation and governance of the instruments analyzed is high, and there is a significant amount of adoption of best practices in some directorates.** Specifically, there are two categories in which almost all instruments for both agencies show very significant strengths, namely, learning during implementation and the management of funding calls.

11. **There are opportunities to improve important processes, especially regarding design.** This opportunity stands to be especially important because there is an urgent need to show impact and results of I&E interventions. We highlight the key opportunities as follows:

- **Lack of an explicit and fully articulated logic model for the instrument is a significant challenge for design and implementation.** This is a missed opportunity given the incentives to produce parts of it to satisfy external requirements and the fairly complete accounting of the individual categories of what taken together would be the logic model in some directorates.
- **The quality of measurement in terms of M&E and impact evaluation is low.** Most instruments do not use an explicit M&E framework and monitor indicators, post-program beneficiary data collection is weak, and the few existing impact evaluations are designed ex post, which compromises the quality of the evaluation results obtained.
- **Lack of consideration of alternative instruments during design, which has resulted in high concentration of direct support in matching grants.** Addressing this issue during design by considering existing evidence on alternative instruments, and a better consideration and justification of the instrument used could enhance the impact of these instruments.

- **Very few instruments have clearly stated objectives at the system level though their justification mentions system level problems that would be addressed by it.** Most objectives are articulated at the project level for individual beneficiaries and participants. There is almost no estimation or clearly stated connection of how the individual project objectives amount to the system level change that justifies the instrument.

12. **Some of these recommendations would require thorough planning and systemic support.** Implementation of a unique M&E framework, support for impact evaluation and support in the consideration of alternative direct support instruments require systemic or institutional support in order to guarantee the coordination and quality of these practices.

13. **The existence of best practices within institutions imply that there are low cost learning opportunities.** This is the case for example for: management of processes, information and documentation, as well as elements such as selection of beneficiaries. The institutions need to create learning spaces for project managers to learn these best practices currently implemented. These learning opportunities of best practices represent a low-hanging fruit and can be put in place in a relatively simple and low cost fashion.

Conclusion: Estimated Efficiency Savings

14. **The total efficiency savings identified in this Public Expenditure Review amount to CLP 318 million (US\$472 million) or 0.2 percent of GDP.** Table ES.1 summarizes the results. Health sector savings account for CLP172 million (54 percent) and education savings for CLP145 million (46 percent). When compared with the total expenditure subject to review in this PER (2.6 percent of GDP), the identified efficiency gains amount to 6.9 percent (see Appendix Table A.13). The report also proposes measures to improve efficiency in other programs (including innovation & entrepreneurship, education procurement and smaller ENLACES programs), though the efficiency savings hereof were not quantified.

15. **If the recommended measures were implemented, the resulting fiscal savings would cover the bulk of the targeted fiscal adjustment for 2016.** The Government of Chile is targeting a reduction in the structural fiscal deficit of 0.8 percent of GDP in 2016-18, or about 0.25 percent of GDP per year over this period. By implementing the proposed measures of this report, it is estimated that the Government could meet close three quarters of the 2016 structural fiscal deficit target.

Table ES.1. Summary of Policy Context, Policy Actions and Potential Savings

Policy Context	Policy Action	Equity Impact	Potential Savings (CLP bn.)	Potential Savings (as % of GDP)
Improve the procurement of drugs in the public sector. Significant efficiency gains and savings can be obtained through better structured and more centralized procurement of drugs for public sector health services.	Reduce the volume of direct procurement of drugs and medical equipment by hospitals and municipalities.		26.1	0.017
	Implement multi-year framework contracts for high volume, high price drugs.		34.4	0.022
	Improve the management and cost control procedures of central pharmacies in public hospitals and expand the joint procurement of drugs with other Mercosur countries.		8.2	0.005
	Subtotal		68.7	0.044
Improve hospital efficiency. Major savings can be derived from improvements in the clinical efficiency and effectiveness, as well as in the management of hospital care services.	Reduce avoidable hospitalizations.		34.4	0.022
	Reduce Caesarean section rates.		1.4	0.001
	Reduce hospital readmission rates.		12.4	0.008
	Reduce hospital length of stay for some key conditions and procedures.		28.8	0.018
	Accelerate implementation of day surgery and other measures to reduce administrative costs and achieve operational efficiencies		26.1	0.017
	Subtotal		103.1	0.066
Total, health			171.8	0.11
Reduce inefficiencies and improve targeting in school feeding program at primary and secondary levels (PAE)				
	Introduce an on-demand modality for beneficiaries from the 3. quintile	Neutral	18.6	0.012
	Improve the monitoring of beneficiaries	Slightly positive	50.0	0.032
	Allow richer students to pay for food rations	Neutral	18.6	0.012
	Subtotal, school feeding		87.2	0.055
Reduce inefficiencies and improve targeting in laptop program (ENLACES-ICT Education).	Change technology to tablets (I)	Positive-Neutral	14.1	0.009
	Offer hardware only to the poorest households (II)	Slightly negative	19.1	0.012
	Offer tablets only to the poorest households (I and II combined)	Slightly negative	25.4	0.016
	Subtotal, laptop program		58.6	0.037
Total, education			145.8	0.093
Grand Total (Health and Education)			317.6	0.20
- as share of 2016 structural deficit adjustment target (0.25% of GDP)				72%
- as a share of public expenditure analyzed in this PER (2.6% of GDP)				7%

Source: Staff estimates.

Chapter 1

Macro-Fiscal Context¹

¹ Prepared by Jozef Draaisma with inputs from Fernando Blanco, Jasmin Chakeri, Lars Christian Moller and Julio Velasco.

Table of Contents

Chapter 1	1
Macro-Fiscal Context.....	1
Table of Contents	2
1. Introduction.....	3
2. Revenue and expenditure trends	6
3. Fiscal dynamics.....	16
4. Fiscal Rigidities	24
5. Fiscal Adjustment in Chile and other countries	26
6. Conclusion	31
Annex 1. Importance of Separating Mining Sector in the estimate of Potential GDP	32
References.....	33

List of Figures

Figure 1.1. General Government Revenue, 2015 (percent of GDP)	7
Figure 1.2. Tax revenue vs. GDP per capita, 2014	7
Figure 1.3. General Government Total Expenditure, 2015 (percent of GDP)	8
Figure 1.4. Public Spending, economic classification(2014).....	9
Figure 1.5. Public Spending, functional classification(2014)	10
Figure 1.6. General Government Gross Debt, 2015 (percent of GDP).....	11
Figure 1.7. GDP and Consumer Price Deflators, 2002-2015 (annual % change).....	12
Figure 1.8. Public Expenditure and Economic Growth, 2002-2015 (annual %))	13
Figure 1.9. Public Expenditure, economic classification 2002-2015.....	14
Figure 1.10. Public Expenditure, functional classification 2002-2015	15
Figure 1.11. Fiscal Balance and Cyclical Adjustments, 2001-2021p ... Error! Bookmark not defined.	
(percent of GDP)..... Error! Bookmark not defined.	
Figure 1.12. Aggregate Revenue, Expenditure and Fiscal Balance 2001-2021p..... Error! Bookmark not defined.	
Figure 1.13. Expenditure growth (annual %, in real terms) 2002-20121p..... Error! Bookmark not defined.	
Figure 1.14. Assets, Liabilities and Net financial Position (percent of GDP)	Error!
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List of Tables

Table 1.1. Chile: Macro Fiscal Indicators, 2010-2016	4
Table 1.2 Main Assumptions for GDP growth and Copper price.....	18
Table 1.2. Rigid Portion of Total Non-Financial Expenditures of Central Government	25

1. Introduction

1. **Strong economic growth in recent decades has enabled Chile to become a high income country and significantly reduce poverty.** Macroeconomic stability, strong institutions, market reforms propelled economic growth. Between 1984 and 2014, annual real GDP growth averaged 5.1 percent (4.1 percent per capita) compared to 2.9 percent (1.4 percent per capita) in the LAC region. This allowed a substantial reduction in poverty from 38.6 percent in 1990 to 7.8 percent in 2013. A favorable external environment contributed to these achievements, but sound policy decisions played a central role in building strong macroeconomic foundations, raising the country long-run economic growth rate and reducing poverty.

2. **Today, the Chilean economy is in the midst of a challenging rebalancing process.** The global economic slowdown and the associated end of the commodity super-cycle had a negative impact on Chile - the world's largest producer of copper. The combination of lower copper prices and higher costs, due to a steadily falling grade of copper ore, has affected mining profitability sharply reducing investment. Lower terms of trade has also cut household incomes and reigned in private consumption. As a result, the Chilean economy expanded 2.3 percent in 2015 – below the 20-year average of 4.1 percent, but above the 0.3 percent contraction estimated for the LAC region.

3. **As a result of the economic growth rate slowdown, fiscal revenues increased less than anticipated and the overall and structural fiscal deficits increased.** Chile has historically maintained strong fiscal discipline with limited fiscal deficits. As a result, the central government gross debt reached a modest 17.5 percent of GDP in 2015 and, at the same time, the country maintains a part of past fiscal savings in its sovereign wealth funds and other liquid financial assets worth about 12.4 percent of GDP. The recent downturn has resulted in an overall fiscal deficit of around 2.2 percent of GDP in 2015.

4. **Fiscal consolidation plays an important part in the ongoing macro-fiscal rebalancing process.** As a first line of defense to absorb the external shock, the Central Bank maintained a fully flexible exchange rate and tightened monetary policy to contain inflation. The government has already announced spending cuts by over half a billion dollars or 0.25 percent of GDP in the budget for 2016. Moreover, anticipating a longer-lasting drop in copper prices and a slower GDP growth recovery, the government aims at gradually reducing the structural fiscal deficit by approximately 0.25 percent of GDP per year between 2016 and 2018, measured with structural parameters comparable year to year. Policy actions required to achieve this target focus on containing growth of public spending as a major revenue-enhancing tax reform was enacted in 2014.

5. **The objective of this chapter is to describe and assess the fiscal framework and the macroeconomic context within which the ongoing process of fiscal consolidation is taking place.** This, in turn, provides the context for the subsequent detailed analysis of selected sectors. Unlike the sector analysis, the macro-fiscal chapter does not contain any specific policy recommendations.

6. **The chapter is structured as follows:** Section 2 benchmarks the level of revenue and expenditure to that of relevant peers and discusses expenditure trends in Chile over the past decade-and-a-half dynamics, including the need for fiscal consolidation in the context of the structural balance rule. Section 3 analyzes the evolution of aggregate revenue and expenditure as well as the resulting fiscal balance and the accumulation of financial assets and liabilities. Section 4 examines sets Chile's fiscal adjustment in the context of some recent international experience with fiscal consolidation focusing on the recent experience in Mexico and Colombia. Section 5 discusses the degree of fiscal rigidity and Section 6 concludes.

Chile: Macro Fiscal Indicators, 2010-2016

	2010	2011	2012	2013	2014	2015	2016p
Central government, % of GDP							
Revenues	21.5	22.7	22.3	21.0	20.7	21.4	21.1
Tax revenues	14.2	15.5	16.1	15.7	15.6	16.8	17.7
Income tax (excluding private mining)	4.7	5.5	5.8	5.5	5.3	6.6	6.5
Value Added Tax	7.6	7.9	8.1	8.1	8.2	8.4	8.5
Other	1.9	2.1	2.2	2.0	2.1	1.7	2.5
Copper	4.4	4.2	3.1	2.1	1.9	1.3	0.1
Codelco	2.7	2.3	1.5	1.0	0.9	0.4	0.4
Private Mining	1.7	1.9	1.6	1.1	1.0	0.8	-0.3
Social security	1.3	1.3	1.4	1.4	1.4	1.4	1.4
Other	1.6	1.7	1.7	1.8	1.8	1.9	1.9
Expenditures	22.0	21.4	21.7	21.6	22.4	23.5	24.2
Wages and salaries	4.2	4.2	4.0	3.8	3.7	3.4	..
Goods and services	1.8	1.7	1.6	1.6	1.8	1.7	..
Interests	1.2	1.1	1.1	0.9	0.8	0.7	..
Subsidies and grants	5.5	5.6	5.3	5.0	4.8	4.5	..
Social security	5.4	5.3	5.1	4.7	4.5	4.1	..
Other	0.2	0.2	0.2	0.1	0.0	0.0	..
Capital expenditure	3.2	3.3	3.1	3.0	3.0	2.8	..
Fiscal balance	-0.5	1.3	0.6	-0.6	-1.6	-2.2	-3.1
Cyclically adjusted balance	-2.1	-1.0	-0.4	-0.5	-0.5	-1.6*	-1.7*
Gross debt	8.6	11.1	12.0	12.8	15.1	17.5	21.7
Net Financial Position	0.0	1.0	-0.4	-1.3	-2.2	-5.1	-10.0
GDP (annual average growth)	5.8	5.8	5.5	4.0	1.9	2.3	1.7
Copper price (USDc/Lb)	342	400	361	332	311	250	216
Exchange rate (CLP/USD, annual average)	510	483	487	495	570	654	674
Inflation (% , annual average)	1.5	3.3	3.0	1.8	4.7	4.3	4.0

*Cyclically adjusted balance excluding tax revenue in 2015 and 2016 from extraordinary capital repatriation tax as well as using revised structural parameters for the output gap and reference copper price

2. Revenue and expenditure trends

7. **This section presents the evolution of public revenue and expenditure in Chile and benchmarks it with relevant peers.** Peers include regional and structural peers, as well as OECD countries. Regional peers belong to the Pacific Alliance Bloc including Colombia, Mexico and Peru. Structural peers are countries with similar economic characteristics and includes Australia, Canada and Norway².

2.1 International comparisons

8. **The size of government in Chile is relatively small.** As measured by its revenue and spending levels as a share of GDP, the size of the public sector in Chile is significantly smaller when compared to that of its structural peers and the OECD member countries. The size of government in Chile is more in line to that of its regional peers.

9. **Chile has relatively low fiscal revenues compared to relevant peers.** At 23.5 percent of GDP, Chile's fiscal revenues are substantially lower than structural peers (37.4 percent) and OECD (40.6 percent), though similar to regional peers (Figures 1.1)³. Differences in fiscal revenues as a share of GDP between countries can be partly explained by different income levels as taxation, the main source of fiscal revenue, is generally found to be correlated to income per capita. Taking a broad definition of tax income (OECD database on taxes) that includes social security contributions and commodity related revenue by the public sector, such a relation is indeed observed. At the same time, significant deviations between the actual and the predicted level of taxation given the level of GDP per capita are also found (Figure 1.2). In this regard, Chile, as well as all its regional peers, collects significantly less tax revenue than predicted given its level per capita GDP.

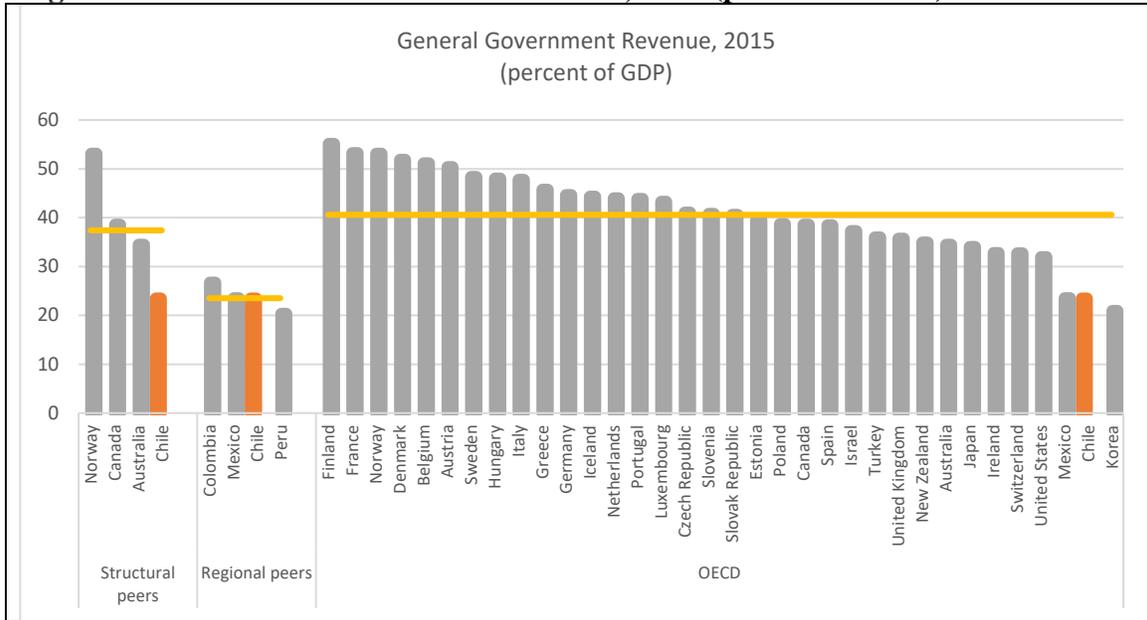
10. **Differences in the funding of social benefits should be taken into account when comparing government revenue and spending levels.** Funding of social benefits, the taxation of social benefits and the existence of tax benefits instead of explicit expenditure may have a non-negligible impact in international comparisons of revenue and spending levels. Chile has a mandatory, privately administrated and funded defined contribution pension system in contrast to the often publicly run pay-as-you-go pension system operated in many of the peers. Even though Chile is not the only country in which a significant of the contributions to the old-age income provision are kept outside of the government accounts, such differences in the delimitation of the general government sector should be taken into account, at least qualitatively, when making international comparisons⁴.

² Annex B of the main report describes the criteria for the selection of these structural peers.

³ For international peer comparisons the data source used is the OECD which has small differences with official data.

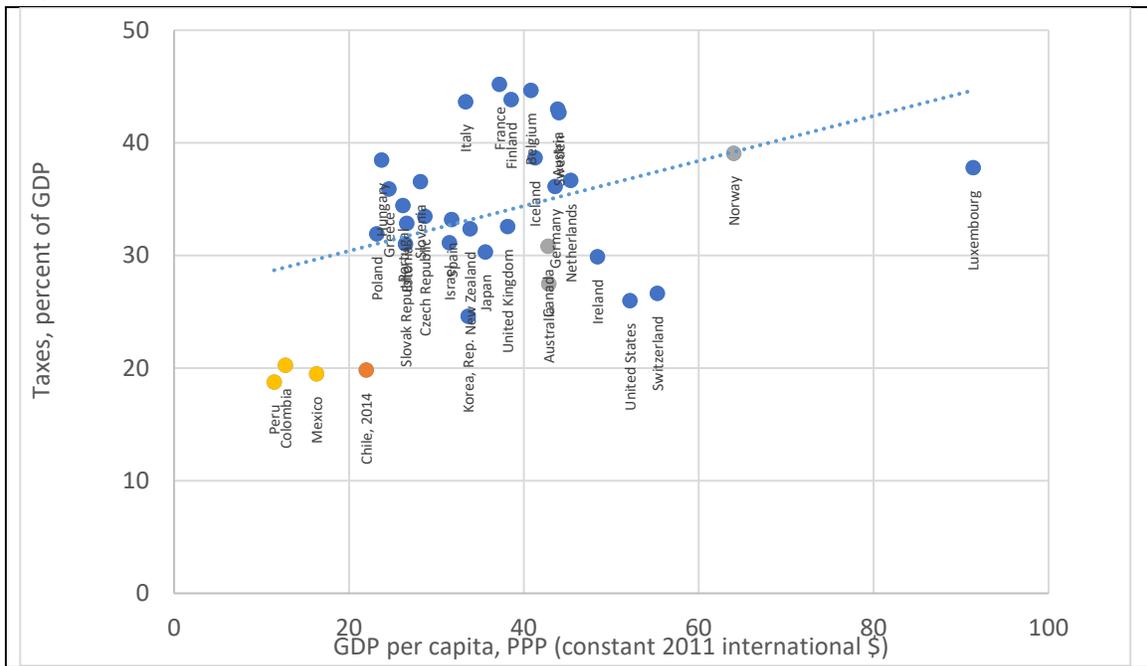
⁴ In OECD countries, pension funds are the main financing vehicle for private pension plans, representing about two-thirds of total private pension assets. The weighted average of pension funds' assets under management to GDP reached 84.4 percent in OECD countries at the end of 2014, with pension fund assets in Chile representing 68.3 percent of GDP. The average annual contribution in pension funds in Chile amounts to 5 percent of GDP compared to 2.0 percent on average in OECD countries. (OECD, 2015)

Figure 1.1. General Government Revenue, 2015 (percent of GDP)



Source: WEO Database, IMF

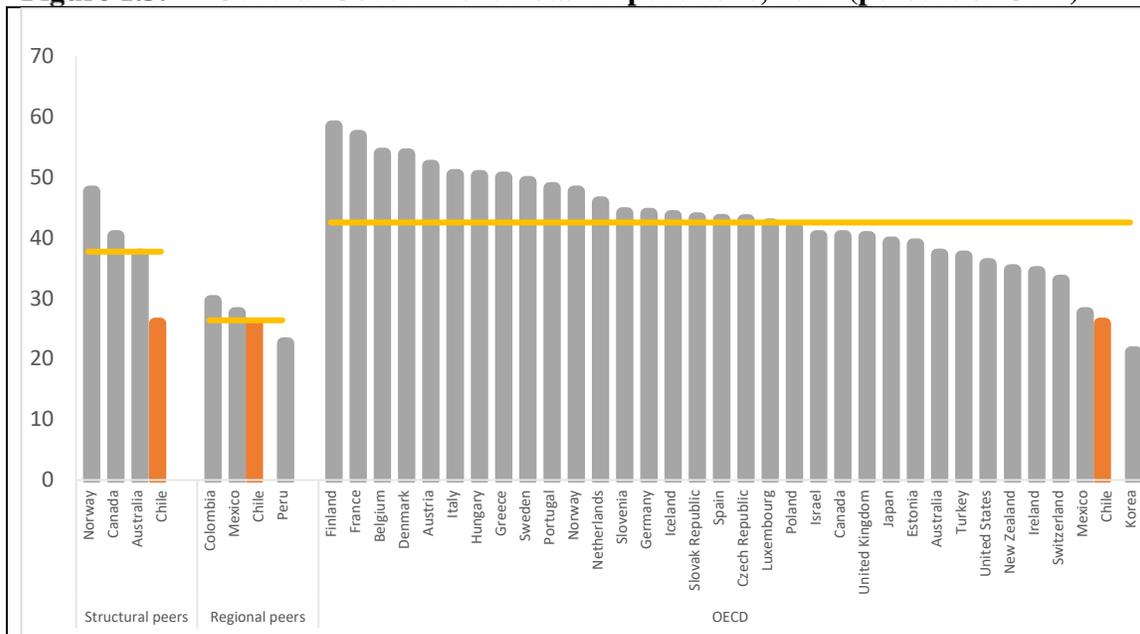
Figure 1.2. Tax revenue (percent of GDP) and per capita GDP (in thousands), 2014



Source: OECD and OECD-CIAT

11. Closely related to the overall level of revenue, spending in Chile as a share of GDP (at about 26% of GDP) is substantially lower than the average for OECD countries (43%) and its structural peers (38%) and more in line with its regional peers.

Figure 1.3. General Government Total Expenditure, 2015 (percent of GDP)



Source: WEO Database, IMF

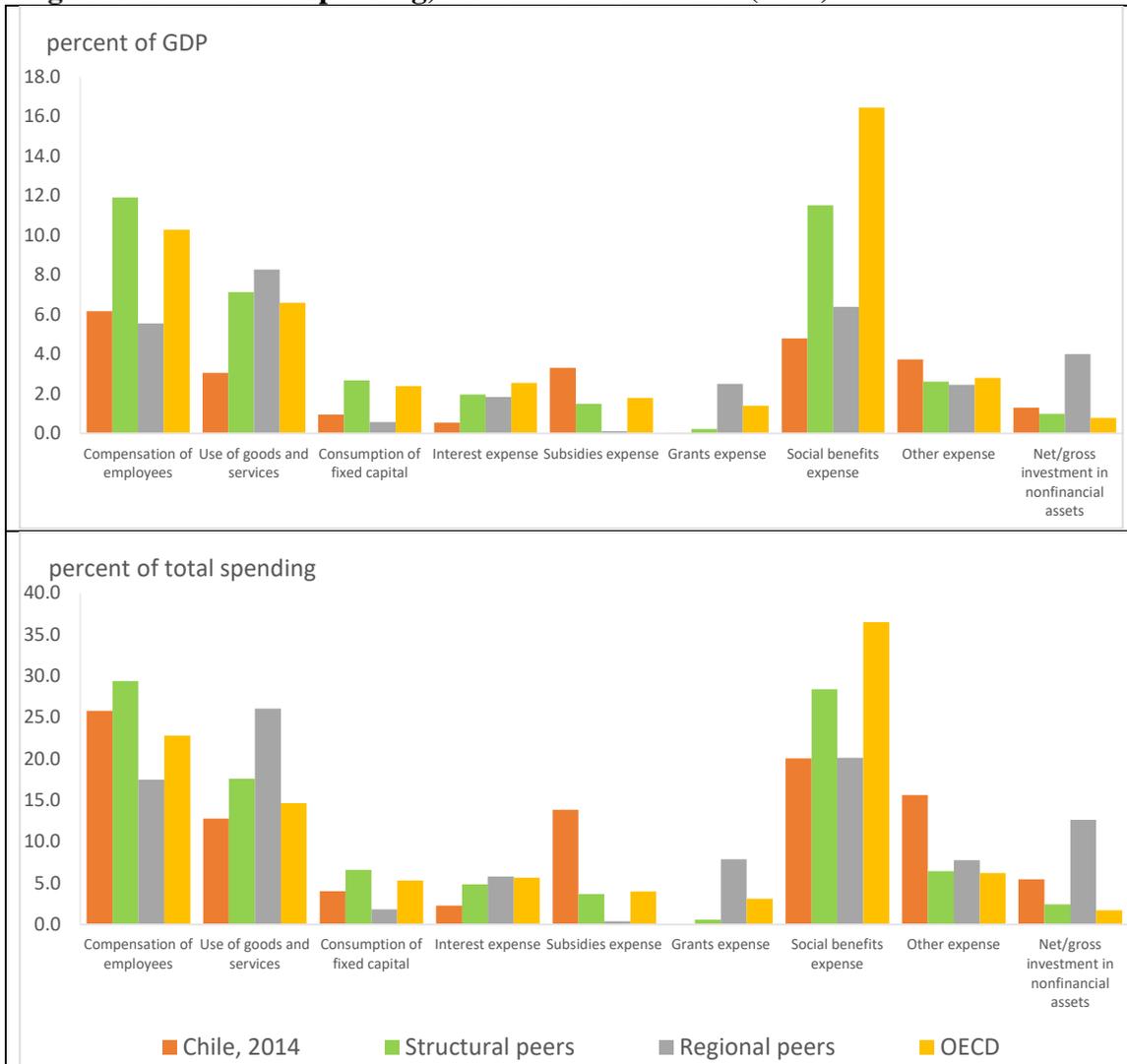
12. **International comparisons usually express categories of public expenditure, according to their economic or functional classification, and as a share of GDP or as a share of total spending.** Expressing categories of spending as a share of total spending is used to show the relative importance of spending in a sector or category of spending in view of the significant differences observed in the overall spending as a share of GDP. Grouping of spending for international comparisons is done by using the economic or functional classification of spending. The economic classification provides data on types of expenditures (e.g., salaries or goods and services), whereas the functional classification of spending groups government activities according to their broad objectives or purposes (e.g., Education, Social Security, Health etc.). It is important to note that how goods and services are delivered, i.e. by entities classified within or outside the general government sector, has significant implications for the comparability of spending categories in the economic classification though less so when comparing overall spending levels or categories of spending in the functional classification. This is particularly relevant in the case of Chile as a significant part of service delivery in the education and health sectors takes place through private providers financed by the public sector.

13. **Lower social benefit expenses explain a large part of Chile’s overall lower level of spending.** Social benefit payments in Chile are significantly below those on average in the OECD or the structural peers, both as a share of GDP and as a share of total spending (Figure 1.4). As a share of GDP, social benefits in Chile are also lower than those in regional peers.⁵ As mentioned before, Chile’s early transfer to a largely privately

⁵ Mexico is not included here among the regional peers as it does not report data to the Government Financial Statistics of the IMF.

administrated pension system explains part of the difference in social benefit expenses. The absence of or less generous other social benefits, such as unemployment insurance and family allowances, should also be noticed in this regard particularly when comparing spending with OECD countries and structural peers.

Figure 1.4. Public Spending, economic classification(2014)



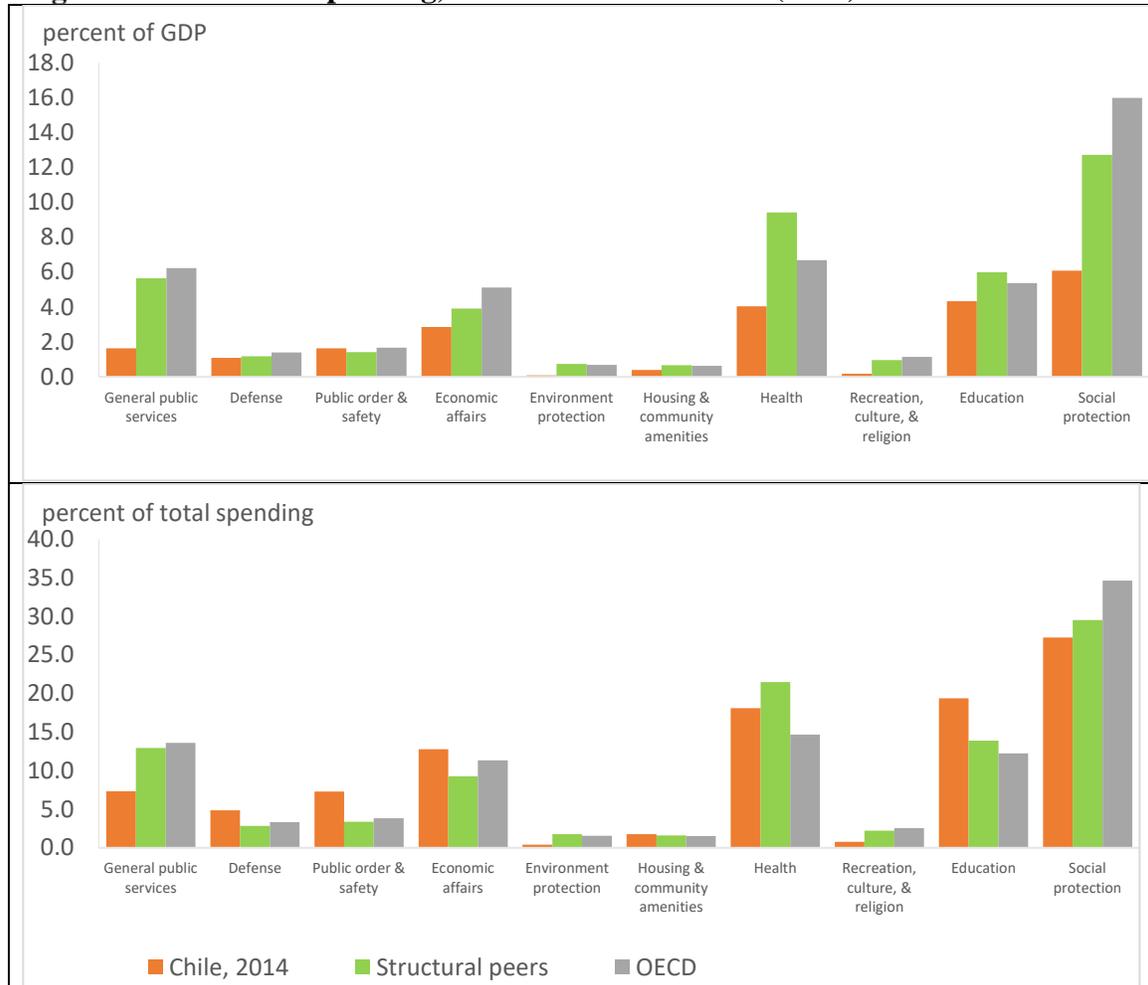
Source: Government Finance Statistics, IMF

14. In contrast, Chile’s higher spending on subsidies and grants is mainly related to the model of public service delivery in education and health. Practice in Chile to deliver large parts of education and health services through private providers paid for or subsidized by the public sector shows up in a significantly higher level of subsidies and grants compared to all peer groups and both as a share of GDP and as a share of total spending. This should in turn show up in relatively lower expenses on wages and salaries and use of goods and services. While that seems the case for the latter category, it is less clear in case of the former. While spending on wages and salaries represent a much lower share of GDP in Chile than in the OECD or structural peers, this is not the case when

compared to regional peers. More significantly, as a share of total spending wages and salaries are relatively high.

15. Public spending in Chile is further characterized by low interest payment and high public investment. A low level of public debt makes that Chile has to spend relatively less on interest payments compared to all peer groups, both as a share of GDP as well as of total spending.

Figure 1.5. Public Spending, functional classification(2014)



Source: Government Finance Statistics, IMF

16. The overall lower level of spending in Chile is reflected in almost all sectors though priorities for spending on education and health are revealed when looking at sectoral spending as a share of total public spending. Chile spends less on Education, Health and Social Protection as a share of GDP compared to the average of the OECD and its structural peers (Figure 1.5).⁶ In terms of share of total spending, Chile spends more on

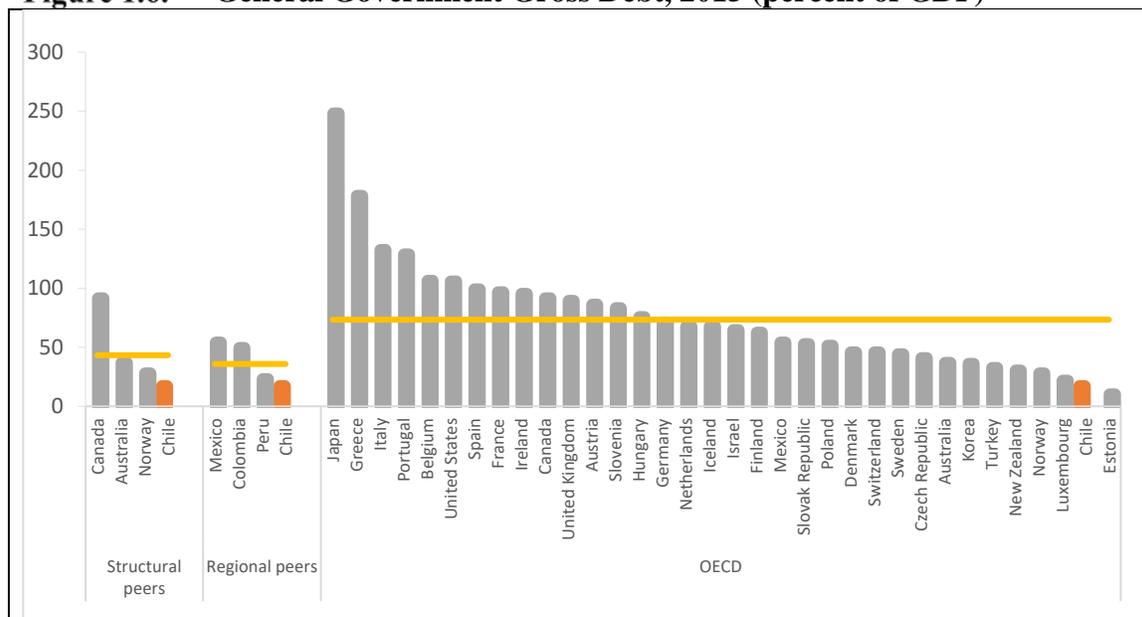
⁶ No consistent information on all categories of spending according to the functional classification is available for all regional peers, though additional information on education and health spending (see

Education and Health compared to its peers in the OECD which is largely compensated by a lower share of spending on social protection. The latter, as observed previously in the economic classification of spending, is lower in Chile as a share of GDP following the reform of the country's pension system and the absence of or less generous other social benefits, such as unemployment insurance and family allowances.

17. High investment levels in the transport sector explains the substantial share of spending on Economic Affairs in Chile. Economic affairs in the functional classification of spending encompasses several sectors. In the case of Chile, the major part of spending is oriented towards the transport sector.

18. Chile has a low level of public debt, one of the lowest among its peers. At a gross debt-to-GDP ratio of only 17 percent, Chile has one of the debt levels among OECD countries at an average of 73 percent. (Figure 1.6). Chile is also at the bottom of the distribution in terms of gross public debt among its structural and regional peers.

Figure 1.6. General Government Gross Debt, 2015 (percent of GDP)



Source: WEO Database, IMF

19. In addition, Chile has accumulated a significant amount of resources in its sovereign wealth funds. Financial assets available in sovereign wealth funds should also be taken into account in analyzing issues of access to credit markets and public debt sustainability. Whereas the concept of net debt takes the availability of these financial assets into account, it subtracts all financial assets from gross debt levels. Differences in valuation criteria and liquidity of the assets among countries make that the gross debt indicator the preferred one for international comparison. Nevertheless, as will be referred to in more detail in the next section, Chile publishes the amount of liquid financial assets

respective chapters) show a slightly higher spending in Chile on education and spending at the regional average on health.

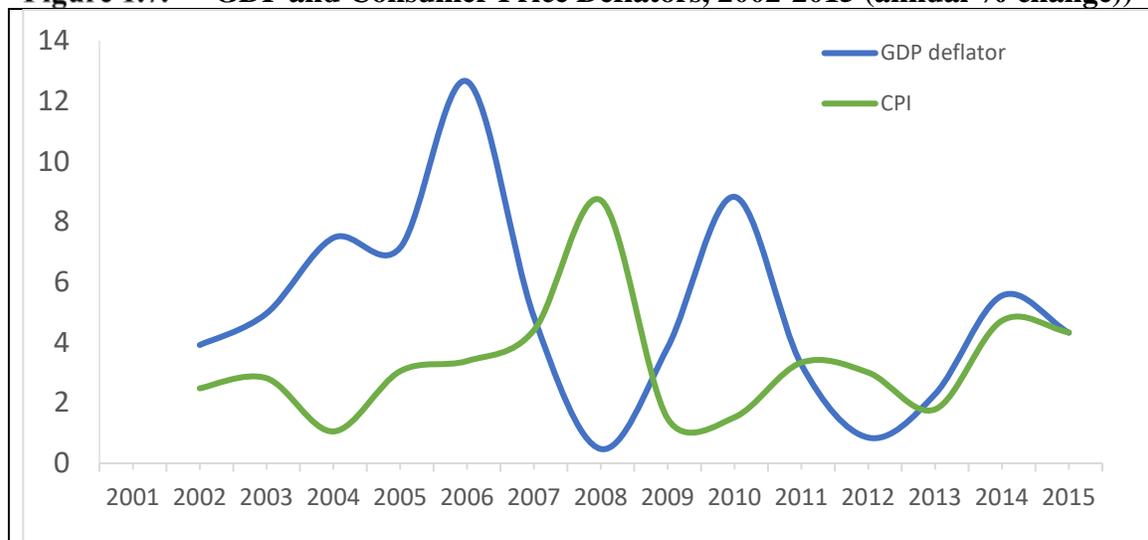
in its sovereign wealth funds and in hands of the national treasury department to an amount of 12.4 percent of GDP in 2015. The availability of these liquid financial assets further lessens any concerns about market access or debt sustainability.

2.2 Expenditure trends in Chile

20. **Public revenue and expenditure’s share of nominal GDP is the preferred indicator for time-series analyses and international comparisons.** For time-series analyses, the rate of spending growth in real terms is also often calculated using the consumer price index as the relevant price deflator. The difference in these two indicators is the relevant price deflator being used, i.e. the GDP deflator in case of the spending share of nominal GDP and the consumer price index in spending growth in real terms. In addition, change in spending’s share of nominal GDP weighs different categories of spending by their share in GDP whereas the growth of spending in real terms does not.

21. **In the case of Chile, significant differences between the GDP deflator and the consumer price index turn the expenditure’s share of nominal GDP in a less adequate indicator for time-series analyses.** The difference between the GDP deflator and consumer price index is often not very large and over the longer run the two tend to converge. In the case of Chile, there has been a significant difference between the GDP deflator and the consumer price index over the previous decade as a result of the significant increase in the copper price. In addition to significant differences in the annual rate of change between these two price deflators, there has been a significant difference in their average annual between 2002 and 2015 with consumer price inflation at 3.3 percent substantially lower than the GDP deflator at 5.0 percent between 2002 and 2015 (Figure 1.7).

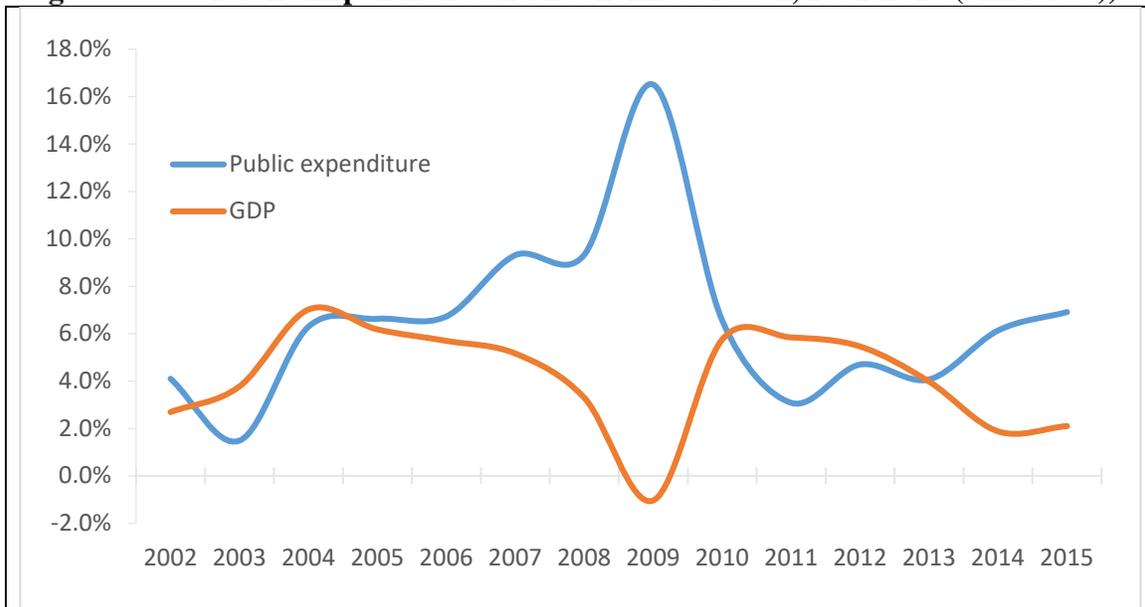
Figure 1.7. GDP and Consumer Price Deflators, 2002-2015 (annual % change)



Source: BCCh

22. As a result, high growth in public spending has not been fully reflected in an increase of spending as a share of GDP. From 2002-2015, the average annual growth of public expenditure, in real terms using the consumer price index, has been 6.5 percent, whereas the average annual growth of economic activity has been 4.1 percent (Figure 1.8). Over the same period, the expenditure's share of nominal GDP only increased from 21.4 to 23.4 percent, whereas an average annual increase of public spending by 6.5 percent in an economy that grows at an annual average rate of 4.1 percent would imply an increase of spending as a share of GDP from 21.4 to 29.4 percent over this 14-year period if the average consumer price index and the GDP deflator are the same.

Figure 1.8. Public Expenditure and Economic Growth, 2002-2015 (annual %)

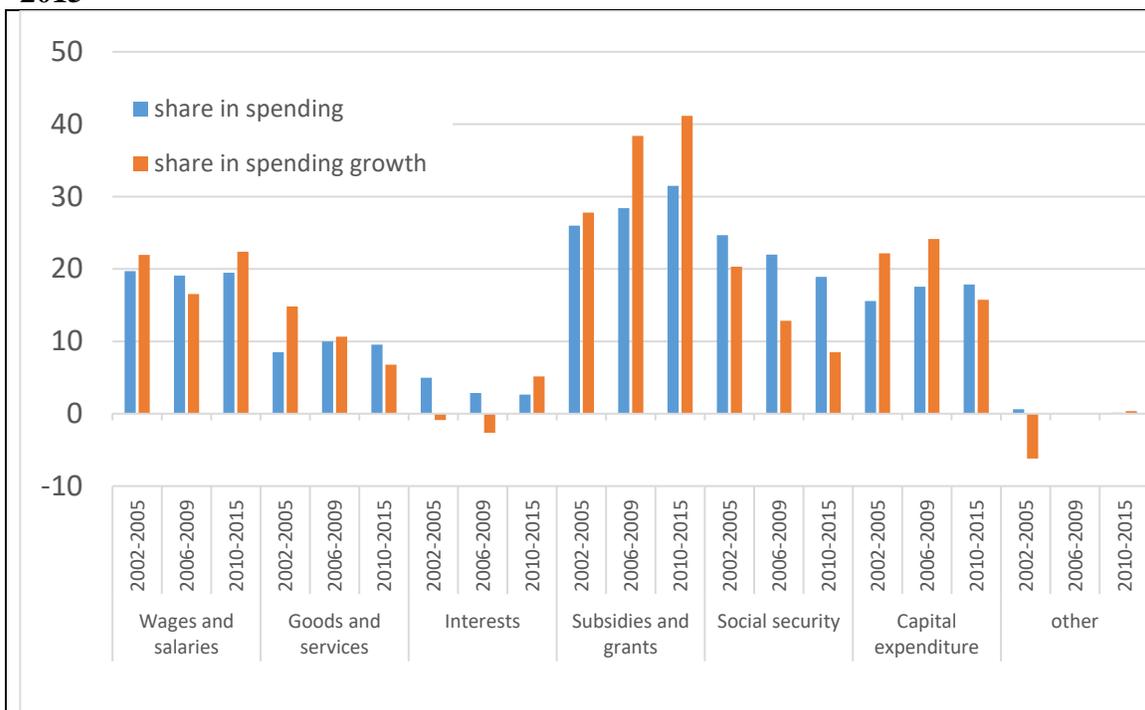


Source: DIPRES, BCCh

23. Spending growth in different categories or sector can be expressed in terms of their contribution to overall spending growth to reflect significant trends in public spending in Chile. In view of the substantial differences between the GDP deflator and the consumer price index, trends in the major categories of spending in Chile over the past decade-and-a-half are expressed in this section by combining spending growth in real terms making use of the consumer price index with the share in total spending to obtain the contribution to total spending growth of different categories of spending using the broad economic and functional classifications of spending. This type of analysis has the advantage of weighing spending growth in real terms of different categories of spending, using the consumer price index as the price deflator, with their share in total spending. As an example, spending on environmental protection increased by 8.6 percent in real terms between 2010 and 2014 whereas health spending increased by 7.1 percent over the same period. However, due to the difference in the share of spending on environmental protection and health (0.4 versus 17 percent) the share in total spending growth of environmental protection was about 0.6 percent versus that of health spending nearly 25 percent.

24. **There has been a strong tendency towards the outsourcing of the delivery of public services.** Applying this type of analysis to public spending data in Chile over the past decade-and-a-half reveals some interesting trends. In terms of the broad economic classification of spending, it shows that “subsidies and grants” absorbed about 40 percent of total spending growth between 2010 and 2015, driven by a strong tendency to outsource the delivery of public services (Figure 1.9). The above average growth in wages and salaries over the same period seems all the more remarkable in light of this trend towards the outsourcing in the delivery of public services that, as will be seen subsequently, took place mainly in the areas of education and health.

Figure 1.9. Central Government’s Expenditure, economic classification 2002-2015



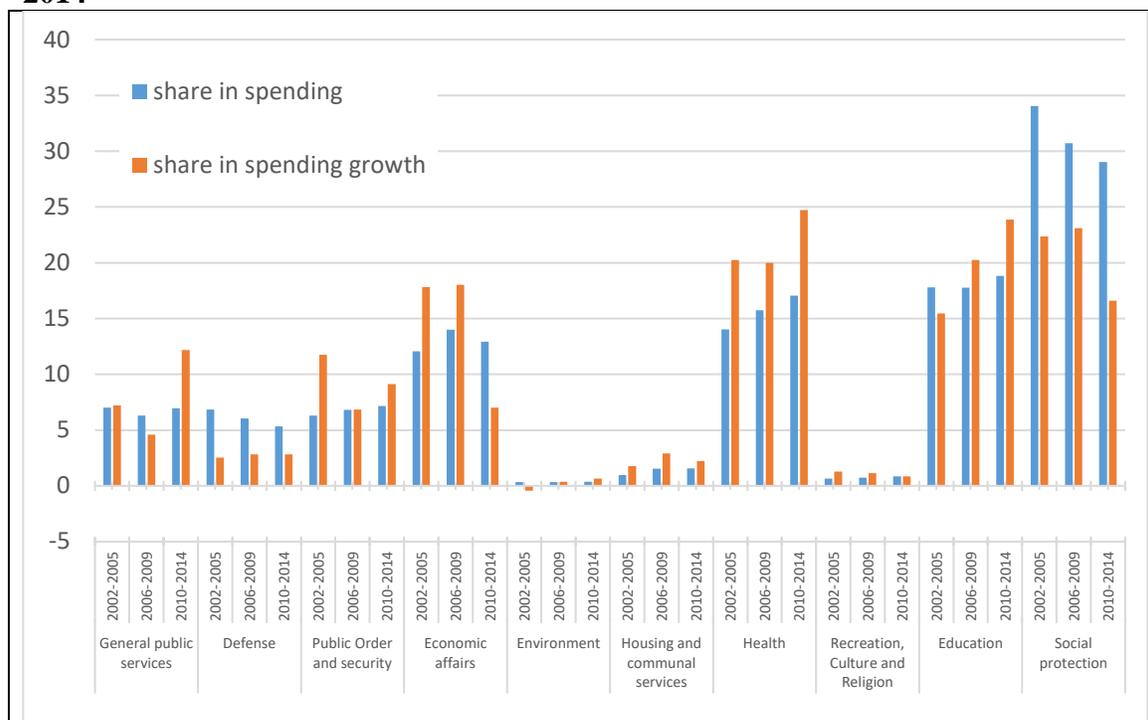
Source: DIPRES, BCCh

25. **Whereas social security is growing at a lower rate than overall public spending, its significant share still implies a substantial contribution to overall spending growth.** The introduction in the early eighties of a privately managed pension system in Chile is currently, after nearly two generations, gradually reducing the transition costs in moving from a publicly operated, defined benefit pension system to a privately administrated, defined contribution pension system. This gradual reduction of the transition cost is driving the more modest growth in social security spending compared to overall public spending, 2.3 versus 5.3 percent in real terms between 2010 and 2015. The significant share of social security spending in total spending implies that social security spending growth still contributed 8.5 percent of total spending growth.

26. Above-average growth in capital spending during the first decade of the century has been reverted more recently, though at almost a fifth of total spending Chile maintains a high level of public investment.

27. The health and education sectors are driving half of the overall spending growth. A similar analysis of trends in public spending according to its functional classification shows the importance of the above-average growth in health and education spending, with each sector representing almost a quarter of the total public spending growth (Figure 1.10). These above average increases in the growth of spending on health and education are facilitated by a more modest growth in spending on social protection which is driven by more modest growth in social security expenses due to a gradual reduction in the transition costs related to the reform of the pension system.

Figure 1.10. Central Government’s Expenditure, functional classification 2002-2014



Source: DIPRES, BCCCh

28. Other remarkable developments include the more modest growth in spending on economic affairs (i.e. transport infrastructure) between 2010 and 2014 after a strong expansion during the previous decade and the recent sharp growth in spending on general public services. This type of analysis can be used to identify the more relevant categories and sectors of spending that observed a rapid growth in spending. While there may be perfectly legitimate reasons for such spending growth, a more detailed review of the underlying driving elements of the growth in spending may focus the identification of areas where more significant cost savings can be obtained.

3. Fiscal dynamics

3.1 The Fiscal Rule

29. **Chile's fiscal policy is guided by a rule with a target for a structural or cyclically adjusted fiscal balance.** The fiscal framework is based on a structural or cyclically adjusted fiscal balance in place since 2001. The adoption of a fiscal responsibility law in 2006 further institutionalized the fiscal framework and created the main sovereign wealth funds. The basic idea of the fiscal rule is to adjust the fiscal balance by taking into account the effects of the business cycle and the volatility of copper prices on public revenue. The fiscal rule thus eases a fiscal policy stance neutral to the economic cycle and eventually facilitates the implementation of a counter-cyclical fiscal policy.

30. **The cyclically adjusted balance (CAB) is estimated by making adjustments to the fiscal balance on the revenue side only.** In its basic, general form the CAB can be expressed as:

$$CAB_t = B_t - TR_t * \left(1 - \left(\frac{Y_t^*}{Y_t} \right)^{\varepsilon_t} \right) - Q_t * (P_t - P_t^*)$$

where B_t is the actual fiscal balance; TR_t the actual (non-copper related) tax revenue; Y_t^* the trend level of GDP, Y_t the actual level of GDP and the division between the two a reflection of the output gap; ε_t the elasticity of tax revenue with respect to GDP; Q_t the quantity of copper sales; P_t the actual copper price and P_t^* the longer-term copper reference price.

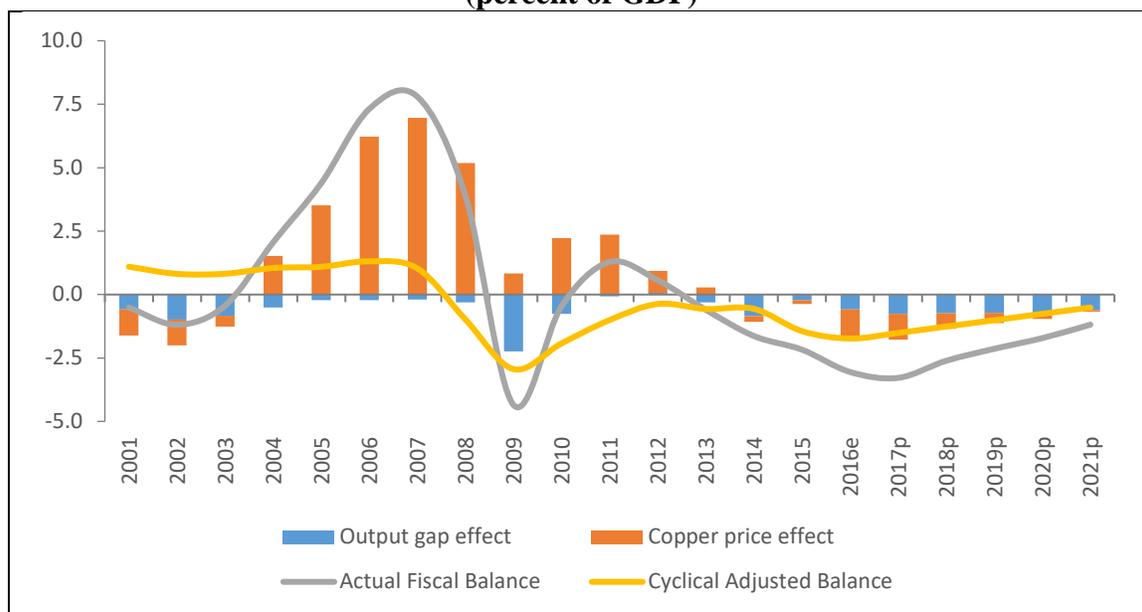
31. **The two critical longer-term variables to determine the structural balance are projected by external expert panels thereby enhancing credibility in the estimates.** The trend level of GDP, Y_t^* , and the longer-term copper reference price, P_t^* , are two critical variables to adjust the actual fiscal balance to the effects of the business cycle and the volatility of copper prices. The use of external expert panels to project, on an annual basis, values for these longer-term variables⁷ greatly enhances credibility in the measurement of the structural balance and in the fiscal policy framework more generally. Such projections remain challenging, nevertheless, as the recent significant adjustments to both the longer term copper reference price and GDP trend growth show.

32. **Cyclical adjustment to the fiscal balance in Chile led to significant adjustments for copper revenue.** The cyclical adjustment to the fiscal balance led to significant adjustments to copper revenue, in particular between 2004 and 2008 (Figure 1.11). While explicable from the sharp upward adjustment to the copper price during that period, the amount of the adjustment remains remarkable in view of the moderate share of copper revenue in the fiscal accounts in Chile. As discussed below, the opposite occurs with

⁷ Technically, experts on the Consultative Committee on Trend GDP give their estimates on growth of Total Factor Productivity, Gross Fixed Capital Formation and the Labor Force on the basis of which the Ministry of Finance generates trend growth estimates according to a methodology that is known by the experts. In the case of the Consultative Committee on the Copper Reference Price, the relation is more direct as experts give their estimate of the annual average copper price over a ten-year time horizon.

respect to the cyclical adjustment due to the impact of the economic cycle on tax revenue where the base, i.e. total tax revenue, represents a large share of total fiscal revenue though the adjustment factor, i.e. the output gap, tends to be small.

Figure 1.11. Fiscal Balance and Cyclical Adjustments, 2001-2021p
(percent of GDP)



33. **Remarkably, the cyclical adjustment to tax revenue has always been estimated to be negative with the only exception of 2012.** An ex-post re-estimate of the business cycle suggests this may be related to the estimated tendencies of hours worked and TFP in the production function through which the level of trend output is calculated. While the almost consistent negative value of this part of the cyclical adjustment could be adjusted by setting a more conservative target for the CAB, the issue may warrant more attention if the methodology fails to identify the business cycle position of the economy. Possible adjustments to the methodology may entail estimating the output gap for the non-mining economy as the impact on fiscal revenue of mining activity is incorporated through the adjustment for the copper price and complement measurement of the cyclical position of the economy with other variables such as unemployment and current account statistics (Vial, 2016).

34. **Adjustments to the copper reference price as well as the GDP trend growth are currently weighing down on the growth of public spending.** The exceptional commodity super-cycle, both in terms of historically high commodity price levels and its duration, seems to have led to some overestimation of the longer-term copper price.⁸ In

⁸ Forecasting longer-term commodity prices continues to pose a challenge to the economic profession in general. For example, in the World Bank's Commodity Markets Outlook maintained a copper price projection for 2016 within a range of 2.95-3.20 USDc/Lb between June 2011 and January 2015 which

addition, the cycle of high copper prices led to an investment boom between 2007 and 2013 that resulted in a more optimistic view of potential output or trend growth (Arellano, 2015). Thus, optimistic projections for the copper reference price and trend growth towards the end of the commodity super-cycle permitted an expansion of public spending that will need to be compensated in the future.

35. **The fiscal policy rule requires that the government commits to a level or trajectory for the CAB.** Between 2001 and 2007, a target of a surplus of 1 percent of GDP was established. This generated a substantial amount of fiscal savings during the initial stage of the commodity super-cycle (2005-2008) and led to the reduction of Chile's public debt as well as the accumulation of resources in its sovereign wealth funds. The current administration originally envisaged a gradual convergence to a structural balance of zero percent of GDP by 2018. However, this target was adjusted in September 2015 due to the economic slowdown. The government is now targeting a reduction of the structural deficit between 2016 and 2018 by about a quarter percentage point of GDP each year, "*measured with structural parameters comparable year to year*". This modified commitment thus envisages a reduction of the targeted CAB from a deficit of 1.6 percent of GDP in 2015 to a deficit of 0.8 percent of GDP by 2018 if the structural parameters (GDP trend growth and the copper reference price) remain unchanged. This conditioning of the reduction of the targeted CAB is all the more relevant at a time of significant adjustment in these parameters.

36. **The fiscal rule ultimately establishes a ceiling for public spending growth.** In the budget preparation process, the government estimates values of the projected fiscal revenue (taxes, social insurance, copper sales and other sources of revenue), the projected levels of GDP, copper prices, exchange rates, imports, among other variables, for the next budget year. In combination with the longer term copper reference price and the trend level of GDP obtained from the external panels and the target CAB, these variables determine the maximum level of government expenditures that can be included in the budget.

3.2 Medium Term Projections

37. **Medium-term fiscal projections prepared for this PER shed important light on the evolution of future public spending growth.** World Bank staff projections prepared in the context of this PER are based on the following assumptions. First, economic growth projections for the 2016-2021 period are drawn from the October 2016 IMF WEO. Second, copper price projections follow the October 2016 World Bank Commodity Market Outlook (CMO) (Table 1.2). The projections also take into account the latest available fiscal information of 2016 and the budget for 2017.

Table 1.2 Main Assumptions for GDP growth and Copper price

stands in stark contrast to the current, actual observation of 2.14 USDc/Lb as published in the CMO of October 2016.

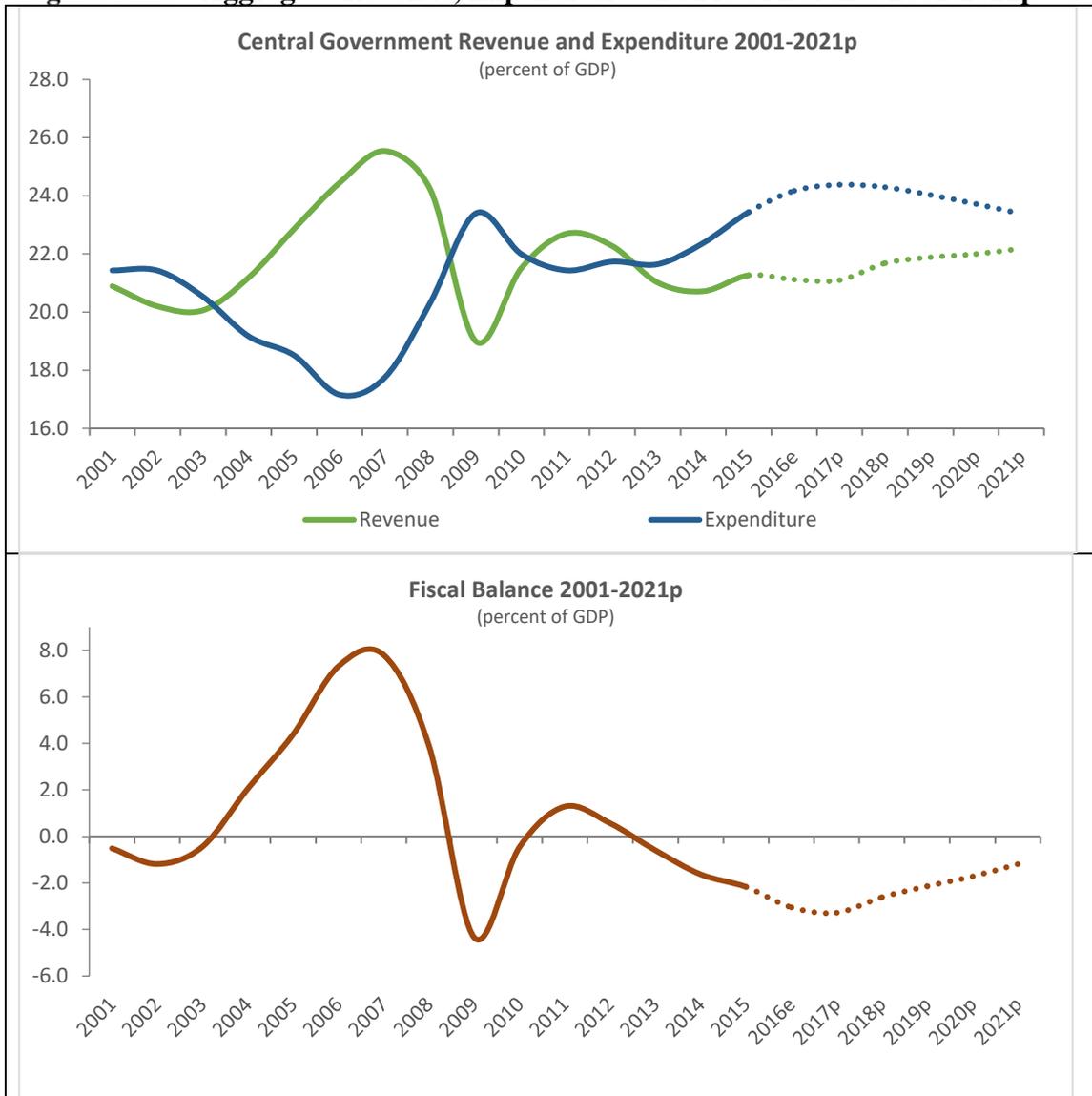
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Average
GDP (percent annual growth)	1.7	2.0	2.7	3.0	3.2	3.4	n.a.	n.a.	n.a.	n.a.	2.9 (2017-2021)
Copper price (USDc/Lb constant US dollar 2016)	213	219	225	232	239	246	253	260	267	274	243 (2016-2025)

Source: IMF WEO April 2016, WBG CMO April 2016

38. **The underlying trend growth and long-term copper price assumptions can be explained as follows.** Both variables have been adjusted downwards in recent years. In the case of trend growth, the external panel reduced its value from 4.2 percent in August 2014 to 3.6 percent in August 2015 and 3.0 percent in June 2016. The latter adjustment to about 3.0 percent, the average of the IMF WEO projection for 2017-2021, seems realistic. The copper reference price was re-estimated in February 2016 by the external expert panel to 257 USDc/Lb from 307 USDc/Lb in August 2014 and 298 USDc/Lb in August 2015. The most recent estimate of the copper reference price by the external expert panel at 256 USDc/Lb confirmed the earlier adjustment made last February and though slightly above the WB CMO copper price trajectory appears to be a reasonable assumption.

39. **Tax reform, enacted in 2014, aims at raising public revenue to finance additional public spending in the areas of education, public health and social protection as well as for fiscal consolidation.** A comprehensive tax reform was passed in September 2014 and is aimed at raising tax revenue by 3 percent of GDP. The tax policy measures, including an increase in the corporate income tax rate and the elimination of a retained earnings tax exemption, are being implemented gradually and will be fully in place by 2018. The fiscal projections assume that the planned increase of tax revenue by 3 percent of GDP fully materializes by 2018. Finally, it is assumed that the current government will continue to observe the fiscal target of reducing the structural deficit by a quarter of a percent per year until 2018 and that the next government will continue this process of fiscal consolidation.

Figure 1.12. Aggregate Revenue, Expenditure and Fiscal Balance 2001-2021p



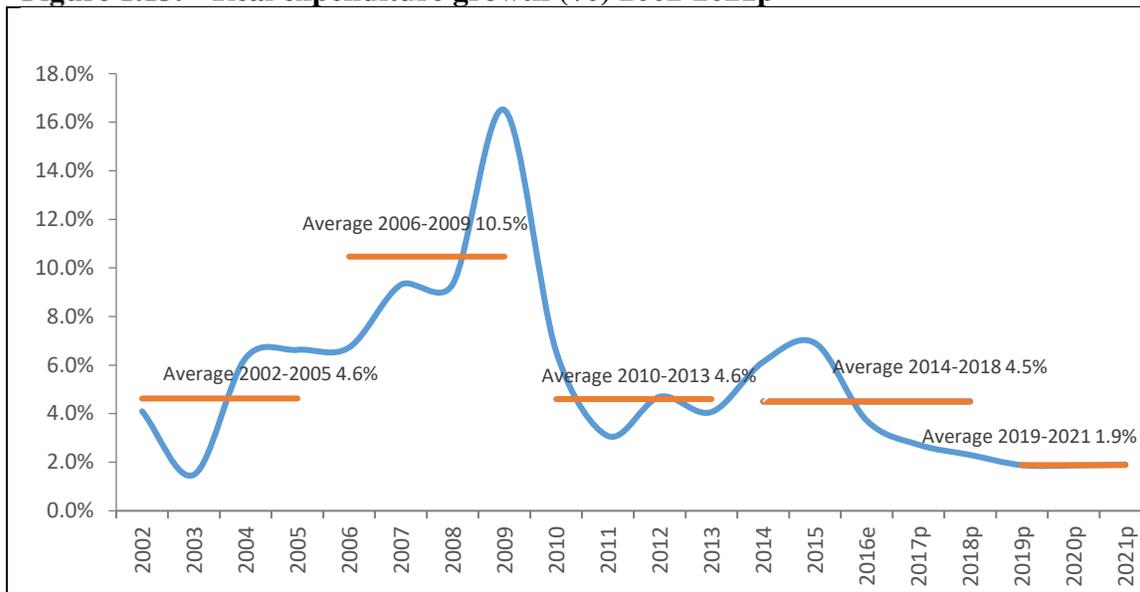
Source: World Bank Staff Estimates and Projections

40. **The fiscal projections show steady increase of fiscal revenue supporting an expansion of public expenditure and a gradual reduction of the fiscal deficit.** On the basis of these assumptions, revenue is projected to grow to about 22 percent of GDP by 2021 allowing for an increase in public expenditure that would peak by 2017 at 24.4 percent of GDP (Figure 1.12). Afterwards, the additional fiscal consolidation and a more modest growth in fiscal revenue as the tax reform should be fully in place by 2018 reduces the space for expenditure growth leading to a slight reduction in the spending-to-GDP ratio to 23.4 percent by 2021. The effective fiscal deficit is projected to peak at 3.3 percent of GDP in 2017 and gradually reduce to 1.2 percent of GDP by 2021.

41. **About one third of the additional revenues from the 2014 tax reform would be needed to compensate for lower copper revenue.** Our projections indicate that the 2014 tax reform will enable a continued real growth of spending of 4.5 percent per year between 2014 and 2018 (Figure 1.13). At a rate of expansion similar to the one observed between 2010 and 2013 (4.6 percent per year), it might prove challenging to allocate all the proceeds from the 2014 to new spending programs. Furthermore, instead of employing additional tax revenue for fiscal consolidation about a third of the additional tax revenue will be needed to compensate the projected structural fall in copper-related fiscal revenue.

42. **A significant reduction in the annual growth of spending is projected for the 2019-21 period.** As the tax reform is fully in place by 2018, it is assumed that tax revenue will increase in line with output growth, unless additional policy measures on the revenue side are taken. In addition, the projections include some additional fiscal consolidation to gradually reduce the structural deficit. This results in a rather tight scenario for the expansion of public expenditure to just 1.9 percent per year in 2019-21 compared to increases of 4.5 percent over the previous decade. Even though financing of part of the current fiscal deficits by drawing on the accumulated financial assets in the sovereign wealth funds is being considered by authorities, the fiscal projections include an assumption that deficit financing continues to take place through public debt as has been the practice thus far.

Figure 1.13. Real expenditure growth (%) 2002-2021p



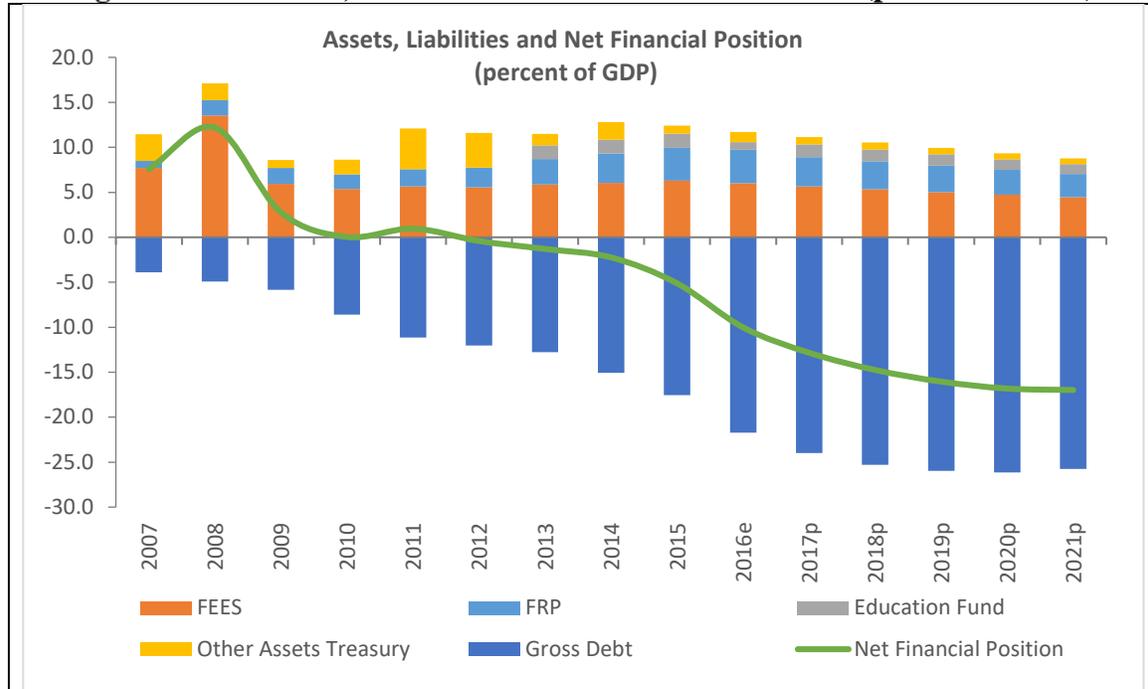
Source: DIPRES, BCCh

3.3 Public Debt Sustainability

43. **Although Chile’s net financial position remains sustainable, it has changed from being a net creditor to becoming a net debtor.** Chile used the resources from the fiscal surpluses attained between 2004 and 2012 to pay off public debt and accumulate

resources in its sovereign wealth funds. The fiscal stimulus in 2009 was largely financed by drawing down wealth funds, whereas recent fiscal deficits have been financed by contracting gross public debt, which gradually increased from 3.9 percent of GDP in 2007 to 17.5 percent in 2015. Meanwhile, the sum of sovereign wealth funds and other liquid financial assets of the treasury remained relatively stable at around 12 percent of GDP over the past few years (Figure 1.14). As a result, the net financial position⁹ of the central government changed from a position of net creditor achieved in 2006-11 to a position of net debtor since 2012.

Figure 1.14. Assets, Liabilities and Net financial Position (percent of GDP)



Source: World Bank staff estimates

44. **Public debt is sustainable over the medium term.** The gradual reduction in the structural deficit target in the coming years would lead to a modest increase in the gross public debt-to-GDP ratio which would peak at 26.1 percent of GDP by 2020. A further reduction of the CAB target would put the debt-to-GDP again on a modest downward path. Chile's public debt can thus remain well below the previously mentioned threshold and debt sustainability is not a concern, particularly in the presence of significant resources in the sovereign wealth funds.

⁹ The Net Financial Position of the central government is published in the annual Public Finance Report of the Ministry of Finance and includes only the more liquid financial assets of the Treasury (FEES, FRP, Other assets of the Public Treasury and the Education Fund). It differs from the Net Financial Liability or Net Debt published in the *Informe de Estadísticas de la Deuda Pública* that also incorporates other categories of financial assets in accordance with IMF guidelines.

4. Fiscal Rigidities

45. **An important challenge for fiscal management in Chile is the degree of budget rigidity.** Mandatory expenditure items and pre-defined allocation of government revenues pose considerable obstacles to policy makers to exert better control over their expenditure levels and composition. Legal obligations generating inertial expenditure dynamics and constraints on the allocation of government resources limit fiscal consolidation strategies. This leads to an undesirable situation where the focus is diverted towards the expenditure items that can be cut as opposed to those that should be cut because they are not aligned with government priorities or are simply inefficient.

46. **Budget rigidity arises both from the spending and revenue sides.** Expenditure rigidities may stem from different features of the regulatory regime and involve various legal, contractual and institutional obligations in the public sector. Expenditures that include institutional or contractual obligations of the government include interest payments, the civil service payroll, entitlements such as social security benefits. The definition of mandatory expenditures is not obvious since some expenditures may be non-discretionary in the short run but closer to discretionary in the medium or long run. This is the case of policy commitments such as social assistance benefits, tax expenditures and subsidy programs, many of which may be flexible in principle but not in practice, especially in the short term.

47. **On the revenue side, earmarking mechanisms are used to guarantee funding of specific sectors or types of expenditures generate rigidities.** The rationale for revenue earmarking relies on the need of predictable funding for priority spending and to protect it from discretion or short-sightedness in providing essential or priority goods with long term positive impacts. To the extent these “protected” expenditures are also those of high quality that meet the collective welfare of the society, the budget rigidities may actually enhance allocative efficiency. However, the problem with earmarking revenues is not necessarily that those protected parts of the budget are always inefficient in terms allocation but that it removes those portions of the budget from the overall allocative decision-making.

48. **While some budgetary inertia may be desirable, the excess of budget rigidity and its related costs for fiscal management outweighs their benefits.** Inflexible expenditures can isolate some spending categories from short-term budget fluctuations or discretionary policy actions. However, extensive expenditure rigidities limit the scope of fiscal policy, increase the complexity of the budget process and prevent the comprehensive realignment of budget priorities.

49. **A comprehensive understanding of their origins and justifications and an accurate measurement of the different types of rigidities is critical.** Classifying budgetary expenditures according to their legal and institutional origin can help to identify priority policy actions to contain spending and reduce budgetary inertia. Policymakers must be appraised of the scope and impact of expenditure rigidities in order to keep certain types of spending under control and discourage the adoption of legislation that may generate more inflexible commitments.

50. **Chile has a moderate level of budget rigidity compared to regional peers.** Comparing the degree of budget rigidity across countries is not a straightforward exercise. There is no commonly accepted methodology, and the sources of rigidity, or what constitutes rigidity, are ill defined in the literatures. In spite of the methodological pitfalls, however, available information suggests that budget rigidity is high among middle-income Latin American countries with a high degree of fiscal decentralization. Using 2003 budget information and a common definition of rigidity, Alier (2007) showed that mandatory spending in Chile corresponded to around two thirds of the non-financial expenditures, which is much lower than Brazil, Argentina and Ecuador. Nonetheless, a study by DIPRES identifies 76.2 percent of the same 2003 budget of the central government as rigid expenditures.¹⁰

Table 1.1. Rigid Portion of Total Non-Financial Expenditures of Central Government

Country and year	Rigid Spending (%)	Source
Argentina (2003)	85	World Bank, 2003
Brazil (2004)	89	World Bank, 2007
Bulgaria (2011)	80	World Bank, 2016
Chile (2003)	76	Crispi and others, 2004
Chile (2003)	68	Alier, 2007
Colombia (2000)	84	Lozano, 2000
Ecuador (2003)	79	Alier 2007
Mexico (2015)	82	World Bank, 2016
Moldova (2011)	86	World Bank, 2016
United States	80	Office of Management and Budget, 2000

Source:

51. **Relatively lower budget rigidity relates to the prohibition to earmark revenues and the lack of revenue-sharing mechanisms with lower levels of governments.** One exception to the revenue earmarking ban is the allocation of 10 percent of CODELCO's copper revenues to the armed forces. In addition, the accumulation rule of the Copper Stabilization Fund (excess copper proceeds due to prices higher than long term copper price) can be interpreted as a revenue earmarking mechanisms. However, their contingent nature and the free allocation of disbursed funds when prices are lower suggest that proceeds from copper are not considered as earmarked revenues. Finally, while the additional tax revenues to be generated by the tax reform are expected to finance permanent spending in education, health and social protection, this is more a policy commitment rather than a formal earmarking mechanism.

52. **Rigidities generated by mandatory spending are stronger but still moderate.** The Chilean legislation requires the budget to include: all obligations set out by law, like pensions, wages of civil servants with tenure, and subsidies; all contractual obligations, like debt service and payments to contractors of public investment projects; and other operating expenses (Alier, 2007). The Chilean pension system (an important driver of

¹⁰Crispi et al (2007). The differences between these estimations is that Alier (2007) considers that 100 percent of capital and goods and services are discretionary, while Crispi and others assumed that 75 percent of capital spending and 30 percent of goods and services were rigid at least in 2003 due to contractual obligations.

expenditure rigidities in other countries) was reformed in the nineties from a defined benefit to a defined contributions scheme. In this direction, the pressures exerted by social security benefits over government spending has been subdued. However, wages and salaries of the civil service and subsidies to private sector have increased substantially and introduced more rigidity to the budget.

53. Broadening the range of expenditures that can be contained or reduced would increase the efficiency of fiscal consolidations efforts. Alleviating expenditure rigidity will require policy actions and reforms to legal and contractual obligations that are beyond the scope of the annual budget process. Curbing long-term trends in mandatory spending, will require policy actions beyond the scope of the annual budget process by the use of more detailed projections for future spending. This could both promote a more efficient distribution of resources between sectors and programs, and incentivize greater technical efficiency in the use of resources within sectors and programs.

5. Fiscal Adjustment in Chile and other countries

54. This section reviews the recent fiscal adjustment in Chile and other Latin American countries, namely Colombia and Mexico. Chile has already initiated measures to support the adjustment. They consisted of tax measures in the 2014 reform amounting to 3 percent of GDP. On the expenditure side, an initial adjustment consisted of a reduction of 0.25 percent of GDP on the approved budget for 2016 targeting mainly recurrent spending (about $\frac{3}{4}$ of the cuts), though some capital spending was also reduced. In Colombia, expenditure reductions are achieved through a hiring freeze, reduced transfers and investments. In Mexico, spending adjustments tend to be tilted towards the reduction of capital expenditure in view of rigidities in much of the recurrent expenditure.

5.1 Fiscal adjustment in Chile

55. Fiscal adjustment in Chile is taking place through multiple channels. The Ministry of Finance announced a fiscal adjustment early this year following a further slump in copper prices during the second half of 2015 and early 2016. The adjustment consisted of a reduction of public expenditure of CLP380 billion, equivalent to US\$540 million or 0.25 percent of GDP, on the budget for 2016. The decision to reduce public spending was consistent in order to keep the expected CAB at its target value. Adjustments to the macroeconomic framework for 2016, including a reduction in the projected growth rate from 2.75 to 2.0 percent and copper price from 250 to 215 US\$/Lb, as well as to the longer-term copper price projections, from 298 to 257 US\$/Lb, would have led to a CAB of 1.4-1.6 percent of GDP. The target value for the CAB had been adjusted previously in the 2016 budget preparation process from a gradual convergence to a structural balance equivalent to 0 percent of GDP by 2018 to the current target of “a reduction of the structural deficit between 2016 and 2018 by about a quarter percentage point of GDP each year, measured with structural parameters comparable year to year”, setting out a more gradual path of fiscal consolidation to accommodate the sharp contraction of economic activity.

56. **The announced expenditure cuts in Chile have been modest thus far.** Fiscal discipline, a strong fiscal policy framework as well and a low level of public debt allow for a relatively modest fiscal adjustment in response to the recent shocks to the economy and its public finances through a sharp decline in copper prices and the related deceleration in economic growth. Earlier revenue projections show a rather tight scenario for the expansion of public expenditure. In particular for the period between 2019 and 2021, that, despite the expected additional revenues to be generated by the 2014 tax reform, proves challenging to commit to new spending programs in education, health and social protection unless additional fiscal space is created through rationalization of expenditure within the existing budget envelope.

57. **Governments routinely impose less well targeted measures to create fiscal space.** These may include a combination of the following: (a) requiring across the board cuts to all agency budgets to achieve aggregate cuts; (b) changes to key indexes that effect spending, for example freezing salaries or benefit payments at nominal levels; (c) the requirement for departments to find “efficiency dividends”, typically through small cuts in ministries administrative budgets (these are routinely around 1-2 percent per annum); (d) the imposition of “sunset clauses” that set a time limit for particular programs or legislation; or (e) “pay-as-you go” rules that require offsets to be made for increasing costs of existing or introducing new programs. After the recent global financial crisis many countries also cut investment spending, despite the potential long-term damage to the economy.

58. **While non-targeted cuts may be necessary to create fiscal space in the short term, they are likely to impact services and may not address structural fiscal problems.** Many countries have used such measures, like cutting or freezing public sector pay or investments, to reduce fiscal deficits. Across the board cuts and freezes that affect programs and services in an undifferentiated way have significant perverse effects (Bourgon, 2009).

5.2 Fiscal adjustment in Colombia 2014-2016

59. **In Colombia, oil-related central government fiscal revenues fell by 2.1 percent of GDP between 2013 and 2015 and are expected to fall by another 1.1 percent of GDP in 2016.** While the Colombian authorities have taken a number of measures and reforms to contain the deficit so far, additional expenditure pressures are coming to the fore. Interest payments on debt increased from 2.2 percent of GDP in 2013 to 2.6 percent in 2015 and are projected to reach 3.0 percent in 2016). At the same time, there is not much space for drastic reductions in investments over the medium term without harming growth prospects. The conclusion of the Peace Agreement will also imply additional public spending, including on rural development. Thus, while the fiscal consolidation path mandated by the Fiscal Rule requires a deficit reduction of 2.6 percent of GDP between 2016 and 2022 (or going from 2.2 percent of GDP in 2015 to 1 percent by 2022 in structural terms), the extra pressures require the creation of even more fiscal space. In order to achieve this, the authorities are implementing expenditure controls, tax policy and administration reforms, and the prudent management of fiscal risks stemming from contingent liabilities.

60. **The reforms taken thus far included a tax reform in 2014.** The reform raised surtaxes on the corporate income tax and extended a number of temporary taxes, thereby raising non-oil revenues by an estimated 0.6 percent of GDP in 2015. The law also established an expert commission to study further tax reform options, including to reduce evasion and make the tax system more equitable and efficient. On the expenditure side, the Government reduced the budget envelope by COP6.2 trillion (a 0.8 percent of GDP reduction vis-à-vis the approved budget) in 2014. Similar budget cuts were implemented in 2015, reaching COP9 trillion (1.1 percent of GDP). These measures have helped to contain the deficit of the Central Government at 3 percent of GDP (2.2 percent in structural terms) in 2015. Much of this reduction came from capital expenditures, which fell by 0.5 percent of GDP between 2013 and 2015.

61. **Additional mechanisms provided the Ministry of Finance with flexibility in adjusting the budget in response to economic developments.** The authorities included in the 2016 budget a COP1 trillion set aside as a “fiscal rule guarantee” as well as a reserve of 1 percent of the total budget of each institution (equivalent to COP1.8 trillion) to cover a potential shortfall in revenues. The first set of adjustments came in February 2016, with the issuance of Presidential Directive No. 1 of 2016, which sets a target of 10 percent savings in recurrent spending (*gastos de funcionamiento*) compared to the 2016 budget envelope approved by Congress in November 2015. It was followed by Decree No. 378 of 2016, issued in March, which announced a cut of COP6 trillion (0.7 percent of GDP) in the aggregate budget envelope and stipulates the specific savings to be achieved by each institution.

62. **Expenditure reductions will be achieved through a hiring freeze, reduced transfers and investments, among others.** The would be achieved as follows: (i) COP660 billion in personnel costs through a hiring freeze and the reduction of indirect personal services by 5 percent; (ii) COP149 billion in expenses for purchase of goods and services (equivalent to 5 percent); (iii) COP1.7 trillion in transfers that are not part of the general participation system or allocated to universities, pensions and reconciliations (equivalent to 10 percent of such transfers); and (iv) COP3 trillion in investment, focusing on non-priority projects and maintaining the coverage of social programs. With these expenditure reductions, the Government expects to comply with the fiscal rule deficit target of 3.6 percent of GDP in 2016.

5.3 Fiscal adjustment in Mexico 2015-2017

63. **In response to a sharp drop in oil prices during the last few months of 2014, the Mexican Ministry of Finance announced by the end of January 2015 a “preventive” adjustment of MXN124.3 billion or 0.7 percent of GDP to the public sector spending in the budget for 2015.** In addition, the Ministry announced a thorough review of public spending in the process of the budget preparation for 2016 aimed at a further reduction of public expenditure. As a result, the budget proposed for 2016 contained an additional reduction of public spending (compared, at the time, to the estimated outcome

for 2015) to an amount of MXN133.8 billion. Finally, in February 2016 –following a further slump in oil prices early 2016– the Ministry announced another round of budget cuts to an amount of MXN132.3 billion, of which the major part –MXN100 billion– will have to take place by the state owned oil company PEMEX.

64. Oil revenue make up a significant part of Mexico’s public finances¹¹, about a third of total public sector revenue between 2010 and 2014. The oil price collapse brought this down by about MXN380 billion (2.1 percent of GDP) to less than a fifth of total public sector revenue in 2015. The immediate impact of this oil price shock on the fiscal accounts has been mitigated by an annually contracted oil price hedge (with resources from a modest oil stabilization fund) and a domestic fuel-pricing policy consisting of a fixed retail price (and a variable excise tax). Proceeds from the oil price hedge in 2015 amounted to some MXN100 billion (0.6 percent of GDP), whereas the excise tax on gasoline and diesel increased by MXN230 billion (1.3 percent of GDP) thereby making up the bulk of the revenue shortfall due to oil price collapse in 2015.

65. The expenditure adjustments early 2015 were thus motivated by an incomplete compensation of oil revenue loss by the price hedge and the higher excise tax, as well as a need to initiate the expenditure adjustment in view of longer-lasting lower oil prices. In particular, the oil price hedge is contracted for the period of one year and a new hedge is contracted under the new market conditions of lower oil prices. In effect, the strike price of the hedge for the 2015 budget was US\$76 per barrel whereas the hedge for 2016 was contracted mid-2015 at a strike price of US\$49 per barrel.

66. Expenditure adjustments tend to be tilted towards the reduction of capital expenditure in view of rigidities (legal or political) in much of the current expenditure (pensions, wages and salaries, social transfers). The expenditure adjustments in Mexico over the past two years are no exception. For example, capital expenditure reductions contributed by about 70 percent of the total expenditure¹² reduction required in the 2016 budget¹³. The additional public expenditure reduction announced in February 2016 is also largely focused on a reduction of capital expenditure by PEMEX. While it is acknowledged that this will affect the level of oil production and economic growth, the capital expenditure reduction is justified by the sharply reduced profitability of some of these investments under a scenario of substantially lower oil prices.

67. The thorough review of public spending in the preparation of the budget for 2016 led to a consolidation of public sector programs and the identification of possible public expenditure cuts in numerous subsidy and transfer programs. Reductions in the budget allocation for subsidy and transfer programs contributed with 14 percent of the required expenditure reduction over the past 2 years. Operating expenses have also been subject to the careful budget review, though these expenses are often also subject to cost saving exercises within a budget year, i.e. after the budget has been approved. In this regard, the reduction of operating expenses contributed by some 13 percent of the required

¹¹ Revenue and expenditure of PEMEX and the electrical utility CFE are integrated and consolidated with the federal public sector finances.

¹² Excluding debt service, tax-revenue sharing and pensions

¹³ In comparison to the initially approved budget for 2015, i.e. before the first expenditure reductions.

expenditure reduction. Even though personnel costs often present a high degree of inertia, budget cuts in Mexico over the past two years included a small, but positive contribution of a reduction in the wage bill to the required cost savings.

68. **The Mexican government focused its strategy to adjust to lower oil revenue on reducing public expenditure, maintaining its fiscal deficit targets and a process of fiscal consolidation reducing its Public Sector Borrowing Requirements from 4.6 percent of GDP in 2014 to 2.5 percent by 2018.** The latter is consistent with a stabilization of the debt-to-GDP ratio. The authorities refrained from raising taxes¹⁴ as a major revenue enhancing tax reform had been approved as recent as end-2013. In fact, as a result of the deferred impact of the reform income tax revenue was up considerably in 2015 and contributed to mitigate the impact of lower oil revenue. Strong opposition by the business sector to the tax reform at the time led the Minister of Finance to pledge no further tax policy changes during the remainder of the current administration.

69. **The adjustment to public expenditure in 2015 and 2016 should lower public spending in Mexico on a more permanent basis by about 2 percent of GDP, compensating thereby for the larger part of the reduction in oil revenue.** This stands in sharp contrast with the previous decade in which public spending increased by 6 percentage points to reach 26.5 percent of GDP in 2014. A higher level of taxation, brought about by a tax reform enacted previous to the oil price slump and increased excise taxes on gasoline and diesel, makes up for the difference in the reduced oil revenue and should allow for a gradual fiscal consolidation between 2015 and 2018. Increasing pension spending and interest payments on public debt may require additional adjustments in 2017 and 2018.

¹⁴ The increase of the excise tax on gasoline and diesel is the result of an existing policy of a fixed, administered retail price.

6. Conclusion

70. **To sum up, the Chilean economy is in the midst of a challenging rebalancing process in which fiscal consolidation plays a key role.** As a part of this process, the government has set a target of reducing the structural fiscal deficit by 0.25 percent of GDP per year from 2016 to 2018, measured with comparable structural parameters year to year. This target would be achieved by a combination of revenue and expenditure measures. While the bulk of additional revenues from the tax reform of 2014 will be used to finance additional public spending a small part could be used to contribute towards meeting the fiscal target. The remainder would have to come from expenditure consolidation.

71. **The objective of this PER is to support fiscal consolidation by identifying opportunities to improve expenditure efficiency.** Improved spending efficiency is a natural first step towards the goal of reducing public expenditures as it aims to maintaining the level and quality of public services largely unchanged. As such, efficiency measures may encounter relatively less political and public opposition compared to direct spending cuts that may negatively affect public service delivery. The subsequent chapters, identifies a series of efficiency-enhancing measures across different sectors and programs and estimates their potential fiscal impact.

Annex 1. Importance of Separating Mining Sector in the estimate of Potential GDP

Potential output is estimated on the basis of Cobb-Douglas production function with constant returns to scale. The external expert panel estimates the capital stock, number of hour worked adjusted by quality of human capital and of total factor productivity (TFP) for the next five years. These estimates are filtered and put together to re-estimate the level of trend GDP. The level of trend GDP thus obtained is compared to the estimated level of GDP for the next budget year to obtain the output gap which in turn is used to estimate the relevant cyclical adjustment.

An almost consistent negative output gap over the past 15 years may be attributed to over-optimistic views on TFP part of which may be due to making those estimates for the total economy instead of separating the Natural Resource from the rest of economic activities. This looks relevant in the case of Chile because mismeasurement of TFP are more likely in natural resource, in particular, if the natural resource stock is not included in the production function. In this case, disaggregating TFP growth by sector may shed some light on some of the drivers and trend of TFP.

For instance, Madrazo and Villena (2015) showed that low overall TFP growth observed in recent years is due to negative TFP in the mining sector—TFP has maintained a robust positive growth outside this sector. The negative mining TFP growth could be linked with reduction of average grade of copper ores from 1.61 percent in 1992 to about 0.87 percent in 2012. This fall has been more pronounced than on average worldwide that went on average from 1.45 percent to 1.12 percent over the same period.

	Total economy		Excluding Natural Resource based Activities		Mining	
	GDP	TFP	GDP	TFP	GDP	TFP
1993-1998	6.5%	2.4%	5.6%	1.8%	8.9%	3.3%
2000-2008	4.7%	0.8%	5.9%	2.3%	0.3%	-6.8%
2010-2014	4.6%	0.4%	5.0%	1.5%	1.5%	-10.5%
1993-2014	4.7%	0.9%	4.9%	1.5%	3.3%	-4.6%

Source: CORFO-UA

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Chapter 2

Health¹

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TABLE OF CONTENTS

Contents

1. Introduction.....	4
2. Lessons from International Experiences of Health Efficiency Savings.....	5
3. International Benchmarking.....	6
4. Health System Efficiency Analysis	13
5. Health Care Cost Drivers	26
6. Recommendations.....	30
Annex 2A: Patient Flow.....	38
Annex 2B: Measuring treatable causes of death.....	39
Annex 2C: Univariate Statistical Analyses.....	40
Annex 2D: Results of the Principal Component Analysis.....	41
Annex 2E: International lessons for efficiency saving policies.....	43
Annex 2F: Additional implementation considerations	44
References	47

Tables of Figures

Figure 2.1. General Government Health Expenditure (percent of GDP)	8
Figure 2.2. General Government Health Expenditure (percent of government expenditure)	8
Figure 2.3. Total health expenditure (percent of GDP)	9
Figure 2.4. Total Health expenditure, by source.....	9
Figure 2.5. Key health indicators for Chile in comparison to other OECD countries.....	11
Figure 2.6. Key health outcomes for Chile, peers, and OECD countries (2013).....	11
Figure 2.7. Key indicators of quality of care	12
Figure 2.8. Access to care indicators	12
Figure 2.9. Changes in caesarean section rates among OECD countries, 2000 to 2013	13
Figure 2.10. DEA approach to measuring efficiency	15
Figure 2.11. Total number of deaths vs. total FONASA population	19
Figure 2.12. Treatable PYLL option 1 vs. option 2.....	19
Figure 2.13. Rank of the robust efficiency score by region.....	22
Figure 2.14. Public Health Spending, 2015	28
Figure 2.15. Drug and Surgical spending	28
Figure 2.16. Drug expenditure by region (%).....	28
Figure 2.17. Labor and Contractor spending	28
Figure 2.18. Labor Spending, 2005-15	29
Figure 2.19. Budgeted less executed spending.....	29
Figure 2.20. Annual growth for health care cost drivers	29
Figure 2.21. Health Care Cost Drivers by Component (2005-15).....	30

List of Tables

Table 2.1. Summary of input and output measures used to calculate efficiency scores	16
Table 2.2. Factors considered in the second stage and correlation with efficiency scores.....	21
Table 2.3. Results of the 4 DEA models of efficiency	22
Table 2.4. The distribution of the indicators across the category of the robust efficiency scores	

Table 2.5.	Estimates from efficiency gains for procurement of drugs and medical equipment	
	34	
Table 2.6.	Summary of Results	35

1. Introduction

1. **This chapter examines the evolution of public health expenditures and the relative efficiency of the public integrated service delivery networks, in order to identify potential efficiency gains in the short and medium term.** To identify efficiency enhancing measures and estimate fiscal savings, the following analyses was conducted: (a) a review of OECD country experience in achieving efficiency gains; (b) a benchmarking analysis of health expenditures and outcomes for Chile; (c) an analysis of the relative efficiency of the 29 public integrated service delivery networks and determinants of efficiency at the regional level; (d) an analysis of the levels, trends and drivers of public health spending; and (e) an estimation of potential efficiency gains.

2. **Chile has a two-tiered health care system, with the majority of the population – 82 percent – covered by a public insurance scheme and the rest covered by private insurance.** The Social Health Insurance (SHI) system is funded by a mandatory 7 percent contribution from all formal workers and the income of pensioners. This contribution provides coverage through the public health insurance fund for most of the population, while coverage from private health insurance companies can be purchased for an additional fee, with the average beneficiary paying 9.2 percent of their income. Private insurance in Chile operates in a poorly regulated market that selects risks and uses *de facto* the public insurance scheme as a second floor insurance mechanism. The poorest segment of the population (about one quarter) is covered by the public health insurance fund at no cost – neither regular contributions nor copayments for services (Bitran, 2013). The public health insurance fund also covers those receiving unemployment benefits, uninsured pregnant women, dependent family of insured workers, those with mental or physical disabilities, and the poor. Services covered by the public health insurance fund are predominately provided through public sector facilities and private health insurance companies primarily through private facilities, although there are some exceptions to both. From an organizational perspective, primary health care services are managed, organized and delivered by municipalities through contractual arrangements with the Ministry of Health, while public hospitals are under the direct management of 29 integrated health care networks. The function of public procurement of pharmaceutical products and medical equipment is partially carried out by a public agency, called CENABAST. It should be noted from the outset that achieving efficiency for the public health insurance systems as a whole is complicated by a dual and segmented market which is the product of two divergent logics of health insurance: one that selects risks (applying the principle of equivalence in individual contracts) and one that pools risks (applying the principle of solidarity in public insurance schemes).

3. **A significant change in the health care system occurred in 2005 with the introduction of explicit guarantees for universal health care.** Chile introduced *Acceso Universal con Garantías Explícitas* (AUGE), which mandates care coverage for a core package of services, in accordance with clinical guidelines and puts limits on wait times and out-of-pocket spending for fifty-six health problems for all patients insured through the SHI system (Bossert and Leisewitz, 2016). These guarantees have since been expanded to cover eighty conditions, after regular revisions to the list.

4. **The report identifies four areas for detailed investigation and identification of efficiency enhancing reform measures.** These areas relate to (1) drugs and medical equipment;

(2) productivity and efficiency in hospital care; (3) primary health care; and (4) health human resources. Recommendations were developed for reforms to generate efficiency gains in the short term, in the context of medium- and long-term reforms required to sustain efficiency improvements in the health sector.

5. **The chapter is structured as follows.** Section 2 reviews the international experience with efficiency savings in the health sector. Section 3 reviews levels and trends of public spending and health outcomes; and benchmarks key performance indicators against peer countries. Section 4 identifies cost drivers for the health sector. Section 5 presents the findings of an analysis of the relative efficiency of public integrated health services networks. Section 6 identifies measures to improve the efficiency of public spending in the health sector.

2. Lessons from International Experiences of Health Efficiency Savings

5. **Following the 2008 economic crisis, many OECD countries implemented a range of policies to reduce spending in the health sector.** In most cases, health spending reforms were part of broader austerity measures that included expenditure reductions in multiple sectors. As a whole, austerity policies proved politically unpopular. Health sector spending cuts had negative consequences for public health, particularly in regards to access to care. These effects will continue to reveal themselves as the implications of neglected care unfold (McKee, et al., 2012). It is difficult to separate the specific impacts of health spending cuts from the effects of economic downturn, which itself is correlated with increases in mental health problems and suicides, but the experience of these countries indicates the need for cautious consideration of possible health impacts of potential reforms in the medium to long term. Many critics of austerity policies argue that preserving and strengthening social protection best insulates a population from the negative health effects of economic crisis (Surhcke and Stuckler, 2012). However, it should be noted that Chile implemented countercyclical policies during downturn situations, which was possible by the existence of reserve funds built in upturn cycles.

6. **To reduce costs in response to the financial crisis, OECD countries enacted health expenditure reductions in four primary areas: pharmaceuticals, personnel, hospitals, and across-the-board cuts.** Pharmaceutical spending reductions were achieved through a mix of negotiating lower prices, switching to generic medicines, and reducing government contributions or increasing user contributions to drug purchasing. Expenditure reductions on personnel and hospitals and across-the-board cuts included freezing salaries, reducing the number of available facilities or services offered, cutting staff, lowering reimbursement rates, and increasing users' payments for services (De Vogli, 2014).

7. **Many policy reforms that produce short-term savings are likely to generate negative consequences in the longer term.** Policies that reduce the amount the government pays for healthcare or increase the amount users pay for healthcare will generally achieve quick expenditure reductions. Wage and price controls are likely to have the strongest short-term effects, particularly when supplemented by tight budgetary caps, according to OECD (2010). However, in the longer term, salary freezes generally reduce the quality and availability of the health workforce, possibly resulting in shortages. Budget caps can restrict service availability and delay the purchasing of

necessary medical equipment and other technologies. Increasing user fees can limit access and worsen financial protection, which may induce longer-term costs from delayed care.

8. **Other efficiency-improving reforms require substantial time to take effect and are unlikely to reduce spending rapidly.** These types of policies entail structural reforms, which typically require substantial up-front costs and may involve administrative or organizational restructuring. There are several examples of such reforms. Providers and facilities can institute improved information and communication technologies to enhance coordination, streamline administration and billing, and improve clinical decision-making. Payments to hospitals can be reformed to avoid incentivizing the overprovision of services, e.g. by using a prospective payment system. Certain aspects of health financing and management can be decentralized, shifting tasks from the central government to regional or local governments. Investments in prevention and early detection (immunizations, cancer screenings, health education, various health promotion activities) can be increased to reduce demand for curative services. Health technology assessment can be instituted to guide coverage decisions. Once established, these reforms can produce genuine improvements in efficiency – achieving more for the same level of investment – as opposed to simply reducing spending.

9. **Various pharmaceutical purchasing reforms may have the greatest potential for short-term savings with minimal long-term negative effects.** These reforms generally fall in two categories: renegotiating the prices paid by the public sector to pharmaceutical and medical technology companies to achieve better rates; and increasing the use of generic rather than originator drugs. The first can be achieved through joint purchasing or centralized procurement; the use of therapeutic reference pricing or international benchmarking; or through product-specific agreements. The second is accomplished by mandating generic substitution; establishing pharmaceutical formularies (preferred drug lists); or instituting measures that improve the timeliness with which generics become available.

3. International Benchmarking

10. **This section compares Chile's public health spending and health outcomes to peer countries.** Chile's performance is compared with regional and structural peers, as well as the average for OECD countries. Regional peers belong to the Pacific Alliance Bloc including Colombia, Mexico and Peru. Structural peers are countries with similar economic characteristics and include Australia, Canada and Norway.² In general terms, international comparisons show a lower level of health expenditure in relation to GDP than most OECD countries; a large share of out-of-pocket expenditures; relatively good health outcomes already observed before the introduction of private insurance schemes; and a demographic transition and aging of the population happening at a faster rate than that in most other OECD countries which is expected to have impacts on the sustainability of the current care delivery models.

11. **Although Chile's health expenditures have increased and outcomes have improved significantly, they remain far below OECD levels while being comparable to regional peers.** Yet, public spending on health increased from 2.7 percent of GDP in 2005 to 3.9 percent of GDP

² Appendix 2 of the main report describes the criteria for the selection of these structural peers.

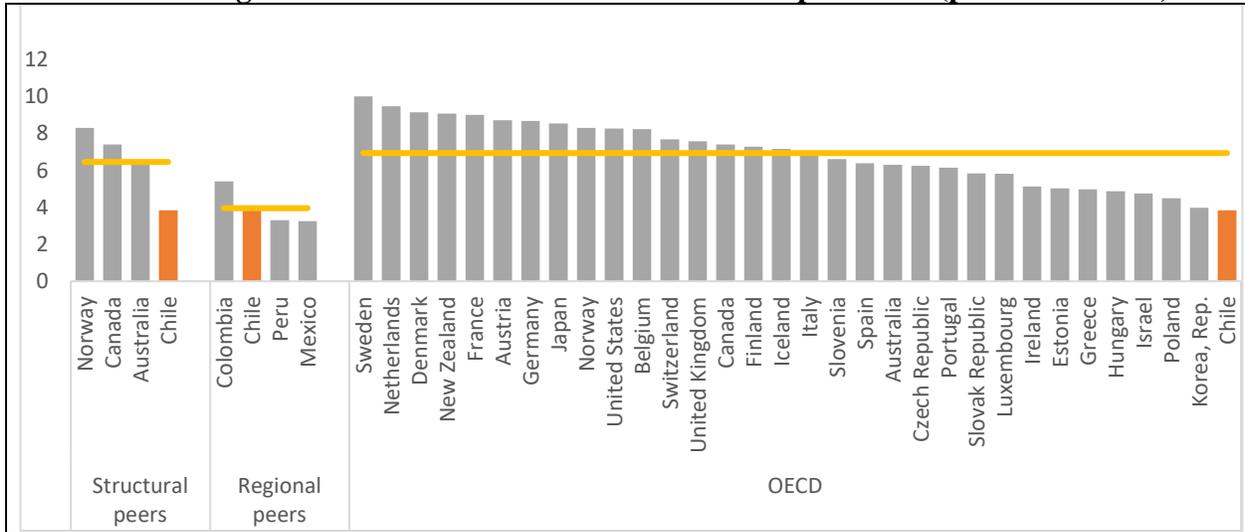
in 2014. This is still the second lowest in the OECD, which averages 7 percent of GDP, and remains below the average of its structural peers at 6.5 percent. On the other hand, it is similar to the regional peer average for the countries of the Pacific Alliance Bloc at 4.0 percent of GDP (Figure 2.1).

12. **However, out of total government spending, Chile devotes a budget share to health that is comparable to other OECD countries.** Chile spends 16 percent of its budget on health, a share that is very similar to the portion that other OECD countries and regional peers allocate to the sector (Figure 2.2). The apparent disconnection between the low public spending on health to GDP ratio and a relatively high level of prioritization of health expenditures in the government budget can be explained by the relatively small size of government in Chile. Indeed, Chile has relatively low fiscal revenues compared to relevant peers. At 23.5 percent of GDP, Chile's fiscal revenues are substantially lower than structural (37.4 percent) and OECD (40.6 percent) peers, though similar to regional peers.

13. **At 3.9 percent of GDP, private health spending, particularly out-of-pocket, in Chile is higher than for OECD, structural and regional peers.** About half of Chile's total health spending is from private sources compared to about a quarter in the OECD and 40.8 percent for regional peers. Out-of-pocket spending accounts for close to a third of total spending in Chile compared to less than a fifth in the OECD and 19.4 percent for regional peers (Figure 2.4).

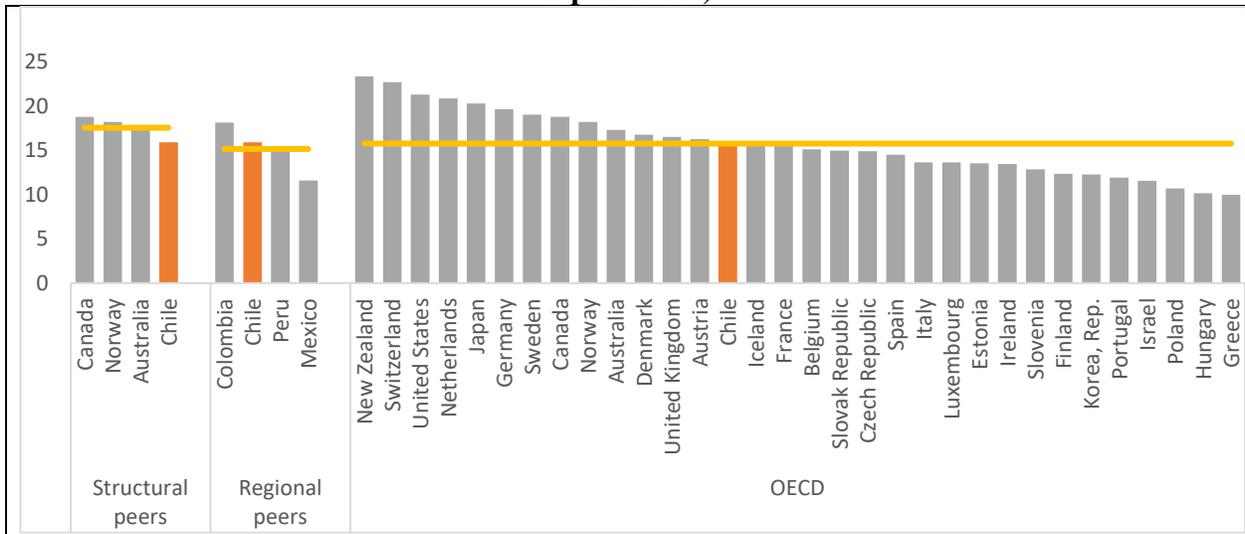
14. **These characteristics pose important challenges for the financing of the country's health system.** Chile faces growing expenditure pressures as the population ages, the burden of non-communicable diseases is increasing, health technology changes, and population's expectations and demands evolve over time. These challenges will put pressure on the government budget, therefore improving the efficiency and quality of its public spending seems to be critical. These improvements can be achieved by adapting care delivery models to the evolving health needs of a population requiring better care integration and better management of complex conditions for populations with multiple non-communicable diseases. Improving the quality of public spending is a priority for the government to improve the future sustainability of the health sector. In addition, Chile will also likely have to improve its efficiency in revenue generation and consider how to increase the fiscal space allocated to the health sector in order to meet the evolving needs of an ageing population. The high levels of out-of-pocket expenditure and catastrophic health expenditure, even when compared to Latin American countries, represent not only a concern for equity, but also a limitation on financing for the health system. These already high rates suggest there is little room for future growth in private financing as a source of funding for the health system.

Figure 2.1. General Government Health Expenditure (percent of GDP)



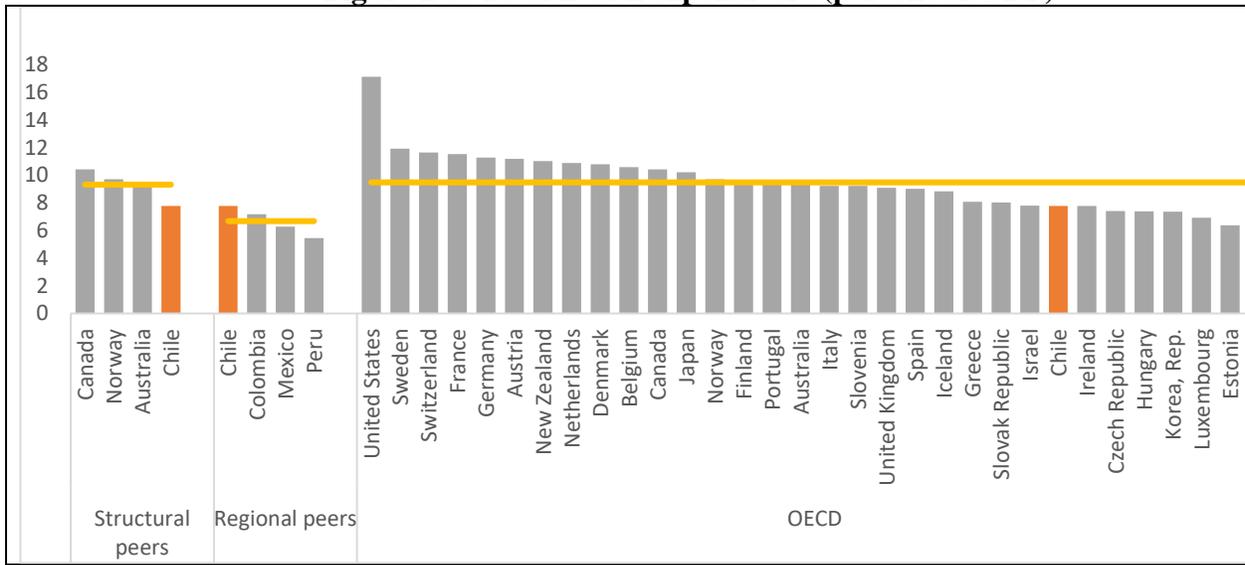
Source: Authors based on OECD Health Statistics, 2015

Figure 2.2. General Government Health Expenditure (percent of government expenditure)



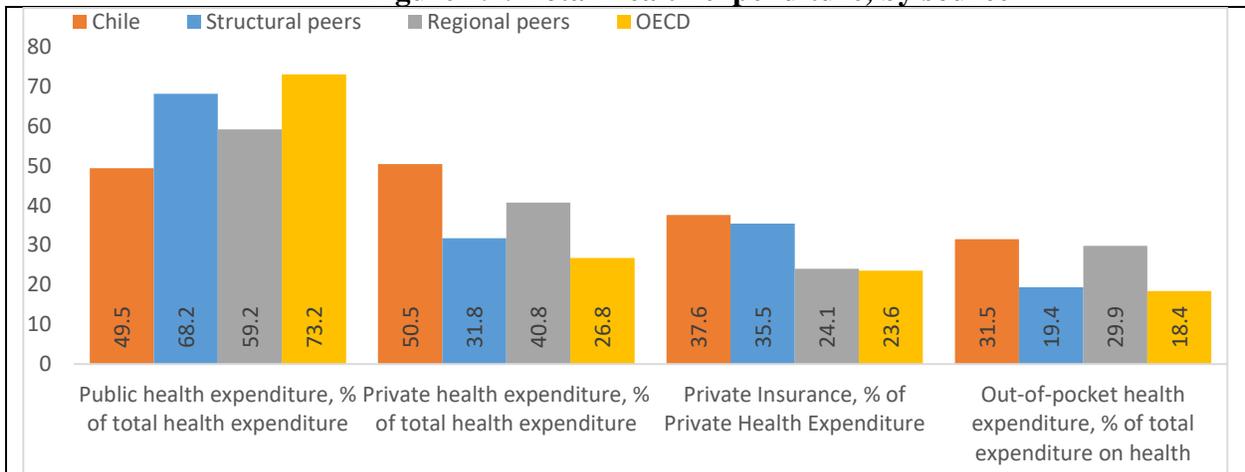
Source: Authors based on OECD Health Statistics, 2015

Figure 2.3. Total health expenditure (percent of GDP)



Source: Authors based on OECD Health Statistics, 2015

Figure 2.4. Total Health expenditure, by source



Source: Authors based on OECD Health Statistics, 2015

15. **Chile’s health outcomes have improved substantially in recent decades, coming close to the OECD average.** Higher life expectancy is a good example. Between 1970 and 2013, life expectancy increased from 64 to 78.8 years – the third highest increase within the OECD after Turkey and South Korea. By comparison, the OECD average is 80.5 years.

16. **Despite these improvements, the country still faces some important health challenges.** In 2013, Chile’s infant and maternal mortality rates were significantly lower than regional comparators, but still higher than other international comparators and about twice the OECD average. In terms of non-communicable disease mortality, performance is mixed. Chile does better than the OECD average on cancer (men), heart disease (both genders), and suicides (women). However, results are worse than the OECD average for cancer (women), stroke and transport accidents (women), and infant mortality (both genders) (Figure 2.5).

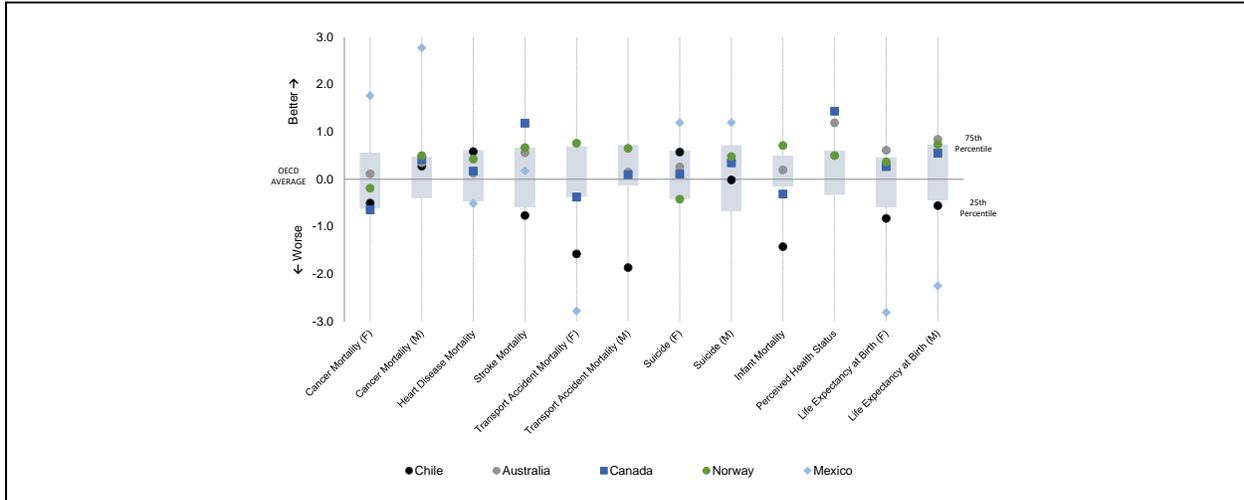
17. **International comparisons show low levels of utilization compared to other OECD countries.** Chile's utilization rates show a low number of doctors per population and few consultations per population; relatively lower hospital lengths of stay for all causes but with higher length of stay for acute myocardial infarctions and no change since 2000, contrary to most of the OECD countries; a hospital occupancy rate close to OECD average; a low number of hospital discharge per population; a low concentration of technology and use of technology per population; a very low number of hip and knee replacements; and a low level of coronary revascularization procedures. These low utilization rates will be hard to maintain with a growing demographic and epidemiological pressure and changes in population expectations.

18. **Chile also does not perform well on a number of indicators of quality of care.** This includes low levels of screening for breast cancer, high levels of mortality after hospital admission for acute myocardial infarction and low survival rates for cervical cancer and breast cancer (Figure 2.7). On the other hand, Chile has relatively low rates of hospital admissions for avoidable causes such as chronic obstructive pulmonary disease (COPD) and asthma. Unfortunately, there is no comparable data on patient safety and patient experience, which are important aspects of quality of care.

19. **Chile performs poorly on access to care.** For the three indicators for which international comparisons are available for Chile, results are substantially worse than for other OECD countries: wait times for cataract surgery, hip replacement, and knee replacement are all worse than the OECD bottom quartile (Figure 2.8)

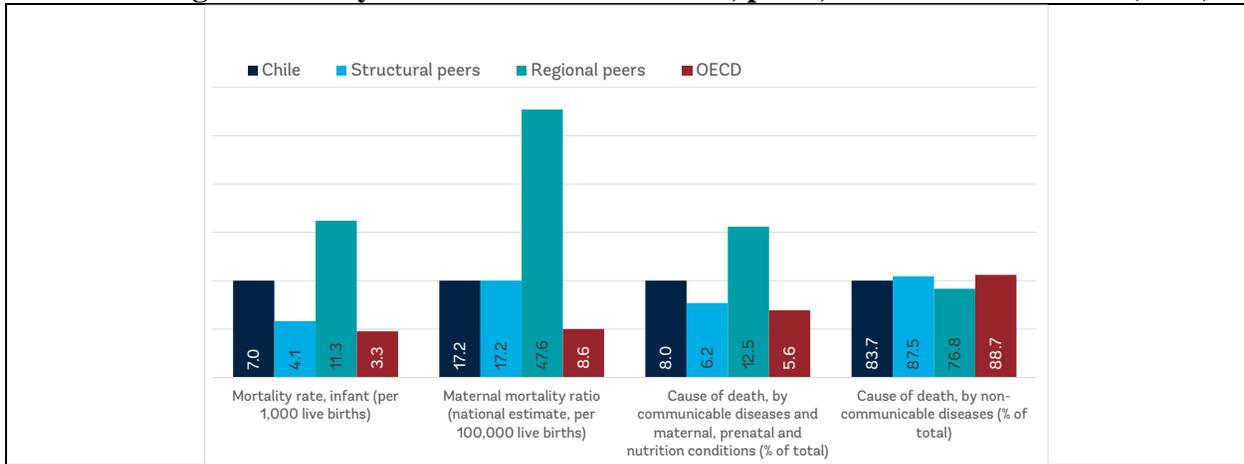
20. **On the other hand, indicators also suggest the overuse of certain procedures that are expensive and risky.** Chile has a very high rate of cesarean sections and this trend has been rising sharply - reaching just above 30 percent in 2007. Chile's rate of cesarean section deliveries is now the third highest in the OECD (Figure 2.9). By 2013, almost half of all women delivered this way, compared to the OECD average of about one quarter. A cesarean section is a medical procedure only necessary in a limited proportion of cases with potential adverse effects when not medically necessary.

Figure 2.5. Key health indicators for Chile in comparison to other OECD countries



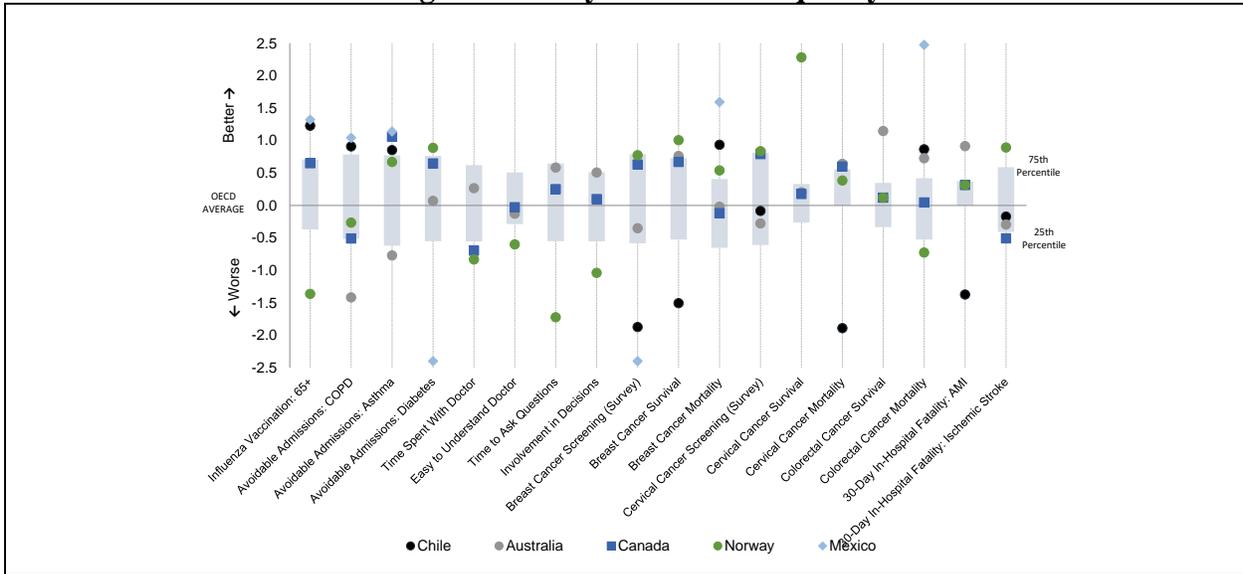
Source: Authors based on OECD Health Statistics, 2015

Figure 2.6. Key health outcomes for Chile, peers, and OECD countries (2013)



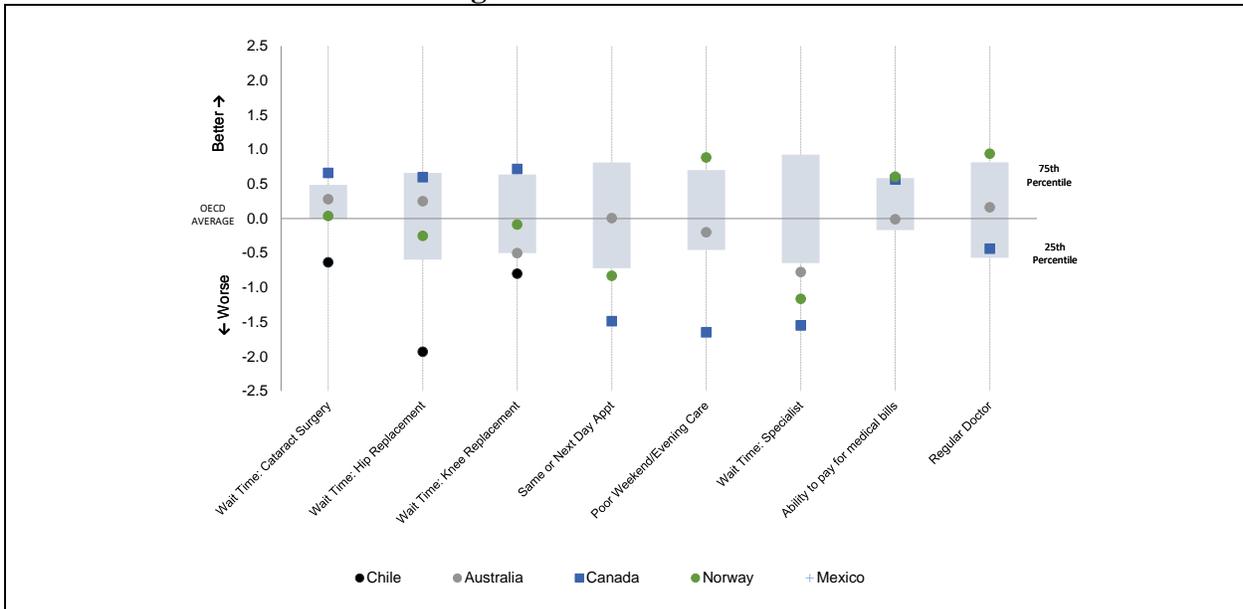
Source: Authors based on OECD Health Statistics, 2015

Figure 2.7. Key indicators of quality of care



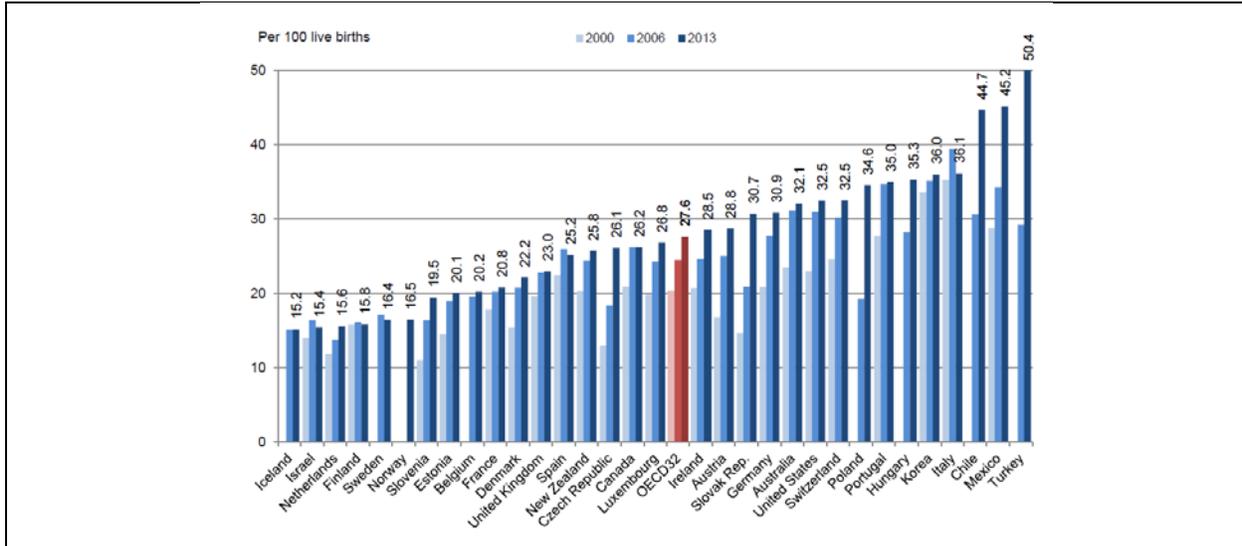
Source: Authors based on OECD Health Statistics, 2015

Figure 2.8. Access to care indicators



Source: Authors based on OECD Health Statistics, 2015

Figure 2.9. Changes in caesarean section rates among OECD countries, 2000 to 2013



Source: OECD Health Statistics, 2015

4. Health System Efficiency Analysis

21. **This section reports the results of an analysis of efficiency across the 29 Integrated Health Services Networks in Chile’s Sistema Nacional de Servicios de Salud (SNSS).** Specifically, the focus is on the efficiency of publicly funded health services for those covered with exclusively public insurance (FONASA). FONASA beneficiaries represent nearly three quarters of the Chilean population and include dependents of contributors, pregnant women, pensioners, and people with mental disabilities.

22. **Technical efficiency measures the extent to which inputs are converted into outputs.** This analysis measures inputs in monetary terms: per capita spending on the main health sectors at the Health Services Area level. The outputs are measures of the accessibility of health services.

23. **Many factors can be expected to affect health system efficiency.** Efficiency is not only about managers and professionals working hard and effectively. It is also influenced by factors beyond their control, including those related to the context in which they work. In this study, we control for key population level measures that may contribute to a more challenging environment to better isolate efficiency related to health system management from factors related to the external environment.

24. **Several international studies have measured health system efficiency and they indicate that Chile performs relatively well.** The most widely cited study is WHO (2000) which reported the results of a comprehensive analysis of health system efficiency across 191 countries. It examined at the efficiency with which the health system used its total health spending to achieve the aggregate of five performance objectives: health status, inequalities in health status, responsiveness, inequalities in responsiveness, and fairness of financial contribution. Chile ranked

33rd, with an efficiency estimate of 87 percent, considerably better than expected given its level of development. More recently, the OECD examined the efficiency of thirty-three member countries (Dutu and Sikari, 2016). This study compared estimates of efficiency using improved life expectancy, concluding that, in 2012, Chile performed better than the OECD average. In terms of input efficiency (potential reductions in health care spending), Chile was in the top quartile of performance and in terms of output efficiency (potential gains in life expectancy), Chile was better than average. Chile's performance in both domains of efficiency improved slightly between 2007 and 2012.

25. **Several other empirical studies have been conducted on the topic of health system efficiency.** These studies are difficult to compare, however, because they consider different measures of inputs and outputs and apply different methods. Nonetheless, some general patterns are observed. First, population health behaviors are an important factor influencing efficiency. For example, several studies have shown that the prevalence of obesity, smoking, poor diet, and alcohol consumption are negatively associated with efficiency (Afonso, 2006; Rijksinstituut voor Volksgezondheid en Milieu, 2014; Verhoeven, 2007; Canadian Institute for Health Information, 2014). Second, health system factors such as payment models and indicators of health system effectiveness and appropriateness appear to be associated with efficiency (Canadian Institute for Health Information, 2014; Joumard, 2010; Wranik, 2012; Bhat, 2005). Third, socio-economic conditions influence estimates of efficiency; therefore, it is important to consider, and possibly control for, factors beyond the control of system managers that may facilitate or hinder the successful use of resources (Afonso, 2006; Canadian Institute for Health Information, 2014; Joumard, 2010; Greene, 2004). While these existing studies provide insight into potential health gains that could be realized if health systems were working optimally, they mostly ignore the regional variations that exist within countries. Regional studies of efficiency within countries can therefore shed additional light on these variations and draw attention to potential efficiency determinants.

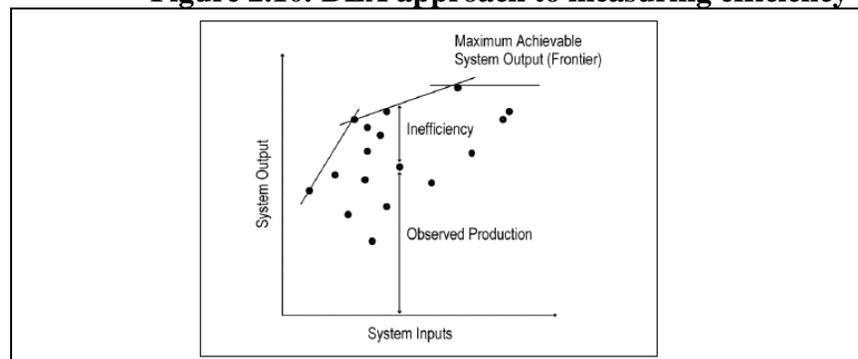
4.1 Methods

26. **This study takes a two-staged approach to measuring efficiency.** The first stage is to calculate efficiency scores, and the second stage is to examine the relationship between these scores and measures of population health and system management.

Stage 1: Estimating efficiency

27. **Efficiency scores were estimated at the Health Services Network level using a linear programming approach called data envelopment analysis (DEA).** DEA is a nonparametric method to measure the productive efficiency of provider units. As a result, it is possible to identify those units which are operating relatively efficiently and those which are not. This analysis also enables to identify the most important factors that affect provider units' performance. Before choosing to use DEA for this analysis, we tested another methodology called Stochastic Frontier Analysis (SFA)³. DEA proved more adapted for an analysis using a small number of observations (the 29 Integrated Health Services Networks). DEA is a commonly used method to measure efficiency, and was used recently by the OECD (2010) and the Canadian Institute for Health Information (2014). This approach determines that a system is inefficient when another system with a comparable level of spending is able to achieve better outcomes. As shown in Figure 2.18, DEA estimates a “frontier” of optimal performance based on the data, and then calculates efficiency based on the gap between the observed level of output and the frontier. One commonly cited challenge with DEA is that it attributes the entire gap between the frontier and the actual output to inefficiency, thus not allowing any room for random error. In order to introduce a random component in the analysis, therefore, this study applies a re-sampling methodology to generate “robust” efficiency scores. In order to ensure that comparisons are being made across Health Services Networks with similar socio-economic conditions, the calculation of the efficiency scores was adjusted for key measures of socioeconomic status. Finally, sensitivity analyses were undertaken to gain further assurance of the robustness of results obtained from the DEA. Consistent with the literature, the efficiency scores are compared across a series of alternate specifications. Details are provided in the “Results” section.

Figure 2.10. DEA approach to measuring efficiency



Source: Authors

Stage 2: Examining the relationship between efficiency scores and measures of population health and system management

28. **Many factors are expected to affect health system efficiency.** Studies have uncovered the importance of population health as well as managerial factors in explaining variations in health

³ In estimating efficiency, nonparametric methods do not assume a specific functional form relating inputs to outputs. Parametric methods, such as the Stochastic Frontier Analysis (SFA) assume functional forms to measure potential output given a certain level of inputs.

system efficiency. Consistent with the literature, this study considers indicators within these two broad categories in the second stage of the analysis. After robust efficiency scores are estimated for the 29 Health Services Networks, a series of univariate analyses are conducted to examine the relationship between each indicator with efficiency. These include correlation analysis and univariate regression analyses on the log of efficiency scores.

29. **Principal component analysis (PCA) was undertaken in order to identify key variables to consider among a larger set of variables that may be correlated with each other.** The issue with univariate analyses is that correlations with efficiency scores may be spurious. Multivariate analyses would be appropriate, but with scores for only 29 decision-making units it is impossible to test for statistically significant relationships between efficiency scores and too many regional characteristics at the same time. We used a technique called Principal Component Analysis to summarize characteristics into a smaller subset of relevant linear combinations of characteristics (called components). We then use these components (the goal is to identify four to five components explaining most of the variation in the efficiency scores) in a multivariate analysis of efficiency scores.

Data

30. **An analysis of efficiency requires measures of inputs and outputs.** In this study, inputs were measured with one spending variable: combined public spending per capita on hospitals, primary health care, and private sector services (the majority of these services are provided by physicians operating outside of public hospitals). Also included as inputs were four population level variables to control for variations in the external environment. It should be noted that the use of the FONASA A population as a proxy for poverty even if appropriate for this study (the FONASA A population is highly correlated with the % of vulnerable families with scarce resources) is not *at par* with and ranks higher than other accepted measures of poverty. Outputs were measured with an indicator of the accessibility of health services: potential years of life lost from treatable causes of death. Table 2.1 summarizes the input and output measures used in the analysis for the 29 Health Services Networks.

Table 2.1. Summary of input and output measures used to calculate efficiency scores

	Mean	SD	Range	
Inputs (000 pesos per capita)			min	max
Total public health spending	318	75	227	542
Environmental adjustors				
% Poverty (FONASA group A)	25%	6%	16%	35%
% Living in rural area	16%	13%	0%	44%
% Indigenous	14%	11%	2%	37%
Outputs				
PYLL from treatable causes (per 1000 population)	213.4	19.8	175.8	257.4
Premature mortality rate from treatable causes (age-standardized)	10.5	0.9	8.8	12.2

Source: Authors based on data provided by the Ministry of Health of Chile

Inputs: total public spending for the year 2013

31. **Total public spending combines three sectors: hospital, primary health care, and spending on private services (MLE).** Estimates of total public spending were derived from the Bureau of Economic Health Information (IES) based on the method of Satellite Health Accounts - System of National Accounts (UN 1993, Lequiller 2014).⁴ It is important to note that there are differences between the estimated total expenditure on health accounts and the total expense recorded in the executed DIPRES budget for purely technical areas from international recommendations. Spending estimates were adjusted for population size in order to be comparable across Health Services Networks.

- **Current hospital spending** includes salary expenses, consumer goods and services, administrative spending, consumption of fixed capital (estimated), interest and taxes paid for all three levels of hospital complexity (high, medium and low). For the purpose of this study we exclude capital spending, which refers to investment in capital goods, such as infrastructure, equipment (health and office furniture), furniture, vehicles, information systems, and land.
- **Hospital spending is adjusted for patient flow across Health Services Networks.** There is some degree of patient flow across Health Services Networks that needs to be accounted for when estimating hospital spending at this level of geography. Therefore, a ratio of patient flow is estimated as the number of hospital separations (discharges and deaths) from facilities within a given Health Services Network divided by the number of separations generated only by residents of that region. Per capita hospital spending is then divided by the patient flow ratio in order to estimate only the hospital spending for residents of the Health Services Network.
- **Primary health care.** Current spending on primary health care includes prescription drugs, and spending in APS (Municipal Primary Health Care) and Non Municipal (dependent Health Services). It excludes capital spending, as well as spending on feeding programs (PNAC or PACAM) and immunizations.
- **Public spending on private health services (MLE).** The FONASA population eligible for publicly funded private services (*Modalidad Libre Elección*; MLE) includes those in categories B, C and D (all except category A, who receive health care with no co-payments). The total spending on private sector doctors, hospitalization and procedures among the FONASA population is estimated and then divided by the FONASA population.
- **Environmental adjusters.** In the calculation of efficiency scores, the study included three key measures of socio-economic status and geography in order to ensure comparisons were being made only among similar Health Services Networks. See Table 1 for more details. Age is not included because the PYLL from treatable causes of death is age-standardized. Also the percentage of the FONASA population with higher level of education is also not included because it was highly correlated with poverty, which is included.

Outputs: indicators of access to timely and effective health care

⁴ Source: Bureau of Economic Health Information (IES), Department. Health Economics, based on primary information SINIM (Subdere), Office of the General Control office of the Republic, SIGFE (Health Services) and FNDR (Subdere). March 2016.

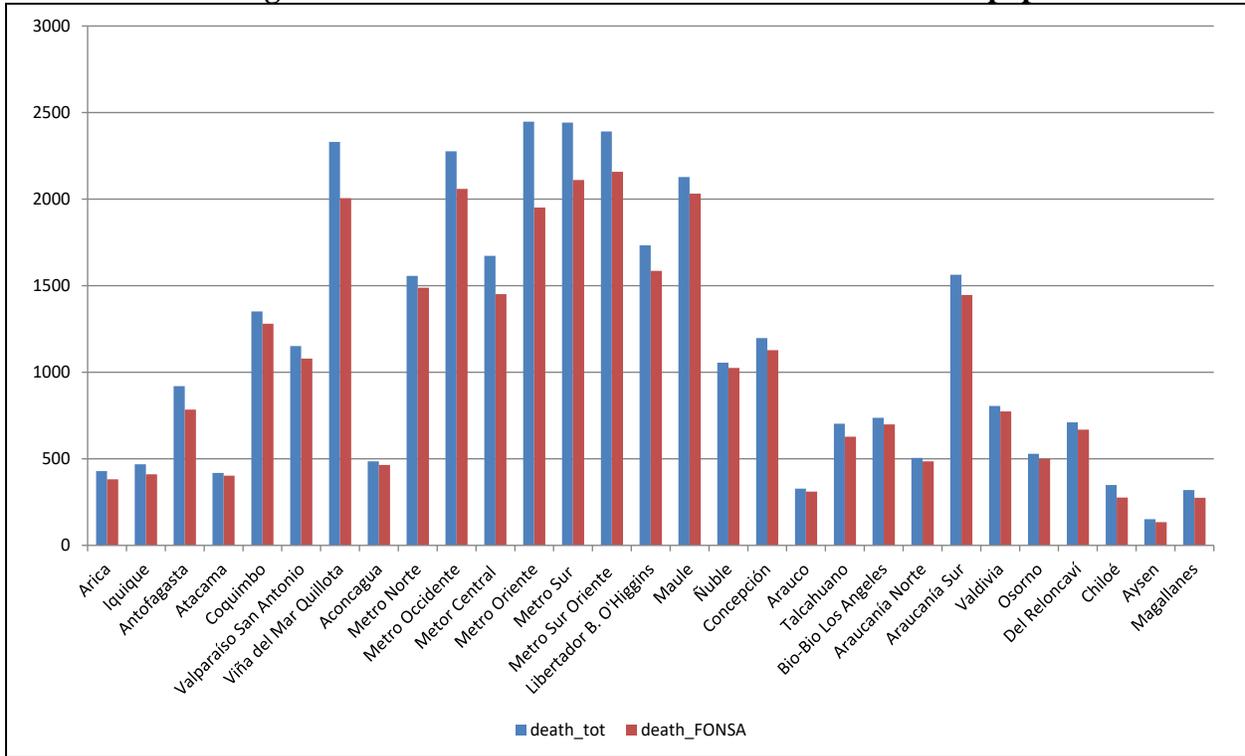
32. **Potential years of life lost (PYLL) from treatable causes of death.** PYLL from treatable causes of death is widely used as a measure of the accessibility of timely and effective health care. Some examples of treatable causes of death include sepsis, pneumonia, colorectal cancer, breast cancer in women, hypertensive diseases, asthma and most other respiratory diseases, renal failure, pregnancy and childbirth. The list of causes of death considered to be treatable was taken from the Canadian Institute for Health Information (2012) and is comparable to other expert lists that have been developed (e.g., Nolte and McKee, 2004). It was important to relate spending to better health outcomes achievable through better health care delivery, as it created opportunities to analyze what interventions from health regions could help achieve better results (outputs) for a given level of expenditure (inputs). Efficiency scores were also estimated using an alternative measure of avoidable mortality - the age-standardized mortality rate from treatable causes of death. PYLL is preferred because it captures intensity by taking into account the age of death (specifically, the difference between the age of death and the cut-off for measuring premature, which is 75).

33. **Death data in Chile include individual information on employment and education, but not insurance status.** Deaths for the FONASA population were therefore imputed based on the distribution of education and employment status of this publicly insured population according to the 2013 National Socio-Economic Characterization Survey (CASEN). There are two options to impute the deaths for the FONASA population, and sensitivity analyses are undertaken to test the robustness of the efficiency scores to the approach taken.⁵ Option 2 is preferred because it accounts for regional variations in the distribution of deaths by socioeconomic status and therefore is a more precise estimate of deaths for the FONASA population by Health Services Network. Please see Appendix 2 for more details on how PYLL were calculated for the FONASA population, and the evidence supporting its use as an indicator of access to care.

34. **In 2013 there were 79,099 deaths in total in Chile of which 33,141 were from treatable causes of death.** Figure 2.19 depicts the total number of deaths for each Health Services Network from treatable causes of death, along with the imputed number of deaths for the FONASA population (using option 1). Figure 2.20 reports the PYLL from treatable causes of death, per 1000 population, for each of the Health Services Networks, based on two methods of calculation (Options 1 and 2).

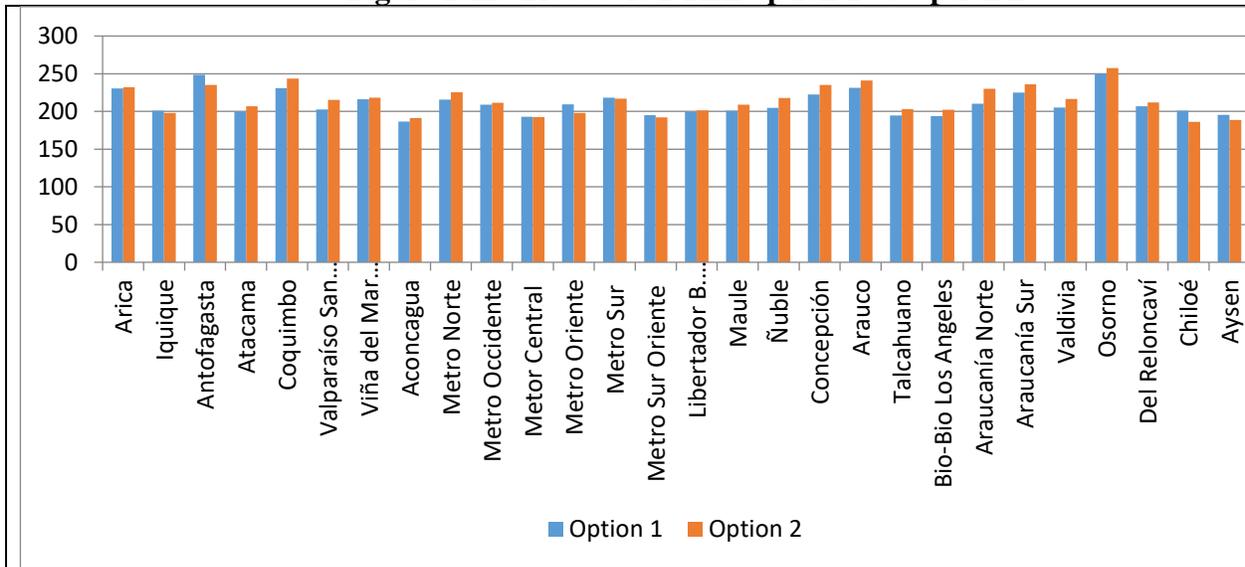
⁵ Option 1 makes two assumptions: first, that the FONASA population has the same mortality rates across socioeconomic groups (SEG) (measured by education and activity status) as the general population by Health Services Network; second, that there are no regional variations in the distribution of deaths by SEG. Option 2, which is preferred, only makes the first assumption, but accounts for regional differences in the distribution of deaths by SEG.

Figure 2.11. Total number of deaths vs. total FONASA population



Source: Authors

Figure 2.12. Treatable PYLL option 1 vs. option 2



Source: Authors

Factors: indicators associated with variation in efficiency scores

35. There are several indicators that were included in the second stage of the analysis to test their relationship with efficiency scores. Included among these were factors related to population health, and those related to system management. Population health factors included:

the percentage of the FONASA population who smokes, and who receive treatment for hypertension, and diabetes. Health system factors include the distribution of funds (the percentage of total spending that is allocated to primary health care, or private services, through MLE), and several indicators of hospital efficiency, including length of stay, readmission rates, and indicators of complexity. In addition, we consider indicators related to the density of health human resources, including the proportion of total physicians that GPs account for as a proxy for investments in primary health care (see Table 3).⁶

4.3 Results

36. **The analysis reveals a relatively high level of efficiency for Chile's publicly funded health system.** The average efficiency scores range from 87 to 92 percent, depending on model specification. Table 2.3 reports the efficiency scores for each of the 4 models that were estimated. These models vary according to the approach taken for imputing deaths, and the choice of PYLL versus the age-standardized mortality rate. The efficiency scores derived from the model with PYLL and option 2 for imputing deaths were selected for the second stage of analysis. These models generated efficiency scores that are highly correlated with each other, with correlation coefficients higher than 0.8. Figure 2.23 reports the baseline efficiency scores for each Health Services Network and it divides the Health Services Networks into three groups, based on the efficiency scores being higher than 90 (high efficiency regions), between 87 percent and 89 percent (moderately high efficiency regions, and 86 percent or under (relatively lower efficiency). The Health Services Networks are presented in rank order (Figure 2.13).

⁶ The Ministry of Health, who supplied the data, noted that estimates of nursing supply are incomplete given that the data only capture nurses with a higher level of education.

Table 2.2. Factors considered in the second stage and correlation with efficiency scores

	Mean	SD	Range		Correlation with efficiency	
			min	max	Model 1 (PYLL)	Model 2 (mortality rate)
Population health						
Smoking (%)	39.03	6.07	26.50	48.50	0.02	0.14
Diabetes coverage (%)	18.82	3.19	14.83	27.15	0.14	0.13
Hypertension coverage (%)	44.40	6.99	30.40	58.78	0.11	0.05
Spending allocation						
% of spending on primary care	27.99	6.24	14.76	42.73	0.11	0.11
% of spending on MLE	12.98	8.99	1.57	38.39	-0.29	-0.30
Hospital indicators						
Hospital occupancy rate (%)	77.04	9.85	51.58	94.73	-0.14	-0.16
Caesarian births (%)	40.58	9.30	26.55	56.37	0.19	0.17
Average length of hospital stay	6.37	1.42	3.5	11.2	-0.08	-0.14
Long-stay patients (%)	6.32	1.45	3.59	9.44	-0.20	-0.23
Readmission overall (%)	4.88	1.75	2.1	9	0.06	0.06
Readmission selected (%)	4.21	1.48	2.1	7.3	0.11	0.14
Urgent 7-day readmission (%)	1.09	0.25	0.65	1.61	0.25	0.13
Complexity index	0.78	0.08	0.62	0.92	-0.07	0.09
Functional index	1.01	0.07	0.87	1.13	-0.30	-0.20
Health human resources indicators						
N° nurses per 10 mil.	8.28	2.54	3.9	15.5	0.16	0.15
N° GP per 10 mil.	11.31	3.26	7.2	24	0.14	0.14
N° specialist per 10 mil.	8.65	2.54	5.5	15.1	-0.01	0.07
N°# Hrs. GP per 10 mil.	334.83	117.04	195	808	0.20	0.16
N°# Hrs. specialists per 10 mil.	227.69	68.95	138	451	0.06	0.11
GP/physicians	0.57	0.03	0.53	0.64	0.27	0.13
GP/nurses	1.40	0.25	1.04	2.18	-0.08	-0.06
GP/support staff	0.46	0.08	0.33	0.65	-0.02	0.09
Nurse/support staff	0.33	0.06	0.22	0.44	0.05	0.11

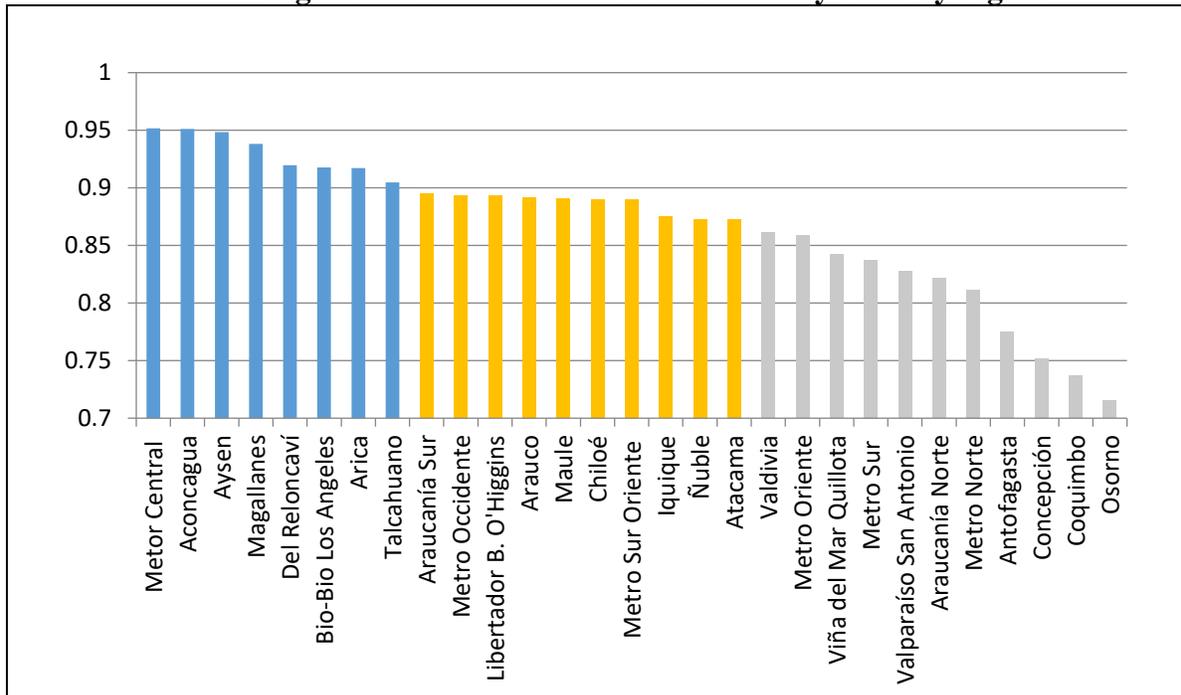
Source: Authors

Table 2.3. Results of the 4 DEA models of efficiency

Model	Output	Robust efficiency score			
		Mean	SD	Range	
				Min	Max
1	PYLL from treatable causes of death (Option 1)	0.92	0.06	0.75	0.97
2	PYLL from treatable causes of death (Option 2)	0.87	0.06	0.72	0.95
3	Mortality rate from treatable causes (Option 1)	0.90	0.06	0.69	0.96
4	Mortality rate from treatable causes (Option 2)	0.89	0.07	0.74	0.97

Source: Authors

Figure 2.13. Rank of the robust efficiency score by region



Source: Authors

37. **Average indicator rates are estimated for each of the three groups of Health Services Networks to examine efficiency patterns.** Detailed results are presented in Table 4, and on average they reveal non-linear associations between a number of indicators and efficiency scores for regions. In other words, there are few clear patterns with indicator rates increasing progressively with increasing (or decreasing) efficiency scores. There is one notable exception to this trend: percent spending on MLE is highest among regions with relatively lower efficiency (17 percent), compared to those with moderately higher efficiency (12 percent), and high efficiency (10 percent).

38. **Correlation analysis suggests that some health system indicators are associated with efficiency scores.** Given the small sample size, we consider correlation coefficients over 0.2 to be meaningful and suggestive of a relationship. Table 2.2, above, describes the indicators included in the second stage of analysis, and reports the correlation coefficients with the efficiency scores from 2 models.⁷ Indicators of population health show only weak correlations with efficiency.

39. **Health Services Networks that spend relatively more on private sector services are less efficient.** Consistent with the descriptive statistics presented in Table 2.4, there is a negative association between MLE spending and efficiency. In other words, Health Services Networks that spend relatively more on private sector services for their publicly insured populations have lower efficiency scores on average than regions spending relatively less on private sector services. This relationship was also supported statistically in a linear univariate regression with the log of efficiency scores as the dependent variable. Results from the univariate analyses with each indicator are reported in Appendix 3.

40. **Networks that invest more in primary health care are more efficient.** Specifically, the share of general practitioners (GPs) in total physician supply has a positive association with efficiency. Regions with the highest efficiency also have the most GPs per capita, the most hours worked by GPs per capita, and, a high percentage of GPs out of total physicians (see Table 2.4). Correlation analysis also supports these trends (see Table 2.2). The positive association between percent of GPs and efficiency is statistically significant (Appendix 3).

41. **Long hospital stays are associated with lower efficiency.** Length of stay (LOS) in hospital, as measured by the functional index, is significantly associated with efficiency. The functional index is a ratio of the median LOS for the hospital, adjusted for case mix, to the median LOS for all hospitals in the country. The analysis revealed a higher index (higher than expected LOS) was associated with lower efficiency scores in the correlation and univariate regression analyses.

42. **Additional indicators that are associated with efficiency are difficult to interpret and require further attention.** Descriptive and statistical analyses reveal a significant positive association between the percent of urgent 7-day readmissions and efficiency. This association is counter-intuitive and requires further attention.

⁷ The two models presented here use Option 2 for imputing deaths for FONASA: model 1 with the output measure with PYLL from treatable causes of death (the preferred, baseline model), and Model 2 (with output measured with the mortality rate from treatable causes of death).

Table 2.4. The distribution of the indicators across the category of the robust efficiency scores

	low	medium	high	Total
Population health				
% smoking	40.9	36.59	39.66	39.03
% hypertension	44.54	45.15	43.4	44.4
% diabetes	18.14	18.82	19.59	18.82
Spending allocation				
% of spending on primary care	25.57	32.83	25.29	27.99
% of spending on MLE	16.65	11.71	10.33	12.98
Hospital indicators				
Hospital occupancy rate (%)	81.83	72.68	76.57	77.04
Caesarian births (%)	38.82	42.17	40.76	40.58
Average length of hospital stay	6.95	5.7	6.48	6.37
Long-stay patients (%)	6.68	5.74	6.58	6.32
Readmission overall (%)	4.94	4.51	5.22	4.88
Readmission selected (%)	4.26	3.9	4.53	4.22
Urgent 7-day readmission (%)	1.04	1.07	1.18	1.09
Complexity index	0.81	0.75	0.78	0.78
Functional index	1.02	1.01	1.01	1.01
Health human resources indicators				
N° nurses per 10 mil.	7.95	7.24	9.8	8.28
N° GP per 10 mil.	11.44	9.78	12.88	11.31
N° specialist per 10 mil.	9.31	6.98	9.77	8.65
N°# Hrs. GP per 10 mil.	315	305.1	389.9	334.83
N°# Hrs. specialists per 10 mil.	229.5	193.2	264	227.69
GP/physicians	0.55	0.58	0.57	0.57
GP/nurses	1.48	1.39	1.32	1.4
GP/support staff	0.48	0.47	0.44	0.46
nurse/support staff	0.33	0.34	0.34	0.33

Source: Authors

43. **Principal Components Analysis (PCA) and multivariate regression provide some support for the univariate results.** Standardized coordinates of regions on two components of the PCA correlate with efficiency scores, both negatively: component 2 and component 5. Note that these two components show a significant, negative link with efficiency in a multivariate analysis controlling for the relationships with all other components. Component 2 is comprised of regions with a better educated population on average, who tends to use more specialist care and spend more on private services; regions on component 2 are also more likely to score high in the "complexity" index. These characteristics of component 2 contribute to lower efficiencies on average, which is intuitive. This component is also characterized by regions with higher occupancy rates, however, which should rather improve efficiency. Component 5 is characterized by longer

stays in hospitals and it is to be expected that such regions are less efficient to reduce PYLL with their resources. Overall, the PCA confirms that regions that use more private services, more specialist services, and have longer stays are less likely to be efficient. Details are provided in Appendix 4.

4.4 Conclusion

44. **The analysis uncovered variations across Health Services Networks in their ability to improve access to timely and effective health care.** This variation emerged even though we compared Health Services Networks operating in environments with similar socio-economic characteristics, such as the proportion living in a rural area, the percent living in poverty, and the percent indigenous. It is important to note that the efficiency scores, and the results of the second stage of the analysis, are not fully conclusive, but rather point to areas that may require further attention. The small sample of 29 Health Services Networks makes it difficult to conduct statistical tests. However the principal component analysis allowed us to undertake a multivariate analysis on clusters of variables that were correlated, providing some support for the findings from univariate analyses.

45. **While some of the indicators included in this study help to explain variations in efficiency across Chile's Health Services Network, it is likely that much of this variation is idiosyncratic.** In other words, there may be unique characteristics of the Health Services Networks and the populations they serve that contribute to their level of spending, the level of access to timely and effective health care they achieve, and their ability to translate inputs into outcomes as revealed by the efficiency scores.

46. **Key findings from this study include the following:** First, efficiency is relatively high in the Chilean publicly funded health system. Second, two Health Services Networks (Aysen and Magallanes), appear to be outliers with significantly higher spending per capita on hospitals than the average for Chile but lower than average premature deaths from treatable causes. Third, there appears to be a significant association between investments in primary health care and efficiency, in particular as measured by the role GPs play in the system relative to specialist physicians. Fourth, longer than expected length of stays in hospital is negatively associated with efficiency. Finally, spending on private care for the publicly insured population (through MLE) appears to have a negative impact on efficiency. These findings, coupled to the calculation of new performance indicators related to the efficiency of hospital care, outcomes and health human resources, show that there is some indication that clinical and operational efficiency in the hospital sector can be improved and variation reduced; and that further strengthening the primary health care system in Chile will be key to sustain efficiency gains in the health sector.

5. Health Care Cost Drivers

47. **Although the efficiency analysis reveals an overall high level of efficiency in the system, certain factors bring distortionary cost pressures.** Chile's public health expenditure has increased significantly over the past decade, driven in part by the introduction of the guaranteed defined health benefit package in 2005. As the second largest budget category, health accounted for 18.3 percent of total public spending in 2015, compared to 13.6 percent in 2005 (DIPRES, 2016). Real public spending on health increased by 10.5 percent per year during 2000-15, making it the third fastest growing budget category. Relative to GDP, this represents an increase from 2.5 to 4.2 percent over the decade, and by 2015, total health spending reached CLP6.6 trillion (US\$10.1 billion). A breakdown of how these resources are spent shows that 75 percent of the public sector's health budget is executed through the 29 integrated health services delivery networks (Figure 2.10).

48. **Drug expenditures have increased substantially over the past decade (Figure 2.11).** Per capita public expenditure on pharmaceutical products reached CLP25 in 2015 compared to CLP7 in 2005 (2005 constant values): a real increase of more than 250 percent in ten years. Regional variability is also observed (Figure 2.12): the three highest shares of drug expenditure as a proportion of total (public) health spending are observed in the more urbanized areas, possibly explained by the presence of more specialized care centers.

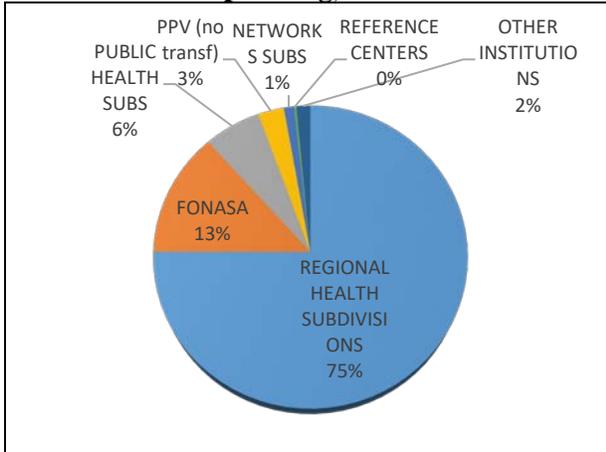
49. **The share of spending on contracts for private physician services has increased substantially in recent years.** In contrast, the share of labor expenses has declined gradually (Figure 2.13). This trend can be explained by an increase in dual practice from a growing number of physicians working in public hospitals for part of their time as salaried employees of the hospital and part of their time being contracted privately. The change in dual practice is clearly a source of expenditure increase with unclear effect on health care utilization levels, which remain low as indicated by OECD comparisons. Prices paid for services contracted to physicians working in the private sector are usually higher than services paid for the public practice of physicians, leading to expenditure pressure on hospital budgets. This gap between public and private remuneration may have influenced the growth of services outsourcing in public hospitals, as reflected by higher contract expenditures. A breakdown of labor expenditures reveals that salary and extra benefits from labor contracts are the key cost drivers in labor expenditure growth (Figure 2.14).

50. **There is a tendency for actual health spending to increasingly exceed assigned spending.** Although the difference between assigned and actual spending fluctuates, the trend is toward greater overspending (Figure 2.15). Actual spending exceeded assigned spending in 2013-15 by 1.2 percent, compared with 2005-08 which exhibits the opposite trend. A decomposition reveals that trend is driven by both labor and supplies (goods and services from operation) expenditures. This either suggests more care demand that is not fully met or higher inflation in health care costs, including practice fees and delivery of pharmaceutical products, given that the mentioned expenses are mostly composed of medicines and care services. The increased demand for care is largely explained by reforms aimed at increasing access to health care services. Budgetary information does not account for the services that are needed but not provided because of insufficient resources, which are one of the main causes of long wait lists in the public sector.

51. **Public health spending is mainly driven by an increase in drug expenditures and payment for contracting of private physicians working in dual practice.** These trends are illustrated in Figure 2.16. The main health care cost driver seemingly is the increase of pharmaceutical expenditure, which has an erratic but definitively increasing trend. Demographic changes and the ageing of the population have not been abrupt and seem to have a modest impact on health care expenditures at this point. Due to a limited ability to disaggregate health expenditures, we could not analyze the detailed impact of the introduction of new technologies and procedures on the increase in health care costs.

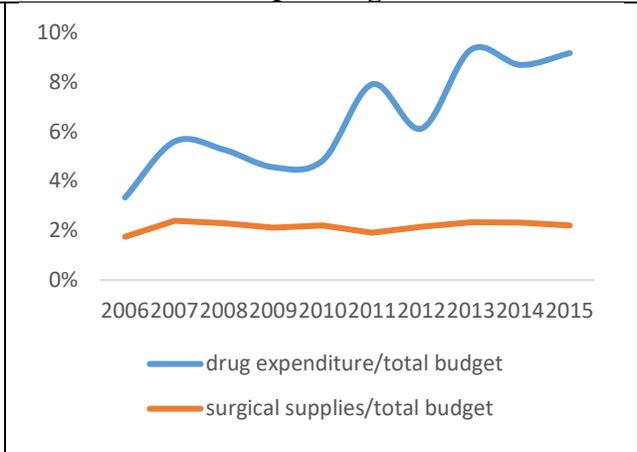
52. **Cost drivers can be assessed in terms of four key components: population growth, ageing of the population, general inflation, and other cost drivers (Figure 2.18).** We replicated an analysis carried out in Canada (Canadian Institute for Health Information, 2012), computing average annual growth rates from FONASA's population, the average age of FONASA beneficiaries, and annual expenditures, to infer an individual contribution from these cost drivers in the average annual growth rate of health care costs. Population growth was not the most important cost driver in this exercise: in the period 2005-2015, an average annual growth of 1.8 percent was observed. This is not the total population of the country, but rather the population of FONASA beneficiaries, which does not include ISAPRE enrollees and other users of public regimes. As such, the dynamic of this FONASA population is influenced not only by demographic factors but also by the private system, particularly the rate of "expulsion" of private system beneficiaries towards FONASA. Likewise, aging has been identified as a weak cost driver, with an estimated annual effect of 1.1 percent in the total growth of public spending, although it will get more important in the mid to long-term: according to the budget directory in the Ministry of Finance (2013), the share of population older than 65 will reach 24 percent in 2050 (compared to 11 percent in 2015). General price-effects have been a considerable driver of health spending: these averaged a growth rate of 3.5 percent per year, accounting for close to 38 percent of the overall increase in health spending, measured by the consumer price deflator. On the other hand, since information on health sector inflation is not available, this factor is considered in the "other" category. It is difficult to identify individual factors in the "other" category, but this generally includes all other factors not considered, such as: introduction of new procedures, changes in technology, changes in service utilization and health-sector inflation beyond general inflation. Other factors combined are the most important cost driver: these average an 8.3 percent rate of annual growth, greater than the other components taken together. It is important to clarify that the effects of these factors vary across regions, and may be interrelated, as seen in the aging effect on services utilization. Finally, it is important to note the increasing additional cost pressures arising from population expectations and citizens' demands. The increase in legal health claims, also known as the 'legalization' of health, is one of the most visible manifestations of these pressures.

Figure 2.14. Public Health Spending, 2015



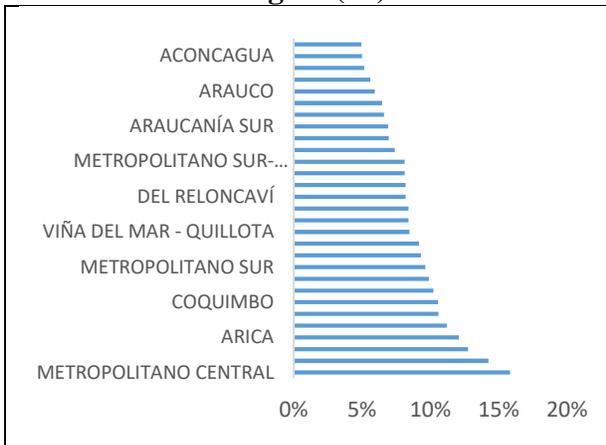
Source: Authors based on DIPRES data

Figure 2.15. Drug and Surgical spending



Source: Authors based on DIPRES data

Figure 2.16. Drug expenditure by region (%)



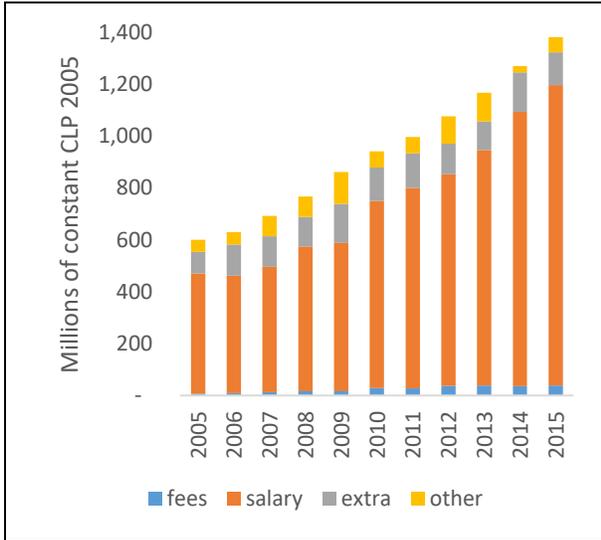
Source: Authors based on DIPRES data

Figure 2.17. Labor and Contractor spending



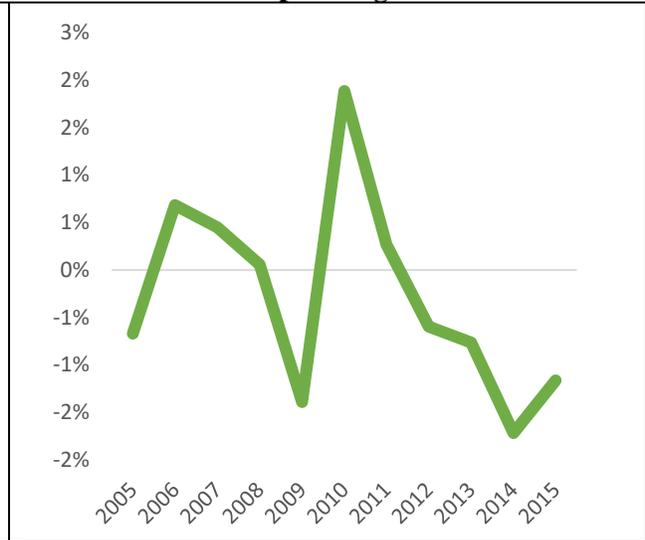
Source: Authors based on DIPRES data

Figure 2.18. Labor Spending, 2005-15



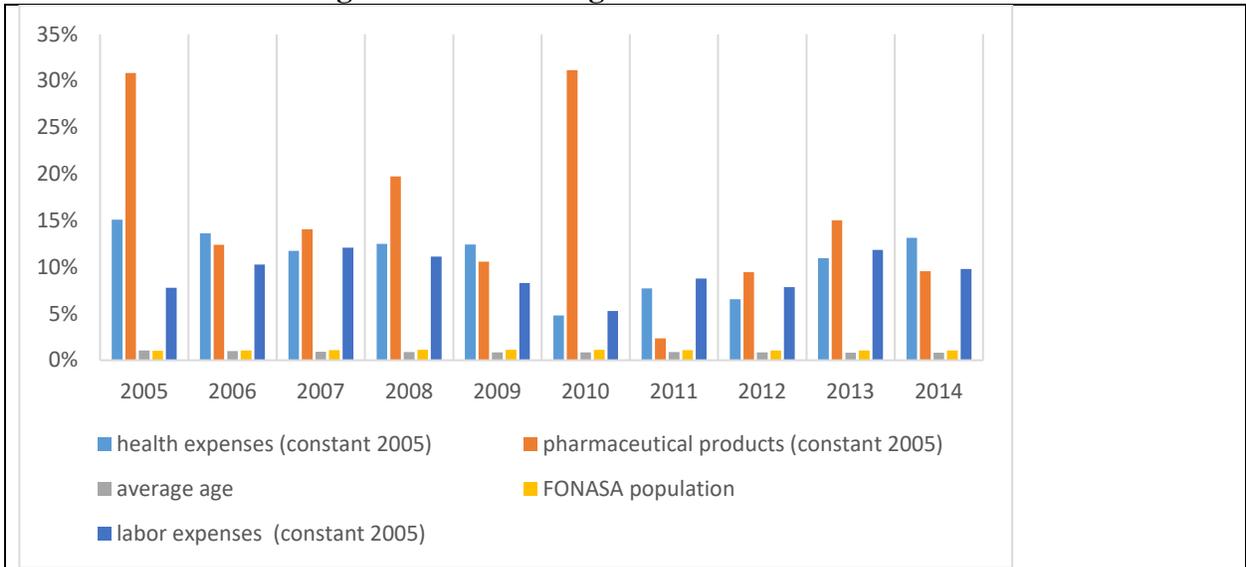
Source: Authors based on DIPRES data

Figure 2.19. Budgeted less executed spending



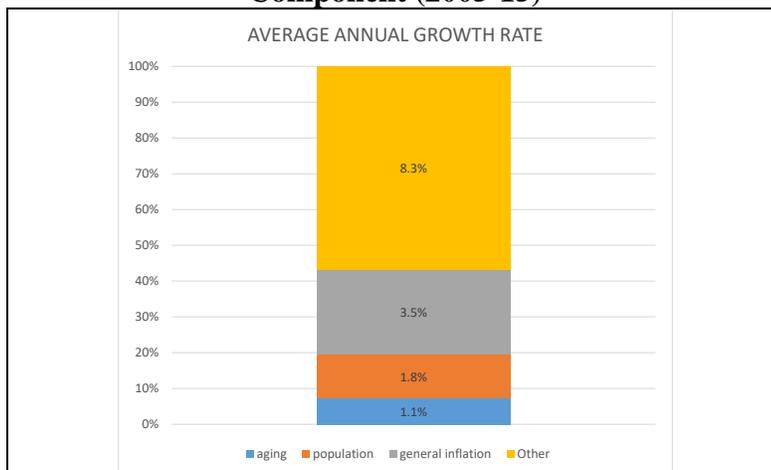
Source: Authors based on DIPRES data

Figure 2.20. Annual growth for health care cost drivers



Source: Authors based on data from the Ministry of Finance (DIPRES)

Figure 2.21. Health Care Cost Drivers by Component (2005-15)



Source: Authors based on data from the Ministry of Finance (DIPRES)

6. Recommendations

53. **The various analyses in the preceding sections point to several important conclusions to guide the development of recommendations for reforms to improve efficiency.** International comparisons indicate that Chile overuses certain expensive procedures, most notably, Caesarean sections. The strongest finding from the regional efficiency analysis was the association between a higher share of FONASA beneficiaries using the free-choice modality (MLE) and relatively lower efficiency. Attention to primary health care also matters: regions with the highest efficiency have the most GPs per capita; the most hours worked by GPs per capita; and, a high percentage of GPs out of total physicians. A higher than expected average hospital length of stay was associated with lower efficiency scores. The analysis of cost drivers found that drug expenditures and contracts for private physicians, driven by dual practice, have increased particularly rapidly in recent years and are the greatest contributors to the overall growth in health spending. Collectively, these findings point to four areas of focus consistent with the experience of other OECD countries in achieving efficiency gains in the short to mid-term: (1) drugs and medical equipment; (2) productivity and efficiency in hospital care; (3) primary health care; and (4) health human resources. It will be important to act on these recommendations in the context of concerns related to the sustainability of the sector with regards to growing hospital debts, lack of policy instruments to control dual practice of physicians, long wait times, and a growing concern over the rapid ageing of the Chilean population. The rapid ageing of the population in particular is calling for the emergence of new models of care, with greater integration of secondary and primary care through proactive care management programs focused on fragile patients with multi-morbidities, which are also high users of services as seen in Canada, the United States and the United Kingdom. Recommendations were developed primarily to generate savings in the short to mid-term in these four areas; however, medium to long term recommendations are also incorporated if efficiency gains over time were to be sustained.

54. **It should be noted that if this analysis touches only upon the efficiency of the public sector, the lack of regulation and ability of the private health insurance companies to select risks create a situation in which *de facto* the public sector acts as the second level insurer for the ISAPRES population.** This situation creates inefficiencies for the sector as a whole and therefore improving the regulation of the private sector will induce efficiency gains mechanically for the public sector. Finally, it should be noted that most recommendations will require better linkage between information datasets and innovative use of existing information systems to create registries and decision-support instruments for policy-makers, system managers and clinical teams.

6.1 Drugs and medical equipment

55. **The largest number of recommendations for short-term efficiency savings fall within the realm of drug and medical equipment procurement.** This is not surprising: as the analysis of cost drivers has shown, medications are the main source of expenditure pressure. A key goal should be to reduce the volume of direct procurement of drugs and medical equipment by hospitals and municipalities by a significant percentage, which could be conservatively estimated to be at least a 50 percent reduction (see conservative estimates below). Substantial progress towards this objective can be achieved by implementing multi-year framework contracts for high volume, high price drugs, improving the distribution and management of stocks, and working with hospitals and municipalities to achieve greater benefits from centralized procurement of drugs. Additional savings can come from defining a core list of medicines and medical equipment composed of high volume and/or high cost medicine and equipment for which procurement and distribution should be optimized in the short term; reducing overhead costs in procurement of medicines in hospitals, municipalities and at CENABAST. Mechanisms should be put in place to better oversee the management and cost control procedures of central pharmacies in public hospitals. Publicizing the prices paid by hospitals purchasing directly from pharmaceutical companies compared to the prices paid through centralized procurement by CENABAST can incentivize policy changes in hospitals. Finally, the possibility of expanding the joint procurement of drugs with other Mercosur countries through a common PAHO drug procurement mechanism should be explored.

56. **In the medium to long term, several additional actions should be considered:** (i) the direct procurement of a stipulated set of medicines and medical equipment could be prohibited, except in case of well-defined emergencies; (ii) a strong Health Technology Assessment function should be implemented in the health sector; (iii) the provision of continuous support including financial support to strengthen the institutional capacity of CENABAST and the strengthening of public financial management to ensure that public hospitals and municipalities pay CENABAST on time for its central procurement services; (iv) benchmarking drug prices paid in Chile against international comparators; (v) strengthening the ability of the health sector to regulate prices of drugs and medical equipment; (vi) The introduction of new mechanisms to increase the amount and volume of drugs procured through bulk purchasing with other Mercosur countries; (vii) establish the conditions necessary to facilitate the emergence of a robust market for generic drugs in Chile; and (viii) the possibility of expanding the production of pharmaceuticals in the country.

6.2 Hospitals

57. **Hospitals are the largest source of government expenditure on health services and several short to mid-term measures can be implemented to improve the efficiency of public hospitals.** First, a DRG-based payment system should be implemented for the sixty-two middle and high complexity hospitals. A per case or prospective payment mechanism such as the DRGs would reduce much of the perverse incentives to provide excessive or unnecessary care and remove the distortions present in the current reimbursement mechanism that relies on production and historic budgets. With the right incentives in place, it could also support reductions in length of stay, help accelerate the transition towards ambulatory care surgery and improve hospital productivity overall. A second priority should be the reduction of low value and inappropriate care, as identified through a DRG-based analysis of the sixty-two public hospitals mentioned above (compared, for instance, to the list developed by the Choosing Wisely initiative). Third, regional health services networks and the Ministry of Health should enforce strict financial monitoring of public hospitals. Fourth, day surgeries for key procedures should be increased. Finally, avoidable hospitalizations and readmission rates should be reduced.

58. **Several reforms are also recommended for consideration in the medium to long term.** Hospitals could be provided with greater autonomy and flexibility over the management of human resources. The management of public hospitals can be professionalized, in addition to strengthening the clinical governance of public hospitals. Other incentives for sound budget management may be explored, such as replacing hospital administrators in targeted hospitals with experienced administrators mandated to balance budgets when hospitals fail repeatedly to balance their budgets. The burden of high cost users should be analyzed and a targeted care plan implemented to better meet their needs. Finally, public reporting on hospital performance for both the public and the private sector should be put in place and awareness of the public built up over time.

6.3 Primary health care

59. **In the area of primary health care, there are several key short to mid-term recommendations.** First, a priority will be to analyze care consumption patterns for fragile, multi-morbid patients and consider how care delivery models can be altered to better meet their needs. This will be key to improve the integration of levels of care that are currently disconnected and fail to meet the needs of a growing proportion of the population, characterized by more complex needs. Furthermore, performance indicators and related contractual incentives for remuneration of primary health care workers should be revised to incentivize productivity gains. The amount of direct procurement of drugs should be reduced by defining targets, enforced through contracts between the Ministry and the municipalities. Finally, objectives for reducing avoidable hospitalizations should be defined and innovations in population health management should be incentivized through an innovation fund such as the one proposed below.

60. **Primary health care reforms in the medium to long term will also be important for ongoing efficiency savings.** The multidisciplinary care model must be strengthened to address non-communicable diseases and population health in communities. Mechanisms need to be developed to improve vertical and horizontal integration of primary health care services. Access to specialist care should be expanded through primary health care networks and organizational and technology solutions such as telemedicine. Payment systems can be changed to improve the mix of capitation and pay for performance. Efficiency of the primary health care sector at municipal level should be analyzed and performance information made publicly available and regularly reported. Lastly, primary health care should be integrated under regional health services networks.

6.4 Health human resources

61. **In the area of health human resources, the primary recommendation for the short term is to work with the medical college of physicians of Chile to avoid abuse in dual practice of physicians working in the public sector. In particular, a labor market analysis should be carried out as a preliminary study to tackle this complex issue.** It will be important for the Ministry of Health to work with the professionals to discuss local contexts where situations of monopoly have led to the negotiation of excessive remunerations for specialized physicians, leading to unsustainable hospital budget deficits.

62. **Inefficiencies in health human resource spending can also be addressed through several medium- to long-term policy changes.** Nurse practitioners and other allied health professionals can be provided an expanded scope of practice. The private sector should be better regulated to avoid unfair competition between the public and private sector for the attraction and retention of medical doctors and specialists. A new agreement related to the dual practice of medical doctors should be negotiated between the public and private sectors.

6.5 Estimation of potential savings

63. **Substantial savings – a total of up to 100 million USD – are predicted from short-term reforms to drug and medical equipment procurement.** Of this total, thirty-eight million USD (see Table 2.5) could be saved by reducing direct procurement (thirty million USD from hospitals,

5 million USD from municipalities, and 3 million USD from regions). Up to fifty million USD of additional savings could come from implementing targeted, multi-year framework contracts (the largest source of savings, which will require for CENABAST to benchmark its procurement practices against leading countries), and up to twelve million USD could be expected to come from other efficiency measures focused on hospital pharmacy management and expanded use of bulk purchasing with other Mercosur countries. Estimates generated from direct comparison between prices paid through direct purchase and prices paid by CENABAST are reflected in table 6 below, as well as additional estimates of efficiency gains.

64. **Improving efficiency in hospitals is expected to generate even larger savings in the short term, due to the size of hospital expenditures in overall expenditures in the health sector.** A total of up to 150 million USD are expected to come predominately from the reduction of clinical efficiencies (112 million USD). This is comprised of: fifty million USD from reducing avoidable hospitalizations; 2 million USD from reducing Caesarean section rates; eighteen million USD from reducing hospital readmission rates; and forty-two million USD from reducing hospital length of stay for some conditions and procedures. In addition, it was estimated that thirty eight million USD could be saved by accelerating the implementation of day surgery and other measures to reduce administrative costs and achieve operational efficiencies.

Table 2.5. Estimates from efficiency gains for procurement of drugs and medical equipment

Direct Drug Procurement			
	Amount if Direct Purchase (millions of US\$)	Amount if Centralized Purchase (millions of US\$)	Potential Efficiency Gains (millions of US\$)
Primary care services	20.6	15.3	5.3
Hospitals	106.1	76.2	29.8
Regional Health Services	9.8	6.8	3.0
Subtotal	136.5	98.4	38.2
Other Sources Efficiency Gains			
Introduction of multi-year framework contracts for high volume, high price drugs			50
Management and cost control procedures of central pharmacies in public hospitals and expand the joint procurement of drugs with other Mercosur countries			12
Subtotal			62
Overall Total			100.2

Source: Authors

Table 2.6. Summary of Results

Source of Hospital Excess Cost	Total Excess Cost (US\$ million)	Estimated Efficiency Gains (US\$ million)
Avoidable Admissions	128.6	50.0
Asthma	4.1	
COPD	43.5	
Congestive heart failure	45.2	
Diabetes	24.1	
Hypertension	6.1	
Angina Pectoris	5.6	
Excessive number of days of hospitalization (low clinical efficiency)	42.8	42.0
Readmissions before 30 days (low clinical effectiveness)	55.9	18.0
Cesarean Section	9.2	2.0
Day surgery and other measures to reduce administrative costs and achieve operational efficiencies	N/A	38.0
Total	236.5	150.0

Source: Authors

65. **Several assumptions were used to estimate potential efficiency gains for hospitals.** The excess cost from avoidable admissions was calculated from the number of hospital discharges due to health problems that, according to the literature, should be addressed at the primary care level and, if well managed, should not lead to hospital admissions. The conditions used were: asthma, chronic obstructive pulmonary disease, congestive heart failure, diabetes, hypertension and angina pectoris. The discharges were monetized using the average DRG rate for each condition. It is estimated that approximately 40 percent of these costs could be reduced by strengthening the primary care level. The cost generated by the excessive number of hospitalization days was estimated by comparing the actual length of stay in fourteen FONASA pilot hospitals with DRG standards. These costs were then projected to the 62 high and medium complexity hospitals. We estimate that proper clinical and hospital management could fully reduce these excess hospitalization days. The cost from readmission rates were generated from the costs of hospital readmissions observed in the fourteen pilot hospitals and then projected to the set of 62 more important FONASA hospitals. We estimate that better clinical management could reduce readmission rates by more than 30 percent. The potential cost savings from reducing the proportion of deliveries through cesarean section was estimated by using the cost difference between a normal delivery and a cesarean section and applying it to a reduction of approximately 20 percent. Finally, we suggest that the work underway of shifting inpatient care to outpatient care should be accelerated and that other operational efficiencies such as back office consolidation could lead to a potential total saving of 38 M USD if proper incentives were in place.

66. **The value of savings from primary health care reforms and reforms to health human resources are more difficult to estimate, but are also expected to contribute to vital expenditure reductions.** In particular, we identified that up to five million USD could be saved if drugs were purchased through CENABAST instead of being procured directly by municipalities.

67. **Efficiency gains proposed amount to 0.11 percent of GDP and were designed to achieve short-term efficiency gains and be sustainable over the medium to long term.** The efficiency gains proposed are summarized and presented in Table 1 of the Executive Summary. It is important to note that since wages make up an important share of hospital spending, decisions related to wages of hospital staff can have an important impact on the ability of the government and its agencies to realize the efficiency gains proposed.

6.6 Implementation considerations

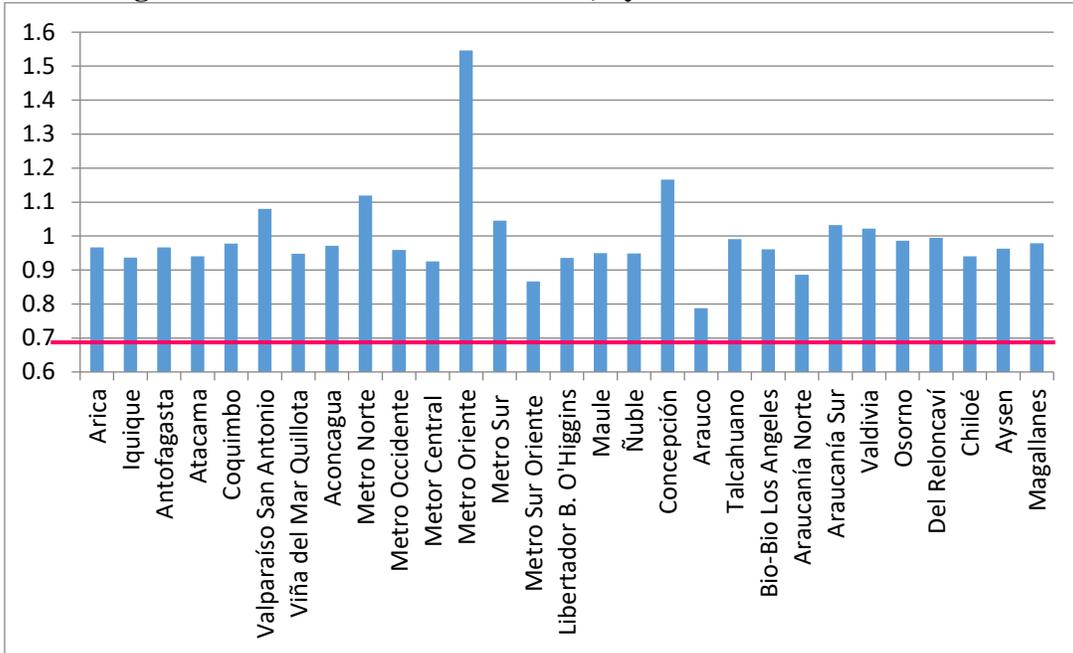
68. **Important factors that may affect the implementation of these recommendations are described below.** Appendix 5 contains additional detail on implementation considerations, including case studies on three efficiency-saving policies in other high- or upper-middle income countries.

69. **While considering the specific actions recommended in each of the four areas, several over-arching recommendations should establish the context for implementing these reforms.** Efforts to achieve efficiencies should primarily be focused on the hospital sector and on the procurement of drugs, where the greatest potential for efficiency gains lies. Targets for efficiency gains by region should be set based on the Public Expenditure Review findings and other analyses. The implementation of the plans necessary for the achievement of these targets for 2017 should be the responsibility of the 29 public integrated health services networks and will induce changes in processes of care, organization and management. A new inter-ministerial task force would be responsible for providing technical guidance and support, as well as for monitoring its implementation progress. Finally, a portion of the efficiency savings could be allocated for the establishment of an innovation fund to help finance the implementation of these efficiency plans in the regions if additional resources were to be identified. A substantial amount of resources should be allocated to the innovation fund in order to support the implementation of change and the realization of future efficiency gains. Regions should apply for access to these resources, which should be allocated through transparent mechanisms by the inter-ministerial task force.

70. **In order to build on and sustain the success of short-term efficiency gains in the health sector, several important complementary efforts will be required.** Information systems will have to be strengthened and mobilized to provide the information necessary for better decision-making based on the needs of high users of the system. Primary health care should be strengthened, possibly entailing a shift to receiving a greater portion of resources, relative to the current situation. Population risk factors, such as smoking, must be addressed through effective campaigns or interventions. Clinical efficiency and effectiveness must be improved – for example, by reducing hospital readmissions and expanding the implementation of hospital payment through DRGs. An essential list of medicines and equipment should be developed and acted upon while sufficient resources should be provided to sustain the transformation of CENABAST into a high-performing procurement agency for pharmaceutical and medical equipment products; and risk sharing mechanisms related to costs should be negotiated with the pharmaceutical industry. Finally, ongoing efficiency plans must be based on detailed and sound analysis of the local situation, with the regions working with hospitals and municipalities.

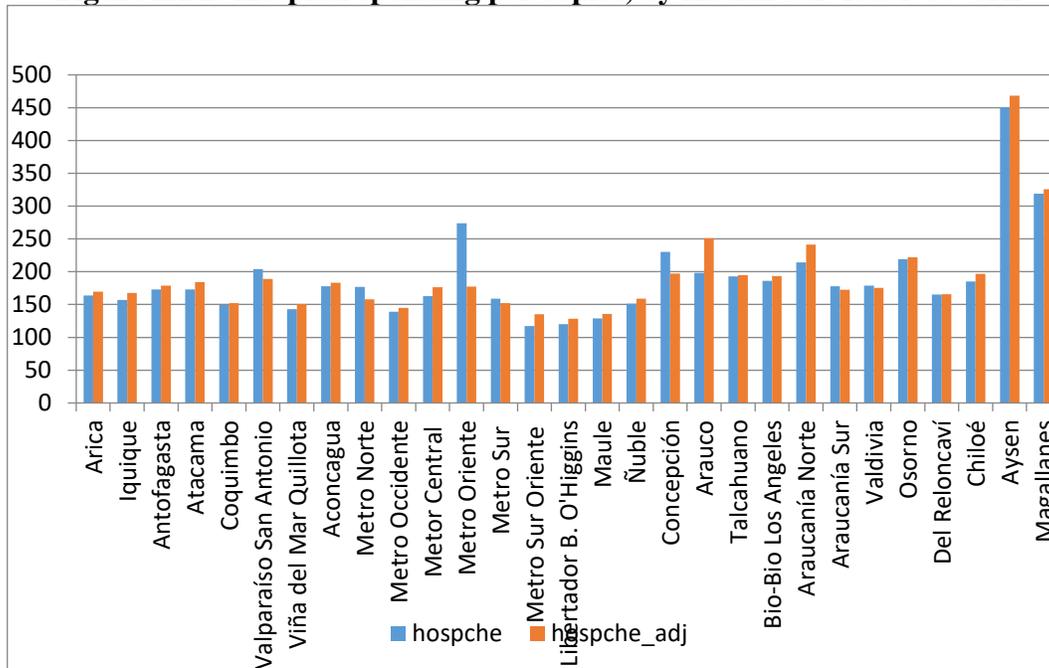
Annex 2A: Patient Flow

Figure 2A.1: Inflow-Outflow Ratios, by Health Services Network



Source: Authors

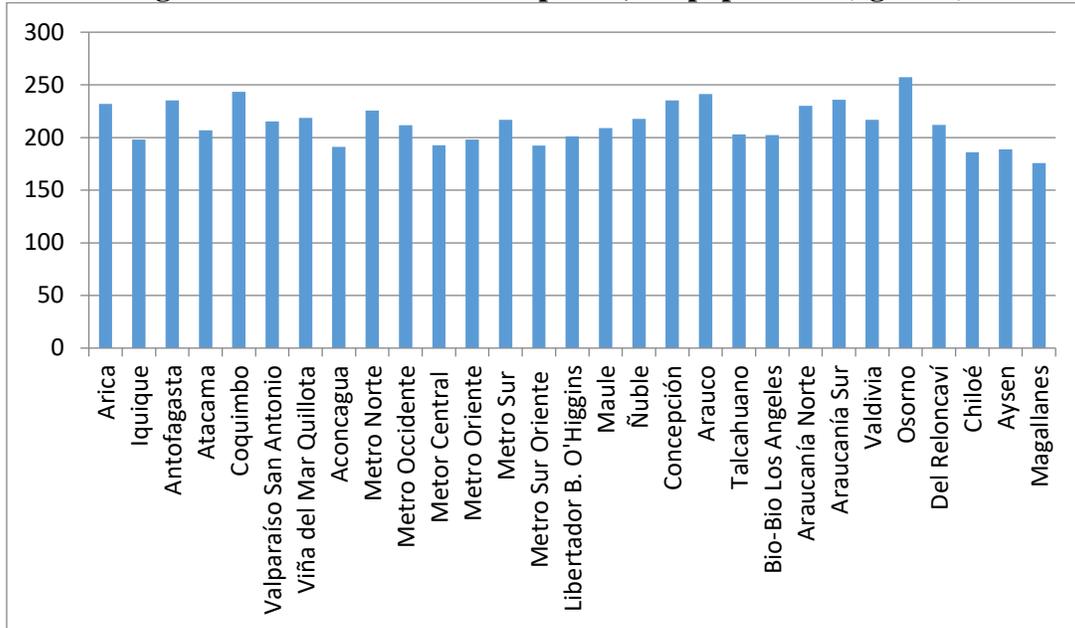
Figure 2A.2: Hospital spending per capita, by Health Services Network



Source: Authors

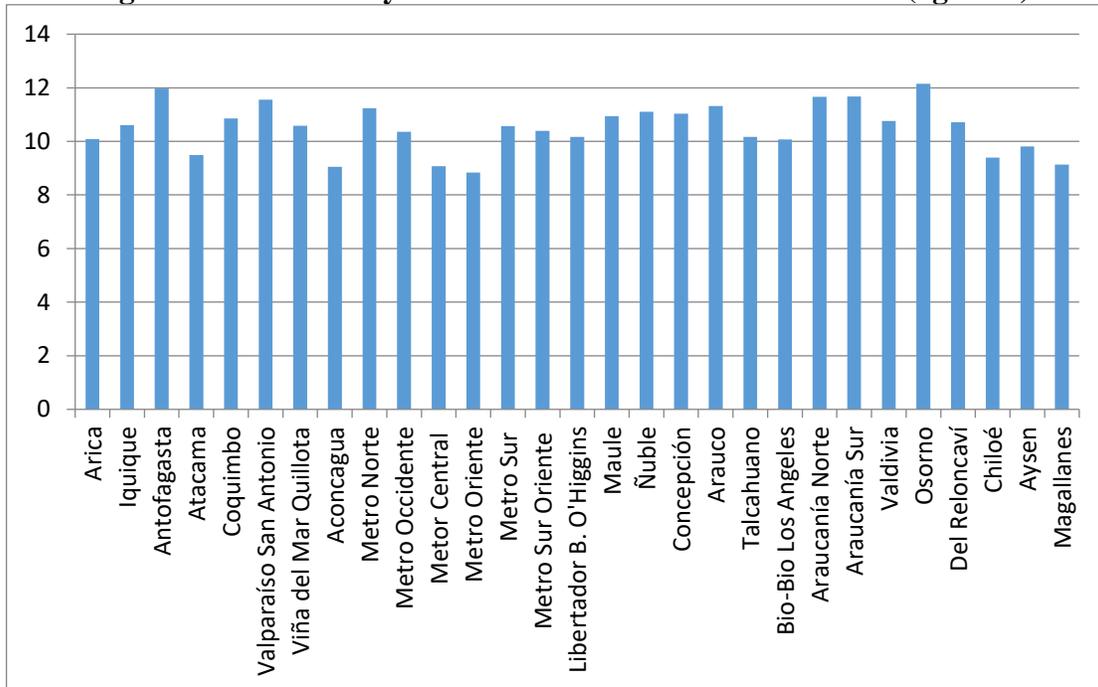
Annex 2B: Measuring treatable causes of death

Figure 2B.1: Treatable PYLL per 10,000 population (age <75)



Source: Authors

Figure 2B.2: Mortality rate due to treatable causes of death (age <75)



Source: Authors

Annex 2C: Univariate Statistical Analyses

Table 2C.1: Results of the univariate analysis of baseline efficiency score

Dependent variable: Robust efficiency score (logarithm)		
	Coef.	p-value
% smoking	0.000	0.977
% hypertension	0.001	0.535
% diabetes	0.003	0.459
% of spending on primary care	0.001	0.513
% of spending on MLE	-0.002	0.117
Average occupancy rate	-0.001	0.479
% birth by cesarean section	0.001	0.341
Average hospital days	-0.004	0.680
readmission selected	0.005	0.582
readmission overall	0.003	0.721
% of specialist visits	-0.000	0.981
% of long stay	-0.010	0.291
% of urgent 7-day readmission	0.077	0.163
Complexity index	-0.071	0.683
Functional index	-0.329	0.102

note: *** p<0.01, ** p<0.05, * p<0.1

Source: Authors

Table 2C.2 Results of regression analysis

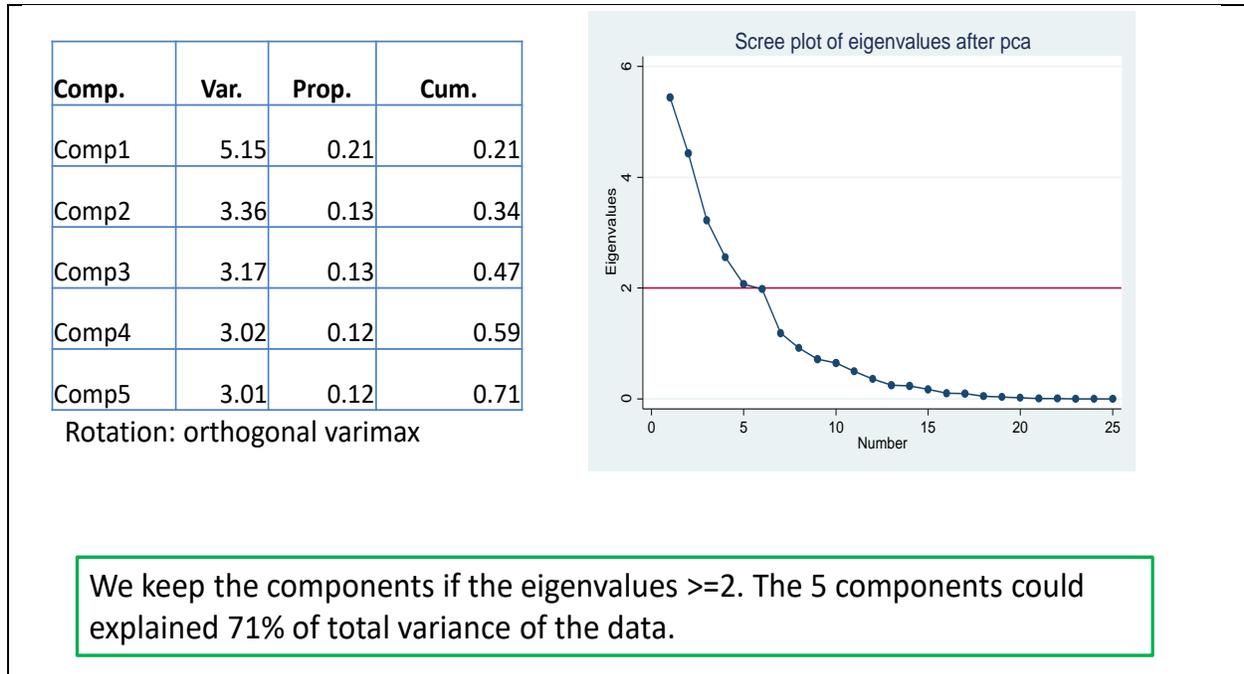
Dependent variables: Robust efficiency score (logarithm)		
	Coef.	p-value
N° nurses per 10 mil.	0.004	0.434
N° GP per 10 mil.	0.003	0.509
N° specialist per 10 mil.	-0.001	0.892
N*# Hrs. GP per 10 mil.	0.000	0.319
N*# Hrs. specialists per 10 mil.	0.000	0.816
GP/physicians	0.706	0.138
GP/nurses	-0.023	0.690
GP/support staff	-0.011	0.950
nurse/support staff	0.071	0.764

note: *** p<0.01, ** p<0.05, * p<0.1

Source: Authors

Annex 2D: Results of the Principal Component Analysis

Figure 2D.1: PCA using health service region – the variances that components explained



Source: Authors

Table 2D.1: PCA – Retain the factor loading with largest values

Variable	Comp1	Comp2	Comp3	Comp4	Comp5	Unexplained
% tertiary education		0.4694				0.1777
% smoking				0.3816		0.2939
% hypertension			0.3711			0.5321
% diabetes			-0.4111			0.2218
% of spending on primary care		-0.2297				0.3724
% of spending on MLS		0.3253				0.378
Average occupancy rate				0.2518		0.1965
% births by Caesarean section					-0.1847	0.7616
Average hospital days				0.3734		0.4286
Readmission selected procedure			0.4406			0.2106
Readmission overall			0.483			0.1691
% of specialist visits		0.4241				0.3834
% of long stay					0.5278	0.1924
% of urgent 7-day readmission		-0.3329				0.5691
Complexity index		0.3602				0.4029
Functional index					0.4355	0.4481
N° nurses per 10 mil.	0.3906					0.06095
N° GP per 10 mil.	0.4344					0.02967
N° specialist per 10 mil.	0.373					0.04606
N°# Hrs. GPs per 10 mil.	0.4142					0.01977
N°# Hrs. specialists per 10 mil.	0.4181					0.04329
GP/total physicians					-0.2786	0.1696
GP/nurse				0.4918		0.1637
GP/support staff				0.4487		0.3781
nurse/support staff					0.2569	0.6361

Source: Authors

Table 2D.2: Multiple linear regression on the robust efficiency scores

Dependent variable: Robust Efficiency Score			
	Coef.	t	P> t
component 1	-0.0251	-0.82	0.418
component 2	-0.0394	-1.32	0.2
component 3	0.0300	1.29	0.211
component 4	-0.0116	-0.36	0.722
component 5	-0.0399	-1.43	0.167
constant	-0.1062	-3.83	0.001
R2		20%	

Source: Authors

Annex 2E: International lessons for efficiency saving policies

Case Study 1. Pharmaceutical purchasing reforms in Serbia

In response to high pharmaceutical expenditures and rapid increases in pharmaceutical spending in recent years, the Serbian government implemented a pilot program in 2014 to explore purchasing reforms. During the pilot, all drugs used in hospitals (one-third of all drugs used in the health system) were purchased centrally by the Ministry of Health rather than by individual facilities. On average, drug prices were 27 percent lower, amounting to a total savings of 25 million Euros. The Ministry of Health is now exploring additional pharmaceutical spending reforms to implement in the short, medium, and long term, including cluster reference pricing, generic substitution, and the use of Health Technology Assessment.

Source: Authors' summary based on Verheijen (2014).

Case Study 2. Gatekeeping in the United Kingdom

The United Kingdom has employed a strict gatekeeping system since the initiation of its National Health Service (NHS) in 1948. All patients are required to register with their choice of general practice, where all primary care is provided by general practitioners (GPs). GPs act as gatekeepers to specialist care, with most specialists working in hospitals. Emergency care and sexual health services are two of only a few exceptions to the strict gatekeeping model. Recently, the speed of referrals has improved; now 80 percent of patients visit a specialist within four weeks of their GP visit. There is generally high public support for the NHS and its model of gatekeeping.

Source: Authors' summary based on Roland et al (2012).

Case Study 3. Examining policies to manage dual practice in Saudi Arabia

The Kingdom of Saudi Arabia and the World Bank recently studied the extent, impacts, and possible responses to dual practice in Saudi Arabia. The country has a fragmented health care system with 60 percent of care provided by the Ministry of Health and the remainder through the private sector or various other government entities. Saudi Arabia is trying to manage the tradeoffs of dual practice – how to maintain physician performance in the public sector without incentivizing quality physicians to leave the public sector – which is exacerbated by a large quantity of expatriate physicians, who can easily choose to work elsewhere.

Currently, dual practice is banned, except for in university hospitals, with provisions. Data collected for this study revealed that 90 percent or more of physicians in universities engage in dual practice, as well as many outside this system, although the proportion is difficult to estimate because it is illegal and not willingly reported. Managing dual practice is now a priority concern for health policy in Saudi Arabia, but views on the best approach to do so range from support for a complete ban to legalizing dual practice for all sectors of the health system. In reviewing policy responses in other countries, the study concluded, “there is no single cross-national policy...to effectively manage the costs and benefits of dual practice...those conditions that affect the interactions between the public and private healthcare sectors must be taken into account in order to effectively manage dual practice through policy.”

Initial interviews indicated three policy options may be most appropriate for Saudi Arabia: a complete ban on dual practice across all public sectors of the health system; harmonization of regulations across all sectors and harsh penalties for any violations; and institutionalizing part-time contracting of consultants in coordination with harmonized regulations. Each of these possible approaches was investigated in detail, presenting costs and benefits of each, and developing recommendations for an implementation plan to manage and monitor impacts. Guidance for implementation included the importance of effective communication between the public and private sectors; involving all stakeholders; ensuring adequate resources and organizational design; mobilizing all actors; and monitoring the impacts of the policy to assess necessary modifications.

Source: Author's summary based on World Bank (2016).

Annex 2F: Additional implementation considerations

Reducing direct procurement of drugs and equipment

There are several possible successful models of centralized purchasing – in terms of the organization, financing, legal status, and mandate – but regardless of the model, important risk and success factors must be considered. Purchasers, suppliers, and contracting authorities are the key stakeholders of a centralized procurement agency; each group’s interests must be considered and adequately addressed. Attractive and sound framework agreements are the products that incentivize cooperation with a centralized procurement agency, thus, these must remain functional and relevant. The agency must be adequately staffed to carry out its key functions – management of contracts and relationships, and provision of support services. Legal risks regarding the choice of suppliers should be anticipated. Lastly, the agency should be careful not to expand beyond the scope of products for which it has the mandate, expertise, and capacity to manage, with the risk of negotiating unproductive framework agreements.

Not all countries with central procurement make it compulsory, as there is a natural incentive to do so due when products become available at lower prices. Information alone can also be a powerful incentive to generate savings. As part of procurement reforms, the UK National Health Service required centralized reporting of purchases, including price information, thereby enabling better assessment and analysis of price differences across purchasers. The collection and publication of such information may encourage hospitals and municipalities to reform their practices for overpriced items.

Multi-year framework agreements

Under a framework agreement, a long-term contract sets the terms under which smaller repeat purchasing orders can be issued for a defined period of time. These contracts may be made with single or multiple suppliers and generally consist of two steps: first, negotiation of the agreement and second, placing orders under the terms of the agreement. With one supplier, the first step is competitive to win the contract; with multiple suppliers, the second step can be competitive or based on other criteria, e.g. an established preference ranking of the suppliers, a set rotation among the suppliers, or a set purchase amount per supplier, as established in the contract. ChileCompra provides an example currently in use by the Chilean government, which employs a framework agreement for certain public procurements.

Reducing low-value care

Addressing low-value care requires identifying low-value services, assessing their rates of provision across different facilities or geographical areas, and implementing reforms to reduce their use. Detailed data are required to accurately identify misuse of clinical interventions because the appropriateness of many services depends on patient and clinical factors; in the absence of such detail, abnormally high rates may be interpreted as an indirect measure of overuse. Possible reforms to reduce inappropriate care may be demand-side (targeted at patients) or supply-side (targeted at providers). Of the available policy options, value-based insurance designs have attracted substantial attention in recent years. These vary patients’ cost sharing for services not strictly based on the expense of the service, but also on the expected benefit of the specific service to the specific patient. Other types of financial incentives include bundled payments or pay-for-

performance schemes, which target providers by rewarding them for the economical use of services.

Managing dual practice

The appropriate policy response to manage dual practice must be determined country-by-country based on careful analysis of provider and health system factors, incentives, and constraints. A recent study conducted by the World Bank in Saudi Arabia (case study 3) demonstrates the detailed analysis of costs and benefits that is recommended in order to decide on an appropriate policy. Pending a more thorough analysis, the current occurrence of dual practice in Chile suggests that one of three reforms may be most appropriate: 1) restricting the volume of services performed or 2) earnings made, by public sector providers in the private sector or 3) permitting some private practice in public facilities. Considering other possible options, banning dual practice would likely pose greater risk of losing providers from the public sector, and increasing public sector salaries would require additional funding; other options may take substantial time to implement and scale-up (e.g. new incentives for exclusive public sector practice).

Possible reforms for managing dual practice can be employed alone or in combination. Among the OECD countries, Austria and Italy limit the quantity of private sector services; France and the UK set a maximum income from such services; and several countries permit private practice within public hospitals, as a stand alone policy or in combination with a cap on the volume of services (Italy) or earnings (France). The option to permit private practice in public facilities can generate revenue for the public sector by charging providers for facilities and equipment used for private services and may also facilitate better monitoring of private sector activities. Between the two versions of limiting private services – by income or volume – the latter is recommended because it does not pose a greater limitation on providers with higher earning potential (the most skilled or experienced providers.) Regardless of the chosen policy or policies, enforcement capacity will be necessary.

Improving the gate-keeping function of primary care doctors

The Ministry of Health may be able to encourage greater reliance on primary care providers as gatekeepers by modifying the incentives in its contracts with municipalities. Financing is the main mechanism to encourage gatekeeping; in general, capitation payments discourage the unnecessary use of specialist care, as compared with fee-for-service reimbursements. These types of financial incentives can either be applied by the Ministry of Health directly to its payments to municipalities (e.g. by paying municipalities on a capitation basis); or can be monitored at the municipal level for their inclusion in provider payment mechanisms (and penalized or rewarded accordingly in payments to municipalities.) Possible indicators for municipalities to report include: the proportion of providers being paid on a capitation or other non-fee-for-service basis; the proportion of non-referred specialist visits that were charged an extra fee for bypassing the primary care provider; or the proportion of each municipality's population registered with a general practitioner (most countries that employ gatekeeping require registering with a generalist.)

If the use of specialist care is universally considered to be too high, municipalities could be penalized (or rewarded) for increases (or decreases) in the number of specialist visits relative to the number of primary care visits. If this indicator were routinely reported, Ministry of Health payments to municipalities could be adjusted by a percentage increase or decrease corresponding

to performance in reducing reliance on specialist care. Average wait times for primary care providers and/or specialists are other possible indicators – if either are particularly high, this may suggest gatekeeping is not functioning optimally, although this presumes an adequate supply of the necessary types of providers. Reimbursements to municipalities could be similarly adjusted for positive or negative performance on these indicators.

Accelerating transition to day surgery

Financing may be the most effective tool to increase the utilization of day surgery - Slovenia successfully incentivized a shift to day surgeries by implementing DRG-based payments and one region of Italy reduced reimbursements for procedures inappropriately performed on an inpatient basis. A similar reimbursement policy is used by insurers in the United States – payments are made at day surgery rates unless providers can justify the need for inpatient treatment. Organizational structure, culture, and tradition are other important but less influential factors affecting day surgery rates. An essential component is that the appropriate facilities for day surgery are available. Several different environments are possible for day surgeries: a hospital-integrated facility, a self-contained unit on a hospital site, a free-standing self-contained unit, or a physician’s office-based unit. Other potential barriers to the expanded use of day surgeries include: regulatory hurdles, lack of emphasis on day surgery in medical education, absence of sufficient home or community support for patients, and poor multidisciplinary teamwork, among others. Each of these potential challenges must be addressed by strong management and organizational capacity within the relevant agencies and facilities.

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Chapter 3. Education¹

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Table of Contents

1. Introduction.....	3
2. International Benchmarking.....	3
3. General Efficiency Patterns at the School Level	10
4. Program Review: Laptops.....	17
5. Program Review: School Feeding (PAE)	24
6. Procurement Analysis of Selected Education Programs.....	30
Annex 1: Stochastic Frontier Analysis	39
Annex 2: Estimating savings from different school feeding targeting scenarios	46
Annex 3: Savings Calculations for MCPA and YEMPC.....	49
Annex 4. Analysis of Bidder Participation and Contract Awards	51
Annex 5. Key Performance Indicators Examples	52
Annex 6: International School Feeding Procurement Experiences	53

Table of Figures

Figure 3.1. Expenditure in education (percent of total government expenditure)	4
Figure 3.2. Government expenditure in education (percent of GDP).....	5
Figure 3.3. Chile: Government expenditure (PPP) per student (percent of OECD).....	5
Figure 3.4. Expenditure composition, by level of education, 2012	6
Figure 3.5. Public Expenditure in staff compensation and capital as a percentage of total, 2011..	7
Figure 3.6. Average Class Size, circa 2012	7
Figure 3.7. Pupil per teacher ratio, circa 2012.....	7
Figure 3.8. PISA scores, 2015	9
Figure 3.9. Correlation between PISA 2015 science score and spending per student.....	9
Figure 3.10.	9
Figure 3.11. Simulations: differences in school-level performance after attributing to all schools top efficiency levels	14
Figure 3.12. Education Procurement <i>PAE</i> , <i>ENLACES</i> and <i>Textos Escolares</i> 2013-2014 (million USD).	30
Figure A1.1 Differences in school-level learning performance (8 th grade).....	41
Figure A1.2 Key factors correlated with student outcomes.....	42
Figure A1.3 Marginal effects associated to increasing input/variable “X” by 10 percent	43
National sample, 8 th grade	43

List of Tables

Table 3.1. Selected Education Indicators.....	8
Table 3.2. Stochastic Frontier Analysis: Inputs associated with top school performance (8 th grade)	11
Table 3.3. Stochastic Frontier Analysis: Factors associated with technical efficiency (8 th grade)	15
Table 3.4. Estimated savings in <i>Me Conecto para Aprender</i> and <i>Yo Elijo mi PC</i>	19
Table 3.5. Estimated Efficiency Gains for School Feeding and ICT Programs	23
Table 3.6. Potential savings associated to fingerprint readers/cards.....	27
Table 3.7. Potential savings with on-demand rations for quintile 3	28
Table 3.8. Potential savings associated with sharing fixed costs.....	29
Table 3.9. ICT Costs during the lifecycle	34

1. Introduction

1. **The objective of the education chapter is to identify potential efficiency gains and fiscal savings for selected education spending programs.** Specifically, this includes: (1) a program providing computers to 7th grade students in public schools (*Me Conecto para Aprender*); (2) a program providing school lunches in public schools at the primary and secondary level (*Programa Alimentación Escolar*), and; (3) a program providing educational text books.

2. **The programs subject to evaluation were jointly selected by the Ministry of Education, the Ministry of Finance and the World Bank team.** Their selection was due to a number of factors. First, they are programs which are not affected by any of the deep and wide reaching educational reforms currently under way in Chile. Second, their share of the education budget is sufficiently sizeable to give rise to potential efficiency gains that are of fiscal importance. Third, incidental evidence at the time of selection suggested a potential for improving the spending efficiency within these programs. The analysis quantifies the potential size of such efficiency gains (whenever possible) and identifies the mechanisms through which they can be achieved.

3. **The chapter is structured as follows.** Section 2 compares Chile's public education spending and outcomes to other countries using international benchmarking. Section 3 examines the ability of schools to translate education inputs into education outcomes using a stochastic frontier analysis and identifies the relevant factors explaining educational performance. Section 4 examines opportunities to improve efficiency of the *Enlaces* laptop program and quantifies potential efficiency gains. Section 5 conducts a similar analysis for the *PAE* school feeding program. Section 6 analyses procurement of goods and services in the PAE, ENLACES and the provision of textbooks.

2. International Benchmarking

4. **This section compares Chile's public education spending and outcomes to other countries using an International Benchmarking Database.** Chile's performance is compared with regional and structural peers, as well as OECD countries. Regional peers belong to the Pacific Alliance Bloc including Colombia, Mexico and Peru. Structural peers are countries with similar economic characteristics and includes Australia, Canada and Norway².

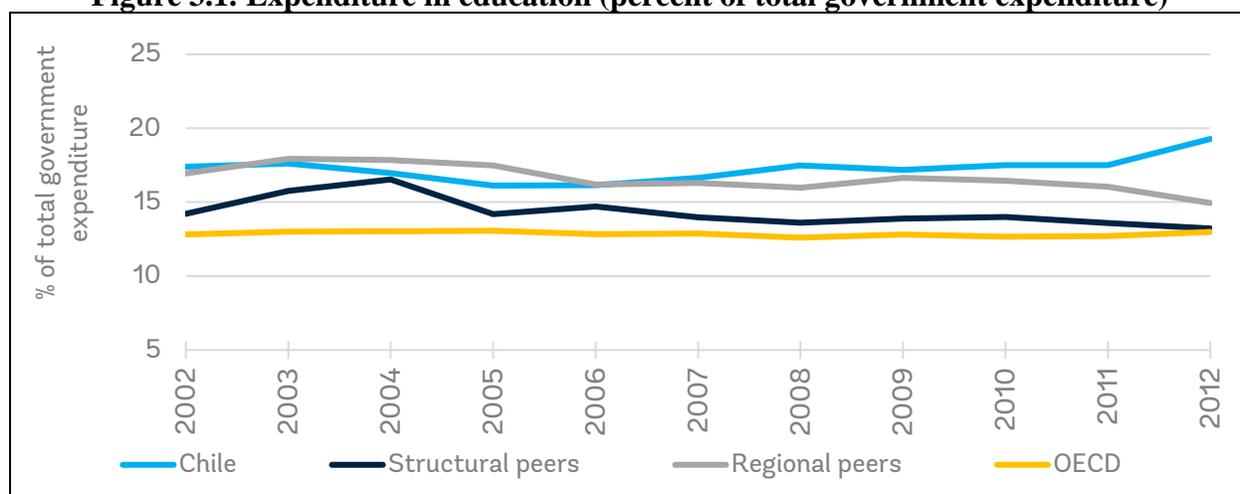
5. **Public education is the most important spending sector in the Government budget and has been increasing substantially over the past decade.** As the largest budget category, it accounts for 20.5 percent of total public spending in 2015 compared to 17.2 percent in 2005. In 2015, total education spending amounted to CLP7.5 billion or about US\$11.4 billion. Relative to GDP, this represents an increase from 3.2 to 4.8 percent over this period. Real public spending on education increased by 9.1 percent per year in 2000-15 making the fourth fastest growing budget categories. Further budget increase are expected in the medium term as the tax-to-GDP ratio is

² Annex 2 of the main report describes the criteria for the selection of these structural peers.

expected to increase by about 3 percentage points on account of the 2014 tax reform and a substantial share hereof would be dedicated to education.

6. **As a result, Chile’s public education system accounts for a larger share of public spending than regional and structural peers, and the OECD.** At around 20 percent, education expenditures as a share of total government spending in Chile has consistently been higher than the observed in structural peers and OECD averages, where spending in education represents around 13 percent of the government budget and higher than in other Latin American countries that allocate 15 percent of their budgets to the education sector (Figure 3.1).

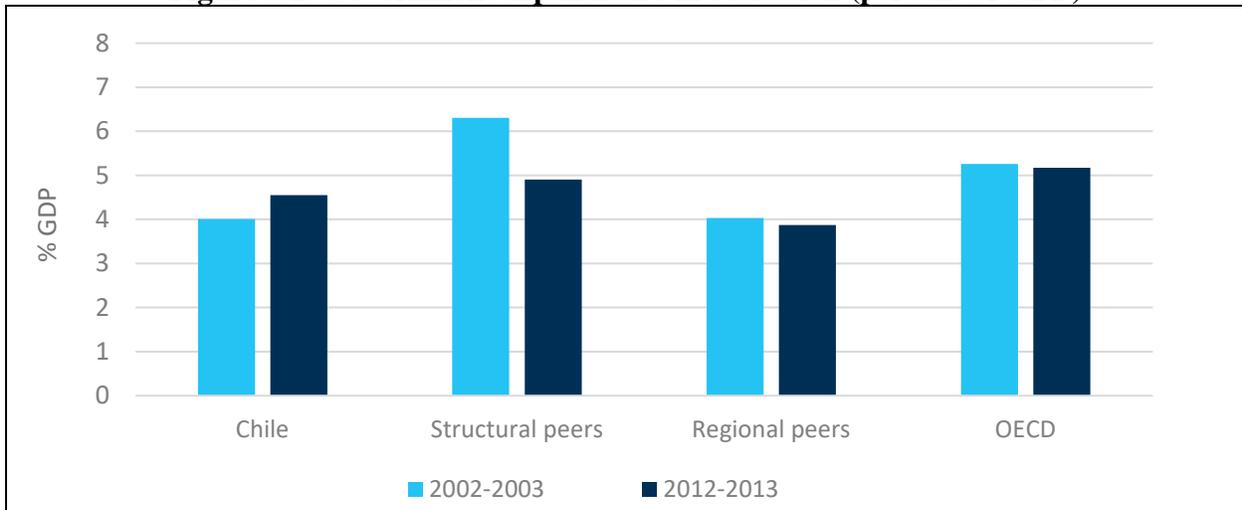
Figure 3.1. Expenditure in education (percent of total government expenditure)



Source: OECD Education at Glance (2014 and 2015). Notes: In Chile, the year of reference is 2013 except for pre-primary education. Year of reference for pre-primary is 2011, except for Chile (2012). Data for Peru is missing, and data for Canada is missing for pre-primary, primary and lower secondary education due to data inconsistencies.

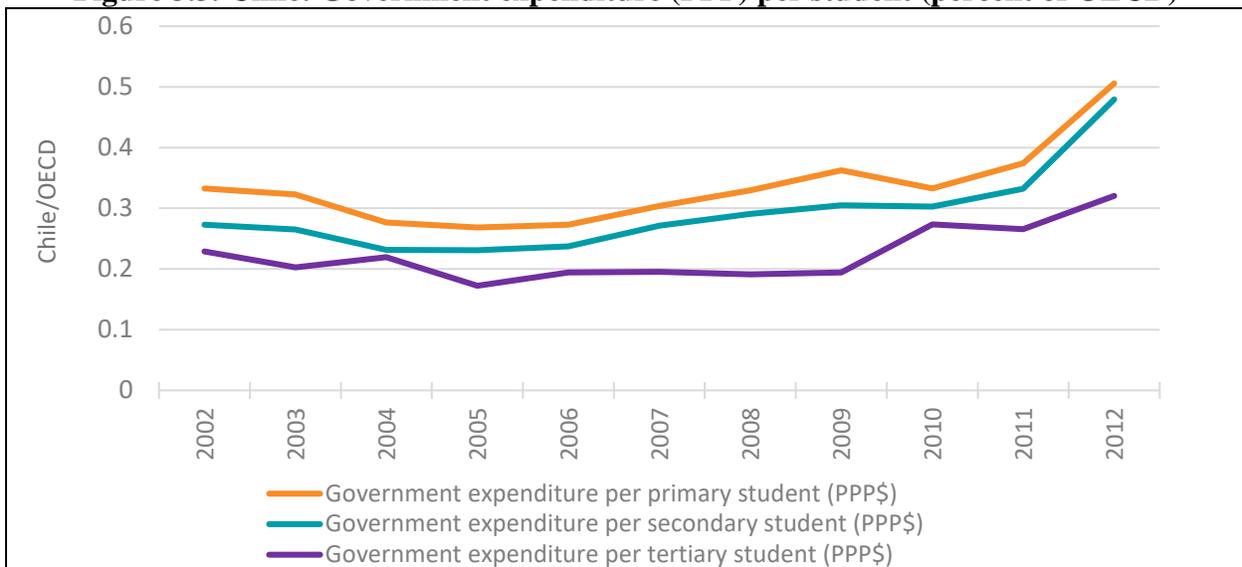
7. **Both as a percentage of GDP and in absolute terms, public spending levels () are gradually approaching those of OECD countries.** Between 2002 and 2012, Chile’s public spending in education increased from 4.0 to 4.5 percent of GDP (Figure 3.2). By comparison, the level in OECD countries (including structural peers) has remained stable over time at around 5.5 percent of GDP. While at significantly lower levels than OECD countries, Chile is also catching up in terms of government expenditure per student especially for primary and secondary education (Figure 3.3). Differences are larger in tertiary education where Chile’s expenditure per student is just 30 percent of the OECD average.

Figure 3.2. Government expenditure in education (percent of GDP)



Source: WDI

Figure 3.3. Chile: Government expenditure (PPP) per student (percent of OECD)



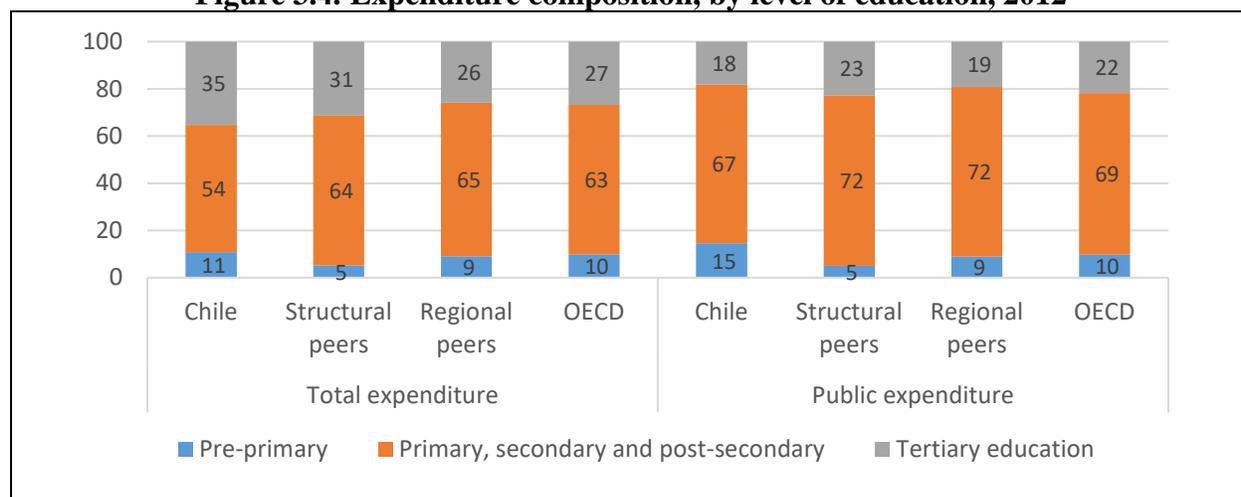
Source: UNESCO

8. **Lower levels of public education spending need to be understood in the context of a smaller size of government and higher private spending, particular in tertiary education.** While budget shares indicate the high priority that Chile assigns to education, the lower levels of public spending in education (in percentage of GDP in PPP values) are explained by the relatively small size of government in Chile measured by both revenue and spending to GDP ratios as documented in Chapter 1 of this report. Moreover, it is worth to note that the private share of total education spending in Chile is 40 percent compared to 15 percent in the OECD. This is particular acute in tertiary education (70 percent in Chile versus 30 percent in OECD). In fact, if private spending is included in the international benchmarking, at 7 percent of GDP, Chile's total spending (public and private) in education is higher than peers.

9. **The ongoing education sector reform is expected to close the remaining gap.** In the 2016 Budget Law, public education spending as a percentage of GDP is estimated to reach 5.2 percent, which is very close to the OECD average of 5.5 percent. Given GDP growth trends in Chile and countries included in the comparison groups, it is expected that public spending per student will catch up the levels observed in structural peers and OECD countries in the next coming years. As the emphasis of the Chile education reform is tertiary education, where the gap with structural peers and OECD countries is larger, it is expected that the convergence to the levels observed in those countries will be accelerated.

10. **The spending composition by level of education is comparable to peers, though Chile spends more on pre-primary and less on tertiary education.** Primary and secondary education represents around two thirds of total spending in the sector. The share of spending in pre-school in Chile is higher than in OECD whereas it is lower in tertiary education. Again, while Chile’s public spending in tertiary education is lower, when adding private expenditure tertiary education accounts for a larger share of spending (Figure 3.4).

Figure 3.4. Expenditure composition, by level of education, 2012



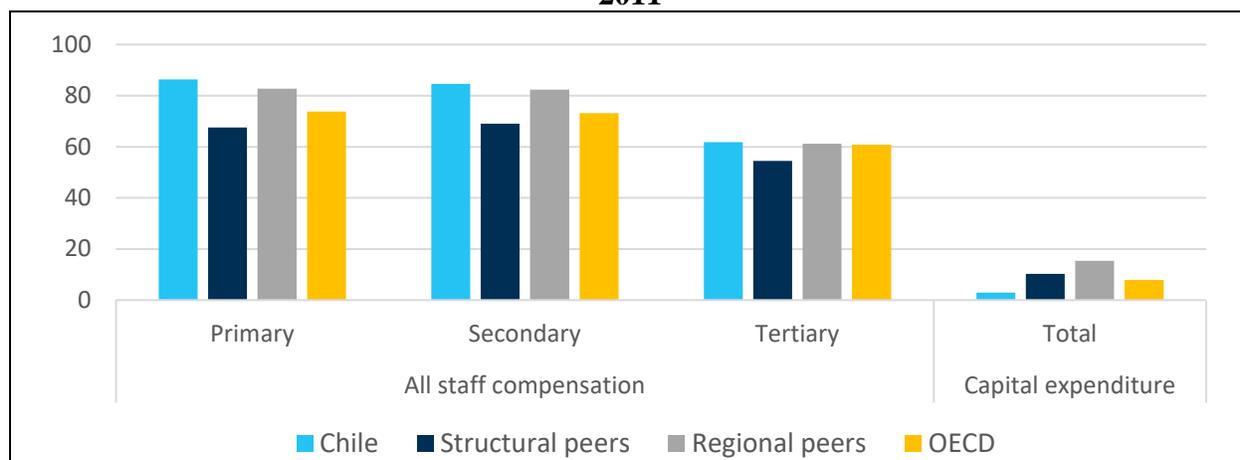
Source: OECD Education at Glance 2014. Notes: The reference year for Chile is 2012. Data from Peru is missing, and data from Canada is only used for tertiary education, due to comparability problems.

11. **In terms of economic classification, education spending heavily favors current expenditures over capital investment.** The composition of education expenditures is heavily focused on staff compensation and significantly less on capital expenditures, than its structural peers. The share of public resources committed to staff compensation in Chile is higher than the regional, structural and OECD average in all educational levels (Figure 3.5 on the other hand, only 3 percent of the expenditure in public educational institutions is spent on capital investment compared to 15 percent in the OECD).

12. **However, the number of teachers and their remuneration does not appear to be the main reason why Chile spends relatively more on staff compensation.** Although there has been significant convergence over the last 10 years, the ratio of students to teachers and the average class size in Chile are significantly higher than in the OECD and structural peers. Moreover, Chilean teachers earn less relative to similarly educated workers than the teachers in other OECD

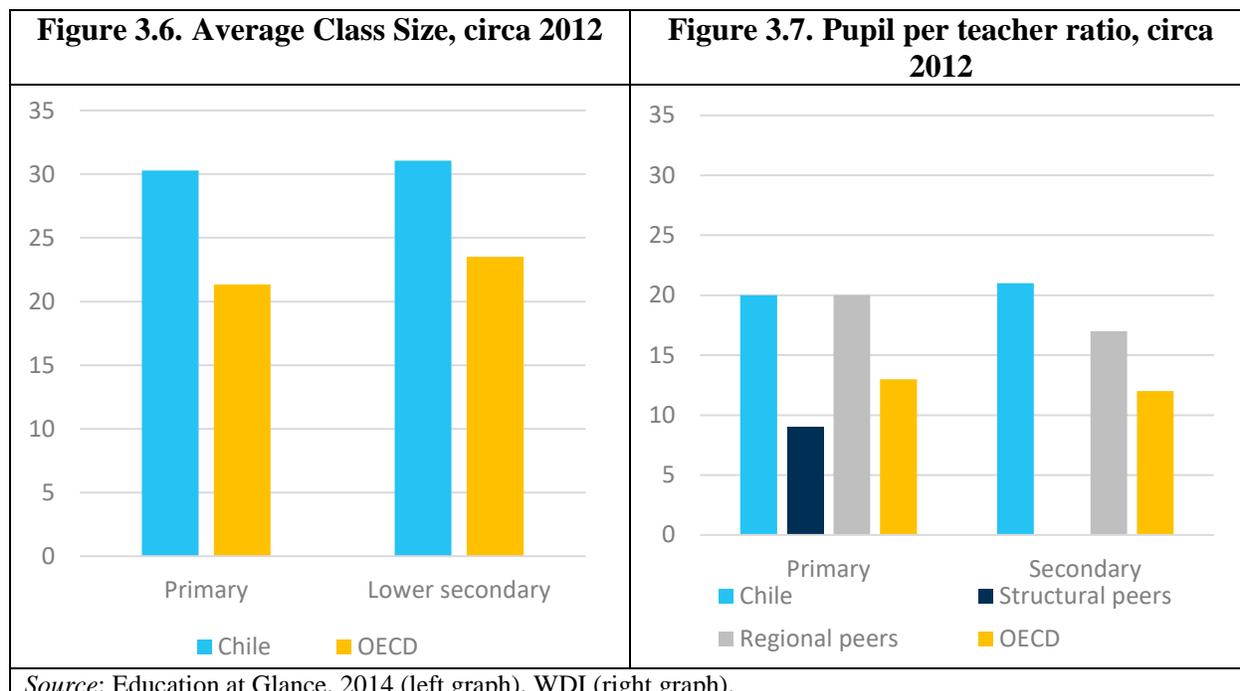
countries across all educational levels (Table 3.1).³ Therefore, the relatively higher share spent on staff compensation may be the result of either higher levels of spending in administrative staff, or lower absolute (nor only relative) levels of capital spending compared with OECD and structural peers.

Figure 3.5. Public Expenditure in staff compensation and capital as a percentage of total, 2011



Source: UNESCO.

Note: The year of reference for Chile is 2009. Data on primary and secondary staff compensation is missing for Canada. Data on capital expenditure is missing for Australia.



³ To this respect, the law project “*Política Nacional Docente*” seeks to raise teachers’ initial salaries by 30 percent and provide access to incentives and new remunerated responsibilities as teachers advance in their career paths.

Table 3.1. Selected Education Indicators

Indicator	Chile	OECD
Pre-primary teachers' actual salaries relative to wages of similarly educated workers	0.55	0.78
Primary teachers' actual salaries relative to wages of similarly educated workers	0.59	0.78
Lower secondary teachers' actual salaries relative to wages of similarly educated workers	0.60	0.80
Upper secondary teachers' actual salaries relative to wages of similarly educated workers	0.63	0.82
Average class size in primary	30	21
Average class size in lower secondary	31	24
Average hours per year of compulsory instruction time in primary	1039	804
Average hours per year of compulsory instruction time in lower secondary	1067	916
Ratio of students to teaching staff in primary	23	15
Ratio of students to teaching staff in lower secondary	24	13
Ratio of students to teaching staff in upper secondary	25	13

Source: OECD Education at Glance 2015

Note: The year of reference for instruction time is 2015, except for Chile (2014).

13. **In terms of demand for educational services, except for early childhood education, Chilean enrollment rates compare to its peers.** In Chile, universal schooling is attained in primary and secondary education. Additionally, enrollment rates in tertiary education almost reaches 80 percent, a figure that compares to structural peers and outperforms regional peers and the OECD. On the other hand, Chile lags behind in terms of early childhood education, with enrollment rates for children aged 2 and 3 years old significantly below the structural peers and OECD average. Within upper secondary education, enrollment in vocational programs is lower in Chile, and it is more expensive. In 2013, only one third of the Chilean upper secondary students were enrolled in vocational programs, a significantly lower share compared to the regional peers (50 percent) and OECD average (46 percent).

14. **In terms of learning outcomes, Chile performs favorably in regional terms, it is still behind OECD countries and structural peers. Furthermore, recent results suggest that the pace of improvements has declined slightly.** Chile's PISA scores in math, reading and science are higher than regional peer, but lower than structural peers and OECD countries (Figure 3.8). These differences, however, seem to be driven to a large extent to differences in the levels of spending per student, given that this variable predicts well the performance in PISA 2015 (Figure 3.9).⁴ In addition, it is worth noting that the rate of growth of PISA scores has slowed-down in

⁴ This is an important point. It means that Chile's outcomes are fully aligned with the average outcomes that would be expected given its spending level per student. In econometric terms this means that Chile's score is located "in the regression line". There are other countries in the region, such as Brazil and Costa Rica that performs considerably worse than Chile, even after controlling by spending. Costa Rica, for instance, spends more per student than Chile and

Chile over the last years, particularly in comparison to its regional peers such as Peru and Colombia. This could be related to the fact that Chile is approaching the spending level where spending per student and educational outcomes are no longer that strongly correlated. As a consequence, while there could be still some room to boost learning outcomes by increasing spending per student, future improvements will likely depend more on efficiency gains.

Figure 3.8. PISA scores, 2015

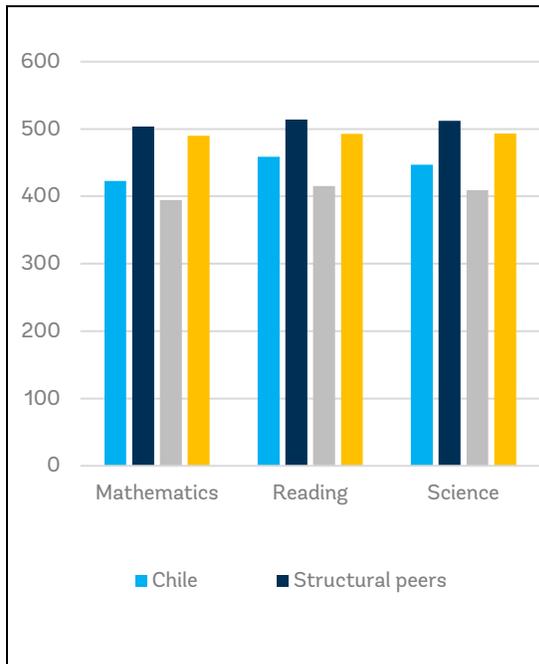
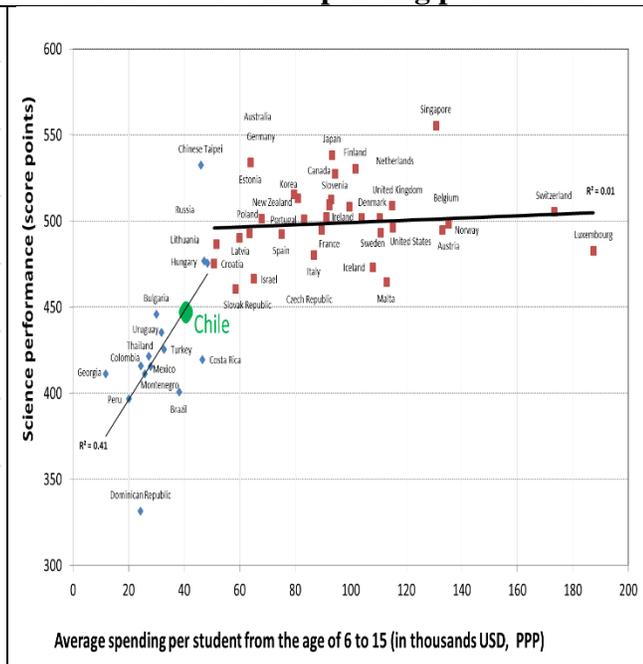


Figure 3.9. Correlation between PISA 2015 science score and spending per student



Source: OECD, PISA 2015 Database

15. **Other outcome indicators confirm the low performance of Chile relative to OECD.** Timely graduation rates in secondary and tertiary education are relatively low when compared to OECD countries. Less than two thirds of Chilean students successfully completed upper secondary education on time in 2012, 8 percentage points lower than the OECD. Chile’s gap is even bigger in tertiary education, where the average on time graduation rate in the OECD almost doubles the Chilean one.

obtains lower scores. However, other countries, such as Bulgaria and Japan perform even better than what would be predicted by their investments in education. Bulgaria, in particular, spends less than Chile and achieves similar results.

3. General Efficiency Patterns at the School Level

16. **The findings of this section suggest that schools are on average efficient at optimizing the allocation of resources, but there is still room to achieve efficiency gains.** The analysis indicates that a large part of the differences in outcomes across schools can indeed be attributed to differences in education inputs and socioeconomic background rather than to diverse efficiency rates across schools. Among critical inputs, teacher quality stands out. However, the analysis relies on a *national* “production frontier” and hence cannot identify inefficiency issues that are widespread across all schools. The cross-national comparisons of outcomes carried out in the previous section, as well as the detailed program analysis of the next sections, indicate that there is significant room for achieving efficiency gains in the education system.

17. **This section analyses efficiency patterns at the eighth grade level in public and subsidized private schools.** Key outcome indicators (reading and math test scores, as well as an index of socio-emotional wellbeing) are compared with educational inputs at the school level.⁵ The analysis estimates the maximum level of educational outcomes that can be achieved with a given combination of school resources and students socioeconomic backgrounds. In doing so, a Stochastic Frontier Analysis (SFA) is used (see Box 3.1 for technical details). The results facilitate an assessment of the extent to which differences in school-level outcomes can be attributed to differences in school characteristics and socioeconomic background as opposed to other unobserved characteristics that affect school performance and efficiency (such as the quality of school management).

18. **The public education system is characterized by notable disparities in learning outcomes.** Key outcome indicators in 8th grade present significant differences across schools (Figure A1.1 in Annex 1). Average math test scores of the worst performing schools (the bottom 10 percent) are only at 68 percent of the average math test scores of the best performing schools (the top 10 percent). A similar picture emerges in reading skills, where average test scores of the worst performing school stand at 66 percent of the best performing ones. Differences in self-esteem and motivation are lower – the average self-esteem and motivation index of the worst performing schools stands at 80 percent of the best performing schools.

19. **The SFA shows that educational inputs play an important role in explaining the performance of the best performing schools.** In reading skills, the resources allocated to the school, the quality of infrastructure, the quality of the teachers (both academic degree and tenure), and the ratio of teachers per students are all associated with high school performance (see table 3.2). The picture is similar for math and socioemotional wellbeing, although a few indicators are less significant, while other (such as technology in the classroom) gain some. With the exception of cognitive skills, the average socioeconomic background of the students also plays a substantial role in driving the performance of the best schools: the education of the parents, the age of the

⁵ As highlighted by the recent developments in the literature on human capital formation, the outcomes comprise both cognitive skills and the socio-emotional wellbeing of students. In particular, the analysis considers reading and math skills (as measured by SIMCE standardized tests) as well as the recent data collected by the *Agencia de Calidad de la Educación* to construct an index of non-cognitive skills, including important factors such as self-esteem and motivation (<http://www.agenciaeducacion.cl/coordinacion-sac/otros-indicadores-de-calidad-educativa/>). See box 3.1 for more details.

students in eighth grade, and the school vulnerability index all substantially improve school performance.⁶

20. **The amount of per-student resources allocated to schools has a robust and statistically significant impact on student learning and socioemotional wellbeing, but the quantitative impact is rather small.** Increasing by 10 percent the resources per students is associated with an increase of around 0.15 percent in test scores. When considering self-esteem and motivation, the effects are even smaller. This finding is consistent with the existing literature on the topic. A significant body of research has found that, after accounting for the socioeconomic background of the students, the amount of per-student resources allocated to schools has limited impact on school performance.⁷ This is particularly true when tuition and public transfers coexist, as households adjust their spending to changes in public transfers Das et al (2013).

Table 3.2. Stochastic Frontier Analysis: Inputs associated with top school performance (8th grade)⁸

	Urban areas			National		
	Math skills	Reading skills	Self-esteem and motivation	Math skills	Reading skills	Self-esteem and motivation
Inputs						
log (proxy per-student resources)	0.014***	0.013***	0.001	0.016***	0.017***	0.005**
log (infra-index)	0.002	0.011**	-0.006**	-0.003	0.001	-0.012***
log(% of teachers with university title)	0.054***	0.071***	0.016**	0.040***	0.055***	0.014**
log(Teacher tenure)	0.005	0.012***	0.003	0.004	0.011***	0.000
log(Teachers per student)	0.014***	0.022***	0.010***	0.006	0.017***	0.023***
Hours of weekly use of the ICT room	0.002	0.001	0.002**	0.000	0.000	0.001
Technology incorporated in the class-room	0.007**	0.005	0.003*	0.008***	0.008**	0.005***
School manager with university title	0.000	0.001	0.001	0.001	0.002	-0.000
School manager tenure	-0.000	-0.000	0.000**	-0.000**	-0.000	0.000
School socio-economic background						
log(average education of parents)	0.124***	0.085***	-0.006	0.138***	0.084***	-0.014**
Average student age	-0.075***	-0.107***	-0.033***	-0.062***	-0.087***	-0.033***
School vulnerability index	-0.063***	-0.051***	0.009*	-0.057***	-0.050***	0.006

Source: Staff calculations.

Note: *, **, ***: significant at the 10%, 5% and 1% level, respectively.

21. **Teacher quality is one of the key inputs to explain top school performance.** Due to lack of availability of indicators accurately reflecting the quality of teachers, the input variable used in

⁶ This is further illustrated with (unconditional) scatter plots in Figure A1.2 (Annex 1).

⁷ Making Schools Work, World Bank (2011)

⁸ Key coefficients are plotted in Figure A1.3 for the national sample.

the SFA is the percentage of teachers with university degree). While roughly proxied by teachers' formal education, the analysis shows that the percentage of teachers with university degree has strong effect on student outcomes, particularly in terms of cognitive skills. For these outcomes, increasing the share of teachers with a university degree by 10 percent is associated with an increase in outcomes three to four times larger than the effect of per-student resources (i.e. an increase of 0.4 to 0.7 percent). This is in line with the international evidence. According to Hanushek (2010), no other input is nearly as important as teacher quality in determining student achievement.

22. **The number of teachers per-student is positively associated with all outcomes.** Holding teacher quality constant, smaller student-faculty ratios are considered to be an important determinant of student performance. Smaller classes allow teachers to promote active learning and interaction with their students, identify and support students that are lagging behind, and provide frequent and detailed feedback on students' work (World Bank, 2016). However, the analysis suggest that the quantitative impact is relatively small. This is in line with international evidence, which shows mixed impacts of reducing student teacher ratios on learning outcomes (Glewwe and Muralidharan, 2016).

23. **ICT Technology is robustly associated with student performance, but only when incorporated into the classroom.** As will be discussed in the analysis of ICT policies, the mere presence of technology does not, by itself, imply any improvement on learning outcomes. The analysis shows that it is key not enough to use the ICT equipment but also to incorporate it into the classroom.⁹ This result is consistent with best international practices on ICT, and highlights the importance of improving ICT usage for pedagogical purposes.

24. **While the analysis suggests that the quality of school managers is not associated with school performance, a great deal of research suggests that this input is crucial** The lack of effect might have to do with the limited information about the actual management skills of the principal. The proxy we use in the absence of a better indicator is manager's education level, which does not have much variation in Chile and may not reflect actual quality of school management. However, international evidence does suggest that quality of school managers is a key determinant of school performance.¹⁰

25. **Socioeconomic background is strongly associated with outcomes, particularly with cognitive skills.** Doubling the average years of education of the parents is associated with an increase in math and reading scores that range from 8 to 12 percent. In other words, the impact of parental background is much larger than, for instance, the impact of per-student resources (up to 10 times larger in the case of math skills).

⁹ This is shown in table 3.2. While the coefficients capturing the impact of "Hours of weekly use of the ICT room" is not correlated with student outcomes, the ones corresponding to the impact of "Technology incorporated into the class-room" is robustly associated with most outcomes and samples.

¹⁰ Bloom, Nicholas, et al. "Does management matter in schools?." *The Economic Journal* 125.584 (2015): 647-674.

26. **The analysis also suggests that the education system is efficient, but the results should be interpreted carefully.** On average, the efficiency rate –i.e the ratio between the observed output and expected output (given both inputs and socioeconomic background) — is close to 90 percent. Furthermore, differences in unexplained efficiency across schools account for only a small fraction of the differences between worst and best performing schools. Figure 3.10 compares actual differences in outcomes across schools, with differences if all schools would have the same unexplained efficiency coefficients as the top performing schools. Attributing the unexplained efficiency coefficients of the top performing schools to all schools changes little to the overall picture: the gap in math outcomes of the worst performing schools would only improve by 6 percentage points, and the gap in reading outcomes by 10 percentage points. However, the methodology used has some limitations that should be taking into account when interpreting the results. In particular, the analysis relies in comparing the efficiency rates of schools *within* Chile. Therefore, the “frontier” is determined by the most productive schools in the country, and hence it does not take into account general inefficiency issues that might be widespread across all schools.¹¹.

27. **Therefore, a large part of the differences in outcomes across schools can be attributed by differences in education inputs and socioeconomic background.** Leveraging the field in terms of educational inputs across schools would therefore likely to lead to substantial equity gains. And the analysis also supports focusing on boosting the performance of schools with students of lower socioeconomic background.

¹¹ Indeed, as discussed in the previous section, while Chile’s performance in PISA corresponds to the expected performance of a country with its level of per student spending (i.e. Chile is exactly in the “regression line”), there are other countries (such as Bulgaria) that are more efficient since their performance surpass their predicted level. Furthermore, the programs analysis carried out in the next sections indicates that there is significant room to achieve efficiency gains by looking at the design of programs that are widespread across schools (such as school feeding and laptops’ programs).

Figure 3.11. Simulations: differences in school-level performance after attributing to all schools top efficiency levels

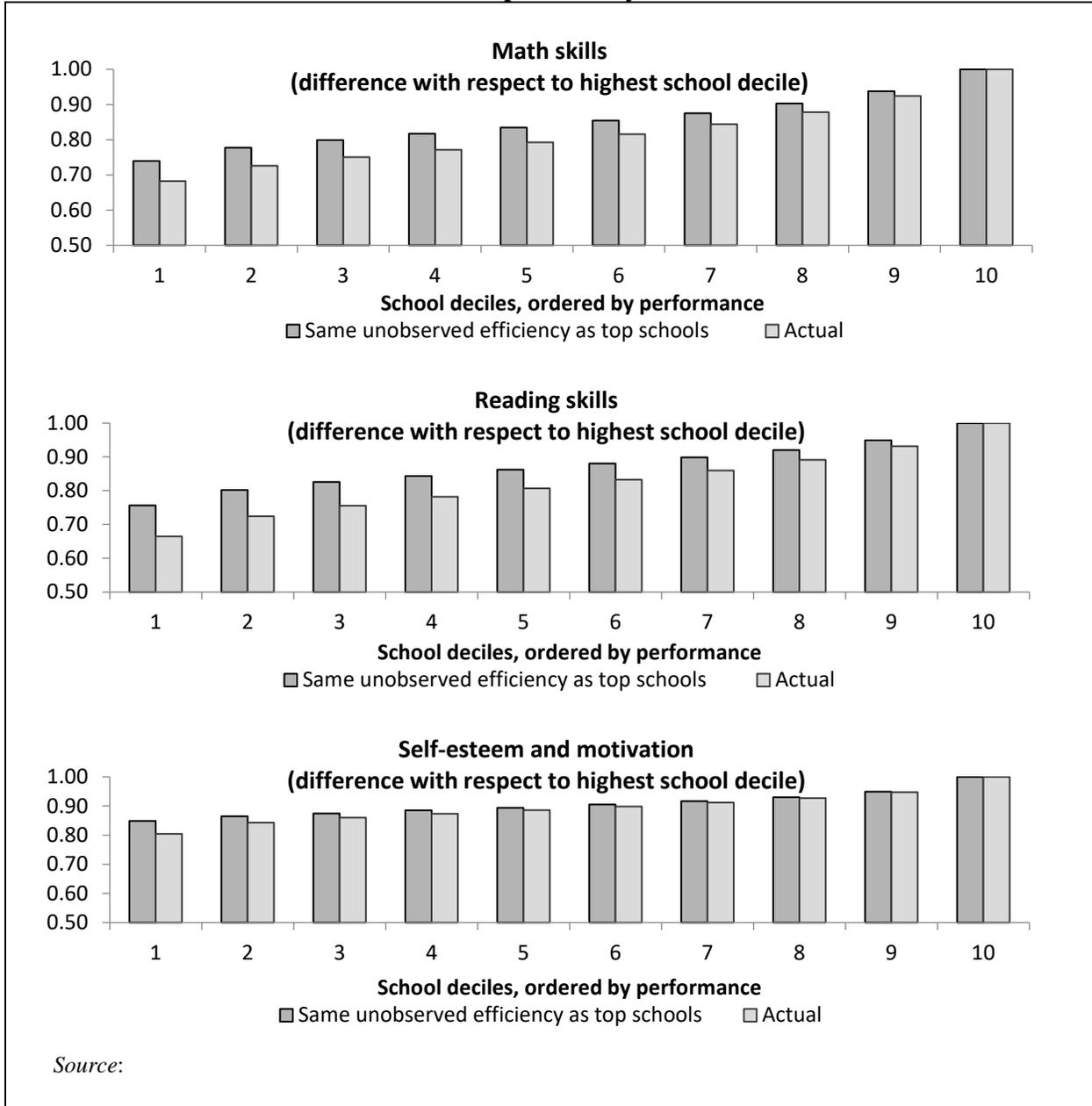


Table 3.3. Stochastic Frontier Analysis: Factors associated with technical efficiency (8th grade)¹²

	Urban areas			National		
	Math skills	Reading skills	Self-esteem and motivation	Math skills	Reading skills	Self-esteem and motivation
Attendance rate - winter	0.190***	0.295***	0.427***	0.225***	0.340***	0.297***
log(school size)	0.017***	0.016***	0.019**	0.018***	0.196***	0.016***
Municipal schools	-0.031***	-0.032***	-0.032**	-0.025***	-0.083***	-0.029***

Source: Authors calculations.

Note: *, **, ***: significant at the 10%, 5% and 1% level, respectively.

28. **Technical efficiency is significantly associated with school size and winter attendance rates.** Table 3.3 looks at factors that could explain some of the variation in unexplained differences in the efficiency levels. Among others, low winter attendance rates, an issue in some regions of the country, and small school size are factors that are associated with low technical efficiency.¹³

29. **Public schools are only slightly more inefficient than subsidized schools.** The analysis finds that, overall, public schools are around 3 percent more inefficient than subsidized in most of the outcomes and specifications. This is an important result. It means that although student performance is considerably lower in public schools, this is chiefly explained by differences in their socio-economic background and the inputs available in their schools, rather than lower efficiency rates in public schools.

¹² This table report the variables correlated with technical efficiency (the term TE_i in Annex 1). Intuitively, TE_i measures the gap between the observed and the expected outcome of the school (after accounting for observed inputs and the socio-economic background of the school). For more details see Annex 1.

¹³ School size has been previously identified as key factor to improve the efficiency in Chile (Gallego et al, 2010). See Annex 1.2 for a description of this study, and a brief review of other key reports identifying efficiency challenges in Chile.

Box 3.1: The Stochastic Frontier Analysis

The Stochastic Frontier Analysis estimates by means of a regression model the maximum level of educational outcomes that can be achieved with a given combination of school resources, holding constant the socio-economic background of the schools. Inputs include a proxy for per-student expenditure (monthly financial resources of the schools including both government subsidies and private copayments¹⁴); an infrastructure index that captures the availability of different facilities in the school (e.g. computer labs, science labs, gyms, etc.); different proxies for both teaching quality (percent of teachers with university degree, teacher tenure, and teachers per students) and school manager quality (tenure and university degree). In addition, they include variables that measure the use of technology in the schools, including a dummy for the incorporation of technology into the classroom—for example, screen projectors, computers—, and the number of hours that the ICT room is used. The socio-economic background of the schools is captured with a rich set of variables, including the level of education of the parents, the school vulnerability index, and the average age of students.¹⁵

The analysis also incorporates a set of “exogenous efficiency determinants” to shed light on key factors that could influence inefficiency in the use of school resources. This approach is appealing since it sheds light on factors or policy variables that help to explain the efficiency gaps (i.e. gap between the expected and the observed outcome), which is key for our analysis. To this goal, the analysis includes variables that are typically out of the control of the school, such as attendance rates and school size.

The outcomes considered include cognitive skills and the socio-emotional wellbeing of 8th grade students. The analysis assesses the impact of inputs on both reading and math skills as measured by standardized tests. It also uses the recent data collected by the *Agencia de Calidad de la Educación* to construct an index of non-cognitive skills, including important factors such as self-esteem and motivation. Nobel laureate James Heckman has pointed out the importance on assessing these broader skills, not only since they are crucial to explain adult outcomes (e.g. adult wages), but also because they are more sensitive to late educational investments.

In terms of interpretation, the main difference with respect to a standard regression analysis is that the stochastic frontier analysis looks at maximum achievable outcomes, as opposed to average ones. When interpreting coefficients from a stochastic frontier analysis, the association between each coefficient and the outcomes should be read as the best achievable one, as opposed to the average one.

¹⁴ This represent 82 percent of the resources of Municipal schools and 94 percent of the resources of subsidized schools.

¹⁵ The results are robust to including the municipality poverty rate as control. However, we exclude this variable from the main specification because it is highly collinear with the education of the parents and the school vulnerability index (these tow variables are preferred since they are at the school level).

4. Program Review: Laptops

30. **Established in the early nineties, the Center for Education and Technology from the Ministry of Education (MoE), Enlaces, is the entity responsible for the management of ICT programs for the public schools system and private schools receiving government subsidies.** Aimed at supporting improvements in the quality of education through the use of ICT, Enlaces serves a twofold goal: close the gap in access and use of technology, and develop digital skills in primary and secondary public and private subsidized schools. Enlaces design and delivers strategies and programs to increase the use of ICT at schools and provides digital educational resources and infrastructure. The total budget of ICT Education programs is CLP 67,120 million (close to US\$100 million) which represents about one percent of budget of the MoE.¹⁶

31. **Enlaces provides 24 projects with different objectives, costs and coverage.** These, in turn, can be classified into five broad categories: support to the educational curriculum, hardware and infrastructure provision, internet connectivity, strengthening of public education and digital inclusion and digital skill development. Their budget and target population present high variability. Ranging from CLP 12 million to about CLP 47,000 million, projects differ in the grades and type of schools targeted. Some of them cover both subsidized and public schools while others focus on public schools only.

32. **Enlaces is one of the most mature initiative among the Latin-American policies and programs related to ICT in education.** It covers all public and private subsidized schools and provides internet connection to more than 70 percent of them. With different levels of intensity and planning, all schools have been integrating ICT into teaching and management, which provides a good stepping stone for new policies to focus increasingly on improving the quality of the different uses of ICT.

33. **This section identifies potential efficiency gains in the different ICT policies developed by Enlaces and other government agencies.** It is based on information received from Enlaces staff, schools and official documents and reports about the program. In several interviews, Enlaces professionals responsible for the design and implementation of the ICT policies were asked to reflect on their functioning and identify possible efficiency improving measures. Their insights were complemented with conversations with 57 public school owners, visits to schools and a survey to 33 subsidized schools in different geographical areas about the provision of internet, hardware infrastructure and ICT maintenance and the schools' main technological needs. Finally, the team reviewed the internal and public documents produced by Enlaces as well as of the different reports on the program.

34. **Policy recommendations for the ICT projects are developed on the basis of a comparison with international best practices.** Examples from other countries in Latin America as well as national and international publications on best practices and the state of the art of ICT for learning and management were reviewed to shed light on possible ways forward for the ICT programs.

¹⁶ While all the policies involve ENLACES, some are actually funded with JUNAEB's budget.

35. **In light of its relatively budgetary importance (more than half), the analysis will focus on *Me Conecto para Aprender*.** Implemented by JUNAEB, *Me Conecto para Aprender* (MCPA) provides a free “entry level” computer to 7th graders studying in public schools, i.e. 103,500 students in 2016, complemented by one year of free internet and some educational content. With an annual budget for 2016 of about CLP 36,900 million it accounts for 55 percent of the total budget for ICT in Education. It is closely related with *Yo Elijo mi PC* (YEMPC), which provides a computer to 30,000 vulnerable 7th graders with good academic records studying in private subsidized schools, with a budget of about CLP10,700 million (16 percent of the total budget for ICT in Education)¹⁷.

36. **The current design of MCPA seems to have a limited impact on educational outcomes.** There are three main reasons for this. First, because many households already have a computer at home, particularly among higher income groups. The MCPA 2016 survey revealed that this policy provides the second or third computer in the household for at least 40 percent of the students (in the 2012 census this figure was as high as 85 percent). Moreover 70 percent of the urban households and 42 percent of the rural ones have some form of access to the Internet. Second, because the laptops are often not used in school for security and weight reasons. And finally, there is no clear strategy in place to associate the equipment with the school curriculum. According to the MCPA 2016 survey, only 51.7 percent of the students uses the computer some days of the week to study or do their homework.

37. **Improved targeting of would thus lead to significant efficiency gains of between 4 and 36 percent of the Enlaces budget.** Targeting either the poorest schools or the poorest students could substantially reduce costs of MCPA without significantly affecting access to ICT¹⁸. For example, targeting schools with an Index of Vulnerability (IVE) higher than 50 or 90 percent, would decrease MCPA cost by 7 and 66 percent, respectively, savings that represent 4 and 36 percent of the 2016 Enlaces budget (Table 3.4). If targeting were done at the student level instead, savings from providing computers only to students in the lowest three or two income quintiles would be 21 and 28 percent of the 2016 Enlaces budget respectively. Although this second option is more equitable, its implementation may create social tensions between beneficiaries and non-beneficiaries of the program at the school level.

38. **Efficiency could also be significantly improved by replacing computers with modern tablets generating savings between 21 and 38 percent of the Enlaces budget.** Modern tablets can serve the same educational purposes as computers at a significantly lower price. Assuming that through a competitive bidding process Enlaces could get a mid-range tablet with accessories for CLP210,000, this reform would reduce the costs of the policy by 30 percent, which represents 21 percent of the 2016 Enlaces budget (Table 3.4). In addition, if the provision of tablets is targeted to the poorest 40 percent, the savings would represent 38 percent of Enlaces budget.

¹⁷ Since both MCPA and YEMPC targeted beneficiaries are students instead of schools, these programs are funded through JUNAEB’s budget and not by Enlaces’s budget.

¹⁸ Under this policy change YEMPC would not present savings, since it is already targeted to the poorest students in private subsidized schools.

Table 3.4. Estimated savings in *Me Conecto para Aprender* and *Yo Elijo mi PC*

	Current design (2016)	Improved targeting (IVE >50)	Improved targeting (IVE >90)	Improved targeting (B60)	Improved targeting (B40)	Provision of tablets	Provision of tablets (B40)
Annual cost (CLP MM)	47,567	45,074	23,229	33,216	28,477	33,514	22,211
Savings	0	2,493	24,338	14,351	19,090	14,080	25,356
Savings (% 2016 Enlaces budget)	0%	4%	36%	21%	28%	21%	38%

Source: Enlaces

39. **The use of modern tablets would not only generate significant savings, but could also lead to improved student learning and utilization.** Given their lower weight, students would be able to carry the tablets to school, maximizing their use, in particular if the use of tablets would be integrated into the curriculum. Accordingly, allocating a small fraction of the savings to developing better educational content, accessories and software, or workshops to foster the integration of the hardware into the school classes, could lead to greater impacts on student learning.

Box 3.2: Potential improvements in the design of smaller ICT programs

This box discusses potential improvements in the design of smaller ICT programs that emerged during the interviews. While these recommendations will not lead to significant savings, they could improve the overall functioning of the program, potentially leading to greater impacts on students and school performance.

Conectividad para la educación

Conectividad para la educación (CE) has room to improve its design. This policy started in 2011, aiming at providing Internet to all public and private subsidized schools. It subsidizes the supply of “last-mile” Internet connectivity through a centralized competitive bidding process among Internet providers in a given geographical area and is implemented by Enlaces and SubTel. By the end of 2015, 69 percent out of the 11,547 public and private subsidized schools were covered by this policy, benefitting 2,700,000 students. With an annual cost of CLP 4,500 million, it represents about 7 percent of the total budget for ICT in Education.

Its current design is too rigid, preventing the connectivity parameters to adjust to changes in the school needs. Once the bidding process to provide free internet to schools in a particular area is finalized, the administrative procedure to modify the connectivity parameters takes between 12 and 18 months. As a result, many municipalities buy additional bandwidth for their schools directly from Internet providers available and negotiate the connectivity conditions each time they need adjustments. It is estimated that direct negotiations by the municipalities to adjust their connectivity have results within one or two weeks.

While preserving the economies of scale generated by the centralized public bidding, options enabling some flexibility at the school level may be explored. Many schools¹⁹ in urban areas already buy additional bandwidth through private provision and make direct investments in ICT (screen projectors, computers, software, better Internet, maintenance) using other sources of funding, such as the Preferential Subsidy (SEP). Centralized public bidding may be complemented by mechanisms that open the possibility of direct negotiation between schools or municipalities with providers. An intermediate solution may be to centrally provide the base connectivity to the

¹⁹ The exact figure is unknown. However, out of the 33 subsidized schools that participated in a short ICT survey and the conversations and interviews with public school owners (DEM), representing 57 schools, only 2 of them of them did not invest in ICT for their schools (screen projectors, computers, software, better Internet, maintenance). This is not a representative sample of schools but it offers an indication that some schools are capable of deciding and actually invest on ICT according to their perceived needs.

Internet and allow the schools to pay an additional bandwidth margin to the same Internet provider according to rules established in the bidding.

For rural or schools of difficult access, centralized public bidding is still the best approach. For those regions where there is little private investment on connectivity infrastructure and, as a result, Internet provision is expensive and may require satellite connection or point-to-point connection between a reception station and a school, centralized public bidding is still the most efficient option. Additionally, Internet connection of schools in rural or underserved communities has a social benefit, since many times schools are the only place with Internet access in the community.

Given that most urban schools can address their connectivity needs in a direct negotiation with the Internet providers, a more equitable policy may put more emphasis on schools with a weak market around them. Currently, only 22 percent of the 7,932 schools that benefit from CE are rural. Additionally, it is estimated that only 500 out of the approximately 3,000 schools located in areas where the market is weak or non-existent will receive Internet during 2016. Given the higher cost of connecting schools in those areas and the proven ability of urban schools to contract Internet provision directly from the market, CE could focus its resources to improving the connectivity of schools in underserved areas, providing to the rest some resources to negotiate directly with the market. A similar practice has already been implemented in Colombia (“*Computadores para Educar*”) and Argentina (“*Conectar Igualdad*”). In order to implement this reform, gathering information on the schools that are able to purchase Internet on their own and the cost of doing so is required.

An alternative solution could be to ensure base connectivity to all schools and allow them to increase the bandwidth directly with private providers if needed. This solution has been implemented in some places in the US. The state pays the base connectivity to the Internet providers and the schools pay an additional bandwidth margin to the same Internet provider (according to rules established in the bidding). In this case, the subsidy could be more focalized, school Internet traffic might be better informed and schools may negotiate good prices for the additional bandwidth.

Tabletas para la Educación Inicial and Iluminación Wi-Fi

Tabletas para la Educación Inicial and Iluminación Wi-Fi are two policies that could benefit from a reallocation of budget toward ICT human capacity development. *Tabletas para la Educación Inicial* (TEI), covering 2,159 public schools and with a budget of CLP 7,786 million, provides tablets for pre-school and 1st graders with well-designed educational content to stimulate mathematical learning. On the other hand, *Iluminación Wi-Fi* (IWF), covers 684 schools, costs CLP 1,198 million and is in charge of the deployment of Wi-Fi infrastructure at each school (routers and others) to gain connectivity efficiency. It is perceived that, in both cases, lack of human capacity prevent schools and students from fully benefitting from them. In the case of TEI, teachers lack support to use the tablet as an educational resource because of the school principals’ little awareness about this pedagogical tool. In the case of IWF, schools do not have the technical expertise to efficiently manage the connections and devices. Training of school personnel would address some of the mentioned inefficiencies.

Mi Taller Digital

Mi taller Digital has a large potential to reduce the “utilization gap”, but there is still room for improvement. Starting in 2012, *Mi Taller Digital* (MTD) consists of a set of six extra-curricular workshops to develop ICT skills on students between 5th primary level and 4th secondary level on robotics, video game production, digital comics, video production and ICT maintenance. Two teachers and two students are trained in each subject during 10 weekly sessions of two hours. This training enables them to replicate the workshop inside their school, which receives the equipment to do so. Despite the high pedagogical value added of this initiative, it is estimated that half of the schools do not replicate the workshop and a large proportion do not address the workshop subjects in class, given their weak connection with the curriculum. To achieve a higher efficacy of this policy, Enlaces should redefine the workshops to be more closely linked to the curriculum, integrate more teachers and more students in each workshop and, in the long term, use this policy to renovate the technological space at each secondary school, with a more comprehensive set of tools (i.e. tablets, 3D printers and design software), connected with other learning resources (i.e. chemistry and biology labs) to allow interdisciplinary learning through projects. These new spaces should encompass a new set of year-long workshops, offering a learning path for students and an advanced laboratory for

teachers. In 2016, this policy benefitted 650 schools, with approximately 15,600 students and teachers, at a cost of CLP 1,706 million.

40. **International experience also shows that for ICT to have an impact on learning and school management, hardware provision is not enough.** The mere presence of technology does not, by itself, imply any improvement on learning outcomes (Pedró, 2012). Consequently, hardware provision may not be cost-effective if it is not coupled with pedagogical tools (Claro, 2010; Schleicher, 2015; Cristia et al., 2012, Barrera-Osorio and Linden, 2009; and Linden, 2008). Experiential learning (i.e. project-based pedagogies), hands-on pedagogies (i.e. game developing and programming for STEAM subjects) and cooperative learning are some known practices in which ICT can have an important role (CEPAL-Claro 2010; OECD-Schleicher 2015).

41. **To achieve efficiency gains in terms of improved learning outcomes per spending unit, it is important to address not only the access gap but also the utilization gap.** The utilization gap relates with the effective appropriation of technology to transform learning and knowledge production. Despite the high penetration of ICT in schools over the last two decades, the SIMCE-TIC 2013 survey shows that only 1.8 percent of the students have advanced digital skills and a further 46.9 percent have only initial skills (Enlaces, 2013). This points to the need to improve ICT usage for pedagogical purposes and for teacher's professional development, spending less on hardware and more on better educational content.

42. **ICT policies should thus aim at striking a balance between hardware provision, educational content, and teacher training.** Mature ICT programs with good nationwide ICT infrastructure, such as Enlaces, should devote a larger share of its resources to in-service teacher professional development, educational models and content. Given the proven ability of schools, especially the urban ones, to address their ICT needs on their own, it would be advisable to downsize the spending on hardware provision, in exchange of a higher spending in pedagogical content and teacher training. Teacher training is of particular relevance. Evidence from Latin America shows that new teachers do not always have the competencies, knowledge and experience to use ICT effectively in teaching when they enter the labor market.

43. **Finally, international experience highlights the importance of evaluating the impact of all ICT policies.** Impact and process evaluations allow countries to learn from their experience and inform the design of future policies, increasing their effectiveness. Although *Enlaces* has undergone many large scale and systemic studies and evaluations, it is recommendable to install more short term evaluation studies to learn about cost-effectiveness and guide policy implementation.

Table 3.5. Estimated Efficiency Gains for School Feeding and ICT Programs²⁰

Policy Context	Policy Action	Equity Impact	Potential Savings (CLP bn.)	Potential Savings (as % of GDP)
Reduce inefficiencies and improve targeting in school feeding program at primary and secondary levels (PAE - Primary and Secondary)	Introduce an on-demand modality for beneficiaries from the 3. quintile	Neutral	18.64	
	Improve the monitoring of beneficiaries	Slightly positive	50.04	
	Allow richer students to pay for food rations	Neutral	18.54	
	Subtotal, school feeding		87.22	0.055
Reduce inefficiencies and improve targeting in laptop programs. (ENLACES-ICT Education)	Change technology to tablets	positive-neutral	14.08	
	Offer hardware only to the poorest households	Slightly negative	19.1	
	Offer tablets only to the poorest households	Slightly negative	25.35	
	Subtotal, laptop programs		25.35	0.015
	Total, Education		112.57	0.070

Source: Staff estimates.

²⁰ A detailed version of this table can be found in Annex 7.

5. Program Review: School Feeding (PAE)

5.1 Context and Challenges

44. **The school feeding program, *Programa de Alimentación Escolar* aims at providing healthy food options at school for vulnerable children.** PAE was established in the 1980s, in a context of high malnutrition, illiteracy and school absenteeism among the poor, on the premise that providing school meals would improve students' nutrition and health. Over the years, PAE significantly contributed to the end of infant malnutrition, which today affects less than 1 percent of the Chilean children, and, as a result, to significant health care savings. Currently, the objective of the program has shifted toward providing healthy food options at school for vulnerable students.

45. **In 2016, the total budget of the PAE program was around CLP 628,000 million, of which about 60 percent were allocated to school feeding in primary and secondary education.** PAE operates across all educational levels, from preschool to adult education. In 2015, about 4 million rations were distributed to 1.9 million beneficiaries located in about 12,000 educational centers. The largest share of PAE's budget is concentrated in primary and secondary education (CLP376,000 millions), representing 60 percent of its budget (and more than 75 percent of *Junta Nacional de Auxilio Escolar y Becas* (JUNAEB) feeding programs).

46. **PAE's target population are the poorest 60 percent of children and youth enrolled in public and private subsidized education²¹.** Beneficiaries are selected according to their socioeconomic score, based on a tool recently developed by the Ministry of Social Development.²²

47. **PAE operates during the whole year, through a public-private partnership.** The program is administered by the National Board of School Assistance and Scholarships (JUNAEB), an agency from the Ministry of Education, which is responsible for the annual bidding process in which private food companies are selected. These companies are responsible for the entire process, from the purchase of ingredients to the actual distribution, and JUNAEB reimburses them for the meals actually served.

48. **PAE is a well-established program, strongly embedded within the social protection policy framework.** PAE is considered an integral component of the Chilean social protection system, covering children from birth to adolescence across the whole country. The nutritional content of the menus is aimed at providing a balanced diet and increasing the intake of fresh fruit

²¹ For pre-school education, PAE provides also free meals to the school staff.

²² It is important to point out that a geographic/school level targeting could lead to significant efficiency gains, but could have important equity implications. As described above, PAE is currently targeted at the student level (the target population are the poorest 60 percent of children and youth enrolled in public and private subsidized education). A different approach is to target the schools (or geographic regions) that concentrate the bulk of PAE's beneficiaries. For instance, PAE could target the schools where the eligible students represent more than 50 percent of the total student population of the school, or could target all the students in *public* schools. This approach is appealing because the average per-student costs tend to be larger if the scale of production is small, and hence school/geographic targeting could lead to significant efficiency gains. However, under this targeting mechanism, a share of vulnerable children attending untargeted schools or regions would not be eligible for the program, which creates equity concerns. One possibility would be to compensate these students with a subsidy equal to the average cost per beneficiary (this option would still create savings since the actual average costs per student would have been larger in those schools).

and vegetables to ensure the intake of vitamins, minerals, fibers and antioxidants as well as to stimulate a positive change in the nutritional habits of the children and their families. Additionally, the centralized procurement model has enabled the entire supply chain to be outsourced, maintaining standards while increasing cost-efficiency.

49. **One key challenge of the program is monitoring the actual number of food rations served to the targeted students, which is critical to determine the cost of the program.** PAE pays the suppliers according to the *observed* take-up rate of the program: the number of food rations (supposedly) served to the beneficiaries of the program. Therefore, monitoring whether the reported rations were indeed served to the targeted students is key to estimate the total costs of PAE.

50. **The number of served rations is estimated with online records filled by each institution (in many cases on a monthly basis).** There is a general consensus that these records tend to be inaccurate, and tend to overestimate the actual number of food rations served to the beneficiaries of the program. Teachers or administrative school personnel are in charge of the online registration²³ and, in many cases, they lack the required training. There is also no obligation of daily registration. A recent survey showed that only 14.4 percent of the schools reported the rations served on a daily basis, and more than 25 percent reported this on a monthly basis. In many cases, in practice, the number of consumed rations is estimated according to the daily attendance rate of each school. This makes the online records unreliable and generates problems of information management, data quality, and indeed, the total cost of the program.²⁴

51. **A 2013 study also indicates that the enforcement of the eligibility rules is weak, and that some non-vulnerable children are also served by PAE.** There is no certainty that the students that appear on the list of beneficiaries are the ones that actually get served. A report from DIPRES (2013)²⁵ found that 63 percent of the non-vulnerable students have actually benefited from PAE, although other estimates set the percentage lower, to around 30 percent. The same report stated that about 40 percent of the schools allocate part of their rations to non-targeted students²⁶. In addition, anecdotal evidence collected in interviews suggests that rations are also served to school workers.

52. **The program also faces some challenges in terms of the acceptability rate.** It is estimated that a significant share of the eligible students do not eat at the centers (around 20 percent in 2010; see DIPRES, 2013).²⁷ In addition, those who actually attend do not necessarily eat PAE

²³ The management of PAE by teachers and administrative staff at the school level allows for significant cost savings for the program. Nevertheless, this could involve significant “opportunity costs” for the government given that those human resources could have been employed in alternative tasks.

²⁴ A simple innovation to monitor the number of food rations would be to cross-check the reported number of rations with attendance records of the beneficiaries. Setting a rule that force the reported food rations to be consistent with these attendance records could potentially create significant savings.

²⁵ Villena, M (2013). Evaluación de Impacto de los Programas de Alimentación de la JUNAEB, del Ministerio de Educación. DIPRES. (http://www.dipres.gob.cl/595/articles-116630_doc_pdf.pdf)

²⁶ In some cases the rations allocated to non-targeted students are not reimbursed by PAE.

²⁷ This could be partially capturing coverage problems in that year.

rations every day. According to self-reported data, the students who regularly attend PAE do not consume around 12 percent of the rations.²⁸

53. Many children also eat double breakfast and lunch meals (at school and home), which points towards inefficiencies associated with a lack of coordination with parents or inadequate targeting. DIPRES (2013) stated that, according to the latest information available, about 30 percent of the students eat breakfast and lunch twice, both at home and at school. This suggest that efficiency gains could be achieved by improving the coordination between parents and PAE.

The institutional capacity of the JUNAEB is also weak. Only a small fraction of the budget of JUNAEB is allocated to operative costs. There is high turnover of employees and the institution faces difficulties to retain and attract highly qualified human resources. This is in part due to the relatively low wage scale of the program in comparison to other programs. The lack of qualified human resources represent a major bottleneck that limit the capacity of the JUNAEB to manage and supervise the operation of PAE. In order to address the challenges identified above, the institutional capacity of the program needs to be strengthened.

5.2 Identification of Efficiency Gains in the School Feeding Program

54. This section identifies opportunities for efficiency gains based on changes in the design and monitoring of the program, and estimates the potential cost savings. The analysis focuses on several scenarios that could potentially lead to cost savings. Not all can be implemented in the short term, and some may require initial investments in order to improve monitoring and administration capabilities.

5.2.1 Improved monitoring of served rations to beneficiaries

55. Investing in monitoring technology (e.g. fingerprints, cards) would allow improved information about the actual take-up rate of the program. As discussed above, the cost of the program depends on the number of served food rations *reported* in the online system. However, there is no certainty that the targeted students are the ones that actually get served. Investing in monitoring technology (such as fingerprints or cards) would allow a better monitoring of students who actually consume the rations, avoiding the additional costs associated with over-reporting the number of served rations, and the leakage to richer students. Once this technology is in place, and in order to reduce food waste, it would be advisable temporarily retiring from program the children who do not consume meals. However, these students should be readmitted upon request of the parents or the school.

56. Improved monitoring technology could save up to CLP 50 billion depending on the change in the actual take-up rate. These savings could be realized in the medium term in a conservative scenario where suppliers are not able to adjust their fixed costs to the reduced scale of operation. Annex 2 describes the methodology used to estimate the efficiency gains. The key

²⁸ The self-reported data is likely an overestimation, as the students answering the survey might be afraid of losing the benefit if they report not attending to the centers

assumption for the simulations is the effective take-up rate of the targeted population after the new technology is in place. According to interviews with PAE program officers, one could reasonably assume that the take-up rate would decrease by between 5 and 15²⁹ percentage points.³⁰

57. **Encouragingly, PAE is already planning to incorporate this technology in all schools over the next three years, but it would require a small initial investment.** The efficiency gains could be gradually achieved as PAE renews the contract with the suppliers and incorporates the technology (one third each year), but will require strengthening the institutional capacity of PAE to better manage and maintaining the monitoring system. A new management system is roughly estimated to cost USD4-6 million (CLP2.7 - 4.1 billion).

Table 3.6. Potential savings associated to fingerprint readers/cards
Savings are expressed as % of the PAE Budget in Basic and Middle School and in CLP millions

Level	Δ take-up = -5 percentage points		Δ take-up = -15 percentage points	
	%	CLP MM	%	CLP MM
Primary	4.3%	11,218	13.0%	33,654
Secondary	4.7%	5,462	14.0%	16,386
Total		16,680		50,040

Source: Staff estimates.

5.2.2 On-demand basis for students in the third quintile

58. **Providing free meals “on demand” for students in the third income quintile could also improve efficiency.** Such a scenario would allow a self-selection of the students at need. It may also help improving the coordination between families and PAE, avoiding the “double lunches” estimated to affect around 30 percent of the students as well as reducing food waste. The target population will still be students from the three poorest income quintiles, consistent with the approach to make the school feeding program available to all of them. However, in this proposal, the parents belonging to the third quintile should fill a short form stating their compromise to send their children to the centers, as an attempt to avoid potential food waste and double lunches. Research from behavioral economics indicates that even a small time-burden could be very effective to reveal the effective demand for the program. However, it is advisable to restrict this mechanism to middle-income families (third quintile), since poorer households may be less informed to make this type of decision. In addition, it is also recommendable that school authorities would be authorized to fill the form, to include students who may be in fragile family situations and may be in need of the program even if parents do not explicitly request it.

²⁹ Preliminary results from field work conducted by JUNAEB indicates that the real decrease in the take-up rate would be closer to the more conservative scenario. If the reduction in the take-up rate was of 10 percent, savings in primary education would be of CLP 22,436 million (8.7% of PAE’s budget) and in secondary education savings would be CLP 10,924 million (9.4% of PAE’s budget).

³⁰ Annex 2 report a sensibility analysis for these results with respect to changes in variable costs.

59. **Requiring the third quintile of students to ‘opt-in’ could save up to CLP18.6 billion depending on the change in the actual take-up rate.** The results are shown in Table 3.7. To calculate the savings under this scenario we use a similar method, except that now the take-up rate only varies for those families from the third quintile. According to PAE staff, it is reasonable to assume that with this policy the take-up rate among students in the third income quintile would decrease by 15 percent. A more “optimistic” scenario in which most of the families with children eating double meals choose not to enroll their children was also considered (decrease of 25 percent in the take-up rate).

Table 3.7. Potential savings with on-demand rations for quintile 3
Savings are expressed as % of the PAE Budget in Basic and Middle School and in CLP millions

Level	Δ take-up = -15 percentage points		Δ take-up = -25 percentage points	
	%	CLP MM	%	CLP MM
Primary	2.7%	7,081	4.6%	11,801
Secondary	3.5%	4,100	5.9%	6,833
Total		11,181		18,634

Source: Staff estimates.

60. **Ration cuts resulting from improved monitoring or on demand provision of food could trigger an increase in the unit cost of meals.** The above two program changes result in a decrease of the meals served in each school. If this decline in the number of rations provided is significant, JUNAEB would be contractually bound to pay a price penalty to the companies in charge of the food provision, which would lead to a significant over-price and, consequently, to a potential overall cost increase. As a result, it is necessary to predict the change in take-up rates based on pilots, which will be carried out this year, to better understand the overall impact of these policy changes and re-negotiate the awarded quantities based on these estimations. Although according to the data provided by JUNAEB, the program is still far away from the cutoff to pay the price penalty (90 percent vs. 80 percent), the currently agreed 30 percent penalty is excessive according to the reported cost –structure and should be re-negotiated in future bidding processes.

5.2.3 Sharing fixed costs

61. **Allowing all children to use the canteen, but asking wealthier students to pay for the meal could save up to CLP 18.5 billion.** The results are summarized in Table 3.8. The fixed costs of the program would be shared with wealthier children. Savings will be associated to a more efficient scale in the production of meals. Students from the top two income quintiles would be allowed to use the school canteen, paying the full cost of their ration, while PAE’s beneficiaries would still receive the meals for free. This option could also reduce the stigmatization of those

who use the school canteen, and help promoting the consumption of healthy foods across all the population.³¹

Table 3.8. Potential savings associated with sharing fixed costs

Savings are expressed as % of the PAE Budget in Basic and Middle School and in CLP millions

Level	30% take-up (non-targeted)	
	%	CLP MM
Primary	4.6%	11,803
Secondary	5.8%	6,739
Total		18,542

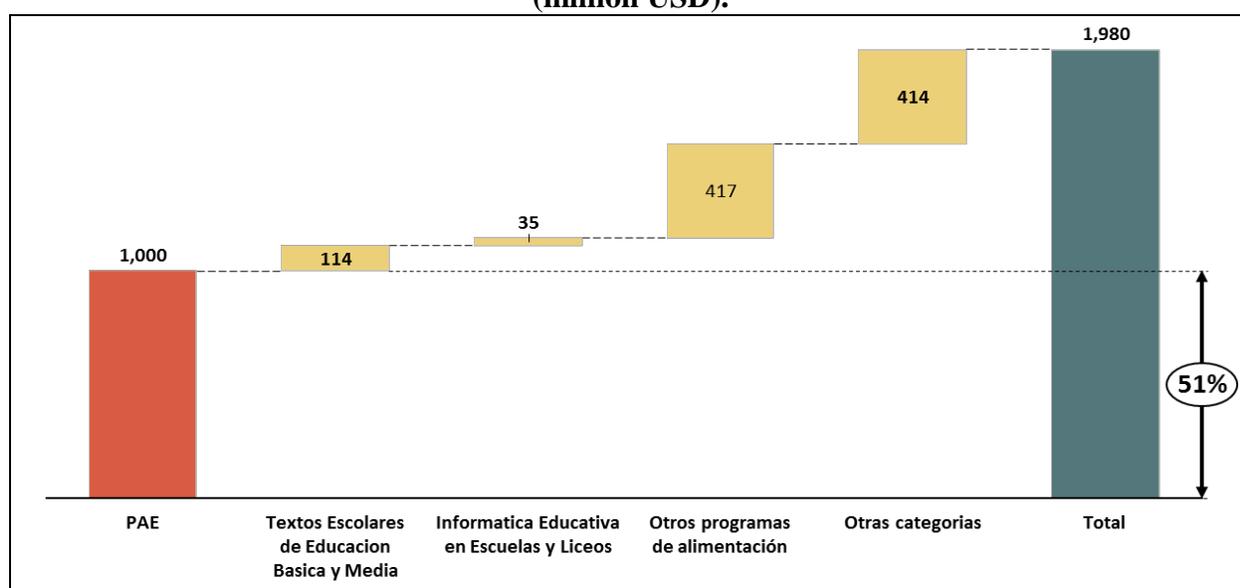
Source: Staff estimates.

³¹ Annex 2 report two different robustness check: (a) a sensibility analysis with respect to fixed costs; (b) a scenario in which in those schools where eligible students represent at least 90 percent of the student population, the program becomes universal.

6. Procurement Analysis of Selected Education Programs³²

62. **Three programs represent about three quarters of the procurement executed by the Ministry of Education: PAE, Enlaces and Textos Escolares.** About ten percent of total education expenditures is allocated to the procurement of goods, works and services while the remaining ninety percent is executed through transfers. This section presents a review of the expenditures of these three programs with the objective of identifying costs savings opportunities. It provides an overview of how those programs work and includes a benchmarking analysis of international experiences. The section also suggests a set of policy recommendations based on the overall findings and analysis.

Figure 3.12. Education Procurement PAE, ENLACES and Textos Escolares 2013-2014 (million USD).



Source: Authors based on Boost database, Public Sector, 2013-2014

7.1 School Feeding Program (PAE)

63. **The procurement of school lunches is considered of high risk given the high value of the amounts awarded and the complexity of the procurement and contracting processes.** As the execution strategy enables the government to have control over the products specifications, the success of the process relies on a close monitoring of suppliers, careful management of prices and a participatory approach.

64. **The bidding process implemented by PAE is designed to maximize control over the final product contracted while minimizing the risks that suppliers are not qualified to fulfill**

³² The procurement team also prepared an online dashboard for procurement in Chile based on the BOOST data base. It's available here: http://tab.worldbank.org/t/WBG/views/ChilePER/1_StartHere?:embed=y&:showShareOptions=true&:display_count=no&:showVizHome=no#3

the requirements of the contract. Bidders must submit at least twelve financial documents and meet at least thirteen financial indices to qualify. The technical evaluation is done in two sub-stages in which different aspects of bids are evaluated. In the first stage, the objective is to assess compliance with the requirements regarding food characteristics and presentation defined in the guidelines. Bids with a score below 90 percent are rejected. During the second stage, additional aspects, such as payments and benefits to the food processors, management systems structure are evaluated using forty-five sub criteria. Furthermore, fulfillment of formal requirements for submission of tenders are evaluated.

65. **Financial proposals are evaluated in a different stage and the bidding documents contain sixty-six restrictions to regulate the formulation of prices by bidders.** Failure to comply results in the rejection of a bid. The model used for the selection of the awarded bidders seeks to determine the combination of bids to maximize the score of the bids.

66. **The strategy selected to deliver services has material impact on the complexity, risks and results of the corresponding procurement activities.** In the case of PAE in Chile, the goal of having tight control over the quality and price of all meals resulted on a few, high profile procurements with high value and high risk. This strategy results in more standardized quality of the product contracted and lower prices as a result of the scale. But the tradeoff of this strategy is more visibility and scrutiny resulting from large contracts as well as a higher risk with larger consequences in case of failure. There are different ways of delivering meals to schools with different results. The USA and Brazil opted for a more decentralized service delivery strategy that results in a larger number of small procurements. The risks and consequences are therefore diluted and one failure is less likely to have a major impact. But the tradeoff of this strategy is less control over the quality and the prices contracted by multiple different agencies. Annex 5 presents the details of the experiences of Brazil, US and New Zealand on procurement of school meals.

67. **There are two main recommendations of the assessment of procurement procedures under the PAE.** The first is to improve the oversight and verification of the quantities and quality of meals actually delivered at schools. The second is to work with suppliers to lower production costs so that the savings can be carried over to the price paid by the government. The first recommendation is simpler to implement and more likely to yield more significant savings. However, it will require an upfront investment on technology, equipment and administrative processes to work effectively as discussed in the previous section. The second recommendation requires much larger investment in time and may result in less significant savings.

68. **The first recommendation requires a shift of focus from the production process to the final output.** Contract management is very detailed in PAE due to the complexity of the services, and ensuring the proper delivery is critical to safeguarding that the success of the bidding process is not lost during execution. The use of performance metrics (KPI) would help to focus on the most important results. Also, beneficiary surveys would help determine the level of satisfaction with services and opportunities for improvement in future procurement processes. It is also suggested to streamline compliance reporting requirements of suppliers. The large number of them increases costs and, in some cases, it has a marginal contribution to the success of the program. In terms of contract management, these are the specific recommendations:

- **To design and implement a system for verification of the number of meals actually delivered by suppliers:** the use of modern electronic tools, such as biometric identification of beneficiaries will be a material improvement in the process for supervision of meals delivered. The system should prompt beneficiaries to provide their biometric identification for every meal they get. Over time, information collected by the system will offer more realistic data about actual consumption and thereby enable the government to better plan the quantities put out for bidding. The potential cost savings of this measure was estimated in Section 6.1.
- **To minimize the number of requirements for supervision of the production phase, on one hand, and to develop performance requirements of the final product on the other hand:** currently, there is a large number of requirements to be met by suppliers about the process of preparation of the meals. These requirements increase the costs for the supplier with limited benefits for the government. Consequently, reduced reporting requirements over the production phase should lower costs. In addition, developing and implementing performance indicators and requirements about the final product delivered will ensure that the supervision effort focuses on what really matters at the end of the day, which is the quality of the meal delivered at school. Annex 5 presents a list of key performance indicators that can help transitioning from a supervision at production stage to final product.
- **To involve representatives of the civil society in the oversight of the delivery of the meals:** presently, the supervision of the suppliers of school meals is done by government officials or third parties hired by the government. Involving other stakeholders in the supervision, such as parents, students and civil society organizations will increase the breadth of the supervision with no cost to government.
- **To allow suppliers the option to prepare meals on industrial kitchens:** currently, bidding documents and contracts require suppliers to prepare the large majority of meals in small kitchens located at schools. This approach increases the costs and, to a certain extent, counters the benefits of the economies of scale aimed by the large bidding processes. Offering the option to suppliers to prepare meals in industrial kitchens will lower costs in many different aspects. However, PAE staff cautioned that it may be a difficult option to implement from a political economy perspective.

69. **The second recommendation is to simplify procedures and requirements for bid submission in order to increase competition and reduce costs.** The strategy for delivery of PAE - large contracts with few suppliers - requires well defined qualification criteria to minimize contract execution risks. Therefore, the process of preparing bids for PAE is laborious and requires a very high level of detail from suppliers. It is important to highlight the fact that some suppliers who appear to have experience do not submit other bids after failing to get an award. Considering this, it is suggested to simplify the requirements for bid submission and minimize the number of documents to be submitted. Bids can be simplified without adding much risk to the process. In terms of the requirements to submit a bid for PAE, this report has two main recommendations:

- Simplify and reduce the requirements to submit a bid for PAE: at present, bidders are required to prepare many documents to participate in a PAE bidding. Bidders have to invest a lot of time and effort to prepare bids that comply with the numerous requirements in PAE processes. The fact that the majority of bidders who were not awarded in recent bidding processes never submitted other bids for PAE might be an indication that the complexity and cost of preparing a compliant bid is seen as a barrier to participate. Simpler requirements to bid should woo qualified bidders and increase competition for PAE contracts. Because of the long history of complex requirements to bid, such a move will have to be coupled with an effective communications strategy with bidders so as to attract them back.
- Redesign the bidding “product lines”: recent PAE bidding processes had two different possibilities of bidding: one for very small quantities of meals, which aims at targeting small and medium enterprises; and a second for large quantities of meals. This design resulted in only two profiles of suppliers, very small and local, or large service providers. Additional lines for bidding, especially for medium-size suppliers, has the potential to increase competition for contracts. However, this strategy shift might increase the administrative costs for supervision of suppliers, as it is likely to result in a larger number of contracts and suppliers to supervise.

7.2 Enlaces’ purchases of IT equipment

70. **From a procurement standpoint, *Enlaces* purchases IT equipment that is distributed to schools.** During 2011-2015, all procurement done by *Enlaces* used framework agreements centrally awarded by the specialized government procurement agency, *Chilecompra*. These framework agreements were awarded for the entire Chilean government. Consequently, *Enlaces* benefited from the scale and bargaining power of centralized procurement processes of IT equipment carried out by *Chilecompra*.

71. **Based on the data available, there is little room to reduce prices paid by *Enlaces* through procurement processes.** The framework agreements used by *Enlaces* to purchase the IT equipment they need is based on large scale procurements done centrally that leverage the spending power of the entire Chilean government on these categories. As a result, any potential savings on procurement at *Enlaces* would probably require a redesign or changes to the program, with likely impact on educational objectives.

72. **Despite the limited prospects for procurement savings, there are opportunities for reducing costs in the maintenance and operation, which normally increase substantially over their life cycle.** A study with US schools estimates that proper support to technology programs demand annual expenses of 30-50 percent of the original investment³³. In addition, the Gartner Group estimates that the total cost of ownership of laptops, notebooks and desktops is about 2 – 3 times the direct cost of the hardware and software.

³³ Seven Benchmarks for Information Technology Investments, Educause.

Table 3.9. ICT Costs during the lifecycle

Phase in lifecycle	% of total cost
Initial purchase	47
Deployment	7
Operations	15
Support	24
Retirement	9
Total	100

Source: Staff calculations.

73. **As a result, the concept of total cost of ownership rather than solely the price of the initial investment is the most appropriate metric to evaluate value for money.** Total cost of ownership includes direct and indirect costs over the lifecycle of an asset. Direct costs include hardware and software, support, consumables, network connection and administration. Indirect costs relate to down time or lost productivity. They typically include suboptimal functioning, user-related issues, unofficial support, unnecessary customization and installation of uncertified software.

74. **One way of curbing lifetime costs is to introduce active management of IT equipment.** This consists of defining boundaries for customization by users as well as control over what software to install.

75. **The main recommendations to reduce costs with computer equipment in Enlaces are:**

- Use total cost of ownership as the metric when investing on computer equipment: as explained above, the purchase cost is only a fraction of the total cost of introducing a computer to a school. It would be useful for MINEDUC to understand the total cost of a computer to the Enlaces program by adding the costs for support and maintenance of the asset.
- Consolidate support of computer equipment: the purpose of minimizing the number of companies involved in offering support to computer equipment is to reduce transaction costs, increase bargaining power and have one point of accountability for the program.
- Consider the possibility of leasing when appropriate: while leasing might result in higher costs in some circumstances, it can lower total lifecycle costs other cases. In this sense, it would be important for Enlaces to determine (1) the costs with support, (2) the time period that a computer asset stays in operation in the system, and (3) the costs of disposal. Leasing costs might prove attractive if a computer asset stays long enough in the system for the support costs to escalate.

7.3 Provision of Textbooks (*Textos Escolares*)

76. **The Ministry of Education implements the *Textos Escolares Program* as one of the main public policies in education.** This initiative provides educational textbooks to students in basic and secondary education in accredited establishments. Accreditation refers to the process through which educational establishments voluntarily assume the commitment to use the school

texts provided by the ministry³⁴. They might include public primary and secondary schools, as well as subsidized private schools. Through this program, the Ministry designs and implements the procurement process, evaluation, accreditation, eligibility process and monitoring of the use of the textbooks. Up to 2014, the whole cycle took about twenty-two to twenty-four months³⁵.

77. Over the years the budget allocated to this objective has been growing consistently incorporating beneficiaries which ended up covering a hundred percent of students in the institutions that are part of the program. There was a large budget increase between 1999 and 2002 which duplicated the amount to extend the number of publications and coverage of the program. The change is reflected on the fact that on 1999 the amount invested was over 5.873 million Chilean pesos (equivalent to US\$8.8 million) and on 2010 this amount increased into 21.000 million Chilean pesos (equivalent to US\$30 million)³⁶.

78. The procurement of textbooks is carried out almost annually through a two stage national bidding process. It begins with the Ministry drawing up the technical basis for the competition and establishing requirements for the preparation of texts, including the specifics of the National Curriculum Framework and other characteristics.

79. During the specified timeframe, different publishers submit their proposal for technical, pedagogical and economic evaluation. The first two are performed in two stages: the technical prequalification and complete evaluation. In the first stage, publishers submit bids, which are subject to a content-based criteria in order to select those bids that meet basic quality requirements. The second stage is an evaluation of the full proposals of those editorials that have passed the first stage, considering the content, orthography, graphic design and multimedia resources. Around 120 external experts participate in this evaluation.

80. Afterward, the bids are assessed on their cost with an algorithm that combines the technical score with the prices offered. This allows the priorities of quality to be considered in the technical-economic evaluation, which should be in line with the budgetary framework³⁷. The bidding document includes a maximum value that can be offered by lot.

81. A key objective to improve efficiency in the provision of textbooks is to ensure timely and cost effective delivery, which is a major cost in the whole process. Based on international experience, the cost of distribution in urban areas is estimated to be between 25 to 30 percent. As of rural areas, the percentage may vary widely depending on accessibility and alternative measures should be assessed. The distribution scheme in Chile, and specifically its costs, do not have a high impact in the Chilean system but it is a factor that cannot be disregarded from the whole analysis given the importance it has on efficiency and timely delivery.

³⁴ *Política de Textos Escolares*, Unidad de Currículum y Evaluación, Gobierno de Chile, 2009. P. 16.

³⁵ *Public expenditures on Education in Latin America. Can it serve the purposes of the Paris Open Educational Resources Declaration?* UNESCO. 2014.

³⁶ “*Política de Textos Escolares*”, Textos Escolares, Unidad de Currículum y Evaluación, Gobierno de Chile, 2010. P.11

³⁷ “*Política de Textos Escolares*”, Textos Escolares, Unidad de Currículum y Evaluación, Gobierno de Chile, 2010. P.20.

82. **The textbooks distribution in Chile is carried out by private firms that are hired through a different bidding process.** The distribution is led by the Administrative Department from the Ministry and the delivery can be done to schools, provincial agencies or municipal education office, which take the responsibility to deliver the materials. The materials should reach schools by February-March, where the planning process for the classes begins. There is also a procurement process to hire a consultancy firm to assist on the process of delivery and use of the materials.

83. **The materials remain in the educational system between one and four years depending on the sector and learning level.** As other countries in the region, such as Argentina, the national scheme for the provision of textbooks in Chile is based on a consumer model of the publishing market, primarily focused on procuring material without reusing it. Based on the local legislation, materials are considered to be student's property. Thus the public education budget on this policy is largely destined for the reprinting and distributing materials. This results in the procurement of goods through standardized models.

84. **The textbook public policy in Chile is managed centrally by the Ministry of Education which becomes the main buyer of the school textbooks market representing fifty percent of the Chilean publishing industry³⁸ and providing a large power of purchase.** The public sector demand has increased considerably over time and the quantities procured by 2015 has reached over 17 million copies. The number of titles offered has also increased and currently there are sixty-six titles that a student uses over his/her whole school life.

85. **Efficiency has been increased but there is still space to increase efficiency and participation to enable lower costs.** In terms of process length, for the two bidding processes for the design and printing of textbooks in 2013 and 2015, the analysis shows a reduction from 148 to 52 days between publishing and bid opening and also 350 to 150 days for the evaluation and award. As regards participation, it was raised from nine to thirteen bidders. However, in 2013, five from fifteen lots were not awarded because of non-responsive bids and in 2015, seventy-five percent of the amount was awarded to a single bidder.

86. **Analyzing textbook costs and the scope for reducing them, requires identifying two types of unit costs: (a) unit textbook cost, and (b) unit annual textbook cost.** The first one, is based on the characteristics of the textbook and origin, the second one, based on a pedagogical analysis. Therefore, in order to identify gaps to reduce costs on the system, the analysis should be done over the main factors that compose unit textbook costs: print runs; textbook extents; formats; number of colors; complexity of design and illustrations; origination from scratch or adaptation; whether the textbooks are imported or locally developed, print locations, speed of payment, distribution costs, among others. But there are also factors that have an impact on the efficiency of the whole provision system cost and should also be considered, such as: distribution effectiveness and loss and damage rates³⁹. The methodology to identify unit prices has wide variations between country, school grades, components considered (i.e. some include distribution). Therefore, the

³⁸ Ministry of Education. 2009. *Política de textos escolares*. Santiago, Chile, Unidad de Currículum y Evaluación. http://portal.textoscolares.cl/imagen/File/biblioteca/Folleto_Politica_2.pdf. Chile.

³⁹ Tony, Red. World Bank. 2015. *Where Have All the Textbooks Gone?: Toward Sustainable Provision of Teaching and Learning Materials in Sub-Saharan Africa*. P.141.

comparison between unit prices among countries becomes unreliable to consider the reasonability of the expenditure.

87. **The origin of suppliers has been changing in the region showing a slow but continuous interest of foreign editorials.** They currently represent twenty-five percent in Colombia, thirty-five percent in Argentina and forty-five percent in Chile⁴⁰, where suppliers from Spain characterize the higher proportion.

88. **Textbooks and teaching guides are widely accepted and used by teachers of establishments.** The physical quality is highly valued although there were some suggestions on their weight at the time of transport, so many choose to leave it in the classroom, at the expense of being able to use it at home to study on their own.

89. **The use of online materials is currently not widely spread in Chile except for the supporting material.** However, since 2010 teachers can access an online copy of the book that has been chosen before receiving the printed materials. This allows them to plan their classes accordingly.

90. **There are different international experiences in the financing and distribution schemes.** Some countries provide scholarships for these materials, others grant the ownership of the textbooks to schools which lend the materials each year and others provide the textbooks directly to students. The experiences vary among and within different regions. This analysis has identified two different approaches based on a similar scheme to the one applied in Chile, with centralized selection of materials and procurement, but with slight differences that might have strong impact on the costs of the whole program. Although distribution costs in Chile do not have a high impact on the total costs of the system in Chile, the purpose of presenting the case of Canada is to illustrate a different approach to the distribution of the textbooks, which is, as mentioned before, the main component of the total cost. The case of New Zealand is particularly innovative combining a centralized scheme but introducing an open textbooks licenses policy.

91. **Canada presents a highly decentralized scheme, aligned with the education system.** The government assesses, through an independent third party, the materials that are submitted by editorials and if accepted, the Ministry decides to include them in The Trillium List. Every board has to provide without charge the textbooks to students based on this list for those subjects that have textbooks approved and may require a nominal deposit in case there is damage or no return of the material. The rest of the subjects may use books approved by the board. The legislation is open to the possibility of the central government to also support procuring textbooks from time to time but the main responsibility relies on the board. Although the model might reduce the possibility of obtaining the lowest costs of massive procurement, it also reduces distribution costs which are a main component of the textbooks policy cost.

92. **In New Zealand where there are no restrictions and there is an increasing model towards open textbook development education.** Initially, the procurement of publishing, design, and other production services is carried out by schools following the Governments rules for

⁴⁰ UNESCO and Karisma Foundation. 2014. *Gasto público en la educación de América Latina ¿Puede servir a los propósitos de la Declaración de París sobre los Recursos Educativos Abiertos?* UNESCO.

procurement. There is a competitive process to become a Ministry of Education supplier and submit a bid after this process has been completed. The pieces are distributed free of charge to schools and any additional copies can be purchased. However, as of March 2014, the government has begun adopting open textbook licenses which allows to use and share free resources produced or funded by the Ministry of Education, as well as resources produced by educators working in New Zealand's public education system. The scheme applied in New Zealand is particularly interesting because it increases competition within the materials but also reduces distribution costs.

93. **International experience on the provision of school textbooks is increasingly moving towards decentralization models, public private initiatives, open licenses and alternative textbooks.** The objective of these initiatives are oriented to increase the service delivery assuring the textbooks reach each student while reducing costs. However, the decision on whether implementing a centralized or decentralized textbooks provision model is aligned with the distribution of functions within the educational system of each country.

94. **The figures analyzed show that a national provision of textbooks generates considerable opportunities for private sector involvement.** This fact may be an incentive to increase competition receiving international bids attracted by high contracts so it is recommended to create the appropriate environment to increase participation and promote competition.

95. **In terms of the *Textos Escolares* program, these are the main recommendations:**

- Consider electronic publishing for selected complementary items in line with the current policy *Recursos Digitales Complementarios*. Given that physical quality is highly valued by teachers but there were also suggestions on reducing the weight in some of the materials⁴¹, it should be explored the possibility of developing a higher percentage of electronic publishing for complementary material. On top of strengthening the use of technology, this would make easier for students to take the materials home. On top of this, as a collateral gain, this could also reduce distribution costs and have a strong impact on improving distribution to remote schools.
- Consider a two-stage strategy for copyrights and printing services. Explore changing the current strategy of buying a three-year license coupled with printing services of textbooks with a two-step strategy of (1) buying copyrights to a textbook and then (2) carrying out an international competitive bidding for the printing services. The international competition for the printing services is suggested because of the characteristics of the Chilean printing market, which has been consolidated around a few printing presses for large jobs and international firms have demonstrated interest and capacity to participating in procurement processes⁴². Expanding the scope of the competition to foreign printing presses might result in lower costs. In such case, the bidding for the printing job should also include the price for the transportation to Chile as part of the price to be evaluated, so that lower printing costs are not offset by higher transportation costs.

⁴¹ Departamento de Economía, Universidad de Chile, 2013, *Servicio de Implementación del Sistema de Seguimiento al uso de textos escolares en uso durante el 2013* p. 68.

⁴² UNESCO and Karisma Foundation. 2014. *Gasto público en la educación de América Latina ¿Puede servir a los propósitos de la Declaración de París sobre los Recursos Educativos Abiertos?* UNESCO.

Annex 1: Stochastic Frontier Analysis

This annex details the methodology and data associated with the stochastic frontier analysis and targeting of the school feeding program.

Stochastic Frontier Analysis

This section, largely based on Greene (2005) and Mastromarco (2008), describes the methodology employed to estimate the stochastic frontier. The advantage of using a Stochastic Frontier Analysis (SFA) is that this model takes into account that deviations from the production frontier might not be entirely under the control of the school, and hence it is less sensitive to outliers. An error is not necessarily an indicator of inefficiency, since there is a possibility of randomness.

We can express the frontier as:

$$y_i = f(x_i; \beta) e^{\theta z_i} e^{v_i} TE_i \quad (1)$$

where y_i is the output of interest, x_i the vector of inputs, z_i is a vector of socio-economic factors, and v_i the error term, that embodies measurement errors, any other statistical noise, and random variation of the frontier across schools. The expression $f(x_i; \beta) e^{\theta z_i} e^{v_i}$ is the stochastic frontier, with a deterministic part common to all the schools ($f(x_i; \beta) e^{\theta z_i}$) and a school-specific part which captures the effects of random shocks to each producer (e^{v_i}). The last element, TE_i , represents the technical efficiency specific to each school, and it equals one if the school achieves the highest output feasible, and is lower than the unity whenever inefficiency arises, in the sense that the output is lower than the maximum output feasible.

To see this, we can solve for TE_i in equation (1) to get:

$$TE_i = \frac{y_i}{f(x_i; \beta) e^{\theta z_i} e^{v_i}} \quad (2)$$

Then, schools with $TE_i < 1$ are using the inputs inefficiently since they could achieve a higher outcome with the same level of spending (represented by $f(x_i; \beta) e^{\theta z_i} e^{v_i}$).

We use the traditional assumption that $TE_i = e^{-u_i}$. With this assumption, equation (1) can be written as:

$$y_i = f(x_i; \beta) e^{\theta z_i} e^{v_i} e^{-u_i} \quad (1')$$

In order to estimate the frontier, we follow a parametric or statistical approach that imposes a specification on the production function. In particular, assuming that $f(x_i; \beta)$ takes a log-log form, the model can be written as:

⁴³ There is debate on whether socio-economic variables should be included as direct control or as part of the TE term. We follow Jayasuriya, R., & Wodon, Q. (2002) and Pereira, M. C., & Moreira, S. (2007) and incorporate socio-economic background as a direct control. As explained by Pereira (2007), this is reasonable assumption since in the traditional education production modelling, socioeconomic-characteristics enter the production function (See for instance Cunha, Heckman, Schennach (2010); see Coelli et al. (1999) for a similar discussion in another context). Nevertheless, the estimated coefficients are robust to both specifications.

$$\log(y_i) = \alpha + \beta \log(x_i) + \theta z_i + \varepsilon_i = \alpha + \beta^T \log(x_i) + \theta z_i + (v_i - u_i)$$

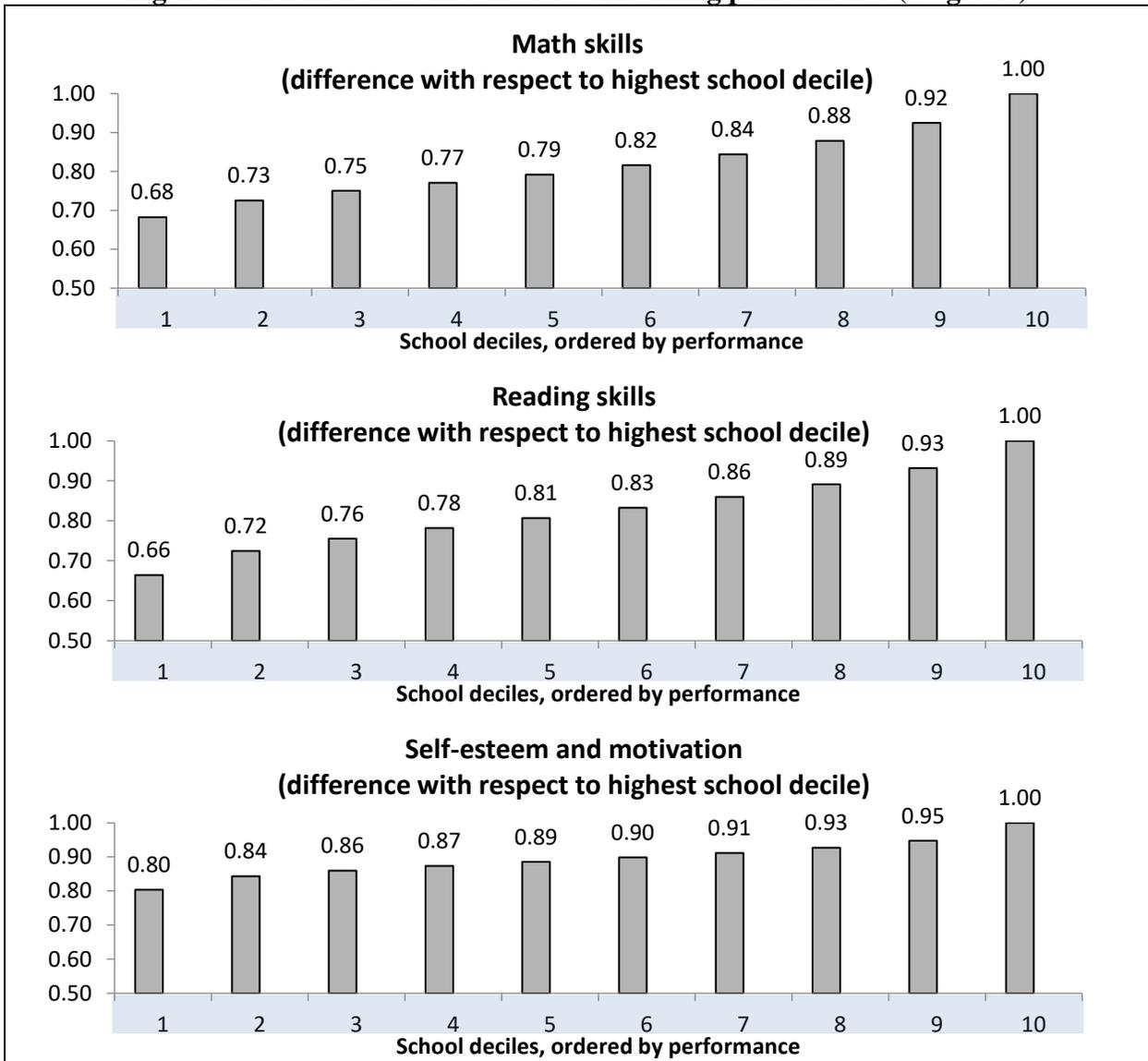
The production process is affected by two type of unobservable factors: statistical noise (v_i), and technical inefficiency (u_i). To estimate the model, some additional assumptions are required. The errors v_i are assumed to have a symmetric distribution, in particular, we assume they are independently and identically distributed as $N(0, \sigma^2)$.⁴⁴ The component u_i is assumed to be distributed independently of v_i and to be non-negative. The non-negativity of the technical inefficiency term reflects the fact that if $u_i > 0$ the school will not produce at the maximum attainable level. We assume that u_i has a half-normal distribution.

It is important to note that given the non-negativity assumption on the efficiency term, its distribution is non-normal and therefore the total error term is asymmetric and non-normal, implying than the OLS estimator is inefficient. Using a maximum likelihood estimator it is possible to obtain more efficient estimates than using OLS.

It is also important to point out that the methodology implemented has an important limitation. In particular, the stochastic frontier is a “national” frontier. Hence, the benchmark for top efficiency is based on the technology of production available in the country. However, it could be the case that most schools of Chilean schools are using outdated production technologies, or are inefficient in international terms, and this would not be captured in the model.

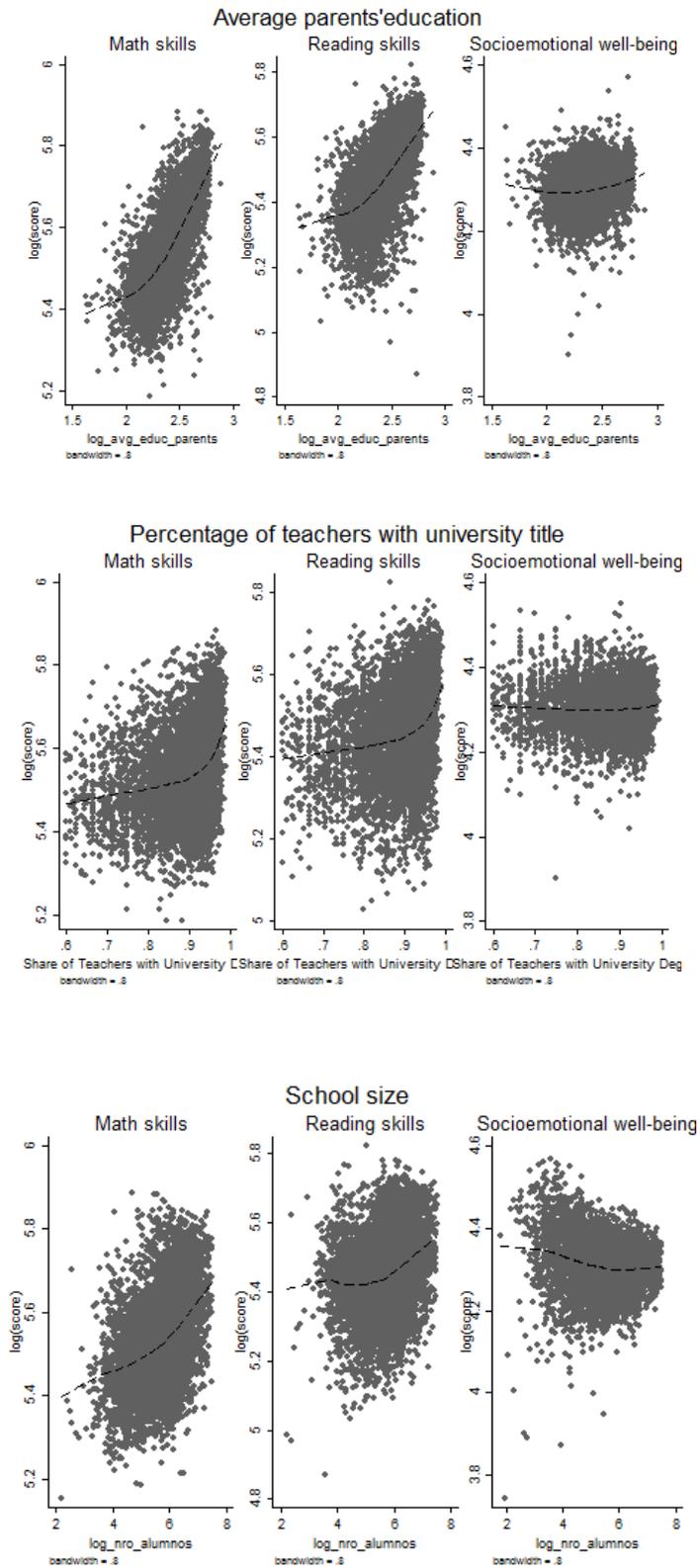
⁴⁴ Any deviation below the frontier is the result of factors partly under the school’s control, but the frontier itself can randomly vary across schools or over time for the same school, so the frontier is stochastic, with a random disturbance v_i being positive or negative depending on favorable or unfavorable external events.

Figure A1.1 Differences in school-level learning performance (8th grade)

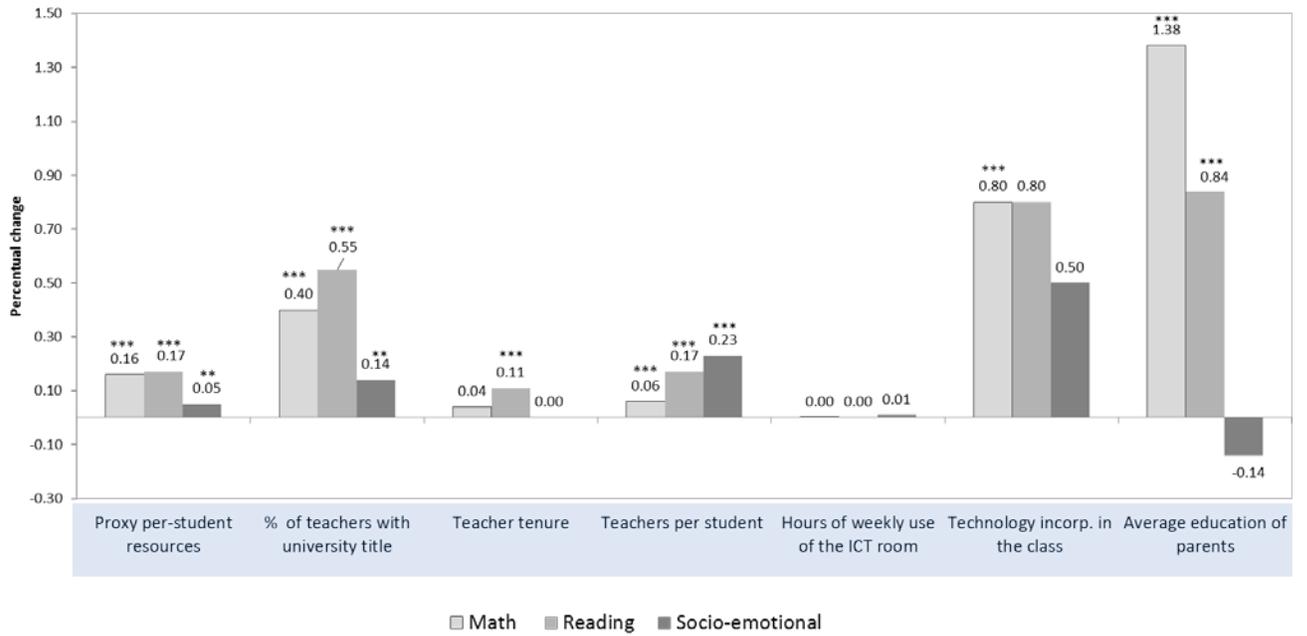


Source: Staff estimates.

Figure A1.2 Key factors correlated with student outcomes



**Figure A1.3 Marginal effects associated to increasing input/variable “X” by 10 percent
National sample, 8th grade**



Note: *, **, ***: significant at the 10%, 5% and 1% level, respectively. “Technology incorporated in the classroom” is a dummy (the reported effect corresponds to the total effect);

Annex 1.2 Literature review

This annex reviews recent studies that analyze potential inefficiencies and ineffective use of resources in the education system in Chile. Key findings include inefficient school size in rural areas, bottlenecks in key human resources (management capabilities at the municipality level and the quality of teachers,) and an inefficient allocation of teachers' time. Solving these issues could lead to both savings opportunities (e.g. increasing school size), or efficiency gains (e.g. improving teacher quality). The ongoing-reforms are addressing most of these identified challenges.

The analysis looked at key reports and research papers. In particular, the analysis looked at reports from the Ministry of Education and other education government agencies. We also reviewed OECD reports that set out the main challenges for Chile and present policy recommendations⁴⁵. Perhaps the most relevant study is a report produced by the Ministry of Education, together with *Agencia de Calidad de la Educación and Superintendencia de Educación*, which reviews public policies aimed at improving the effectiveness in the use of resources at schools in Chile. Its objective is to provide a picture of how Chile approaches the use, distribution and administration of resources so that they can contribute to achieving the country's educational objectives to the fullest. In this context, the review also identifies a series of weaknesses in the structure of the education system that in some cases may indicate an ineffective use of resources.

There is evidence that school size in rural areas is suboptimal and that there are potential net benefits associated with school consolidation. In other words, economies of scale more than compensate required additional infrastructure and greater travel distances⁴⁶. Gallego et al (2010)⁴⁷ find that expenditure is inefficient in the decentralized system. The authors posit an institutional explanation for the suboptimal choice of school size. Mayors, they argue, face electoral costs if they decide to close and merge schools and soft budget constraints allow them to run deficits associated with the suboptimal size structure. A closer relationship between the local and central government would reduce the extent of the inefficiency.

Small municipalities are characterized by limited management capabilities, a key input to allocate resources effectively. A model of public education administered by municipalities entails a number of efficiency challenges. The current model allows each municipal authority to prioritize education matters relative to other matters at its discretion. Also, there is considerable disparity in the amount of resources and management capabilities among municipalities. While large municipalities like Santiago have resources to elaborate their own quality assurance mechanisms, some smaller municipalities may have only one staff in charge of the entire local

⁴⁵ "Revisión de Políticas para Mejorar la Efectividad del Uso de Recursos en las Escuelas", Ministerio de Educación, Agencia de Calidad de la Educación y Superintendencia de Educación, Enero 2016; "Análisis de indicadores educativos de Chile y la OCDE en el contexto de la Reforma Educacional", Serie Evidencias, Centro de Estudios MINEDUC, Nro. 31, 2015; Paulo, Santiago, et al. *OECD Reviews of Evaluation and Assessment in Education Teacher Evaluation in Chile 2013*. OECD Publishing, 2013; Education at a Glance 2015, OECD Indicators.

⁴⁶ The MINEDUC report refers to the school consolidation process as the "rationalization of the school network".

⁴⁷ Gallego, F. A., Rodríguez-Sickert, C., & Sauma, E. (2010). The Political Economy of School Size: Evidence from Chilean Rural Areas. *Pontificia Universidad Católica de Chile Documento de Trabajo*, (375).

education system. All of this diminishes the state's capacity to equally guarantee access and quality of education to the entire population⁴⁸.

Teacher selection standards are weak, which limits teacher quality and harms student learning. Upon graduation, teachers can immediately begin teaching and do not have to meet any additional requirements (such as passing competitive examinations or a standardized test), and have no registration or probation process once in practice.⁴⁹ Also, when starting their careers, teachers in Chile do not have formal induction programs. In this regard, the *Nueva Carrera Docente* project proposes an induction system for new teachers graduated from universities through mentorships from experimented professionals to guide and support new teachers. Induction programs at the beginning of the teachers' careers can bring long-lasting benefits for education systems. More immediate benefits include strengthening and fostering the new teachers' confidence to share their new ideas and enthusiasm in schools, or preventing teachers from leaving the profession within the first few years

Compared to the OECD average, teachers in Chile have one of the highest numbers of teaching hours per year which could lead to an inefficient use of the time. For instance, long teaching hours might come at the cost of less time available for non-teaching activities such as lesson preparation, homework correction, and in-service training and staff meetings. Also, teaching hours and the extent of non-teaching duties may also affect the attractiveness of the teaching profession.

Parent's information regarding school quality is limited, which restricts the impact of competitive pressures on school performance. There is evidence that the quality of parent's information about schools is not as good as desirable for competition to lead to higher productivity, and access to this information as well as incentives to use it vary by socio-economic background, raising equity issues.

Despite the previous challenges, a number of studies have concluded that Chile is at education frontier in the regional context. A number of studies have concluded that Chile is at the frontier of the education dimension. The analysis is based on a sample of developing countries. It finds that Chile ranks among the most efficient countries in the region in terms of public spending in education.⁵⁰

⁴⁸ At the end of 2015 the Congress started the discussion of a bill focused on public schools with the main purpose of displacing management from municipalities to local services ("desmunicipalización") depending directly on the ministry of education.

⁴⁹ Education at a Glance 2014, Chile Country Note, OECD.

⁵⁰ Herrera and Pang (2005); Ribeiro (2008); Salazar Cuellar (2014).

Annex 2: Estimating savings from different school feeding targeting scenarios

This Annex describes the methodology used to simulate potential savings under alternative targeting scenarios in primary and secondary schools. For each educational level, we assume that the budget can be calculated as follows:

$$Budget = \sum_{L=P,S} \sum_{s=1}^{N_L} I(Income_s \leq \underline{U}) \cdot \alpha \cdot VC_L + Fixed\ costs$$

Where L stands for the education level (primary and secondary), N_L and K_L represent the number of students and rations provided in each education level, $I(.)$ is an indicator function that takes the value 1 if the student is eligible and 0 otherwise, $Income_s$ is the socioeconomic group (as measured by MIDES), \underline{U} is the threshold to be eligible for the program (currently poorest 60 percent of the population), VC_L is the variable cost per student in level, and *Fixed costs* represent costs that do not vary with (local) changes in the number of beneficiaries, such as cooking equipment. Since not all the eligible students end up attending PAE, we incorporate a parameter α that captures the *observed* take-up rate of the program. This was computed as the ratio between the eligible population in 2016 according to the targeting instrument; and PAE's estimation of the number of students that will attend to the center during this year.

While PAE does not have detailed data on the cost structure of the program, they recently estimated the share of key components, which is detailed in the following table:

Table A2.1:

Item	Percent
Raw materials	40.9%
Labor costs	33.7%
Operational costs	10.2%
Utilities	5.0%
Investments	4.1%
Fines	2.5%
Taxes	2.1%
Administrative costs	1.6%

Source: JUNAEB

Under this disaggregation, it is reasonable to assume that the variable costs consist of the sum of raw materials and labor costs. While this report did not have access to the average costs per student in *each* school, the report estimated the average cost per student (and education level) by dividing the budget of 2016 allocated to each level, and the total number of estimated beneficiaries for this year (JUNAEB, 2016). By combining the information on the cost structure, and total and average costs, we approximate the average variable costs per student and the total fixed costs.

It is worth mentioning that cost parameters for primary and secondary schools are calculated separately, since the nutritional level of the rations vary by educational level and, consequently, the costs are different too.

Finally, potential efficiency gains are estimated as follows:

$$efficiency\ gains = \frac{Budget_0 - Budget_s}{Budget_0}$$

Where Budget₀ is the current budget, estimated using the cost parameters and the information on eligible beneficiaries by school; and Budget_s is the estimated budget in the simulated scenarios.

Sensibility analysis and robustness checks

Robustness check 1: allowing variable costs to increase with large adjustments in the number of quantity served (fingerprint reader-optimistic scenario)

The following table reports a robustness analysis for the savings estimations reported in the left panel of table 3.6. The analysis considers different scenarios for increments in variable costs (0 to 5 percent)

	Δ CV	Δ -15% take-up	
		% savings	Savings CLP MM
Primary	0%	13.0%	33,654
	1%	12.4%	32,056
	2%	11.7%	30,458
	3%	11.1%	28,861
	4%	10.5%	27,263
	5%	9.9%	25,665
Secondary	0%	14.0%	16,386
	1%	13.4%	15,680
	2%	12.8%	14,973
	3%	12.2%	14,267
	4%	11.6%	13,560
	5%	11.0%	12,854

Robustness check 2: allowing fixed costs to increase with larger targeted population

The following table reports a robustness analysis for the savings estimations reported in table 3.8. The analysis considers different scenarios for increments in fixed costs (0 to 5 percent).

	ΔFC	30% take-up (non-targeted)	
		% savings	Savings CLP MM
Primary	0%	4.6%	11,803
	1%	4.3%	11,263
	2%	4.1%	10,722
	3%	3.9%	10,182
	4%	3.7%	9,641
	5%	3.5%	9,100
Secondary	0%	5.8%	6,739
	1%	5.6%	6,510
	2%	5.4%	6,281
	3%	5.2%	6,052
	4%	5.0%	5,823
	5%	4.8%	5,594

Robustness check 3: providing free meals to sub-sample of non-targeted children

The following table reports a robustness analysis for the savings estimations reported in table 3.8. The scenario (1) correspond to the benchmark case reported in the chapter. The scenario (2) also assume that in those schools where eligible students represent at least 90 percent of the student population, the program becomes universal.

	Scenarios	% savings	Savings CLP MM
Primary	(1) In all schools	4.6%	11,803
	(2) Free meals for non-vulnerable students who represent less than 10% of the students	4.0%	10,436
Secondary	(1) In all schools	5.8%	6,739
	(2) Free meals for non-vulnerable students who represent less than 10% of the students	5.5%	6,457,120

Annex 3: Savings Calculations for MCPA and YEMPC

This annex aims to provide a more detail explanation on the estimation process of the savings for *Me Conecto para Aprender* and *Yo Elijo Mi PC* under the two suggested policy reforms: improved targeting and the provision of tablets instead of computers.

A. Improved targeting

This scenario assumes that savings will only take place in MCPA, since YEMP already targets the poorest students in private subsidized schools. As a result, savings calculations are estimated by varying the share of public primary schools that will still benefit from the program when changing the targeting threshold to different vulnerability levels. The distribution of schools with known vulnerability index (IVE) is summarized in the following table:

IVE Primary public schools	Number of schools
0 - 15%	15
15 - 20%	20
20 - 30%	65
30 - 40%	159
40 - 50%	282
50 - 60%	455
60 - 70%	753
70 - 80%	1,368
80 - 90%	2,164
90 - 100%	2,720
Total	8,001

Considering that the MCPA budget is currently distributed evenly across all schools, each school is estimated to receive CLP 4,608,691. Consequently, the savings in MCPA attributed to different IVE thresholds are summarized in the following table:

IVE threshold	Beneficiary schools	Annual Cost (CLP)	Savings (CLP)
50%	7,460	34,380,832,351	2,493,301,649
60%	7,005	32,283,878,099	4,590,255,901
70%	6,252	28,813,534,029	8,060,599,971
80%	4,884	22,508,845,201	14,365,288,799
90%	2,720	12,535,638,605	24,338,495,395

B. Provision of tablets instead of computers

Under this scenario, savings will appear both in MCPA and YEMP. Currently, the cost of the equipment provided in both programs varies, but for the savings estimation it is assumed that the tablet provided will be the same in both policies. The computer costs for MCPA and YEMP for 2015, which are the latest available and, therefore, the ones used in the savings' calculations assuming that they didn't change in 2016, are the following:

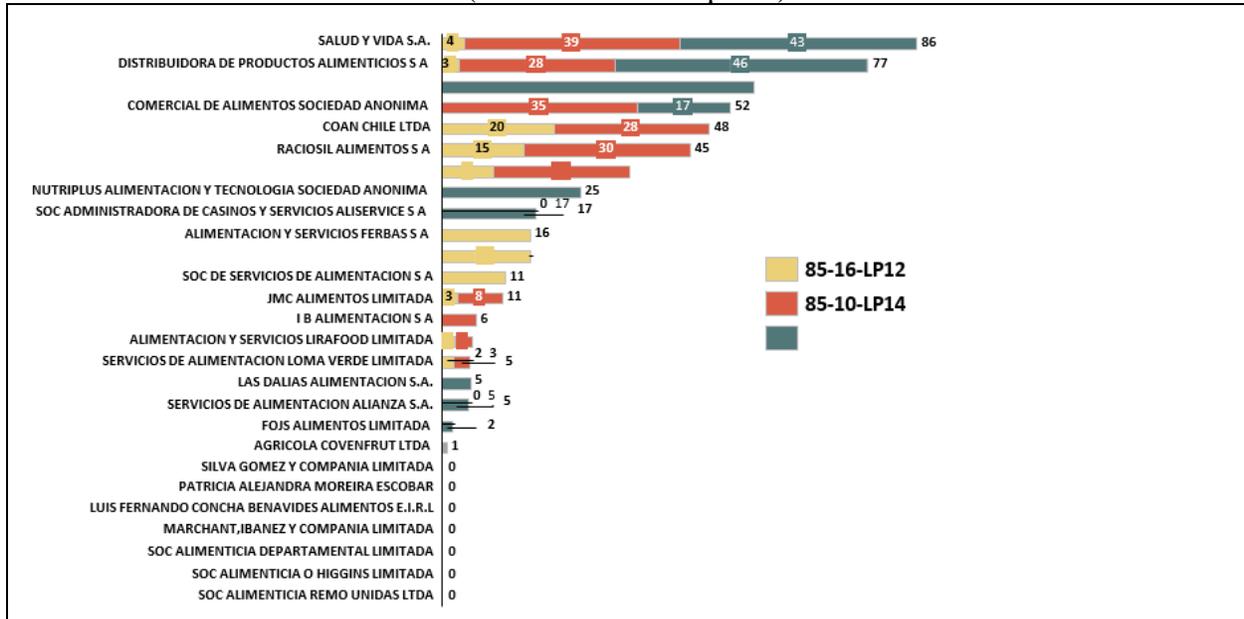
Policy	Unit cost of a computer	Beneficiaries	Weighted average cost per beneficiary
MCPA	288,914	103,500	315,473
YEMP	354,620	30,000	

On the other hand, it is estimated that Enlaces could buy the mid-range tablet with accessories through a public bidding process at about CLP 210,000 each. Therefore, assuming that the costs besides hardware provision (Internet, maintenance, etc.) will not change, the potential savings of this reform would be the difference between the cost of providing computers and the cost of providing tablets, that is:

Beneficiaries	Cost of computers (CLP)	Cost of tablets (CLP)	Savings (CLP)
133,500	42,115,586,730	28,035,000,000	14,080,586,730

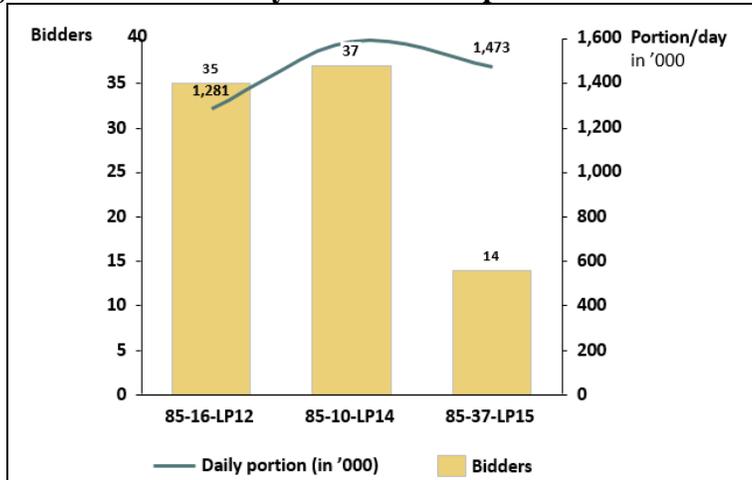
Annex 4. Analysis of Bidder Participation and Contract Awards

Figure A4.1: Awarded suppliers by Procurement process
(in billion Chilean pesos)



Source: Authors based on mercadopublico.cl.

Figure A4.2: Bidders by Procurement process and ration volume



Source: Authors based on mercadopublico.cl.

Annex 5. Key Performance Indicators Examples

Table A5.1:

Metrics	KPI	Measurement
Costs	Identification of saving's opportunities	Degree to which the supplier seeks to identify opportunities for savings in the supply chain.
	Cost transparency	Degree to which the supplier shares details of production costs.
Delivery support	Responsibility	Degree to which requests are answered according to contractual obligations.
	Problem resolution	Degree to which the supplier resolves complaints or problems identified by staff
Flexibility enabling business	Problem resolution	Indulging in empowering the resolution of problems
	Accuracy of billing	Degree to which supplier invoices provides accuracy and error
Quality	Beneficiaries' satisfaction	Degree to which the beneficiaries are satisfied with the services
	Quality of the rations	Rations delivered with the specified quality
	Complaints from beneficiaries	Number of complaints submitted
	Quality consistency	Quality consistency throughout performance of the contract
Innovation	Process optimization	Degree to which the supplier suggests improvements to the process
Risk compliance	Adherence of labor policies	Degree to which the supplier meets labor policies and safety of employees
	Product safety	Degree to which rations are according to standards
	Retention level of key staff	Extent to what food handlers are replaced
	Contractual terms	Degree to which the supplier meets contractual terms

Source:

Annex 6: International School Feeding Procurement Experiences

The *Programa Nacional de Alimentação Escolar (PNAE)* in Brazil is a federal program that assists all basic education students who attend schools managed by the government, philanthropic organizations or the community. It is a very mature program created in 1955 that provides financial resources from the Federal government to the local authorities to be used on the purchase of food and menus that must meet federal nutrition standards. In 2014, the program amounted R\$3.6 billion, about US\$1.7 billion and benefitted forty-two million students.

The National School Lunch Program (NSLP) in the United States is a federal public policy providing school meals in more than 100,000 schools and began in 1946. Schools receive cash subsidies and food and must serve lunches and snacks that meet federal nutrition requirements free of charge or at reduced prices to eligible children. In 2012, the program served more than 31.6 million students at a cost of US\$11.6 billion.

New Zealand has a different approach over school lunches and it is considered a responsibility of the parents in which the government should not interfere. Students bring lunches from home or purchase them at school canteens. Some schools provide a free food canteen for those children that occasionally do not take lunch and there are also non-profit organizations that offer food to students for those cases. Multiple companies provide food delivery services in schools. Parents can choose online products and indicate the time of delivery.

Ultimately, the quality of implementation is equally or even more important than the original design. There is no best practice: each country needs to develop food distribution modalities that adapt to local institutions and political economy constraints.

Figure A6.1: Procurement profile



Source: Authors

The delivery scheme that each government implements has a strong impact on the type of procurement carried out. In Chile, the suppliers prepare the meals in schools, or in industrial kitchens, which results in the development of three bidding processes with great visibility and complexity and high risk. In the United States, the Federal Government reimburses in cash or food and local authorities can choose how to deliver meals. Participating schools can choose whether to

operate their kitchen or hire a provider; and the procurement is carried out following federal and local regulations. In Brazil, the program funds only the purchase of food and meals that are prepared in schools by employees of local governments or third-party suppliers. To procure under this scheme, the local governments carry out several bids with mainly local participation.

The bidding and awarding process that results from the service delivery strategy is very different in the programs analyzed. Figure A6.1 summarizes the main characteristics of each approach considering the complexity, risk, time for implementation, transaction costs and level of control required.

A delivery scheme where a large number of beneficiaries is allocated in different places makes the task of ensuring that meals are delivered in the quantities and with the quality contracted, a hard and complex effort. In the Chilean case, the contract management must assure the delivery of more than 1.5 million daily meals in more than 11 thousands schools.

While the control and supervision of the contract is extremely important, it is equally important to achieve a balance between the requirements that are demanded to suppliers and what is really necessary to ensure compliance with the program's objectives. Reports and documents increase transaction costs for suppliers, so Key Performance Indicators are a useful way to consider what is necessary for the success of the contract without creating friction and unnecessary costs that do not contribute directly to the main objective (see Annex 5 for examples).

Annex 7: Table 3.6. Estimated Efficiency Gains for School Feeding and ICT Programs (detailed table)

	Conservative		Optimistic		Impact on Equity
	(a) MM CLP	(b) % of the prog. budget (*)	(a) MM CLP	(b) % of the program budget (*)	
Short-term					
PAE - Basic and Upper secondary					
(a) On-demand basis (quintile 3)	11,181	3.0%	18,635	5.0%	negligible
(b) Improved monitoring (short term)	5,560	1.5%	16,680	4.4%	slightly positive (reduce leakage)
(c) avoiding price penalties (short term)		(tbc)		(tbc)	neutral
ENLACES					
School targeting: School Vulnerability Index>70%	8,061	12%	8,061	12%	negative
student targeting: B40	19,090	28%	19,090	28%	slightly negative
student targeting: B60	14,351	21%	14,351	21%	slightly negative
More efficient hardware (<i>Tablets for all</i>)	14,081	21%	14,081	21%	positive-neutral
More efficient hardware + targeting (B40)	25,350	38%	25,350	38%	slightly negative
Medium-term:					
PAE - Basic and Upper secondary					
(b') Improved monitoring (100% of total savings by 2019)	16,679.92	4.4%	50,040	13.3%	slightly positive (reduce leakage)
(c') avoiding price penalties (100% of total savings by 2019)		(tbc)		(tbc)	neutral
(d) Sharing fixed costs	18,542	4.9%	18,542	0.1%	neutral
Maximum potential savings (short term + medium term)					
PAE	46,403	12.3%	87,217	18.3%	
ENLACES	25,350	37.8%	25,350	37.8%	

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Chapter 4

Innovation and Entrepreneurship¹

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Table of Contents

1. Context: The Demand for Innovation and Entrepreneurship	3
2. The Innovation and Entrepreneurship Policy Mix	9
3. The quality of the instruments and the policy mix	18
4. Conclusion.....	30
ANNEX 1 Tables and Figures	33
ANNEX 2.1 Figures and Tables Portfolio Analysis.....	50
Annex 2.2 Redundancy analysis across instruments - CORFO.....	54
ANNEX 3. Tables and Figures Functional Analysis	57
Annex 3.1 Methodology Public Expenditure Review in Science Technology and Innovation....	62
Annex 3.2 Cluster Analysis of Instrument Functional Scoring	64
Annex 3.3 Cluster Analysis of the Policy Mix	68
Annex 3.4 Summary of Results and Recommendations.....	73
References	77

Table of Figures

Figure 4.1. Resource allocation by I&E objective (millions of pesos)	11
Figure 4.2. Distribution of mechanisms of intervention	13
Figure 4.3. Share of the budget by matching grants use	15
Figure 4.4. Box plot by dimension	19
Figure 4.5. Radar diagram functional analysis of average performance.....	22
Figure 4.6. Box plot by directorate.....	26

List of Tables

Table 4.1. Summary of scores by dimension.....	19
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1. Context: The Demand for Innovation and Entrepreneurship

1. **This section describes the demand for innovation and entrepreneurship policy.** It describes Chile's innovation and entrepreneurship (I&E) policy framework, including the public expenditure on I&E. It is important to highlight that the analysis is implemented in a period where both institutions analyzed have implemented a significant restructuring of their programs, which shapes the scope of the analysis to primarily analyze these changes. To organize the presentation, selected output and outcomes metrics of innovation performance are linked to inputs, including R&D, policy instruments and programs, and existing framework conditions (Annex A1.1).

1.1. The demand for innovation and entrepreneurship policy

1.1.1 Selected innovation outcomes

2. **Demand for I&E policy, programs and instruments is high, particularly for small and medium enterprises, and for firms operating in regions.** At the aggregate level Chile's labor productivity has been increasing steadily over the past 30 years, revealing a pattern of convergence with its structural peers (Figure A1.2). Capital formation seems to have significantly driven the increase in labor productivity and growth. However, TFP growth has been declining since the 1990s (Figure 4.1). Chilean manufacturing productivity is generally much lower than in the US, although it is comparable for the very largest firms (Figure A1.6).

3. **Chile's lagging export sophistication is related to deficient innovation.** Chile's low economic complexity suggests an inability of Chilean firms to create novel products and develop sophisticated exports beyond mining and agriculture. The economic complexity of Chilean exports has deteriorated over the past 15 years and is currently lower than the observed in most of its structural and regional peers, except Australia and Peru (Figure A1.7). In addition, Chile's export sector shows patterns of low diversification and high relative concentration (Figure A1.8).

4. **At the firm level, innovation incidence among firms is lower than the one of structural peers, and possibly is declining.** The innovation incidence among Chilean firms at 23.7 percent in 2012 - measured in its widest definition of process, or product innovation - remains below structural peers but above regional peers (Figure 4.2). Innovation incidence appears to have been declining (from 37.9 percent in 2004 to 23.7 percent in 2012) although longitudinal comparability between surveys needs to be confirmed, due to potential measuring biases.² This could be partially explained by high commodity prices during the period, which drives investments towards these sectors and limits the incentives to invest in innovation activities in manufacturing and services.

5. **Incidence of innovation remains low for SMEs, and for firms operating in regions.** In the last available survey (8th innovation survey 2012), the innovation prevalence rate for SMEs was lower than for bigger firms, at 22.7 percent and 40.1 percent, respectively. Furthermore, the rate of firm innovation seems to be particularly low in the following regions: V, VIII, XI, XII, and

² It is unclear whether this negative trend reflects a large decline on Innovation activity or an improvement in Innovation measurement.

XIV, ranging from 9.9 percent (IX R. de la Araucania) to 19.6 percent (XIV R. de los Rios). (Table A1.1).

6. **The total early stage entrepreneurial activity has been increasing, from 16 percent in 2010 to 25.9 percent in 2012, according to the Global Entrepreneurship Monitor (GEM).** In 2015, about 25.9 percent of the adult population were involved in early stage entrepreneurial activity, the highest proportion of the population among OECD countries, although 25.3 percent of them were compelled to entrepreneurship activities by necessity.

7. **The Government of Chile is supporting innovation and entrepreneurship through CORFO, SERCTOTEC and CONICYT.** In 2012-14, *Corporación de Fomento de la Producción* (CORFO) invested a total of US\$11.8 million in the *Start-up Chile* entrepreneurship program, supporting 240 startup ventures per year. During the same period, CORFO channeled US\$12.5 million through incubators, accelerators and pre-seed financing.³

1.1.2 Firm level investments & capabilities for innovation and entrepreneurship

8. **Innovation has been constrained by the lack of critical inputs at the firm level, such as R&D investments and managerial capabilities.** Chile's low investment in business R&D, especially among industry, and absence of complementary managerial capabilities seems to be constraining innovation among firms. At 0.4 percent, Chile has the lowest GERD intensity among structural peers in 2014 (Figure A1.9). Moreover, Chile has one of the lowest rate of business R&D expenditure among OECD and regional peers only above Greece, Peru and Luxemburg (Figure A1.10). The level of public financing to private R&D remains high, implying that the innovation system is interrelated to the public sector research. Regional R&D investment is concentrated in Santiago and the V region, both accounted for 58.3 percent of R&D expenditures in 2012 (Table A1.2). However, R&D investment is not the only factor determining rates of innovation among firms. Managerial practice and talent, labor quality, particularly for technical and production requirements, and capital quality are also necessary. In this regard, between 2004 and 2014, managerial capabilities of Chilean firms ranked below those of structural peers, but in line with regional peers (Figure A1.11).

9. **Chile has a strong base of entrepreneurs and new business formation is accelerating.** In 2014, the density of new businesses in Chile was 8.0 per 1,000 people aged 15-64 (top 13 worldwide) compared to 2.0 in LAC and 6.4 in High Income countries. This rate increased gradually from 2 to 3 in 2004-2008 and has accelerated since 2009.

10. **Chile also has one the largest nascent entrepreneurship rates among its peers.** On the entrepreneurship side, Chile's nascent entrepreneurship rate is 16.5 percent, larger than its structural peers and in line with the region. This shows significant nascent entrepreneurship rates and activities and suggests that there is a significant base of entrepreneurs in the country. The existing productivity and innovation gap among SMEs points towards lower quality of the

³ According to CORFO (2015) Startup Chile leveraged US\$96 million in additional funds, and creating a total of additional 1,138 jobs. Also, according to the same sources CORFO's investments on incubators, accelerators and pre-seed financing leveraged US\$71 million in fund raised, supporting revenue of about US\$600 million and generating an average of 1,200 new jobs per year.

entrepreneurship ventures created, which is in line with some of the findings for the region (Lederman et al., 2014)

1.1.3 Framework conditions for innovation and entrepreneurship

11. On the demand side, a specialization in low-knowledge intensive sectors and prevalence of small firms partly explain the R&D gap. Chile has traditionally shown a revealed comparative advantage in natural resources-based sectors, where firms seem to operate close to their technological frontier. While the Chilean economy does not specialize in R&D intensive industries, the level of investment in R&D has traditionally fallen below the level that would have been expected, controlling for its pattern of specialization (Maloney and Rodriguez-Clare, 2007). Moreover, a characterization of firms conducted by the OECD shows that the vast majority of Chilean firms belong to the technology-adapting firm's category (OECD, 2013). This group exhibits high levels of heterogeneity, with signals of variable productivity performance and limited ability to innovate. This segment tends to have a high density of small and medium sized firms, working in the service industry, and experience of lack of skills, limited information on technological and market opportunities, and limited funding.

12. Chile has a sound set of macroeconomic policies, and reputable institutions, but a mixed picture of recent trends in competition suggests Chilean government should exert careful monitoring as absence of competition may hold back innovation performance among firms. At the level of the local enabling environment of enterprises, Chile has an economy that has managed low rates of inflation, shown fiscal prudence and presented a predictable environment for businesses to invest. It also features a favorable legal and regulatory framework to not only attract but also retain foreign direct investment. However, emerging evidence for domestic competition has shown mixed signals of improvement in some areas while deterioration in others. The World Economic Forum's Global Competitive Index (GCI) shows that for the period 2010-14, Chilean local competition improved, particularly in technological readiness, and higher education and training, but that market concentration worsened. Similarly, the OECD product market regulation index suggests that competitive regulations ease from 2008 to 2013, but are still above the OECD average. In addition, between 2006 and 2010, the proportion of firms reporting 6 or more competitors decreased from 56 percent to 49 percent of respondents (Table A1.3).

13. On the supply side, elements of Chile's achievement has deteriorated, possibly hindering availability of wider skills for innovation, and revealing the scarcity of human resources for science and technology. The Chilean science and innovation system ranks between structural peers and regional peers, and shows deficiency in terms of the presence of top universities in the innovation community, and in terms of the publications of researchers in respectable journals (Figure A1.12). Nonetheless, international co-patenting and co-authorship activities is above average, in the same ranking. The Chilean STI system lags behind its peers in its ICT infrastructure and innovation skills (Figure A1.13). International educational achievement tests indicate that the prevalence of first level achievement among respondents has decreased between 1998 and 2013 from 47.4 to 44.3 percent for reading comprehension, from 49.0 to 42.0 percent for writing, and from 53.0 to 51.4 percent for quantitative abilities (Table A1.4). In addition, the reduced stock of researchers and scientists and the weak collaboration between knowledge providing institutions and firms has prevented innovation among firms. Supply of

skilled personnel presented a major constraint for Chile's economic development. In 2011, Chile had 0.8 researchers per one thousand employees, representing less than half than in the OECD area as a whole (Figure A1.14). In addition, an OECD review of innovation policy in 2007 indicated that most R&D is financed by the government and carried out by universities.

14. **According to the Global Entrepreneurship Monitor (GEM), Chile's entrepreneurial ecosystem ranks well in 2014, with solid physical and sociocultural infrastructure.** The GEM ranks Chile favorably in terms of government policies and programs, even when compared to its structural peers (Figure 1.14). In terms of entrepreneurial culture, Chile ranks strongly in perceived capabilities, opportunities and intentions. The GEM deems that formal education for entrepreneurship in Chile is inadequate, ranking even below Mexico and most of its structural peers. The relatively high rate of fear of failure presents an area for future work and improvement. Chile's entrepreneurial ecosystem lagged behind its peers in terms of access to entrepreneurial finance – venture capital, and transfers systems for R&D.

1.1.4 External factors affecting local innovation and entrepreneurship activity

15. **Slowdown of demand for commodities has likely had a mixed affects in performance of both, productivity and innovation for Chilean firms.** The falling demand for Chilean commodities, especially for mining and agricultural goods, has pushed many companies to cut costs, in a relentless pursuit for efficiency improvements. Miners operating in Chile were confronting some of the world's highest wages already, which has led to further downsizing and layoffs (Deloitte, 2016). However, the downturn has also prompted companies to cut discretionary spending, which has normally served to fund R&D, for example, through the exploration of new deposits. Moreover, mining total factor productivity (TFP) declined by 8.7 percent during the period 2000-14, owing to deteriorating ore grades (Figure A1.15).

16. **Chile has an open trade regime and favorable legal and regulatory conditions to attract and retain foreign direct investment, a key contributor to productivity-enhancing technology diffusion.** FDI inflows in Chile have stood among the highest in the OECD, and have represented an important source of investment in the mining, financial and utilities sectors. While FDI increased from an annual average of 6 percent of GDP in the early 2000s to 8.5 percent in recent years (WDI, 2016).

1.2. The Innovation and entrepreneurship policy framework

17. **This study analyzes I&E instruments of CORFO and SERCOTEC.** CORFO is an implementing agency, executing policies to advance programs for productive innovation and entrepreneurship. It belongs to the Ministry of Economy, Development and Tourism. SERCOTEC is also an implementing agency, specializing in supporting micro and small entrepreneurs. Both agencies work in coordination with CONICYT whose main role is to promote the formation of advanced human capital and research capacity in science and technology in Chile (Figure A1.16).

18. **During the past 25 years, the policy framework for I&E has undergone significant changes and enjoyed steady and cumulative improvements.** Policy makers have introduced measures to improve governance in the policy framework, insulating institutions from political

sway, improved coordination among key innovation stakeholders (i.e. the inter-ministerial committee for innovation), and enhanced the long term planning process and the one for improved allocation of financial resources (i.e. national council for competitiveness and innovation (CNIC) under an advisory role). Another important measure was the creation of the Innovation Fund for Competitiveness (FIC) for funding innovation programs. In terms of areas of focus and programs, the focus went from supporting neutrally all sectors to adopting a targeted approach that relied in supporting specific sectors with a comparative advantage. In addition, the policy mix was expanded with the inclusion of indirect support (tax incentives), collaboration enhancing instruments, and entrepreneurship support programs. Finally, a drive in support programs has increased funding of activities for the regions. Tables A1.5 and A1.6.A provide a simplified analysis of the evolution of the policy framework.

19. The latest policy framework (2014) features an ambitious set of policy measures, supported by an unprecedented increase in the budget of MINECON. During the first 100 days, president Bachelet introduced the National Agenda for Productivity, Competitiveness and Growth to be led by the Ministry of Economy and implemented through a multi-ministerial executive platform. The implementation of this agenda is expected to move firms from a production structure concentrated on the production and export of raw materials to one based on knowledge and innovation. Its duration is from 2014 to 2018 with a funding of CLP674 billion (US\$1.2 billion). The increase in the budget of MINECON allowed the creation of the Strategic Investment Fund with CLP46.8 billion (US\$78 million) and the recapitalization of the SME Guarantee Fund - FOGAPE for US\$500 million.

20. CORFO introduced the 2018 Entrepreneurship Policy to promote dynamic entrepreneurship and to allow new ventures shape productivity and sustainability in existing economic sectors. CORFO's expenditures for supporting increased from about US\$10 million in 2005 to about US\$36 million in 2014. The entrepreneurial development framework contains five pillars: i) access to funding (seed, start-up, and expansion and growth capital); ii) education and training, (pre university, university, and specific entrepreneurship training); iii) culture, (tolerance to risk and failure, preference for self-employment, celebration of self-made wealth); iv) taxation and regulation, (incentives, business registration); and v) coordinated support (mentors, advisers, networks and incubators). Allocation of pre-seed financing at the national level grew from US\$6.1 million to US\$12.1 million between 2010 and 2013. The number of incubators supported by CORFO went from 6 in 2010 to 17 in 2013, with an equivalent increase in disbursement of CLP895 million to CLP1.8 billion, in each year respectively.

21. CORFO and SERCOTEC conducted a programmatic rationalization exercise based on the identification of key challenges through a diagnostics exercise. We provide a summary of the results of this rationalization in Tables A1.7 and A1.8. The existing Innovation and entrepreneurship framework, together with the most current mix of policy instruments and programs, suggests policy makers have made changes, which are consistent with these priority areas. We summarize the main findings from the latest policy framework in relation to the previous one.

- *Increased emphasis on promoting entrepreneurship* - an increased focus on dynamic entrepreneurship, particularly in the early stage of business development. Financing for

entrepreneurship programs grew by more than 50 percent between 2014 and 2015 in relation to the previous four years.

- *Increased targeting of different stages of enterprising life cycle* – the agenda introduced specific measures that address the multiple needs of entrepreneurs throughout the cycle: seed, start-up, early growth, growth and scaling up.
- *Further reach with entrepreneurship programs to previously unattended groups* – The new policy framework has extended national programs, such as *Startup Chile*, to the regions, and introduced new programs such as the regional entrepreneurship program. Moreover, policy makers introduced the Social entrepreneurship program (SSAF), and the women entrepreneurs facility (measure 20 of the agenda), which includes access to finance (i.e. banking), and nonfinancial support such as mentoring, training and regulatory reforms.
- *Expanded scope of instruments to include additional non-financial support* – Within the new agenda, the current administration has also introduced non-financial instruments to complement direct financial support assistance. Non-financial measures included ease in regulations for enterprising, introduction of the national award for role model entrepreneurs, and the launching of the mentoring networks.
- *Increased support to priority sectors with active involvement of the private sector* – the current administration has resumed its approach to support industries with revealed comparative advantages such as mining, logistics, foods, high value services, tourism, and aquaculture, among others. Measures to materialize support include the strategic investment fund, the round tables for public private dialogue, the mining commission for Chile’s economic development, and strategic development plans for high potential sectors.
- *Balanced support from technological innovation to technological diffusion*. The technology diffusion program under innovation capacity axis, and the technology transfer and commercialization axis, with a variety of support initiatives for the Tech Transfer Office (TTO) and licensing have stricken a finer balance between innovation and diffusion of innovation.

1.3. Public expenditure in Innovation and Entrepreneurship

22. **Chile’s STI expenditure has grown steadily over the past years.** CORFO and CONICYT implement the bulk of programs, accounting for 73.8 percent of total STI expenditures between 2007 and 2015. Traditionally, about four fifths of the budget from CONICYT are allocated to research, and disbursed through programs such as FONDECYT, FONDEF, and FONDAP, while the remaining to formation of advanced human capital through scholarships. CORFO invests in innovation programs, to promote R&D through fiscal incentives and matching grants, and to promote applied innovation and transfers of technology, through the unit programs for technological capability development. The dynamic entrepreneurship program supports high-growth firms, through early-stage financing, provision of seed capital, and a network of incubators and accelerators.

23. **Investments in R&D, human capital and innovation accounted for about 77 percent the budget in 2015.** R&D dominated allocation of financial resources, representing about 43 percent of all expenditures during that year (Figure 4.3). A significant portion of R&D investments has been traditionally channeled through direct research support at universities, and has historically comprised provision of basic R&D. By contrast, countries in OECD tend to allocate proportionally

less funding to basic R&D provision and proportionally more funding to technology diffusion and technology based entrepreneurship (World Bank 2008).

24. **The use of tax incentives to increase business R&D is relatively limited compared to OECD.** The inclusion of R&D tax incentives in 2006 has made the Chilean policy mix more diverse. Chile still relies predominantly on the use of direct incentives, however, through its variety of matching grants, grant and loans schemes. OECD countries have been shifting direct support towards tax incentives and other instruments, such as knowledge transfers and equity financing (OECD STI Outlook 2014). In 2012, government support to business R&D was 0.027 percent of GDP, the fourth lowest in the distribution of the selected 39 countries (mostly OECD). In addition, Chile has the fifth lowest proportion of indirect support through tax incentives as a proportion of total business R&D support in the sample, with 12 percent of indirect funding as a proportion of total government's financial support to business R&D for 2012. Structural peers including Canada, Australia and Norway featured 86, 82, and 36 percent, respectively (Figure A1.18).

2. The Innovation and Entrepreneurship Policy Mix

2.1 The innovation policy mix budget

25. **Although innovation and entrepreneurship programs represent less than 0.5% of public expenditure, the budget allocated to innovation and entrepreneurship has been increasingly steadily.** In addition, the number of instruments implemented has been significantly rationalized after a sharp increase from 2010 to 2015. SERCOTEC has 10 instruments. CORFO has a large number of instruments (69 in 2016) in its portfolio, increasing from 67 in 2010 to a staggering 92 in 2015, which was rationalized to 69 this year. Based on the information provided for the five directorates of CORFO, the number of instruments and budget allocated to them have been increasing significantly, particularly in 2015,⁴ although still low for OECD standards. The process of reformulation of innovation and entrepreneurship policy has yielded (in the case of these five directorates) an increase from 8 to 17 instruments in 2015, afterwards reduced to 7 in the case of the Directorate of Technological Capabilities; 11 to 17 in the Directorate of Entrepreneurship directorate; and 15 to 19 in the Directorate of Innovation. The Directorates of Competitive Development and Investment Finance experienced a reduction in the number of instruments from 18 to 17 and 15 to 9 each. As shown in Figure A2.1, most of the budget 700 billion pesos (78% of CORFO in 2015) goes to the Directorate of Investment Finance. This is the result of CORFO being an unusual agency; both a development bank and innovation agency. The budget for the Directorate of Technological Capabilities has remained stable between 22 and 24 billion pesos and the budget for competitive development is 42 billion pesos. The Directorate of Entrepreneurship directorate grew threefold from a very low base of 7 billion in 2010 to 27 billion Chilean pesos in 2015. In the case of the innovation directorate the budget stayed constant during the period 2010-14, 23 to 25 billion Chilean pesos but experienced a large increase in 2015 to 102.5 billion Chilean pesos. A large part of this increase was due to allocations in two instruments – “*prototipos*” and “*validación y empaquetamiento*” in order to expand the programmatic offer

⁴ We do not have information on the budget allocation for 2016 and new instruments could still be launched this year.

and include the “last mile” of the innovation cycle. In the case of SERCOTEC, we do not have information prior to 2015, but the number of instruments was reduced to 10, representing a budget of 27 billion Chilean pesos.

26. Most of the policy support was horizontal (sector neutral), and resource allocation was relatively concentrated in a few instruments. All of SERCOTEC interventions were horizontal. In the case of CORFO and excluding financing and investment given its size, around 14 percent of the budget was earmarked to vertical instruments with evident sector component – targeting strategic sectors; 54% for the directorate of technological capabilities, which is more directly linked to strategic sectors.⁵ When considering the financing and investment directorate instruments, only 2% of the budget has a vertical focus. Figure A2.2 shows the degree of budget concentration in 2016 first semester represented by the area between the 45 degrees line and the Gini curve. The curve excluding investment and finance instruments shows that the 60 percent of instruments with lower budget allocation represented less than 20 percent of the budget and the 20 percent of instruments with higher budget allocation represented around 60 percent of the totality of resources. This distribution of resources was not excessively concentrated when compared to other countries in the region such as Colombia. However, when financing instruments are considered, there is a large concentration in a few indirect instruments; Garantía CORFO that has 69% of the budget, followed by Garantía COBEX with 6.6%.

2.2 Coherence of the mix by objectives, departments, instruments used and types of beneficiaries

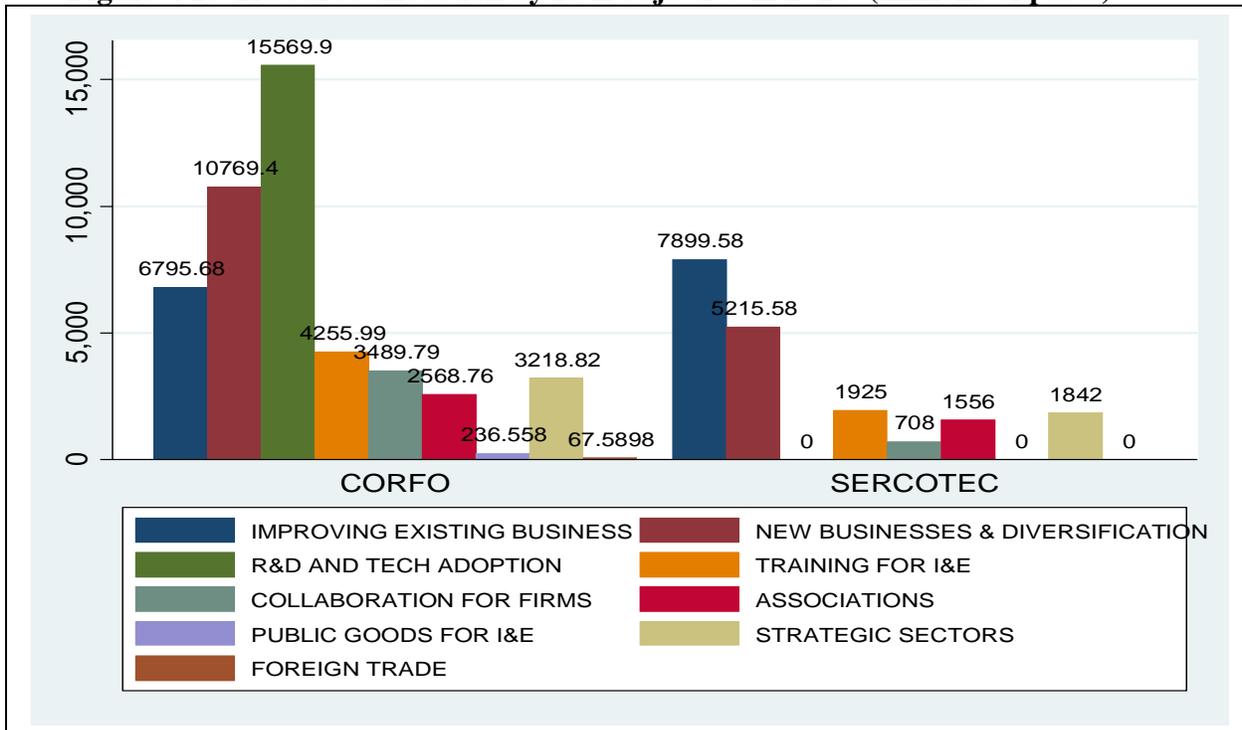
27. The budget allocation followed stated goals; showing coherence with the drive towards diversification, productivity and collaboration. In general, allocation of policy resources at the aggregate level showed consistency with stated objectives of diversification and increasing productivity. In addition, resource allocation was consistent with the need to increase collaborative efforts for innovation, given the lack of collaboration between firms and between firms and academia arising from the innovation surveys. Figure 4.1 shows the distribution of the budget by objectives of I&E, excluding financial instruments. Most resources were allocated to supporting innovation activities, the creation of new businesses and to new business diversification or strategic sector support. Moreover, financial support to improving existing businesses enjoyed a significant share of the public budget, especially for SERCOTEC. Interestingly strengthening collaboration and associations presented a significant allocation of the budget in CORFO, and less so in SERCOTEC.

28. The allocation of resources between innovation, supporting new business creation and diversification of existing businesses is coherent with the policy needs and objectives to change the economic structure and increase productivity. Excluding finance instruments

⁵ These instruments are: *Programas Tecnológicos, Perfiles De Programas Otras Especies Potenciales, Programas Tecnológicos de Diversificación Acuícola, Programa Mejoramiento Genético Para Fruticultura, Nueva Ingeniería Para El 2030, Emprendimiento Turismo Intereses Especiales, Consorcios Tecnológicos Empresariales, Centros De Extensionismo Tecnológico, Bienes Públicos Estratégicos Para La Competitividad, Programa Formación Para La Competitividad, Preinversión en áreas de manejo de pesca artesanal (PIAM), Fondo de asistencia técnica (FAT): grupos de transferencia tecnológica GTT, Preinversión en Riego (PI.R), Programa Estratégico, Programa De Apoyo A Proyectos Estratégicos En Etapa de Preinversión (PRAP), Nodos Estratégicos Para La Competitividad, Programa de fomento al cine e industria audiovisual and Fondo de exploración minera fenix.*

(directed mainly to productive investment and foreign trade), we observe a balanced distribution of resources between creating new businesses and supporting R&D and tech adoption – 24% of resources each – and improving existing businesses 23%. This is consistent, as we saw in the previous section, with the fact that the rate of early stage entrepreneurship is relatively high and a significant number of new businesses have already been created. In addition, the balance between diversification within existing businesses and new strategic sectors seems quite prudent in terms of resource allocation, if we assume that these strategic programs are likely to be more risky given the objective of supporting growth of new sectors in the economy. The amounts allocated to these new sectors are still relatively small.

Figure 4.1. Resource allocation by I&E objective in 2016^a (millions of pesos)



Source: Authors. Excluding finance instruments. ^a First semester

29. **While SERCOTEC tends to focus less on supporting early stages of entrepreneurship, CORFO’s portfolio is increasingly concentrated in early stages and growth.** Figure A2.3 shows the allocation of resources by firms’ life cycle: pre-seed and seed, start-up, growth and consolidation. In the case of CORFO, the start-up stage received slightly stronger support than scale up, but much stronger than pre-seed and seed and mature firms. This is due to financial instruments, which target primarily these two stages of the life-cycle; when these financial instruments are excluded the shares across all stages of the life-cycle are similar. In the case of SERCOTEC most resources are allocated to growing firms and much less on early stage. In the case of CORFO, looking at different directorates show different approaches to support during the life cycle. On the one hand, the innovation directorate follows an innovation cycle approach biased towards supporting growing and mature innovative firms, while on the other hand the entrepreneurship directorate tended to support proportionally more the early stages – seed, pre-seed and startup.

30. **The current budget allocation is not consistent with achieving rapid growth in R&D targets although this may be more appropriate given the country's productive sector.** Our estimate suggests that around 24 percent of the resources in non-finance instruments targeted directly increasing R&D and technology adoption, which is unlikely to create in the short-run much private additionality in terms of R&D expenditure and convergence to OECD average. Figure A2.4 shows resource allocation by intermediate outcomes and shows that instruments that directly or indirectly impact business R&D are a very small fraction of resources, given the size of finance instruments on addressing ecosystem and framework conditions. However, this seems appropriate and consistent with the productive sector, given that most innovation is likely to be based on imitation and technology adoption, and the use of R&D efficiently requires complementarity factors such as a developed scientific base and high quality firm managerial capabilities. Regarding the later, instruments targeting basic competencies and managerial practices still have a low budget allocation, even when excluding finance instruments.

Box 4.1. Mechanisms of intervention for I&E

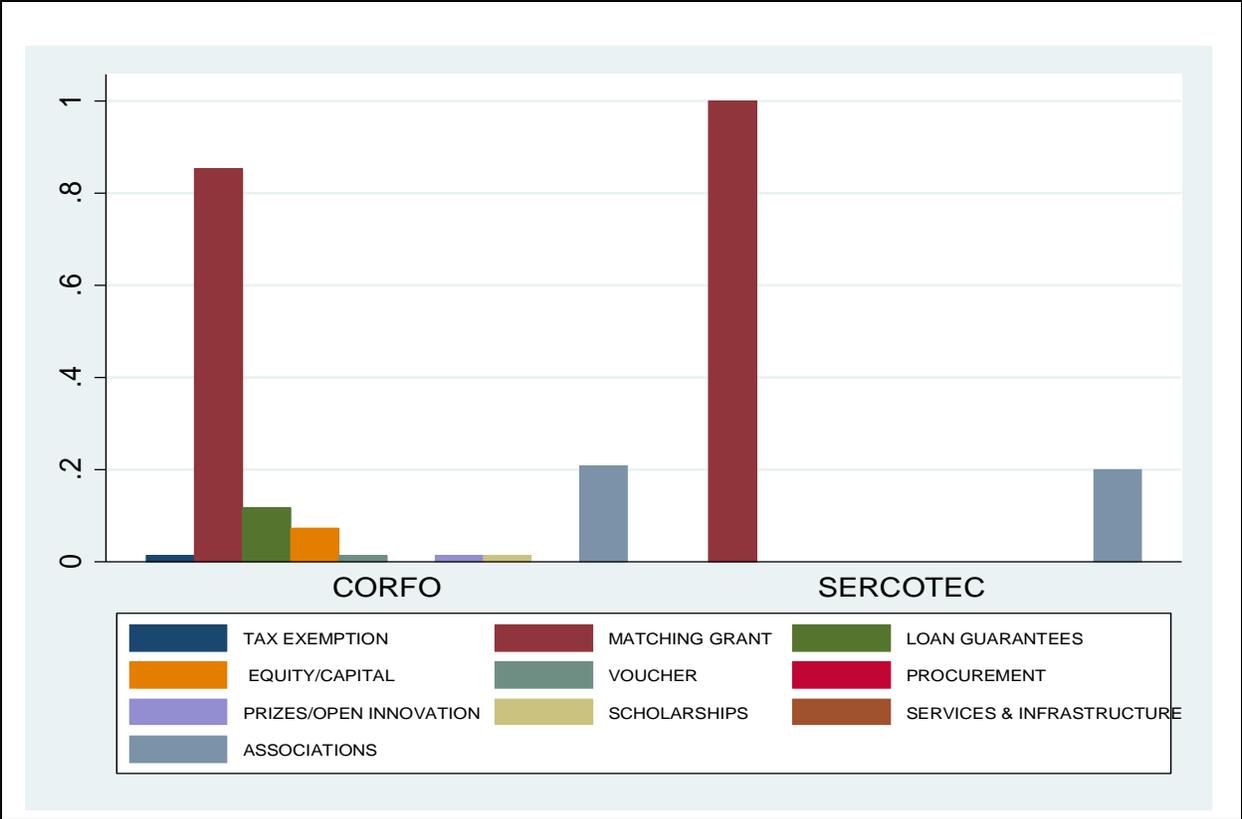
There are 12 main mechanisms of intervention were identified for innovation and entrepreneurship policy including: tax exemptions, matching grants, credit guarantees, equity investments, vouchers, public procurement, prizes, scholarships, services and infrastructure, goods provision, associative instruments and clusters and regulation. Some, like the direct provision of goods and services have become rare in the last decades; other such as vouchers, prizes or public procurement are becoming increasingly important. While these mechanisms are not necessarily relevant for all institutions and for similar use, it is important to keep in mind that similar use and objectives can be achieved by alternative mechanisms.

Most of I&E interventions imply some type of subsidy in order to overcome a market failure, such as positive externalities. In the case of a positive externality, the objective is to provide a subsidy to induce firms to change their behavior by equating their private benefit to the social benefit. However, there are different mechanisms through which this can be achieved. For example, in the case of an instrument that want to support diversification within the firm by supporting prototyping, the main market failure is likely to be an inefficient financial system that perceives financing prototyping activities as too risky. In this case, one could provide a matching grant or a credit guarantee through a lending institution to cover part of the risk. The choice depends on different factors; such as the size of the market failure, the inefficiencies in the financial sector, the financial needs of the firm or the implementation costs of each alternative. The same occurs for other objectives of innovation policy such as technical assistance by consultants, diagnostics, collaborations or implementation of standards. Public interventions can provide assistance directly via extension services, a matching grant for consultancy services or a voucher. Again, each instrument will have its pros and cons, and depending on the context one instrument or a mixture of them may be more or less optimal. However, the choice and design of the most appropriate mechanism of intervention is important and it is likely to have significant implications for effectiveness.

31. **There is a significant concentration in matching grants as the main mechanism of intervention.** Figure 4.2 shows the proportion of instruments (by number, not resources) by intervention mechanism among all potential innovation policy instruments that exist in OECD countries. The graph shows that most instruments use matching grants, 68 instruments. There are several instruments supporting the creation of associations or clusters of firms (18 cases), and the finance instruments focus on loans and loan guarantees (8 instruments in 2016) and capital investments/equity (5 instruments). Only one instrument in CORFO uses a voucher scheme. The use of matching grants as the main mechanism of intervention in direct support to I&E is very common among OECD countries, but there is a lack of systematic assessment of alternative mechanisms of intervention during the design process that may explain part of this concentration,

although there has been an increase in the variety of mechanisms of intervention in CORFO's portfolio. It is important, therefore, to justify in the design of each of the instrument whether a matching grant is the optimal mechanism in each case. In addition, it is important that even when some of these instruments target specific types of disbursements, the use of direct financial mechanisms relies on beneficiaries knowing how to use resources correctly, which is not always the case.

Figure 4.2. Distribution of mechanisms of intervention



Source: Authors.

32. **The design of co-financing mechanisms within matching grants looks relatively similar across projects, but co-financing rates increase with the size of the project.** Most of the budget for matching grants (69 percent) is allocated to instruments with 30 percent or less co-financing.⁶ Also, a large part of the budget (68 percent) is allocated to instruments requiring a single co-financing rate, while the remaining 32 percent uses two or three co-financing criteria depending on the size of the firm and or the modality of the intervention. Interestingly, while most of the budget is allocated to instruments with a higher proportion of subsidy, when looking across projects, those projects with larger size tend to imply larger co-financing by beneficiaries. This level of homogeneity within instrument co-financing rates is unlikely to be optimal in practice, since different projects and different beneficiaries require different levels of co-financing given by

⁶ 61 percent of the budget allocated called for 20 percent -30 percent of co-financing and five programs (representing 9 percent of budget) mainly from SERCOTEC were a full grant.

different project complexities and financial constraints. While designing mechanisms requiring variable co-financing rates may add complexity and increase administrative and transaction costs, it is advisable to focus efforts on testing and measuring the impacts of alternative mechanisms. One element that can help in the design of these co-financing mechanisms is to ask applicants to reveal their co-financing needs during the application process (See Box 4.2 for some options from the experimental literature).

Box 4.2 Optimizing matching rates of grants schemes – a few alternative designs based on bidding

Design 1: Bidding after proposal assessment

Procedure: All applicants submit their project proposals -> Grant committee assesses each proposal and publishes a funding priority list -> The applicants, after being informed of their places on the priority list, place their bids to the grant issuer

Result: The higher bid an applicant places, the more likely the project is going to be selected; the matching rate for each selected project is the bid placed by its applicant.

Pro: Easy to implement

Con: Having known the project priority, the applicant has an incentive to place lower bids, thus the bids do not necessarily reveal applicants' real need for public funds.

Design 2: Bidding before proposal assessment

Procedure: All applicants submit their project proposal, including a bid of their matching rate -> Grant committee assesses proposals based on a certain rule to combine the proposal quality and bid

Result: The matching rate for each selected project is the bid placed by its applicant

Pro: Solves the problem of underbidding in the first design

Con: This procedure places more burden on the grant committee

Design 3: Bidding after proposal assessment with uniform rate (a Vickrey–Clarke–Groves (VCG) auction mechanism)

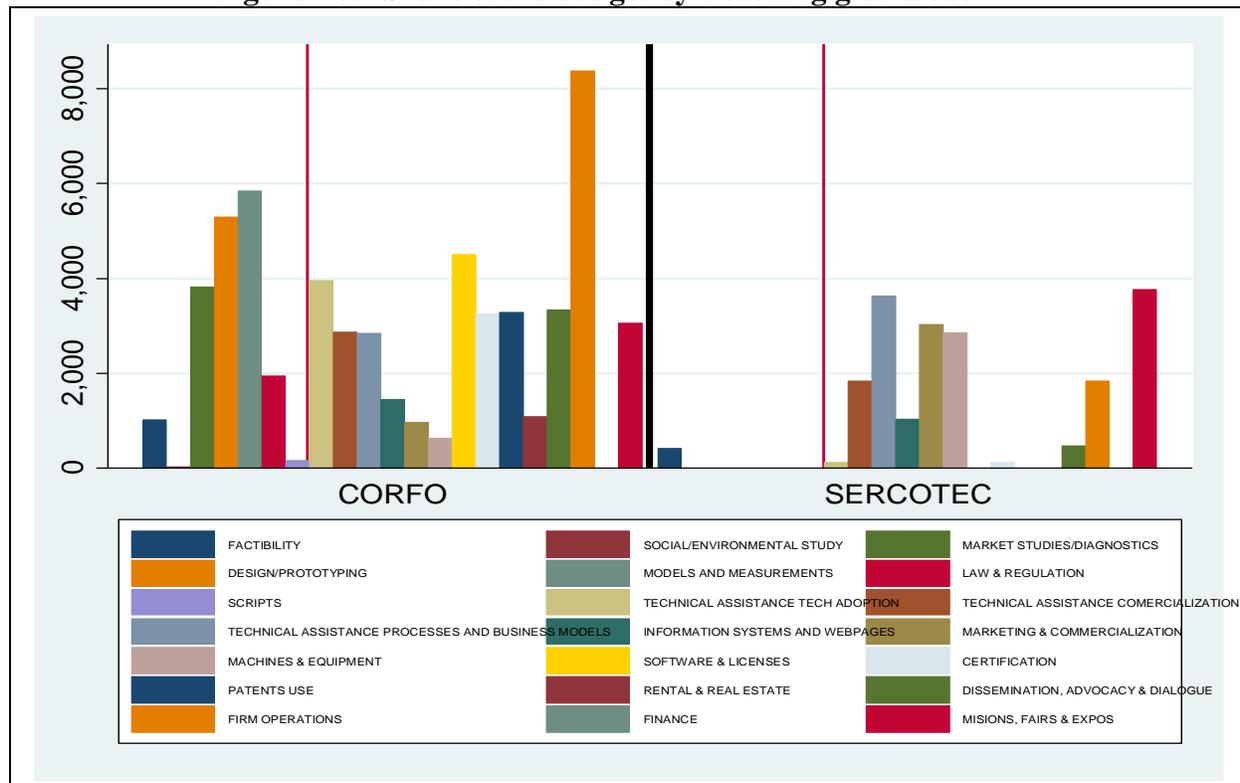
Procedure: The same as in Design 1; the difference is the matching rate for all selected project is the same: it is the highest bid placed by the applicants who are EXCLUDED from receiving the grant.

Pro: Simplifies firms' optimal bidding strategy. Since the applicants cannot affect the final matching rate to their benefit by manipulating their own bid, all applicants should simply bid with their true copayment capacity.

Con: May not be the optimal mechanism for the grant issuer – the final copayment rate can be too low for the awarded firms. Plus the complexity of the bidding process might confuse applicants.

33. **A large part of instruments support project implementation.** Figure 4.3 shows the allocation of the budget by use of instrument funds. The red vertical lines separates the uses of funds related to the functions of design and pre-feasibility (on the left), from the funds which have been used to support the function of project implementation on the left. In the case of CORFO, 69 percent of the budget allocation went to support project implementation, while in the case of SERCOTEC, hardly any funds were allocated to support either pre-feasibility or design. In the case of CORFO, a higher proportion of the budget financed firms' operations (14 percent); and diagnostics, design and models and measurement, with around 8 to 10 percent each. In the case of SERCOTEC, funds mainly support management and business models (19 percent), finance the purchase of machines and equipment (15 percent) and support missions and fairs (20 percent). Among these, the most subsidized uses were management and business model development, which grants a subsidy of 70 percent or more of the project in the most used instruments.

Figure 4.3. Share of the budget by matching grants use



Source: Authors.

2.3 Size, scale effects and redundancies

34. **Several instruments with small budget allocation are unlikely to achieve any significant impact due to lack of scale resulting in potential spending inefficiencies.** Fifteen instruments⁷ in the portfolio presented a budget allocation below 50 million pesos during the course of the first semester of 2016 - less than 100k USD –, a small amount which suggest potential limitations of these programs to achieve any sizeable impact. Also, program implementation requires achieving a minimum critical mass of firms in a relatively short timeframe to be successful, which calls for a sufficient budget per instrument (Teubal, 2010). More importantly, most of these instruments provide some financial support to businesses and the ratio between administration and supervision costs to effective support provided is likely to make them

⁷ Fortalecimiento De Capital Humano En Transferencia, Programa de generación de emprendimiento capital Semilla, Programa Formación Para La Competitividad, Semilla Expansión, Absorción Tecnológica Para La Innovación, Preinversión en áreas de manejo de pesca artesanal (PI.AM), Fondo de asistencia técnica (FAT): grupos de transferencia tecnológica GTT, Prototipos De Innovacion Empresarial, Subsidio Semilla de Asignación Flexible para Emprendimientos de Innovación Social, Apoyo A La Operacion De Espacios Colaborativos De Cowork, Prototipos De Innovacion Social, Programa Territorial Integrado (PTI), Programa Regional de Apoyo al Emprendimiento, Redes De Mentores, and Programa De Aceleración De Emprendimientos En Sectores Estratégicos

inefficient. As a result, it is necessary to assess whether these eight instruments would be integrated into other programs, as components of other existing instruments, or should be terminated.⁸

35. **Cluster analysis suggests that there are no overlaps across directorates and there is a stark division of labor across CORFO's three directorates and SERCOTEC.** An inductive hierarchical clustering analysis of instrument objectives and beneficiaries resulted in groups of instruments that can be clearly mapped to the four entities in which these instruments belong. This analysis shows clear differences in emphasis between groups of instruments. This result has two interrelated consequences. First, there are few chances of unproductive overlaps across directorates. Second, there is a chance of lost complementarities.

36. **There are still a few opportunities for program rationalization of the instrument portfolio within directorates at CORFO.** Starting from the base of all active instruments in 2016, we revised their profile and selected a shortlist of 40 instruments based on their general name and stated scope (See Annex 2. For a detailed explanation). Within this list of 40 candidates, we look at similarities and differences in terms of objectives, sought outcomes, strategies, scope of support, and sources of funding. We adjusted for those instruments that seem were on the way out, with active budgets for the first semester of year 2016. Thus, we reviewed 14 cases comprising 40 instruments, of which only 3 cases⁹ comprising 6 instruments presented opportunities for consolidation within one directorate. In these cases, the question is whether more efficiency without compromising impact is likely to be achieved by consolidating them.

37. **There are areas not covered appropriately by the existing programs in CORFO.** Two areas stand out. First, there is no coverage of basic research related to innovation. While this may be the objective of CONICYT, this separation reflects a stereotypical distinction between basic and applied research and ignores the opportunities for innovation related to a broad view of R&D in general. Second, targeting of increased participation of women could be improved by in addition to having a women entrepreneurship program, mainstreaming gender in some of the existing programs. SERCOTEC includes this criterion in some of its programs and there is a specific program aiming to increase the number of female entrepreneurs. However, since there are substantial productivity gains by incorporating women as entrepreneurs (Cuberes and Teignier, 2015) and other roles in support of innovation, best practices for increased participation of women recommend that increasing their participation should be a general criteria to measure the performance of I&E programs. Women do not appear to be beneficiaries for highly innovative activities nor knowledge creation related to innovation other than the specific program designed for female entrepreneurs.¹⁰ SERCOTEC has no support for knowledge creation activities, which appears simplistic if truly innovative activities are going to be encouraged with their support even for smaller firms.

⁸ It is worth noting that we conducted this assessment with partial information on expenditures in the first half of the year, so the assumption is that the level of execution at the end of the year will at maximum double by the end of the year. Given these limitations, any implications from this conclusion need to be considered carefully once the final execution budget data is obtained.

⁹ These three cases relate to: gestión de la innovación, oficinas de transferencia y licenciamiento and subsidio semilla de asignación flexible.

¹⁰ One positive exception in CORFO is the new call under Startup Chile.

2.4 The quality of the policy mix: an initial assessment

38. **The composition and quality of the instrument portfolio shows high coherence levels with the demand for innovation resulting from our context analysis.** The analysis of this section suggests that in general there is coherence between the *de facto* objectives of the portfolio of instruments, the main policy objectives and the diagnosis of the innovation and entrepreneurship ecosystem. Although a more thorough evaluation of the existing policy mix needs more evidence on impact, there is a good general alignment of objectives, needs and instruments. In addition, CORFO and SERCOTEC have increased deployment of instruments in regions, consistent with the identified needs in the previous section.

39. **The coherence of the policy mix was improved in 2015 and 2016, but can be strengthened further by focusing on scalability.** While efforts to increase the quantity of entrepreneurs, especially from the entrepreneurship directorate, appear to be successful, according to the high rates of early stage entrepreneurship, it is critical to put more emphasis on addressing the challenge of scaling up. This balance has been improved in the reshaping of programs occurred in 2015 and 2016 and the role of finance, innovation and competitiveness instruments in supporting scalability, but it is critical to continue supporting post-entry growth, which is the main challenge.

40. **Improving productivity requires a renewed effort on improving managerial practices.**¹¹ The emphasis on improving these practices, especially for existing SMEs, is small in the current portfolio, since the innovation directorate focuses more generally on supporting the innovation cycle and the entrepreneurship directorate on early stage entrepreneurship. In this regard, the introduction of the “*Centros de Desarrollo de Negocios*” and “*Centros de Extensionismo Tecnológico*” is expected to play an important role in addressing the managerial gap if sustained and scaled in the medium and long-run, which requires a significant budget allocation. Enhancing management capabilities at the firm level, particularly around adopting structured management practices such as lean manufacturing, target setting and monitoring, organization as well as other production, marketing and distribution routines. Evaluating these centers and if effective scaling them up, can play an important contribution in addressing the challenge of scalability.

41. **More effort is needed to consider alternative instrument mechanisms of financial support beyond matching grants.** As mentioned above, it is necessary to explore alternative instruments such as vouchers¹² or other instruments. While matching grants might be preferred in most cases, as we will see in the following section it is important to provide a good justification of their use based on consideration of alternative instruments. In addition, more work is needed to explore and test alternative co-financing rates with the objective of increasing their efficiency and effectiveness.

¹¹ According to Bloom and van Reenen (2010) around 30 percent of productivity differences are explained by differences in managerial practices.

¹² Vouchers have the advantage of being more agile to support collaboration or linking SMEs with knowledge providers. On the other hand, one must design some auditing of the scheme since the probability of fraud by non-performing the activities is larger than in matching grants schemes.

42. **There are opportunities to rationalize the existing portfolio and to look for management and implementation efficiency savings especially in CORFO.** Despite the process of rationalization of instruments, there are still some instruments that have too small a budget to have any sizeable impact, especially given the high management and implementations costs in relation to the support provided. Moreover, there are potential synergies in unifying some of the instruments within six cases with very similar goals.

3. The quality of the design, implementation and governance of the instruments of the policy mix

43. **The objective of this section is to evaluate the quality of the different instruments of the innovation and entrepreneurship portfolio in Chile.** For a sample of 15 instruments of both SERCOTEC and CORFO, we implement the functional analysis based on the methodology of Correa (2014) (See Annex 3.1 for a detailed description). The methodology uses semi-structured interviews to evaluate the quality of design, implementation and governance – coordination among instruments, among institutions and position within the policy mix – in relation to international best practices. It is assumed that these 15 instruments, which account for 37.6 percent of the budget of non-investment and finance instruments in 2016, is a representative sample of the instruments used by each institution as well as of the full population of innovation and entrepreneurship programs in Chile, so they consist in a mix of the best and worst programs of the entire portfolio.¹³

3.1 Overall performance and gaps

44. **Chile’s innovation and entrepreneurship instruments are of relative high quality in terms of design and implementation processes.** Table 1 shows the summary statistics for the 15 instruments considered under our analysis. The first row summarizes all the elements and different dimensions of the analysis. Given that we had no priors about which of the different elements of the analysis is more critical for effectiveness, we used unweighted averages to draw our own conclusions. For each instrument it is calculated the average score for the 31 elements of the three dimension – 14 elements of design, 13 elements of implementation and 4 elements of governance. Then, the scores are averaged to obtain an overall estimate for the portfolio of instruments and also to calculate a set of descriptive statistics. The analysis revealed that on average the quality of the design, implementation and governance of the portfolio of instruments is of relative high quality in relation to best practice. The average overall score for the 15 instruments is 3.93,¹⁴ which is not far away from best practice (a score of 5). The average score value was also extremely close to that of the median instrument; and the variance was relatively low, ranging from 3.19 to 4.61. This fact is confirmed in Figure A3.1 panel (a) in the Annex 3 that shows the distribution of scores for the 15 instruments. This implies that all the instruments analyzed stood above the score of 3 and tended to attain a high level of quality.

¹³ The sample excludes instruments from two directorates of CORFO – “Desarrollo Competitivo” and “Inversion y Financiamiento”.

¹⁴ The results weighting the different instruments by their relative budget are remarkably similar. The average increases slightly to 3.94 and the spider diagram equivalent to the one in Figure 5 is almost identical.

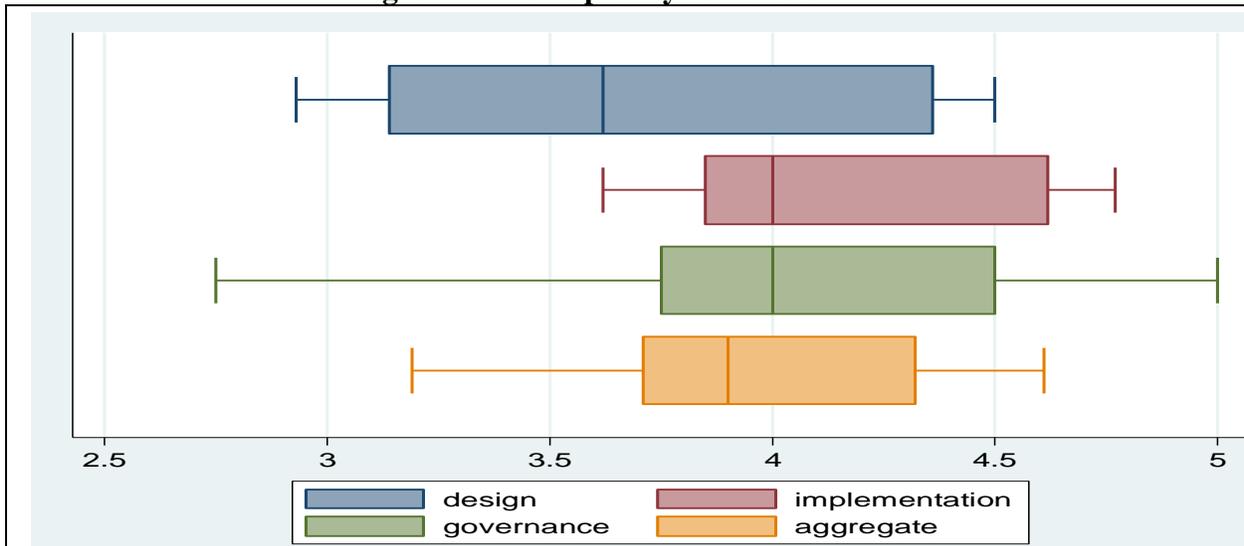
Table 4.1. Summary of scores by dimension

	mean	Median	Standard Deviation	minimum	maximum
Overall	3.93	3.90	0.44	3.19	4.61
Design	3.71	3.62	0.56	2.93	4.50
Implementation	4.14	4.00	0.38	3.62	4.77
Governance	4.02	4.00	0.64	2.75	5.00

Source: Authors.

45. **There has been a significant effort of rationalization and improvement of instruments, but some differences across directorates remain.** There are several reasons that explain this relative good performance. We documented in the interviews that almost all the instruments have gone through an exercise of rationalization of the programmatic offering, which has resulted in revisions not only of the different instruments used, but also of the different processes followed in design and implementation. In the case of SERCOTEC, management made significant efforts to introduce some best practices in the new programmatic offering. In the case of CORFO, some of the directorates have undertaken efforts to revise the rationale behind the instruments design and introduced changes in the implementation of their instruments. Although, as we will see in the next section there are differences across directorates in the extent and quality of these changes, overall the changes introduced seem to be in the direction of implementing best practices. In addition, there have been other complementary efforts in the budget office of the Ministry of the Finance (DIPRES) to adopt some good practices in many of the dimensions included in our functional analysis.

Figure 4.4. Box plot by dimension



Source: Authors.

46. **Design emerged as the dimension with the greatest room for improvement.** Disaggregating the analysis along the three main dimensions analyzed suggests that design is relatively weaker than implementation and governance. The average score for design is 3.71,

which is more distant from best practices than implementation (4.14) or governance (4.02). In addition, as panel (b) in Figure A3.1 shows this average is influenced by two modes: one with a significant number of instruments that have an average score around 3 for design, which suggest that they are further away from best practice, and a second mode, which featured instruments closer to this best practice. The variance is even larger for the governance dimension, where the worst performing instruments have a score of 2.75, revealing significant governance problems. For the implementation dimension we find a narrower variance and a clustering of instruments with a score close to 4, which stands as a relative high score.

47. Most of the improvements introduced recently have focused mainly on implementation. The main reason why design seems to be lagging behind the other dimensions is due to the fact that most of the recent efforts that have been introduced have been more targeted to implementation processes than design. For example, some improvements were introduced in documenting changes and learning, but fewer adjustments were introduced in the design of logical frameworks. In addition, since most of the instruments have been implemented for several years with many of the changes being applied to ongoing implementation and governance arrangements.

3.2.1 Design

48. Lack of a logical framework (or theory of change) is a systemic weakness of instrument design. A good design is essential for impact, since the instrument is less likely to succeed or achieve its full potential when critical elements are missing.¹⁵ The radar diagram in Figure 5 summarizes the average scores for all 14 elements analyzed, from origin to M&E practices embedded in the design process. Analyzing the specific elements of design, the absence of an explicit and fully articulated logic model for the intervention and the weakness of the existing measurement frameworks seem to be the most important limitations. Most instruments show a tacit logic model that has not been developed to include clear indicators, which can track the performance of the implementation of the instrument. Even in cases where a logical framework has been developed using the form requested by DIPRES, these frameworks were incomplete and/or too aggregated at the budget line level, limiting the ability to track results from the different interventions. One of the most important aspects of a logic model that is missing even in cases where many individual components of one are present is the connection between the front end of the model (inputs, activities, outputs, beneficiaries) and the outcomes and impacts. This connection is the core of the theory of change of an instrument and is the basis for monitoring and evaluation, and, therefore, a very important component of instrument design. Having a logical framework is critical to designing an instrument, since it makes explicit how the proposed intervention is intending to achieve results, allowing for monitoring of its different elements that are necessary for achieving impact. It is best practice that each instrument has its own logical framework that makes explicit how the intervention is expected to work.

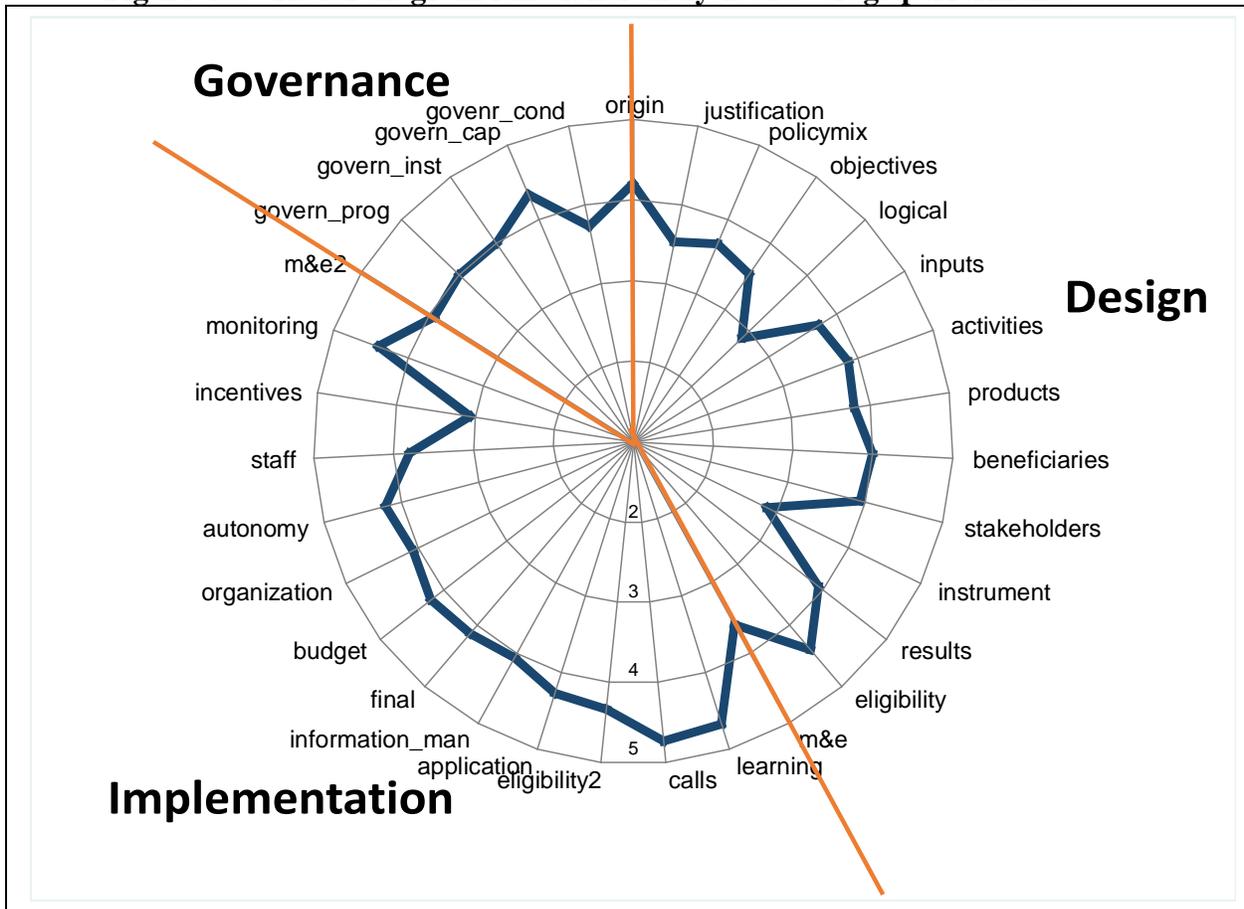
49. Measurement and monitoring systems in the sampled instruments were far from best practice. Most instruments lack a formal M&E framework with sufficient indicators to monitor progress of instrument implementation towards its intended goals. It is worth noting that the few impact evaluations already implemented are *ex post* evaluations, which were not included in the

¹⁵ For example, considering all the stakeholders that can affect the intervention, bad targeting or the choice of the wrong instrument are problems that are difficult to address during implementation.

design of the instrument *ex ante*. CORFO and SERCOTEC are currently undertaking efforts to include an M&E framework for some of the instruments. This would be critical for learning during implementation since it will favor evidence-based decision-making. Nevertheless, it is important that these agencies coordinate efforts so the different instruments use a compatible set of indicators, enabling an effective governance of the measuring and learning system, with clear roles and responsibilities. In addition, it is important to design the impact evaluations in advance, especially in those cases where there is uncertainty about the benefits of scalability of the instrument.

50. **Instrument selection and mechanism design may be significantly improved.** We identified significant improvement opportunities in relation to instrument choice– the instrument used to influence the behavior of firms - and its mechanism design. As described in section 2, the bulk of the instruments we found relied on matching grants to address market failures. More importantly, we found that during the design phase little attention was paid to assess alternative options for instruments that may attain the same goal and what were the advantages of using one or another type of mechanism. While choosing the optimal intervention instrument and designing it to maximize additionality is an extremely challenging task, especially for those instruments that are supporting very diverse innovation projects in different sectors, it is unlikely that this homogeneity of instruments maximizes impact. The assumption of most instruments is that providing co-finance will effectively remove the market failure so the main problems are just related to financial market imperfections, which may be the case for some areas but is unlikely to be the problem in all areas. Therefore, a better framework for instrument selection and for mechanism design is needed. This would require carefully studying the problems that constitute the market failure in the Chilean context, reviewing the evidence from different international experiences to identify what instrument has proven to work to address the same market failure in other contexts, making adjustments for differences in context and considering whether these are viable alternatives. It is important to justify the selection made in the process of instrument design. Once the instrument is selected, it is important to evaluate different mechanism designs. In some cases a piloting phase may be warranted, requiring measurements of results to justify final choice and full implementation. This is a more specialized task than the usual management of a project and that requires the support of dedicated “intelligence” or design offices.

Figure 4.5. Radar diagram functional analysis of average performance



Source: Authors.

51. **Each instrument should have an appropriate justification and with its rationale of contribution to the policy mix.** While most instruments have very clear and documented origins, we found a few cases where their justification may need to be significantly improved. This includes providing a documented diagnostic of the prevailing problem and market failure to be addressed, and an attempt of quantification of the problem. In most cases, the reference to the market failure is implicit in the narrative and in other cases, there is no attempts to assign an economic cost to the problem to be fixed. In several occasions where reference to a diagnosis is made, the study is often a general country or sector level study that does not address the specific problems that the instrument is supposed to address through its intervention. In addition, one important element for the coherence of the programmatic offering for innovation and entrepreneurship is the extent to which individual instruments are designed thinking about the potential complementarities with other instruments. This analysis is especially important for STI policies since the diversity of instruments in STI can be attributed to the existence of multiple failures which justifies having a broader set of interventions simultaneously – *the policy mix*. While the process of rationalization discussed earlier has resulted in a significant increase in links between instruments and reduced substantially the existing overlaps, this process has been unertaken *ex post*. In addition, we find that its application varies substantially across directorates. For example, in CORFO the Directorate of Innovation made important efforts to provide some justification of the policy mix, and adjust

some of its instruments towards supporting the innovation cycle of the firm. SERCOTEC's staff has simplified the pool of instruments, focusing on targeting the different stages of the life cycle. It is important, however, in the future, that new instruments are justified in terms of how they complement existing interventions.

52. The planning of inputs, activities, beneficiaries, stakeholders and eligibility requirements follow best practice. We found several elements of design that are very strong and close to best practices. There is a well-founded system for considering inputs and activities when we looked at the terms of reference of the revised instruments. In addition, we found that in general managers give good consideration to potential beneficiaries, those that could benefit the most from the intervention, as well as good consideration to the several stakeholders that matter for the intervention. Furthermore, the process of eligibility criteria tends to be transparent, clear and with straightforward mechanisms for conflict resolution (although we could not verify the practical application for this finding since we were unable to survey beneficiaries).

3.2.2 Implementation

53. Implementation is strong for most surveyed instruments. In the case of the implementation of instruments, we focus on 13 elements that relate to processes and practices during implementation. As shown in Figure A3.1 (c), implementation tends to be robust with an average score of 4.14 and with smaller variance. The process of rationalization implemented in some of the instruments led to the introduction of best practices processes in the Directorate of Technological Capabilities in CORFO and in SERCOTEC, where we found very strong documentation in terms of learning and monitoring of processes.

54. Measurement during implementation needs to be improved. Although the average score for the existence of an M&E framework and impact evaluation is relatively high, it masks significant differences across institutions. For example, SERCOTEC has developed an M&E framework, though still incomplete, and some impact evaluations have been planned. In the case of CORFO, however, it is important to adopt and implement an M&E framework that allows good measurement and learning with unified and measurable indicators.

55. Staff incentives from implementing agencies may be improved by linking individual incentives to performance. The weakest element found relates to lack of adequate individual incentives. Although each staff have developed results agreements with their managers, most of the remuneration was agreed for at the institutional level and based on aggregate institutional performance. This leads to incentive misalignments since a better link between instrument management, tasks and remuneration represents best practice. In some cases, we also identified staffing problems (i.e. shortage of personnel), but generally, our perception was that the human and financial resources available were enough to guarantee the quality of the instruments. It is important, however, to keep in mind that with the increase in decentralization of implementation some problems with capacity at the regional level can arise. As a result, it is important to keep and even improve some of the existing training activities available.

56. Learning, calls for proposals and monitoring of processes follow best practices for most instruments As suggested earlier most staff from the agencies have introduced new

processes during implementation that rank close to best practices. For example, formal processes of learning were documented in mid-term reviews for the delivery of instruments, and some include discussions with beneficiaries, formal or informal. This should be linked to the M&E framework. In addition, it was found that calls for proposals were issued using best practices in terms of dissemination of information. More importantly, these calls tend to be planned in advance and it was found few instances where additional calls were necessary – mainly due to emergencies – that could have disrupted the intended objectives of the instrument. It is important to emphasize that some instruments have adopted very strong monitoring of processes. For example, SERCOTEC is using ISO certified documenting processes. The Technological Capabilities directorate at CORFO is also introducing best practices in management processes.

57. Information management, including software systems, need to be improved. Although all instruments use management systems, the software platform in place may be improved, especially in the case of CORFO. The main problem identified is that managers are required to use parallel systems for some project management tasks, which is particularly pervasive for information that could have been relevant for M&E purposes. Ideally, the staff employing the system should be able to manage projects flawlessly perform financial control and conduct M&E through seamless integration.

58. Finalization of participants in the instrument is clear, not so much the instrument itself. One of the challenges in innovation and entrepreneurship instruments is that outcomes are achieved just in the medium and long-term and not during intervention. There are always uncertainties and risks for beneficiaries associated with participation in the instruments. As a result, it is important to design clear rules on the participation in the instrument, completion and follow up information. The instruments have clear rules on participation, timing and exclusion of beneficiaries. Follow up after participation is often limited. Although beneficiaries commit to provide information after the completion of the grant, in practice this information is difficult to obtain. In this regard, more effort needs to be devoted to obtaining that post-program information, and a good information and M&E system would greatly contribute to this purpose.

59. Financial and human resources allocated to instruments were generally adequate to meet their intended goals. According to the functional analysis, it was found that the level of financial and human resources is adequate for most instruments as far as routine operation is concerned, although these resources are more adequate for CORFO than for SERCOTEC, especially regarding the availability of human capital and training opportunities in Santiago and Regions. In general, instrument managers are able to operate with autonomy and flexibility while keeping their accountability in check.

3.2.3 Governance

60. There is significant variance in the quality of the governance arrangements of the instruments. The governance analysis focused on four elements that have to do with relations with other instruments, institutions, constraints to impact - resulting from other regulations and policies – both awareness and actions taken. In general, although the average score for governance was found to be significantly high, around 4, there is significant variance across instruments and directorates.

61. **Coordination is relatively efficient.** The fact that the Chilean national system of innovation is thin in terms of institutional actors helps greatly its coordination. At least for CORFO most instruments are designed by and respond to specific sub-committees that have representatives of other instruments and institutions. This is expected to facilitate coordination to have spaces of sharing experiences across institutions since there are no formal direct mechanisms of communication across those responsible for implementation of instruments.

62. **There is some awareness of external constraints for implementation, although not for all instruments.** Most of the staff with responsibility for implementation of instruments are generally aware of external limitations. One important limitation is the fact that legislation establishes that beneficiaries need to set aside a guarantee for any subsidy received. In some cases, where there has been some previous failure or credit rating problems it may very difficult for the beneficiary to obtain the bank guarantee. In general most instruments have tried to overcome these problems. One element, however, that was not always identified was the role of the financial system, especially for instruments related to seed financing. Discussions on the role and limitations of the financial sector are limited, and financial institutions receive little attention as stakeholders. In the future, and given the fact that these instruments are trying to remediate financial imperfections, it would be necessary to consider inputs from financial sector stakeholders on how the instrument can help markets to reduce these financial imperfections, bringing the private sector closer to a more prominent role on providing innovation finance.

3.2.4 Cluster Analysis

63. **Cluster analysis confirms the correlation of directorates with the quality of design and implementation.** We carried out further analysis to determine patterns of performance and deeper connections across instruments and practices using clustering techniques.¹⁶ The advantage of this methodology is that it allows grouping between instruments without any prior assumptions, letting the data reveal underlying patterns (See appendix for a description of the methodology). The analysis shows 5 clusters of variables which - interestingly - interrelate management practices across domains. The first cluster links several design variables with the monitoring of processes and with the monitoring and evaluation of results in implementation. The second group links the dimensions of design that focus on targets of the instruments with the implementation practices connected with them and the staffing situation. The third group ties the consideration of alternative instruments, the definition and account of results, both in design, with information management, finalization and incentives (which are supposed to be results based), all three in implementation, with relationships across programs in governance. The fourth group relates learning in implementation with two dimensions of governance, namely, capabilities to deal with rules and conditions from other jurisdictions and with the existence of uncontrolled external constraints. The last group relates four implementation variables, namely, the implementation of out of program Funding Calls, the budgetary situation, the organizational structure and the relative autonomy of staff to make decisions with the governance dimension of relations and with other institutions. The grouping of cases across performance and similarity measures confirms our preliminary finding that instrument performance is linked to the directorate and institution in which they belong. The clustering grouped all the instruments in the Directorate of Technological Capabilities together,

¹⁶ The assessment is implemented to CORFO instruments only, since SERCOTEC instruments were analyzed jointly.

three of the four in the Directorate of Entrepreneurship and split the instruments from Innovation into two groups of two. StartUP Chile, which belongs to the Directorate of Entrepreneurship was classified as an outlier. This last result is not surprising since we had already observed that by being hosted outside of the main office, it had developed a particular managerial style. In summary, the general observations for each directorate are still valid showing a similar scale of performance as observed with the previous grouping. The dimensions with most opportunities for improvement have to do with key dimensions of design (policy mix, logic models and alternative instruments) and with the key design specifications, especially M&E with the cascading effects in implementation. The last practices are improvable mostly in Entrepreneurship and Innovation.

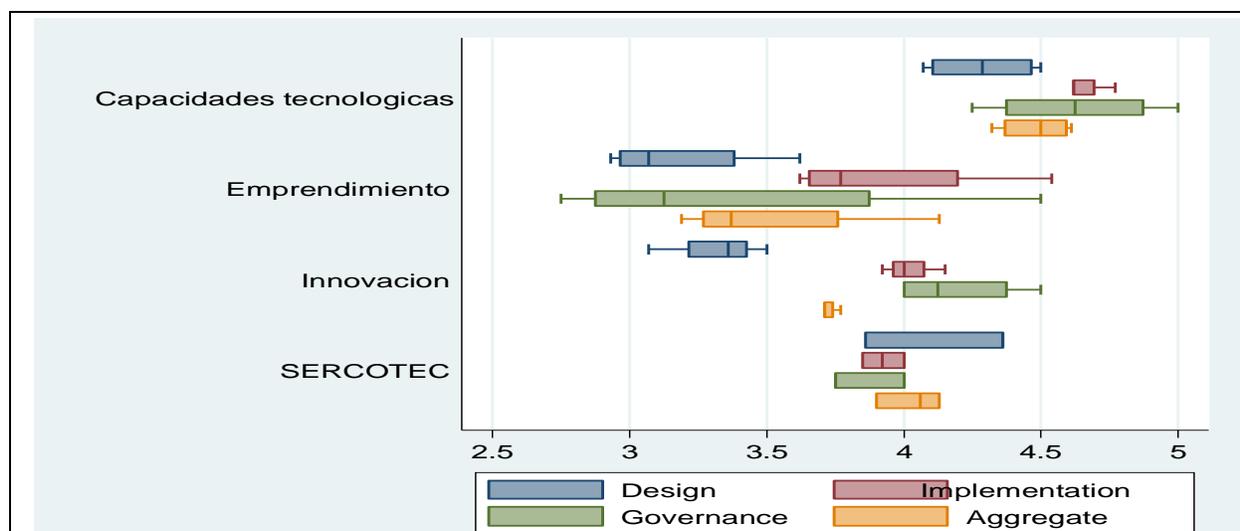
3.3. Institutional performance

3.3.1 CORFO

64. **Most instruments have good practices, but there is significant variance across directorates.** The analysis comprised 12 instruments of CORFO in 3 directorates, namely, Technological Capabilities, Entrepreneurship and Innovation. Overall, CORFO shows a high average score close to 3.9. Figure A3.2 Panels (a) to (c) summarizes the average score for CORFO and each of the three directorates, since one of the main patterns that was found across the instruments of this agency was the adoption of common management practices within each of the directorates. Given that CORFO represents about 80 percent of the programs assessed, most of the weaknesses have been already identified in the previous section. This include lack of a logical framework, weaknesses in instrument design, weak measurement and monitoring and lack of individual incentives for managerial staff.

65. **The Directorate of Technological Capabilities develops best practices.** Figure 4.6 shows a box plot for design, implementation and governance and the aggregate score for each of the three directorates. Overall, we find that the Directorate of Technological Capabilities has the best instruments in terms of their functionality, a score of around 4.5 on average, close to best practice and with little variance across its instruments. In this directorate, a number of best practices are instilled from the top and disseminated across its offices, reflecting a substantial efforts in improving the rationale of the instruments and the management of processes. The instruments in this sub-directorate were consistently strong, scoring many 5s, in most implementation categories, except for one category in which sub-directorates have little control that has to do with incentives for personnel based on performance. In this case, the score was the indifference point (3), since the agency wide practices include an individual performance contract. However, individual performance is measured independently of the performance of the instruments they manage. This is the main reason for the lower score. Panel (d) in Figure A3 in the Appendix shows the same weaknesses pointed above for CORFO, while in the remaining elements of the analysis these instruments tend to score higher and closer to best practice. The instruments in this group have a relative weakness in the absence of a fully articulated logic model and the lack of consideration of alternative instruments, though they did not have the lowest scores of the sample in these categories either.

Figure 4.6. Box plot by directorate



Source: Authors.

66. **The Directorate of Entrepreneurship presents a large variance across its instruments, in particular in governance areas.** The average score of these instruments is around 3.5 mainly driven by weak design and low quality of governance in some instruments. In this case, one instrument, managed outside of the main CORFO office, reflects differences from this pattern. In the implementation and governance it is as strong as the other directorate, but it shares weaknesses in design with its relatives under the main office umbrella. These instruments are relatively stronger in implementation than in design and governance, though not as strong in implementation as the other two sub-directorates. Their weaknesses in design and governance are almost a full point below the top performers. The categories of justification, objectives and concern for the policy mix by design are significantly weaker than the rest of the agency. The latter category translates all the way to lower scoring in governance as well, since the tentative relation to the policy mix translates to lower levels of coordination with other instruments, agencies and jurisdictions. Their monitoring and evaluation are also weaker, both in design and implementation. In addition, the justification of these instruments appears to be weaker than for the rest of instruments, especially in identifying, measuring and addressing market failures; and the managerial practices are much weaker than in other directorates of CORFO as well.

67. **The intermediate performer is the Directorate of Innovation.** The set of instruments in this sub-directorate had average scores ranging from the high 3s to the mid 4s, with an average of 3.7. They were particularly strong in implementation categories, in which they are similar to the instruments of the Directorate of Technological Capabilities, and in Governance, showing high levels of coordination with other instruments, other agencies and awareness of jurisdiction interactions. Some of the implementation categories were slightly lower than the Directorate of Technological Capabilities' instruments, since the adoption of best practices in Information management and Human Resource management did not have the consistent diffusion from above and have room for improvement. They are also somewhat weaker in the practices of monitoring and evaluation. The design set of categories is one of the weakest parts of the performance of these instruments. In addition to the general weaknesses in logic models and consideration of alternative instruments –in which they actually have a mixed performance with two instruments scoring above average in both and two below average– they have relatively lower scores in many of the

components of the logic model outside of the articulation of the full model and in monitoring and evaluation by design. The instruments, however, would benefit greatly from having clearer and well defined objectives.

68. **Some weaknesses are systemic to the institution managing the instruments and require more structural solutions.** Some of the weaknesses are systemic to the institutions and need to be addressed at the level of the institution or at the level of the national system of innovation. Specifically, the lack of a logical framework, of a system of M&E and the weaknesses in instrument design need to be addressed at the level of CORFO. In the case of the logic models and M&E there is already some ongoing work in CORFO, but also in DIPRES and the Ministry of the Economy. What is critical is not to find a unique model that addresses the needs and objectives of different institutions but one that primarily serves as the guide for their design and implementation. Regarding, mechanism design, it is important to think about a specialized office that can provide advice and disseminate knowledge in this area.

69. **There are low cost opportunities for inter-directorate learning.** Given the high level of performance at sub-directorate level for units within CORFO, there is good reason to believe that practices of diffusion and adoption of best management approaches are already in place that may be expanded to other sub-directorates. It seems there are opportunities for improvement grounded in better inter-sub-directorate coordination.

3.3.2 SERCOTEC

70. **Most elements of design and implementation show good practices.** This agency show patterns that have some commonalities with CORFO but also some interesting differences. It shares with CORFO the strength of its learning practices, and with the Directorate of Technological Capabilities the monitoring and evaluation by design and implementation. It is consistently stronger in the formality of the origin of instruments that are grounded in systematic diagnostic studies and formal processes of decision-making. They have clear and measurable objectives in design and best practices in the monitoring of management processes in implementation. Together with the high performing monitoring evaluation categories goes good information management in which they also have best scores.

71. **Design procedures are close to best practice.** Looking across categories, they score highly in many of the design categories showing that they have very good coverage of individual items that belong in the logic model but that have not taken the next step to actually put it together and use it as a management tool. There was actually a moment of discovery during the interviews in which the instrument managers connected the dots and realized that they could have this management tool developed very easily and benefit at low cost from its completion. They very readily understood that it was a useful thing to do and did not consider it a mere fad or heavy handed auditing requirement.

72. **The main weak elements are found on implementation.** They share with the rest of the instruments analyzed the relative weakness in lack of fully articulated logic models and lack of consideration of alternative instruments during design. But the weakness of these three instruments is the core implementation administrative categories (budget, human resources, process

management, autonomy, incentives) in which they score 3s across the board, making them weaker than the rest of the sample in this respect. Their governance was relatively good, scoring mostly 4s, except for the relation with other agencies where they showed some limitations (It is worth noting that SERCOTEC has developed relationships with specific agencies such as INDAP, SERNATUR, and regional governments in the context of either responding to emergency situations or targeted programs, which require the nimble and flexible implementation capacity of SERCOTEC).

3.4 Summary and Main Recommendations

73. **Design, implementation and governance of I&E instruments generally reflect best practice.** Several patterns emerge. First, all instruments scored above the middle range and have an average score close to 4 (on a 5-point-scale). This suggests a significant adoption of best practices in many categories of design, implementation and governance of the instruments. Second, there are two categories in which several instruments for both agencies show very significant strengths: learning during implementation and the management of funding calls. These categories achieve very high scores on average for the set of instruments. In the learning category, all instruments have systems to collect experiences and lessons learned regularly and to document them with a specific routine to feed the results into improvements and further versions of the instrument. For the management of funding calls, there are defined rules that avoid the pitfalls of *ad hoc* activities and only allow for non-programmed funding calls under emergencies defined by national law. There is a tight adjustment of design and implementation of funding calls leads to a highly efficient management of these activities.

74. **Lack of an explicit and fully articulated logic model for the instrument is a significant challenge for design and implementation.** There are two categories that show significant weaknesses across all instruments with an average score in the high 2-range, both under the design dimension. One is the existence of an explicit and fully articulated logic model for the instrument. Most programs do not have one and what they have is, in general, a partial documentation of components of the logical model that is prepared in response to a requirement of the budget office (DIPRES). It is frequently used adequately to guide some design and management decisions but is not fully expanded in all its contents. This weakness is a missed opportunity given the incentives to produce parts of it to satisfy external requirements and the complete accounting of the individual categories of what taken together would be the logic model. It reveals that it is missing a level of integration of vision of the instruments that may be easily fixed with potential for high payoff relative to investment.

75. **The second weakness is the lack of assessment of alternative instruments to the one selected during the design phase.** This weakness is less surprising since there is a widespread notion in STI policy that best practices are acquired by imitating other countries that have highly perceived results in the instruments for similar objectives. Therefore, the design phase is often truncated as it takes other country models as its point of departure without careful study of the contextual differences, related to structure of the economy, relative level of development, existing capacities, and so forth. Even when individuals seem to know information about the context, there is no systematic study of how all the contextual information fits together and relates to the specific function of each instrument and its objectives. There are also agency's organizational culture

issues that lead to preferences for instruments that are understood and easy to launch when a new policy objective must be addressed.

76. **There are low cost learning opportunities within agencies.** A full set of recommendations is presented in Annex 3.4. A first set of recommendations should focus on facilitating the learning of existing best practices within directorates in CORFO and between CORFO and SERCOTEC. This includes management of processes, information and documentation, as well as elements such as selection of beneficiaries, or other elements where best practices are identified.

77. **Some of the important weaknesses identified require more systemic interventions.** The second set of recommendations, including the ones related to the two important weaknesses identified above, require a more systematic approach. The recommendations regarding a better justification of existing instruments, including identification and quantification of market failures, and a fully developed logical framework and its M&E framework should be embedded in the documentation (“*ficha*”) required by DIPRES. This should be at the level of the instrument and then aggregated at the program level. The quality of this document should form the basis for the approval of the budget for the instrument. There is only one process that is standardized and has the components that are necessary for all the stakeholders – DIPRES for budget monitoring; MINECON and CORFO/SERCOTEC for their design, planning and monitoring. On the other hand, it is important that each institution supports the design and measuring frameworks of each of the instruments with dedicated and well equipped units that can provide intelligence on mechanism design, existing best practices, design of M&E and indicators and impact evaluation. These units should also support leaning and capacitation of instrument managers.

78. **In the short-run, adopting already existing best practices, developing full logical frameworks and implementing a harmonized M&E framework should be a priority for the institutions.** This is likely to enhance the impact of existing instruments and help with the efficiency in the medium-run.

4. Conclusion

79. **The main conclusion is that CORFO and SERCOTEX’s I&E *policy mix* is generally coherent with the main government policy objectives and the existing demand conditions. The overall quality of design and implementation of most instruments is relatively high.** Although a comprehensive assessment of the *policy mix* would require an analysis of the efficiency and, especially, the effectiveness of the different instruments within the mix and their complementarities; the composition of the policy mix responds to the emerging demand for I&E policy. The *policy mix* meets the strategic priorities set by the Chilean government, particularly for increasing economic diversification, increasing productivity and business innovation and increasing economic inclusion. In addition, the policy mix has struck a sensible balance between vertical and horizontal strategies, and across the scope of support for the different stages in the innovation cycle. There is, however, room for improvement, both in the composition and in the content of instruments to improve Chile’s performance. We sum up these opportunities in sections 2.4, 3.3 and Annex 3.4; highlighting among these below the most important ones for improvement.

80. **The Government of Chile should explore and evaluate the use of alternative instruments of direct financial support beyond matching grants and different co-financing mechanisms.** While there is no clear evidence supporting the need for moving from direct to indirect support¹⁷, diversification in the use of instruments is consistent with increasing proportional support towards *growth* (post entry), as a relatively more advanced stage in the innovation life cycle. This can also bring instruments that are less distortionary when indirect support is also considered, more cost effective and that leverage more private resources. In the case of CORFO, there has been an effort in the last years to use other instruments such as equity finance, loan guarantees, prizes and the expanded use of vouchers for innovation. More work on considering the different tradeoffs, calibration, piloting and evaluation of alternative instruments and mechanism design in terms of co-financing during the design phase is needed, especially in SERCOTEC.

81. **The Chilean government should continue to further support stages of growth and consolidation, and managerial quality among SMEs.** Entrepreneurship rates are high in Chile, and there are indications suggesting that the innovation ecosystem is partially building up through startup instruments. Consequently, we contend that the government should continue the focus started in the last years of support within the lifecycle towards scalability and growth, areas that remain challenging. In addition, our analysis revealed that management quality was average, and likely insufficient to allow Chile's performance in I&E to increase to the standard of OECD's countries. Building managerial capabilities in Chilean firms is particularly important given the conditioning nature this capability has with inducing growth of business led R&D. In this regard, instruments such as "*Centros de Desarrollo de Negocios*" and the "*Centros de Extensioismo Tecnológico*" may provide an important vehicle to achieve this goal if proven effective and sustained and scaled over time. Boxes 4.1 and 4.2 provide policy options for I&E interventions and enhanced and effectiveness of matching grants as well as some alternative schemes based on bidding.

82. **Further rationalization of programs can increase the efficiency of the policy mix.** Recent efforts in program rationalization has contributed to substantial improvements in design and implementation. However, the assessment above identified few but concrete opportunities for additional rationalization in instruments featuring lack of scale and high costs of implementation per beneficiary. In our view, the ability of these instruments to achieve objectives is limited and they are not expected to generate a critical mass of participants within a reasonable timeframe. Finally, we also found a few opportunities for programmatic consolidation within directorates at CORFO for instruments that present objective overlap and slight differences in terms of target beneficiaries.

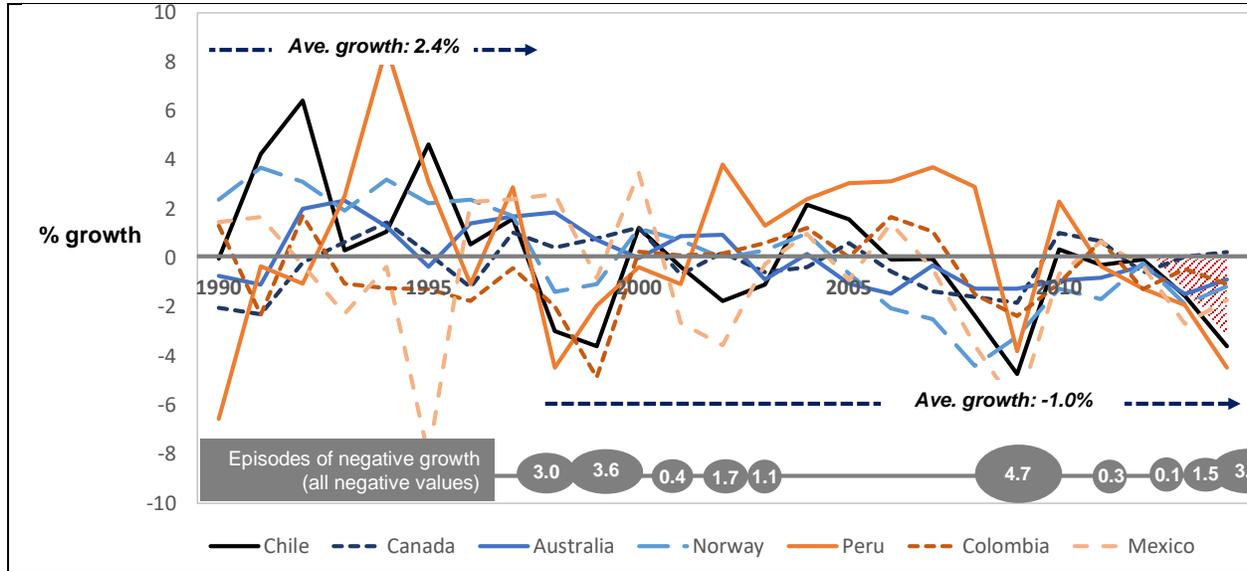
83. **There are opportunities to improve processes of design and implementation of instruments and an urgent need for better measurement to show impact.** We strongly

¹⁷ There is no strong international evidence to support a shift from direct to indirect support. Most of the evidence focuses on support to R&D. In the OECD, countries such as the US and Israel have larger shares of direct support vis-à-vis indirect support for R&D, and Germany does not have tax incentives for R&D (Busom et al., 2011). Also there is some evidence that more financially constraints, younger and smaller firms are less likely to apply for tax credits. The evidence also for tax incentives in the EU is mixed. Although there is some studies some additionality, this tends to be small, and there is no correlation between size of incentives and innovativeness of the country (Straathof et al., 2014).

recommend carrying out diagnoses that are specific to the instruments rather than lose interpretations of macro level documents, the systematic use of logical frameworks for each instrument, as well as employing better measurement systems, including the implementation of harmonized M&E frameworks and designing of impact evaluations *ex ante*. The functional analysis showed relatively high quality of design, implementation and governance. However, the Chilean government can achieve significant improvements in specific elements, especially regarding design. These improvements include: reliable systems for monitoring and learning, consistency in the inclusion of logical frameworks, consideration of alternative mechanisms for interventions, inclusion of impact evaluation during the program design phase and adoption of information systems, especially in the entrepreneurship directorate. While some of these recommendations would require thorough planning and systemic support, important inter-directorate learning opportunities of best practices, which represent a low-hanging fruit, can be put in place in a relatively simple and low cost fashion. Finally, it is important to remember that there are broader policies such as the requirement of very expensive financial guarantees to access government assistance, general rules of the financial system or the quality of education that also need to be considered because they limit the ability of these instruments to have impact.

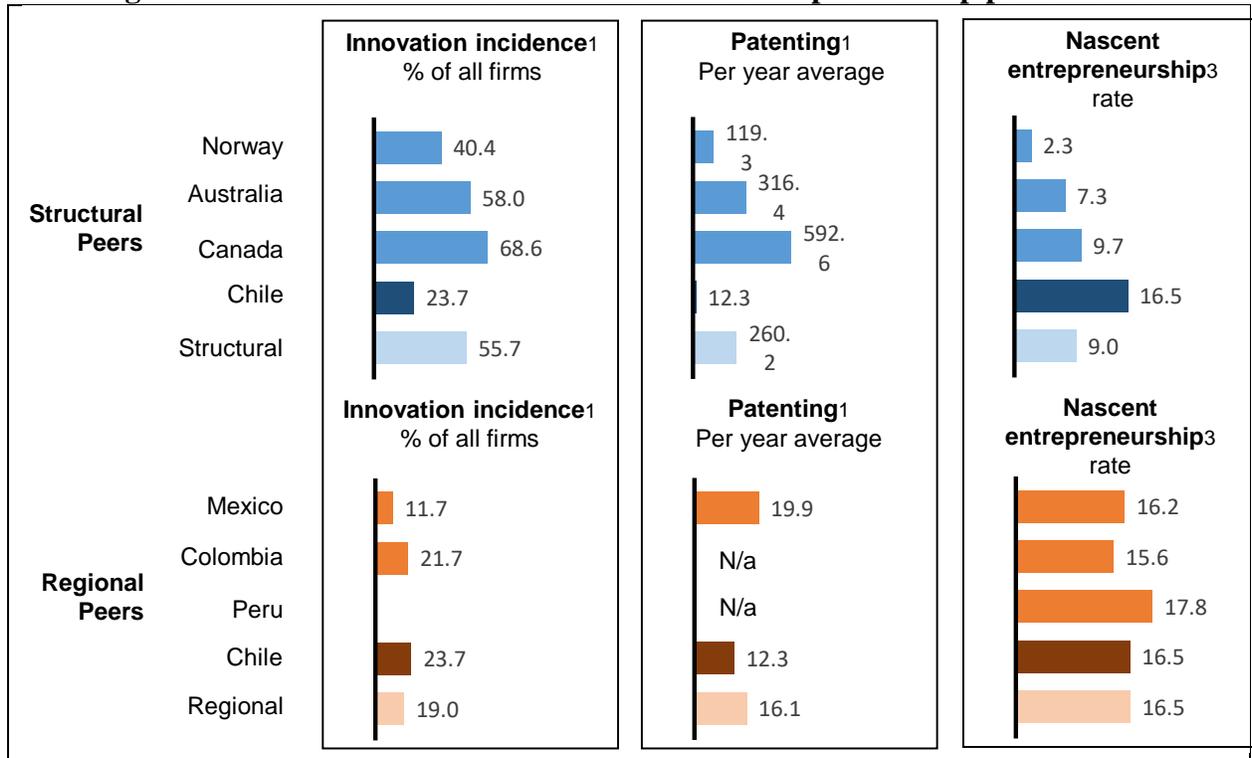
ANNEX 1 Tables and Figures

Figure A1.1: Growth of Total Factor Productivity - Estimated as a Tornqvist Index, 1990-2014



Source: The Conference Board. 2015. The Conference Board Total Economy Database, May 2015

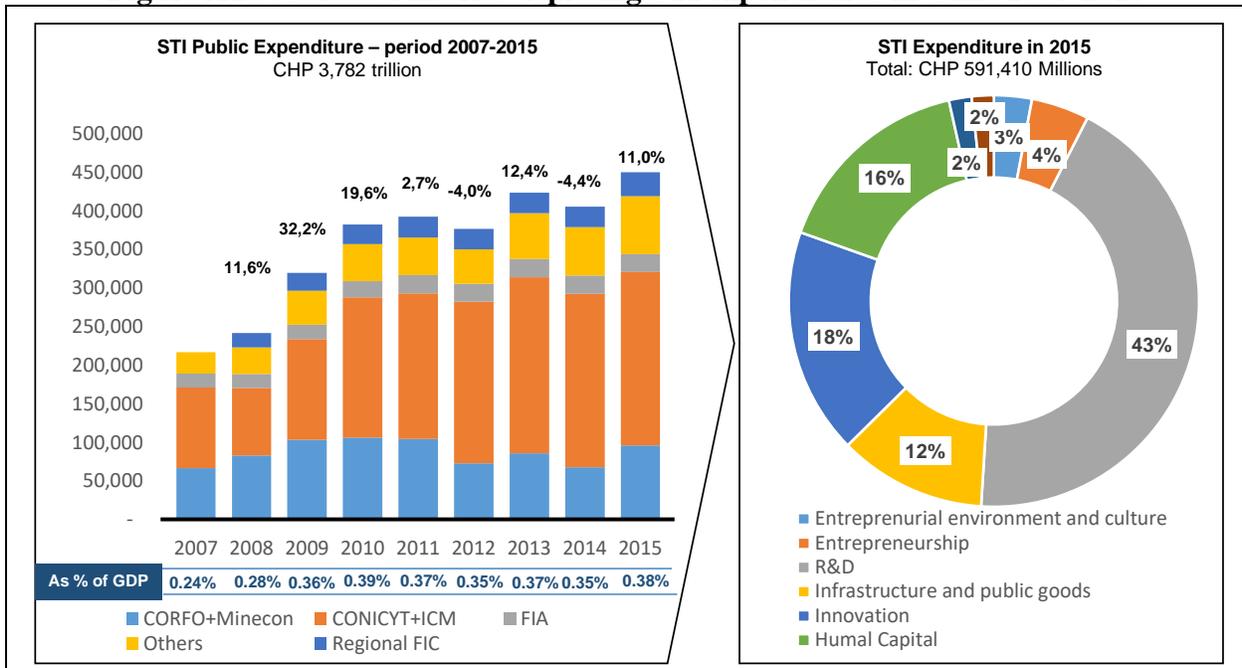
Figure A1.2: Selected metrics for innovation & entrepreneurship performance



Source: OECD; Chilean, 8th Innovation Survey, author's calculations.

Note: (1) Product and/or Process and Marketing and/or Organizational innovators, percentage of all firms, Innovation Indicators; (2) Number of "triadic" patent families (priority year); (3) Percentage of 18-64 population who are currently a nascent entrepreneur.

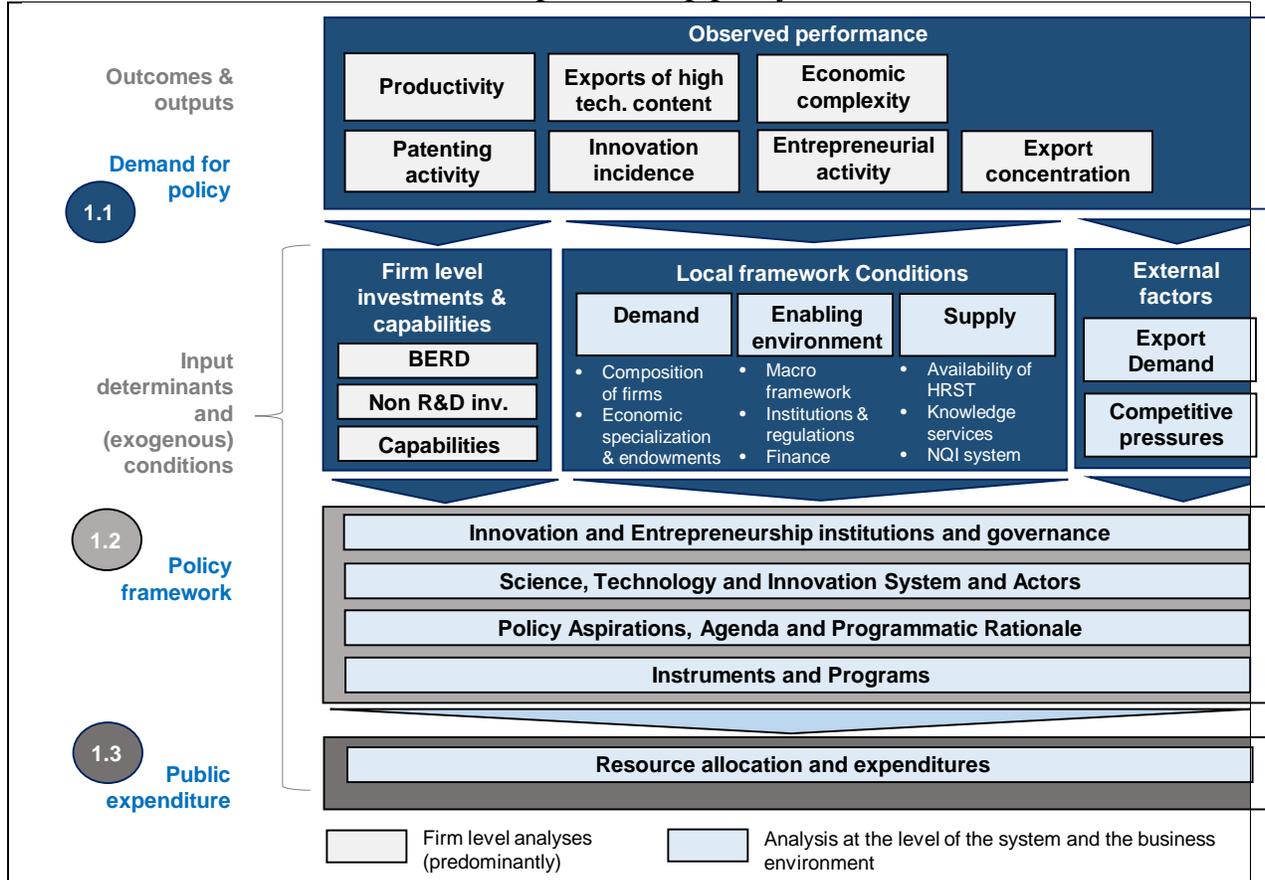
Figure A1.3: Selected metrics depicting STI expenditures in Chile 2007-2015



Source: Innovation Division, MINECON.

Note: FIE 2015 resources of CLP \$16.130 Million, are not included.

Figure A1.4: analytical framework to assess demand for innovation and entrepreneurship policy



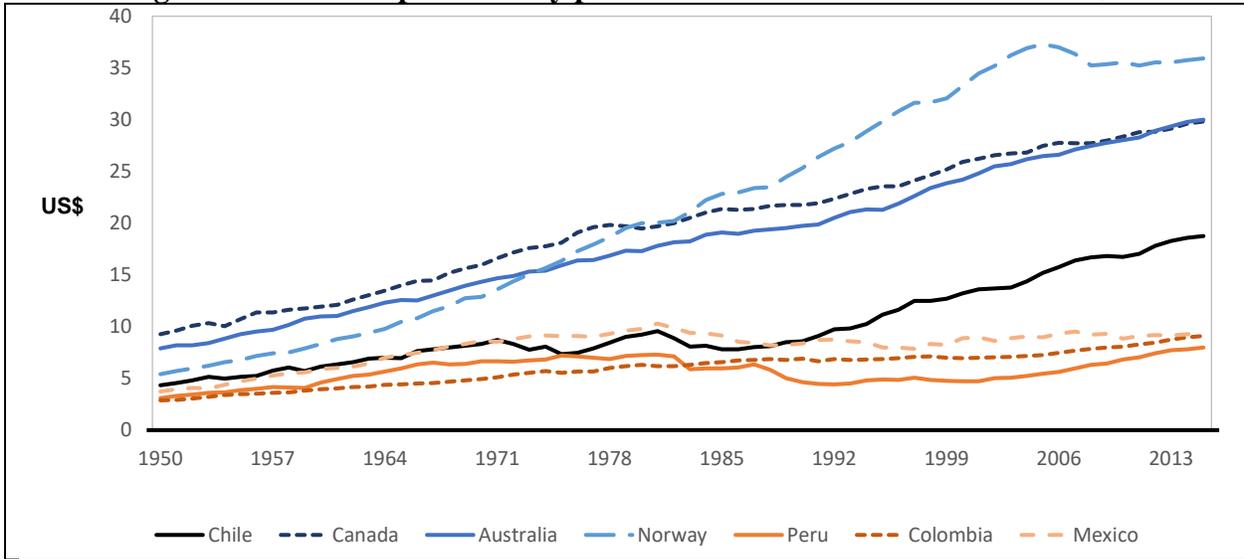
Source: Authors.

Notes: We used this analytical framework to relate the signals of unmet demand that we observed to input determinants and exogenous conditions for innovation and entrepreneurial activity at the firm level. We looked first at firm-level investments & capabilities, which focuses on specific inputs that correlate with innovation rates at the firm level.

Then, we proceeded to look at the existing framework conditions, which include both inputs and conditions. It is worth noting the distinction, as the analysis comprises policy levers (i.e. endogenous variables), and prevailing conditions (i.e. exogenous parameters), understanding that both affect the incidence of innovation, but that only the former remain under the control of the policy maker. Framework conditions is comprised of underlying factors that affects demand for innovation, such as Composition of firms, and Chile's Economic specialization (and natural endowments). We also looked within the framework conditions the enabling environment of firms for innovation, which investigates the favorable conditions from the macro policy framework, the quality of IE related Institutions & regulations, and the depth of the innovation Finance market. Lastly, our analysis of the framework conditions considered the supply side of innovation, which included access to the stock of human resources for Science and Technology (HRST), provision level of knowledge services, and the availability of national infrastructure for innovation, including national quality infrastructure (NQI) system.

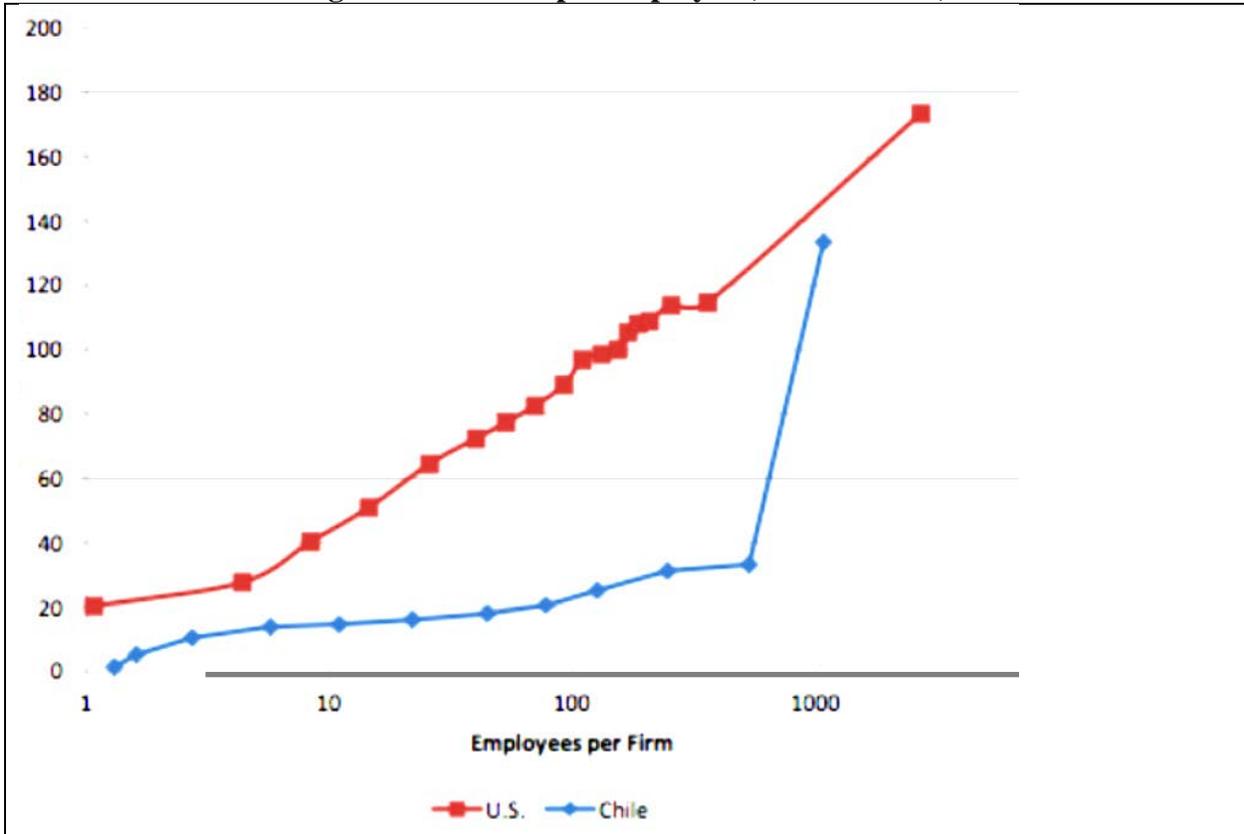
Finally, we proceeded to look at external factor (determinants) of innovation activity and economic performance among firms, which lay predominantly outside of the scope of the policy maker. These includes exogenous parameters such as the level of demand for Chilean product and services, competitive pressures from globalization, and other external factors such as availability of foreign capital, among others.

Figure A1.5: Labor productivity per hour worked – 1950-2015 1990 US\$1



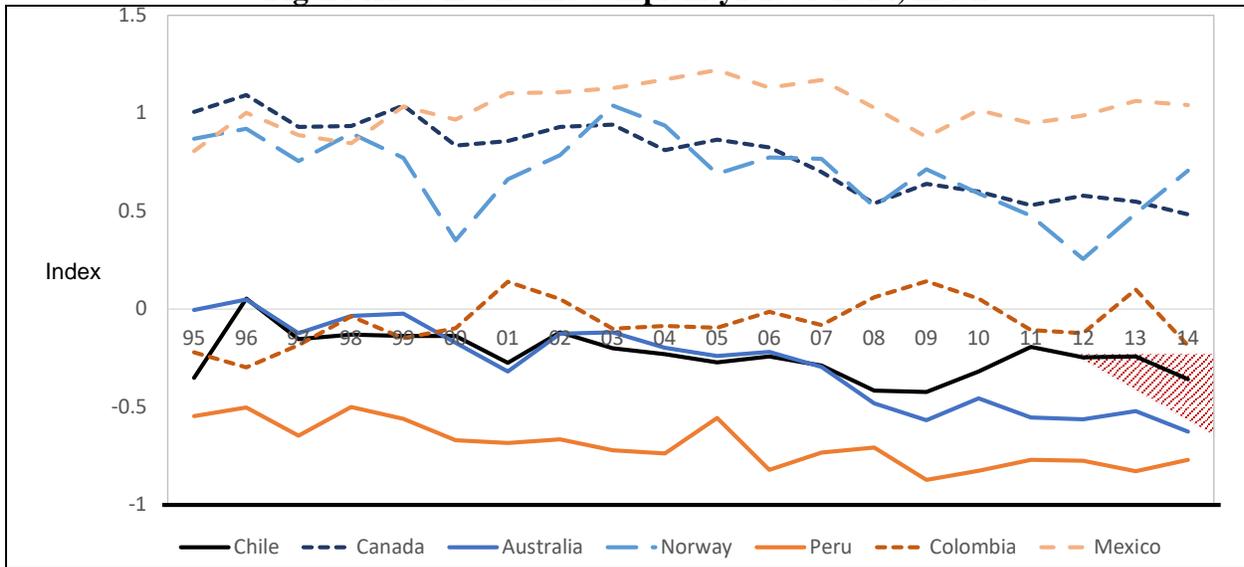
Source: The Conference Board. 2015. The Conference Board Total Economy Database, 2015; authors' calculations.
 Note: (1) Converted at Geary Khamis PPPs

Figure A1.6: Sales per employee (Millions CLP)



Source: Reproduced from Analysis of Recent Productivity Trends in Chile, Syverson, 2014

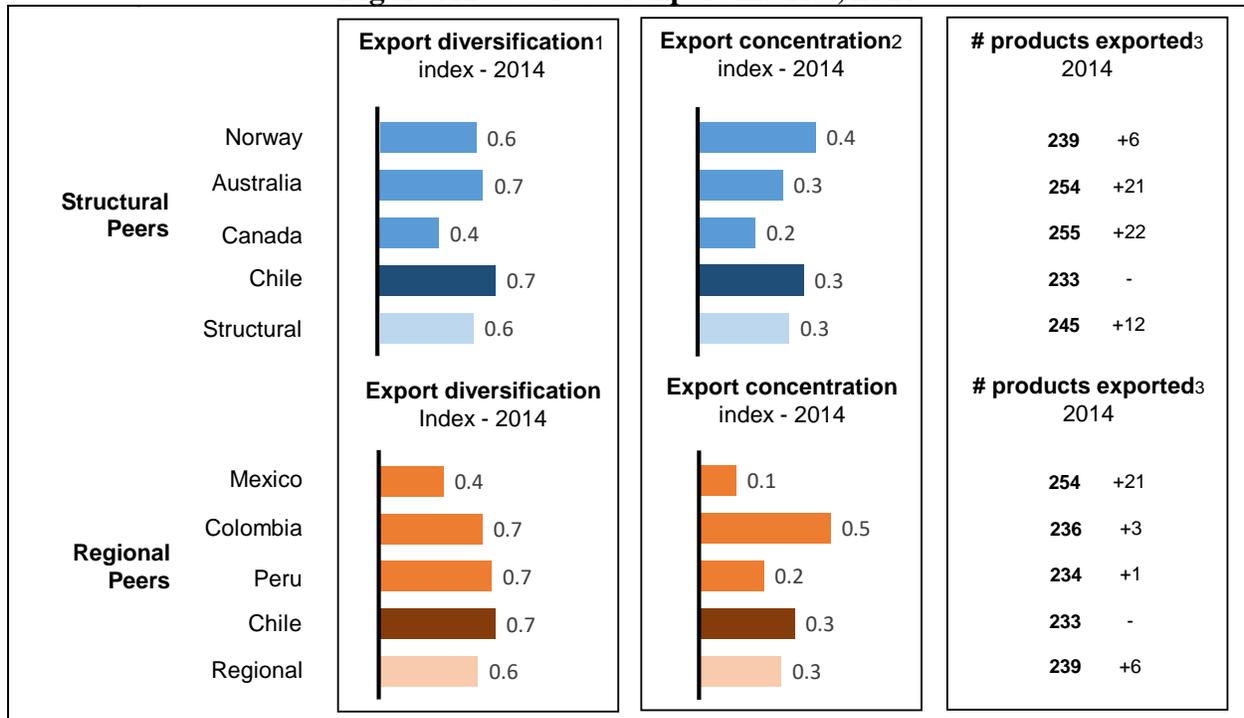
Figure A1.7: Economic complexity1 1995-2014, index



Source: Atlas of Economic Complexity, Harvard, CID; author's calculations.

Notes: (1) ECI ranks how diversified and complex a country's export basket is. ECI is a scale that uses the theory of and calculations for economic complexity to rank countries according to their level of complexity.

Figure A1.8: Selected export metrics, 2014



Source: UNCTAD author's calculations.

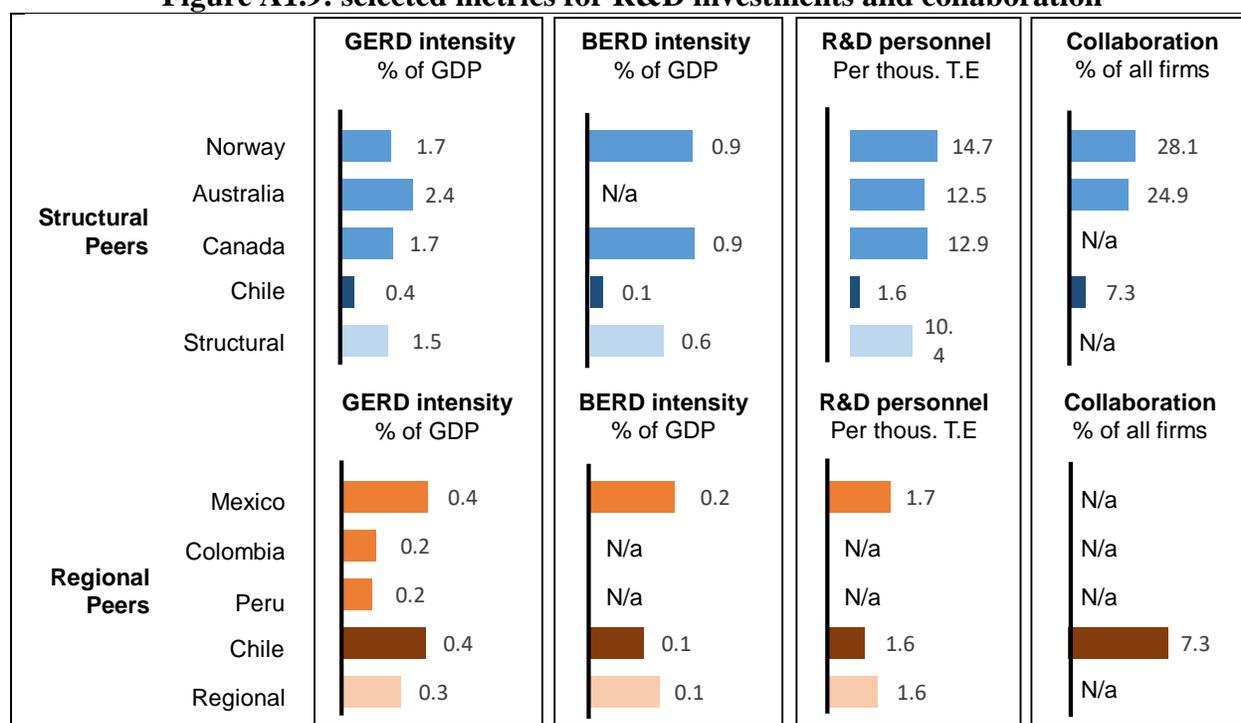
Notes: (1) The diversification index is computed by measuring the absolute deviation of the trade structure of a country from world structure. The diversification index takes values between 0 and 1. A value closer to 1 indicates greater divergence from the world pattern. (2) Herfindahl-Hirschmann Index (Product HHI), is a measure of the degree of product concentration. HHI is used in order to obtain values between 0 and 1. An index value closer to 1 indicates a country's exports or imports are highly concentrated on a few products (3) Number of products exported (or imported) at the three-digit SITC, Rev. 3 level.

Table A1.1: Innovation incidence by region, 2010-2012

N°	Región	Innovación tecnológica			Innovación no tecnológica			Innovación General
		Producto	Proceso	Subtotal	Gestión	Marketing	Subtotal	
I	R. de Tarapacá	6.6%	18.3%	21.1%	6.3%	7.0%	8.1%	22.0%
II	R. de Antofagasta	16.9%	20.3%	24.4%	21.4%	20.7%	24.2%	29.9%
III	R. de Atacama	20.4%	23.5%	24.3%	28.6%	14.5%	28.7%	32.8%
IV	R. de Coquimbo	7.1%	18.4%	19.3%	13.6%	11.6%	17.7%	26.1%
V	R. de Valparaíso	10.3%	14.4%	15.4%	13.9%	10.4%	15.4%	18.8%
VI	R. del Libertador General Bernardo O'Higgins	22.1%	23.4%	27.2%	13.0%	11.5%	16.8%	31.8%
VII	R. del Maule	21.5%	18.9%	24.8%	13.5%	9.5%	14.9%	25.6%
VIII	R. del Biobío	7.5%	8.8%	11.5%	8.4%	4.9%	10.7%	15.8%
IX	R. de La Araucanía	3.2%	5.5%	6.8%	5.4%	5.8%	7.3%	9.9%
X	R. de Los Lagos	13.2%	17.7%	18.6%	10.5%	6.9%	12.9%	22.1%
XI	R. de Aisén	14.2%	4.6%	17.1%	4.1%	2.5%	4.4%	17.6%
XII	R. de Magallanes y de La Antártica Chilena	12.0%	6.6%	13.5%	7.0%	8.4%	13.6%	17.9%
XIII	R. Metropolitana de Santiago	11.1%	16.0%	19.9%	15.7%	10.9%	18.7%	25.8%
XIV	R. de Los Ríos	7.4%	12.8%	13.9%	12.2%	8.4%	12.7%	19.6%
XV	R. de Arica y Parinacota	4.0%	17.7%	18.2%	6.9%	5.9%	8.9%	22.9%
Total		11.6%	15.6%	18.8%	13.8%	10.0%	16.4%	23.7%

Source: Reproduced from 8th Innovation survey

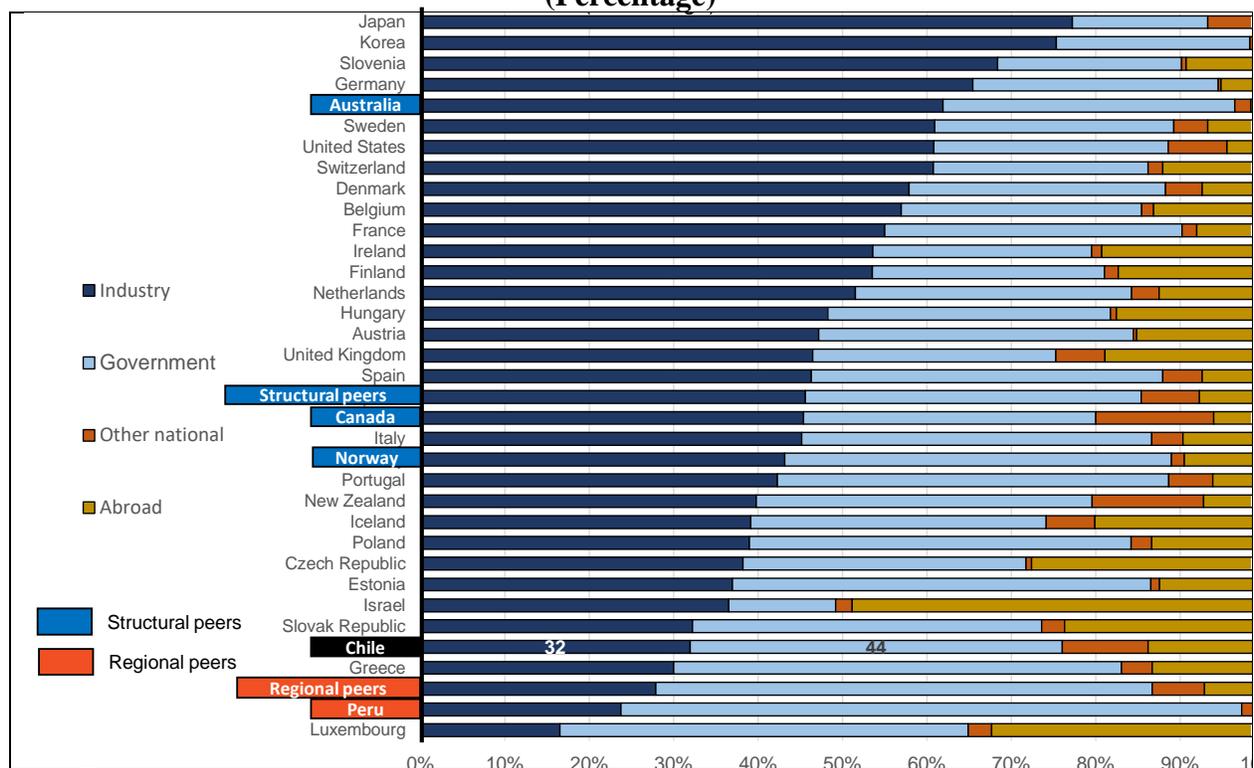
Figure A1.9: selected metrics for R&D investments and collaboration



Source: UNESCO, OECD; Author's Calculations.

Notes: (1) Government expenditure in R&D; (2) Business expenditure in R&D, in 2012; (3) Total R&D personnel per thousand total employment (FTE); (4) Firm cooperation in Innovation Activities - as a percentage of all innovative firms, Innovation indicators.

Figure A1.10: Investments in R&D by source of funding for selected countries in 2013, (Percentage)



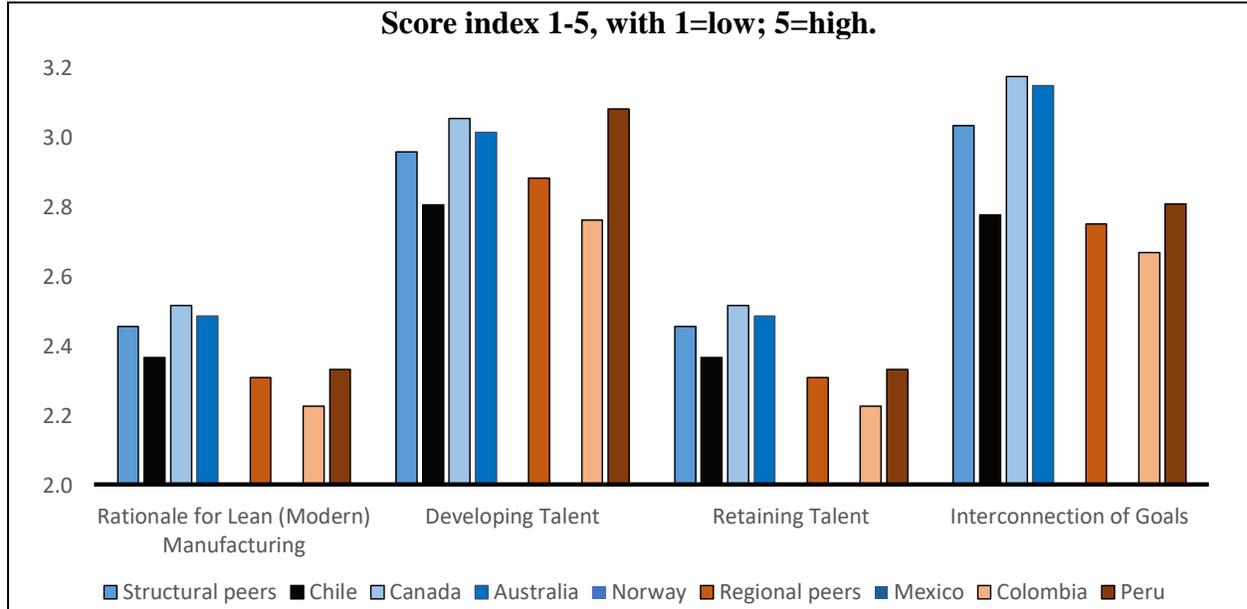
Source: OECD, Main Science and Technology Indicators Database, 2013; Author's Calculations.

Table A1.2: R&D investment share by region

Regiones	Empresas	Estado	Edu. Superior	IPSFL	Total
XV	1.3	0.6	1.1	1.5	1.2
I	1.0	1.2	1.1	0.4	1.0
II	4.6	1.0	5.6	2.3	4.6
III	1.1	1.5	1.9	0.5	1.4
IV	1.7	1.3	1.2	2.9	1.6
V	7.4	4.3	17.0	7.4	11.2
VI	3.3	0.5	0.6	4.8	2.1
VII	3.1	0.5	5.8	3.1	4.1
VIII	7.8	1.8	9.5	6.1	8.1
IX	2.4	2.1	10.6	2.6	5.8
XIV	1.7	0.9	8.2	2.5	4.4
X	6.6	2.3	2.3	8.4	4.7
XI	0.7	0.9	0.4	1.3	0.7
XII	0.7	2.0	2.9	3.8	1.9
RM	56.7	79.2	31.6	52.4	47.1
TOTAL	100	100	100	100	100

Source: Reproduced from 8th Innovation survey

Figure A1.11: Selected key managerial metrics for structural and regional peers of Chile 2004- 2014



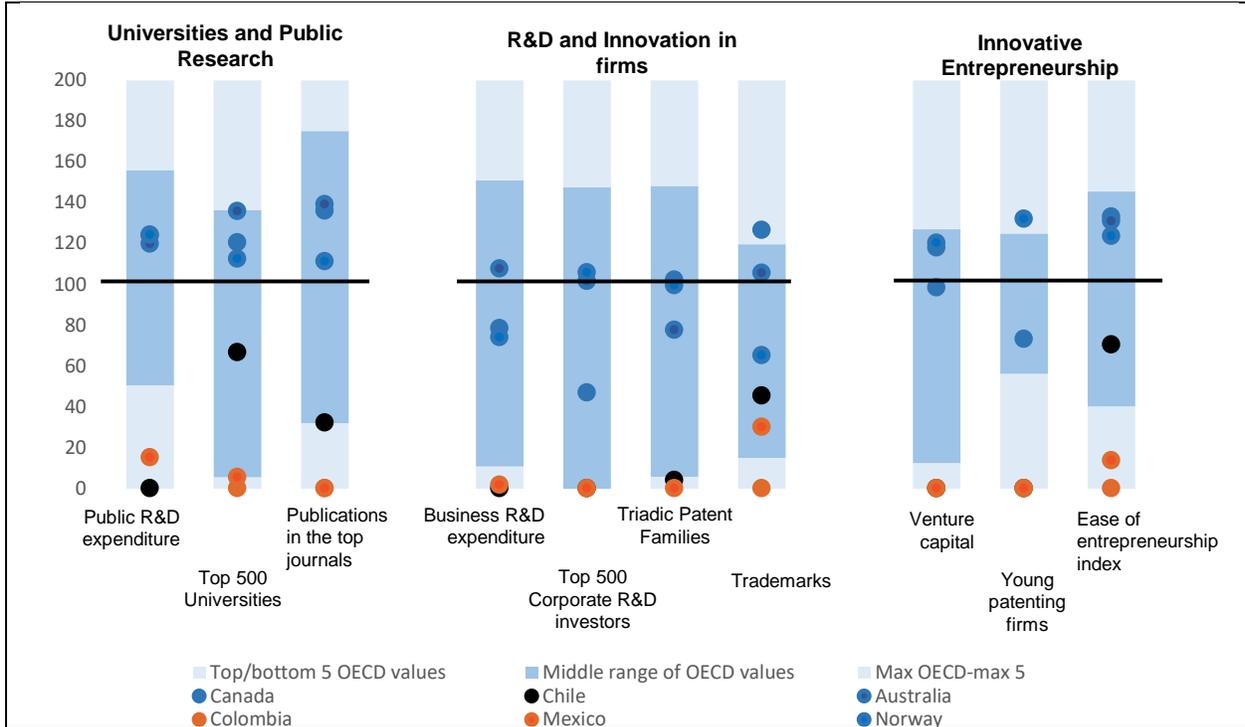
Source: 2004-2014 World Management, Survey Manufacturing Data

Table A1.3: Firm responding to specific business constraints 2006 – 2010; Percentage of firms (percent)

Number of reported competitors	Fraction of respondents, 2006	Fraction of respondents, 2010
0	3%	4%
1	3	5
2 to 5	38	42
6+	56	49

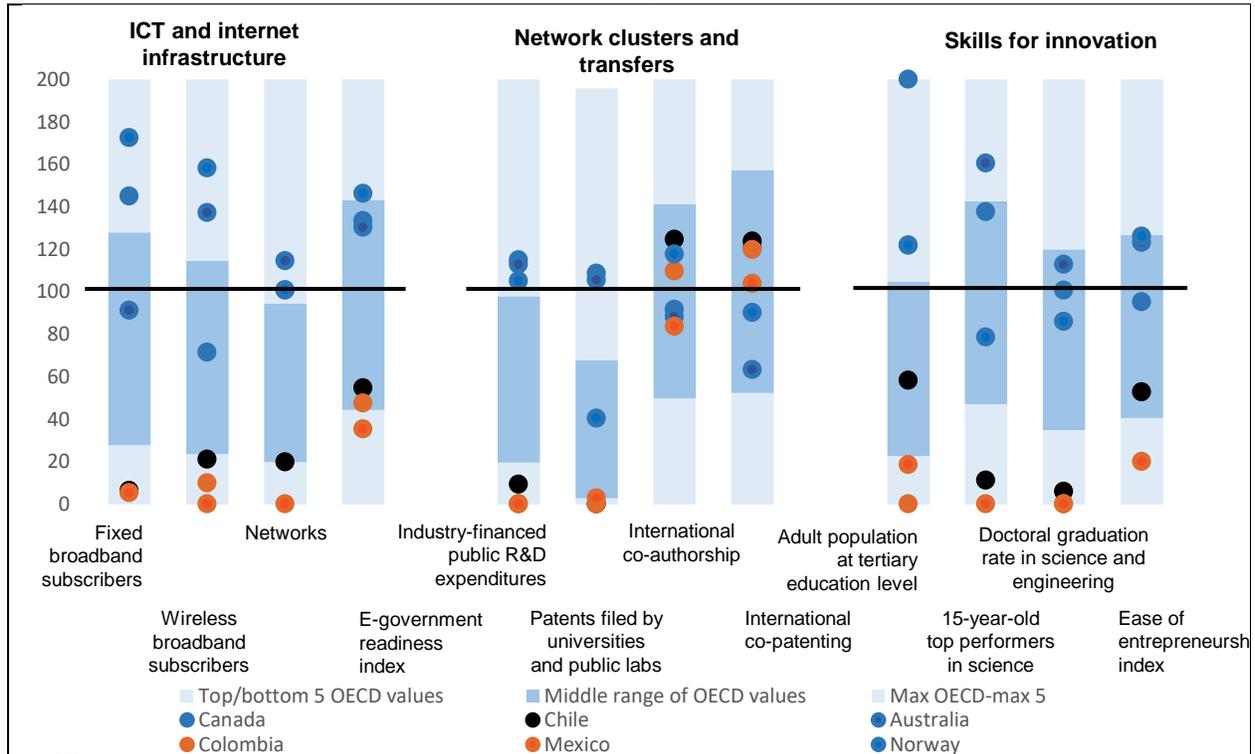
Source: Reproduced from Syverson, 2014, based on World Bank Survey

Figure A1.12: Comparative performance of national science and innovation systems, 2013



Source: OECD, Main Science and Technology Indicators Database, 2013; Author's Calculations.

Figure A1.13: Comparative performance of STI Interactions and skills for innovation, 2013



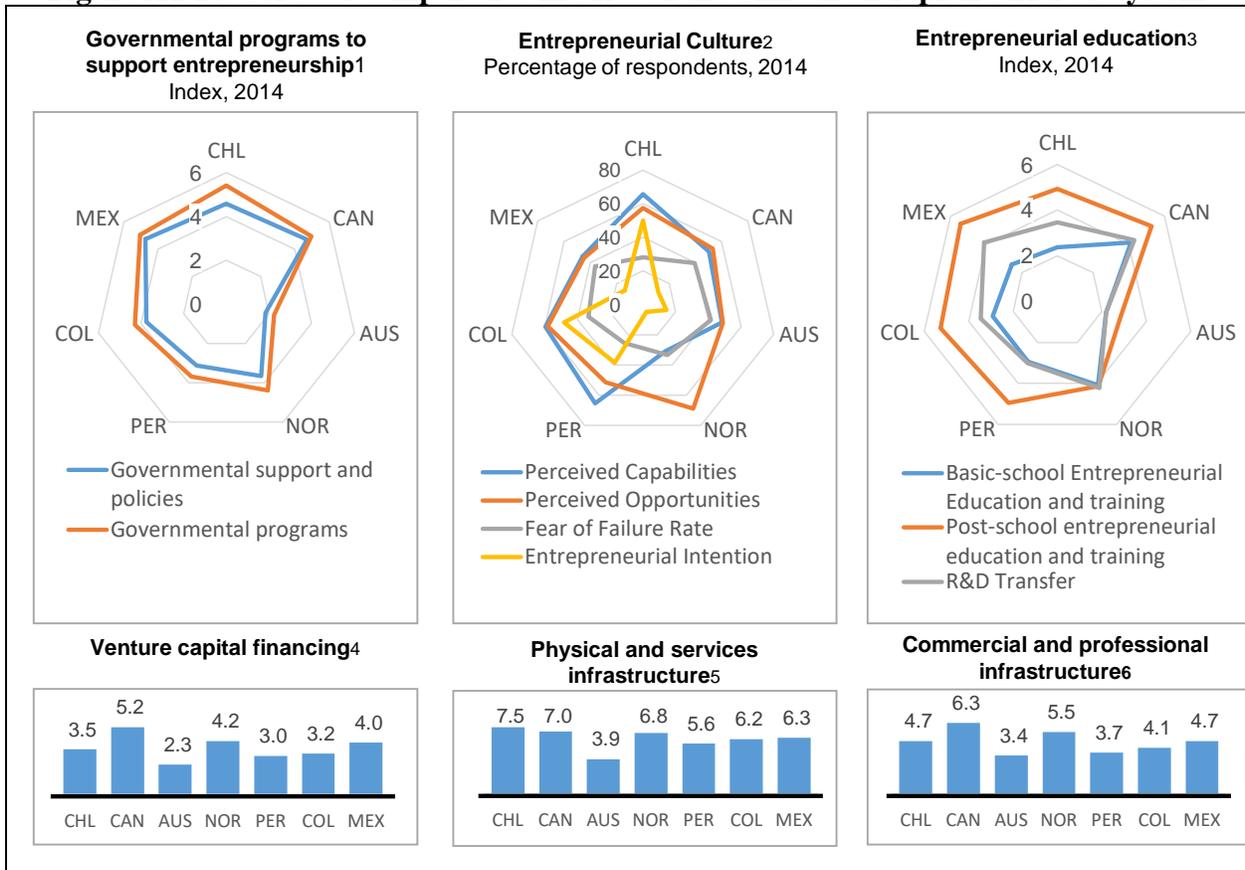
Source: OECD, Main Science and Technology Indicators Database, 2013; Author's Calculations.

Table A1.4: Comparative performance of national science and innovation systems, 2013

	Prosa		Documentos		Cuantitativa	
	1998	2013	1998	2013	1998	2013
Nivel 1	47.4	44.3	49.0	42.0*	53.0	51.4
Nivel 2	33.7	37.2	33.4	41.6*	25.7	28.9
Nivel 3	15.0	13.9	14.6	14.2	16.4	15.3
Nivel 4 y 5	3.9	4.6	3.0	2.2	4.9	4.4

Source: Reproduced from *Cerrando La Brecha de Habilidades y Productividad en Chile*, based on information from *Centro de Microdatos*, 2013.

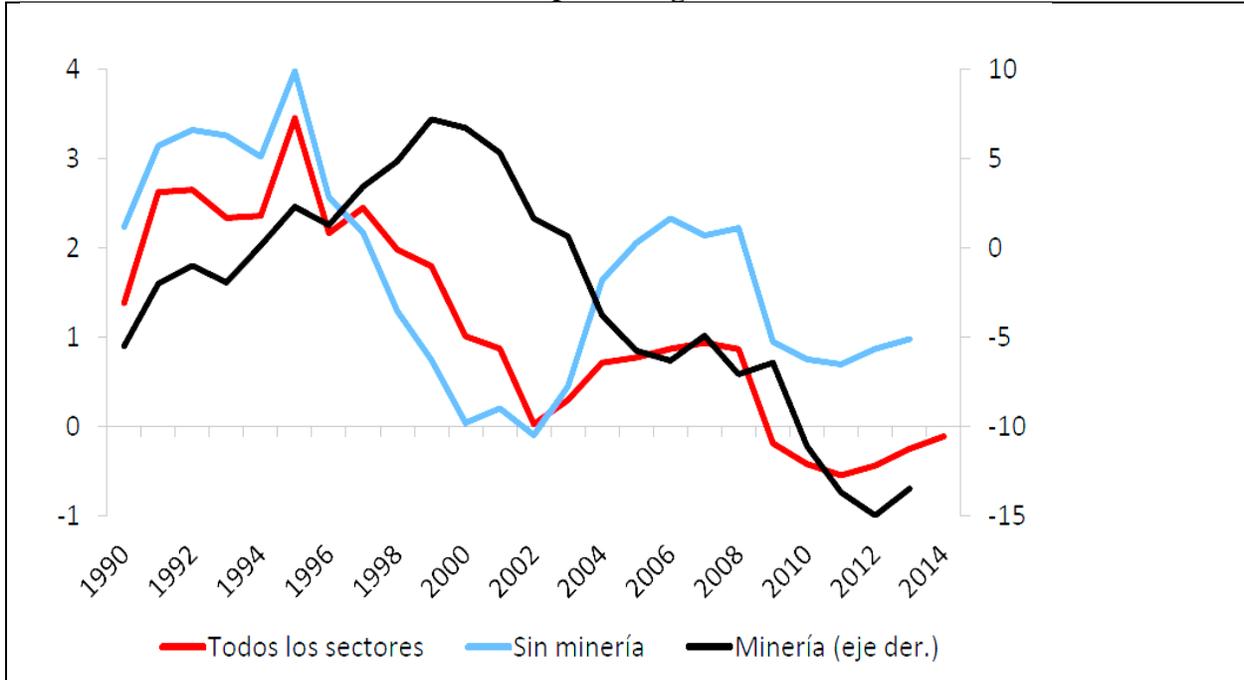
Figure A1.15: Selected comparative metrics of the Chilean entrepreneurial ecosystem



Source: Global Entrepreneurship Monitor Consortium; based on national expert surveys.

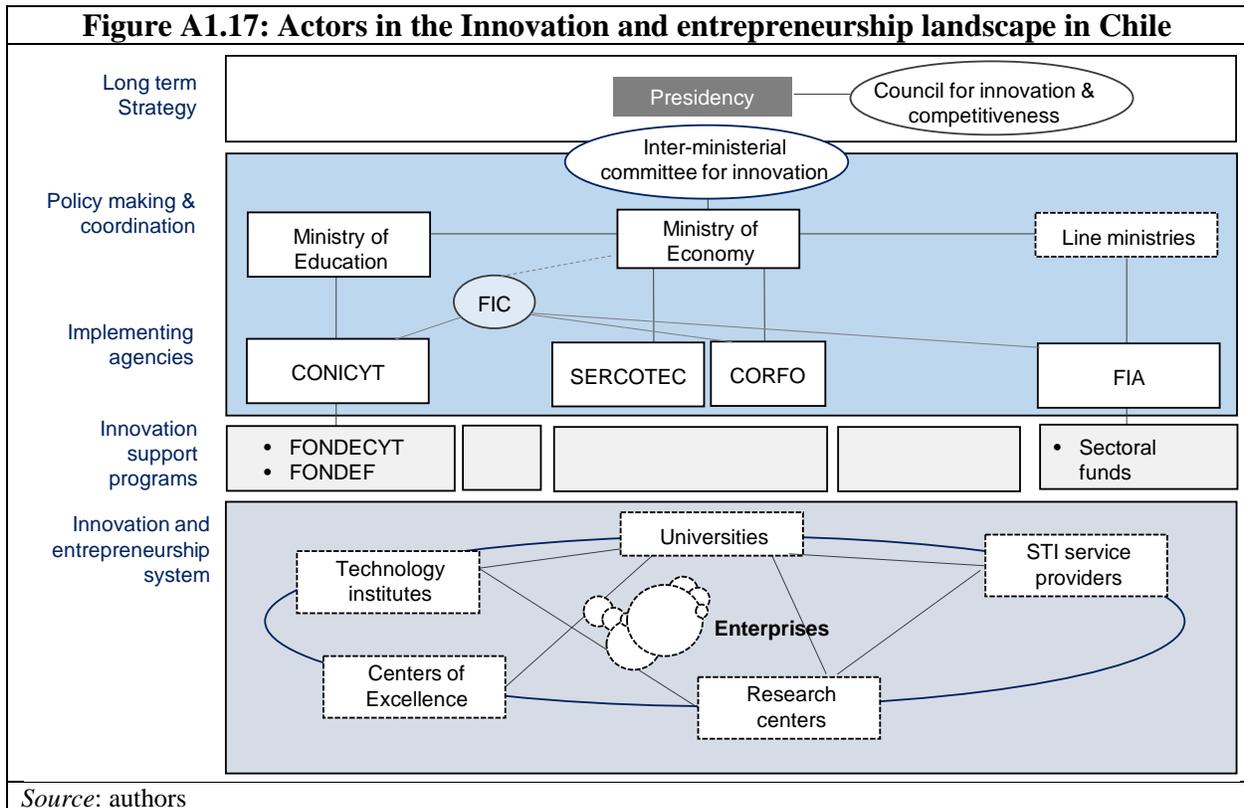
Note: (1) The extent to which public policies support entrepreneurship, (2) Percentage of 18-64 population (3) The extent to which training in creating or managing SMEs is incorporated within the education and training system in reference, (4) The availability of financial resources—equity and debt—for SMEs (5) Ease of access to physical resources—communication, utilities, transportation, land or space—at a price that does not discriminate against SMEs; (6) The presence of property rights, commercial, accounting and other legal and assessment services and institutions that support or promote SMEs.

Figure A1.16: TFP growth in Chile by mining and non-mining sectors, 1990-2014; percentage



Source: Reproduced from Chile's Growth Performance (Note), based on information Central Bank of Chile.

Figure A1.17: Actors in the Innovation and entrepreneurship landscape in Chile



Source: authors

Table A1.5: The evolution of the policy framework for IE: Governance & strategy

	1990-2005	2005- 2010	20010- 2014
Governance functions		CNIC⁵	CNIC
Strategy & monitoring		Committee (Inter-ministerial but presided by Min. of Economy)	Committee (Inter-ministerial but presided by Min. of Economy)
Policy coordination	PDIT² (Min. of Economy)		
Implementing agencies	CORFO³ (Min. of Economy), CONICYT⁴ (Min. of Education)	CORFO (Min. of Economy), CONICYT (Min. of Education)	CORFO (Min. of Economy), CONICYT (Min. of Education)
Assessment	<ul style="list-style-type: none"> • Institutional framework was vulnerable to political sway. • PDIT did not exert influence over implementing decisions, operating in a decentralized fashion, and weakening administration. • Multiple agencies were running innovation programs, which prevented exploitation of economies of scale and scope. • Problems of coordination and fragmentation of programs, creating confusion among clients and inefficiencies. 	<ul style="list-style-type: none"> • Committee facilitated coordination among several ministries and execution of CTI policy. However, it did not work well during this period. • CNIC played advisory role, and facilitated strategic planning and resource allocation. It also supervised implementation of CTI policy. • Royalties enabled resources for implementation. • The CNIC was not ratified by congress, leaving it vulnerable to political change. 	<ul style="list-style-type: none"> • The government curtailed the CNIC's influence, reducing its budget, # of counselors and limiting its role to advisory. • CNIC did no longer play a role in the budgetary agenda. It lost its functionality for supervision and command of accountability. • Ministry of Economy strengthened the administration of the committee.

Source:

Notes: (1) Benavente, et al., based on Tekes framework, (2) Technological development and Innovation program, (3) Chilean Economic Development Agency (4) National Commission for Scientific and Technological Research, (5) National Innovation Council for Competitiveness; (6) Innovation Fund for Competitiveness.

Table A1.6: The evolution of the policy framework for IE: areas of focus & Programs

	1990-2005	2005- 2010	20010- 2014
Strategic focus			
Areas of strategic focus	<ul style="list-style-type: none"> • R&D spending but in the absence of a long term and articulated strategy. • Horizontal promotion of R&D projects. 	<ul style="list-style-type: none"> • Long term strategy to transition from a resource driven to a knowledge driven economy. • Generate improvement across 4 axis : infrastructure, legal and regulatory framework, financing and trade and technologies. 	<ul style="list-style-type: none"> • The government did not manifest preference for innovation subsidies. • Short term priorities: Reallocation of resources to earthquake relief and increased support of basic science
Programs	<ul style="list-style-type: none"> • Competitive funding, under neutral approach, focusing in the role of market and demand. • Grants to individual projects (initially) and firms (later). • PCT program (1992) • FONDAP (1997) • Millennium initiative (1999) • Regional S&T centers (2000) • Chile Innova (2001) • PBCT (2003) 	<ul style="list-style-type: none"> • Develop clusters with high potential for growth. • Develop ST consortia • Introduce priorities at the regional level. • Introduce R&D tax incentive • National Innovation Strategy • Mining royalties to capitalize FIC⁶ • External evaluation (M Teubal) 	<ul style="list-style-type: none"> • Shift allocation of resources towards credits and support of R&D intensive companies as well as new companies with technological content and high potential for growth and firms of larger size. • Reduce support to softer innovation • The technology diffusion program was halted. • Recommendations from the evaluation were not taken into consideration.
Assessment	<ul style="list-style-type: none"> • The dominant approach was to support neutrally all sectors. • Support was multidisciplinary, but delivery was in the hands of several agencies. 	<ul style="list-style-type: none"> • Evaluation suggested to strengthen the venture capital industry, deepen the work on clusters and diversification, develop advanced human capital, 	<ul style="list-style-type: none"> • Inter-ministerial committee was strengthened. • Regions continued to gain more prominence managed increasingly more resources.

Source: Reproduced from J.M Benavente and J.J. Price.

Table A1.7: Programmatic rationalization for MINECON

Key challenges	Goal
<ul style="list-style-type: none"> • Increase the level of R&D, particularly from private sources (BERD) • Achieve economic diversification, and enable Chilean economy reduce dependency on resource based commodity exports through structural transformation • Guide creation of knowledge on its potential use, particularly for fostering economic development. • Expand availability of advanced human capital in a coordinated fashion, with active involvement of the private sector. • Extend STI capabilities and ecosystems to the regions, under a public and private scheme. • Promote innovation that enables inclusive growth • Boost the entrepreneurial ecosystem • Strengthen institutional coordination and capacity to advance innovation and competitiveness policy 	<p>Increase productivity</p> <ul style="list-style-type: none"> • Unleash the full potential of sectors with revealed comparative advantages through fostering innovation and building capabilities. • Diversify the existing productive base to include complex economic activities that feature a high technological content.

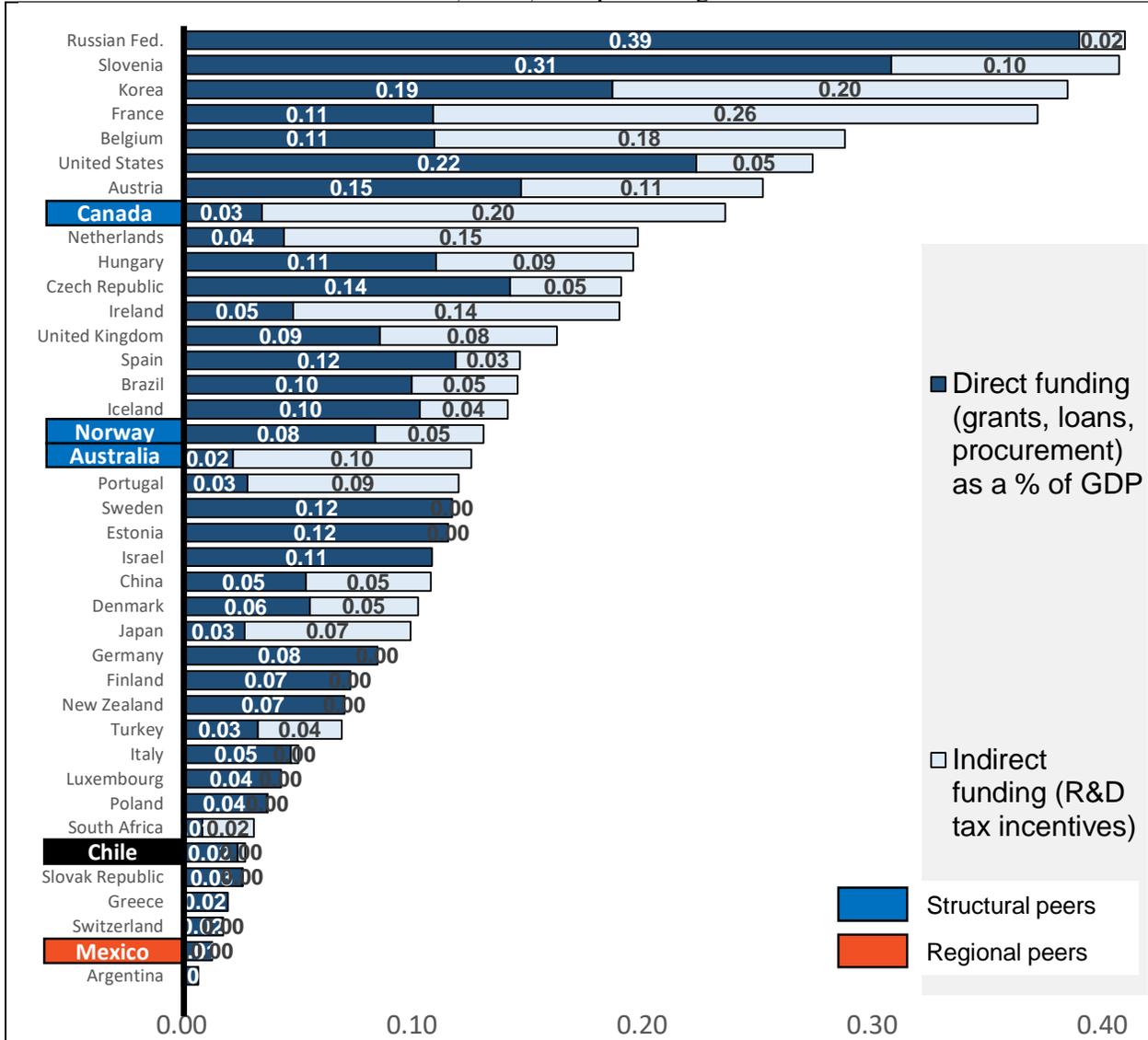
Source: Reproduced from Innovation Division, MINECON

Table A1.8: Priority areas as a result of the programmatic rationalization for MINECON

Priority Area	Description
Selectivity	<ul style="list-style-type: none"> • Leverage development on existing economic sectors with revealed comparative advantages, and others with high potential for development. Includes public and private dialogue for productivity, strategic programs for smart specialization, Fund for strategic investments and natural labs.
Institutional strengthening	<ul style="list-style-type: none"> • Increase development impact via on the basis of better coordination, measurement and learning. Includes building the institutional legality of the Innovation Council (CNIC), creating the productivity commission, and introducing regional coordination platforms.
SME innovation	<ul style="list-style-type: none"> • Bridge the gaps of productivity across sectors, particularly to increase SMEs innovation incidence. This will include the business innovation programs (CORFO) and the further support of the technology extension centers (CORFO).
Entrepreneurial ecosystems	<ul style="list-style-type: none"> • Improve Chile's entrepreneurial environment, and induce creation of new enterprises. Includes extending Start-up Chile program to the regions (CORFO), scaling up promising ventures which have been validated (CORFO), and boosting Explora program (CONICYT)
Inclusive growth by innovation	<ul style="list-style-type: none"> • Enable innovation for all, and inclusive growth. Includes the Social Innovation Program, with its fund, and Public Innovation Policy Programs, which seek to instate an innovation culture within the government, such as GobLab.
Holistic approach to Human K, Science & Technology	<ul style="list-style-type: none"> • Strengthen Chile's scientific foundation, skills and R&D capacity. Includes supporting existing programs (FONDECYT, FONDEQUIP, FONDEF, etc), improving coherence of the human capital development policy and tightening linkages between industry and universities.

Source: Reproduced from Innovation Division, MINECON

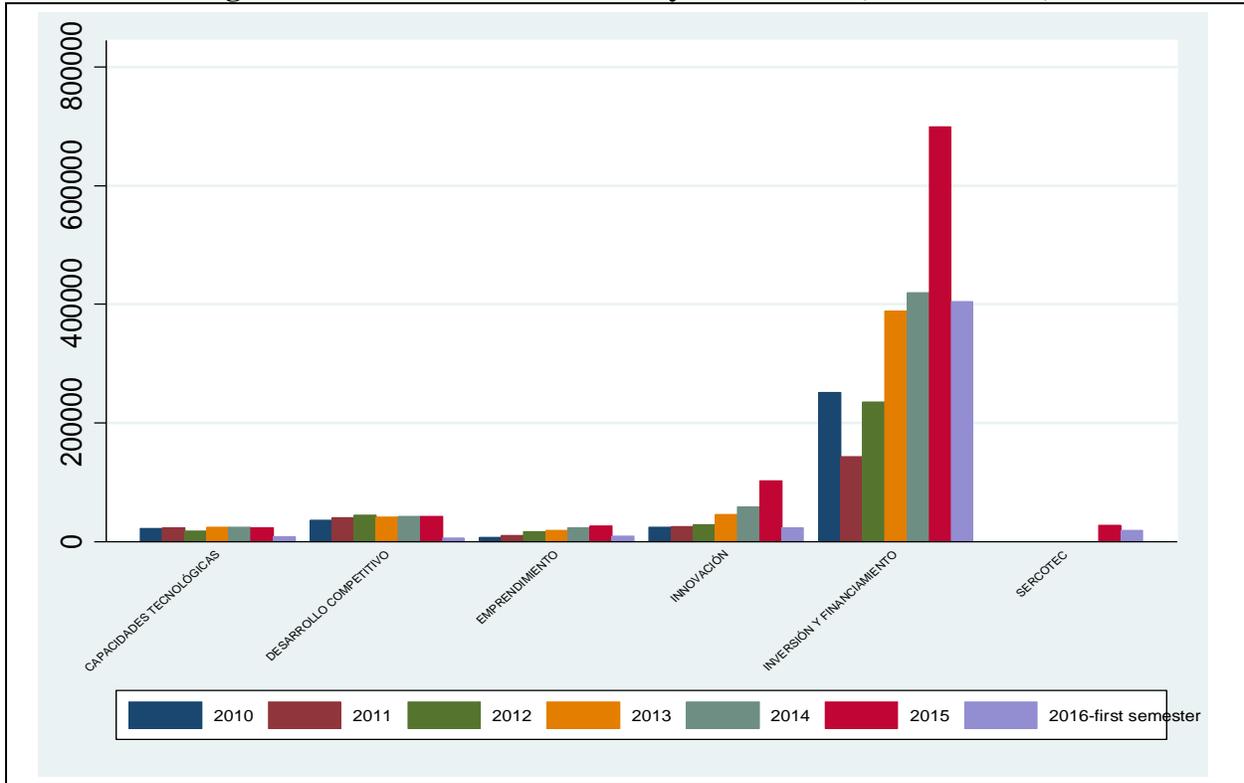
Figure A1.18: Government funding of business R&D, direct funding and R&D tax incentives, 2012, as a percentage of GDP



Source: Reproduced from OECD, STI Policy Outlook 2014.

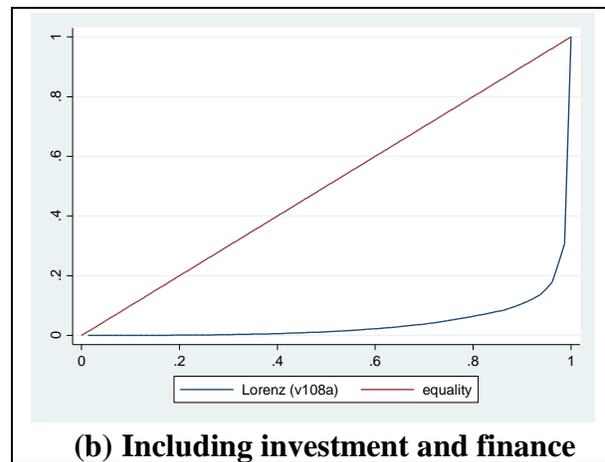
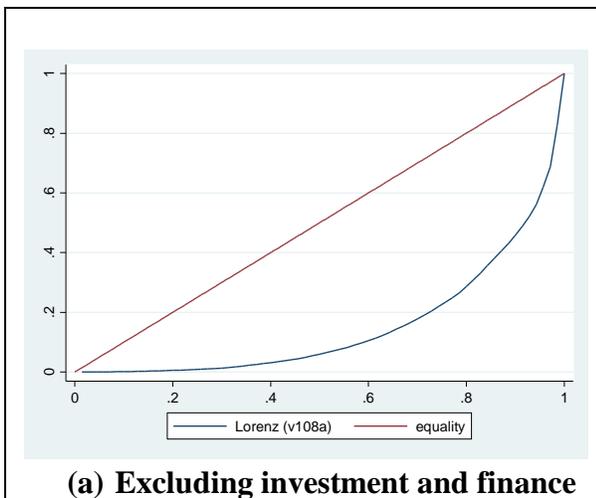
ANNEX 2.1 Figures and Tables Portfolio Analysis

Figure A2.1: Resource allocation by Directorate (million Pesos)



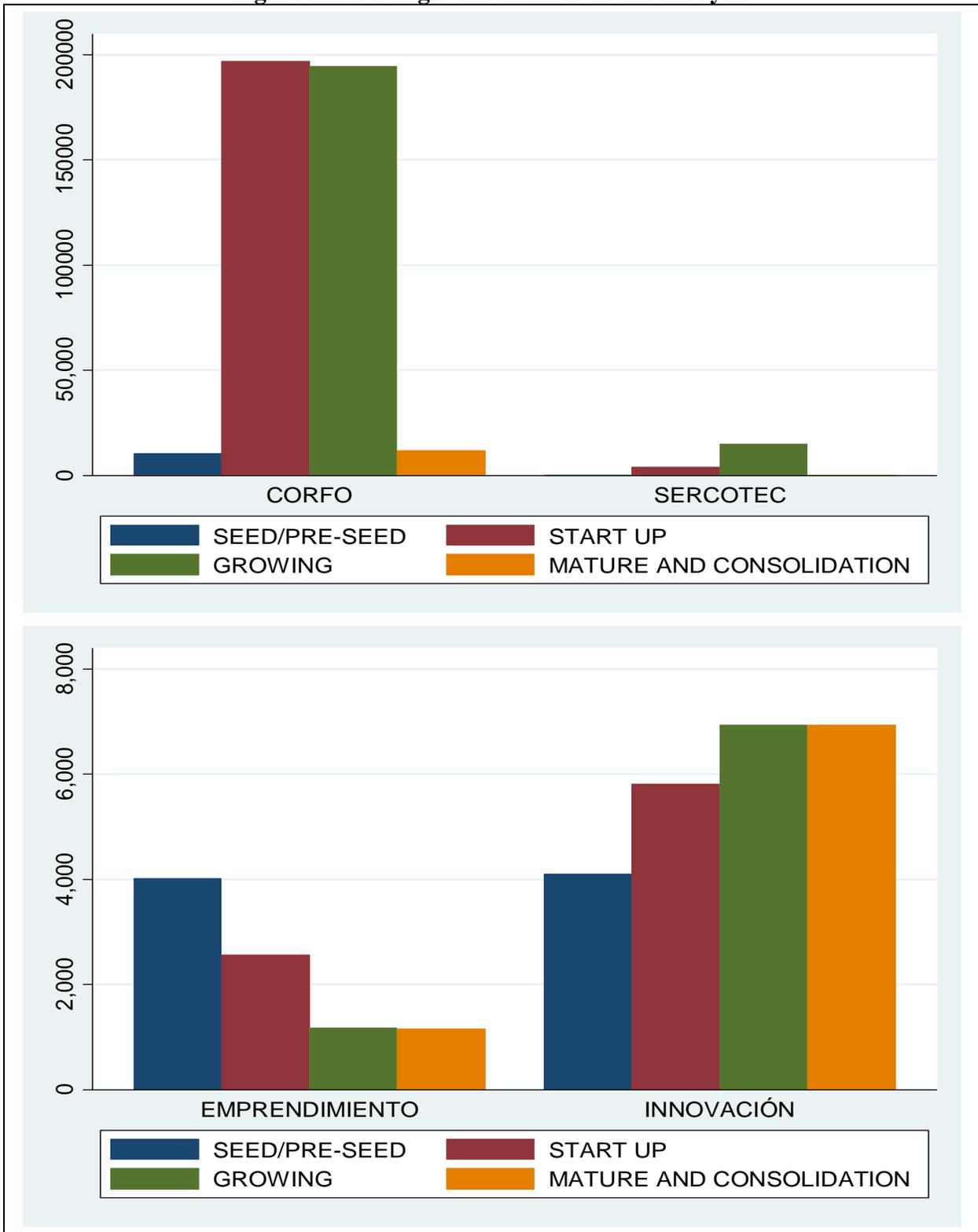
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Figure A2.2: Concentration of the budget by instrument



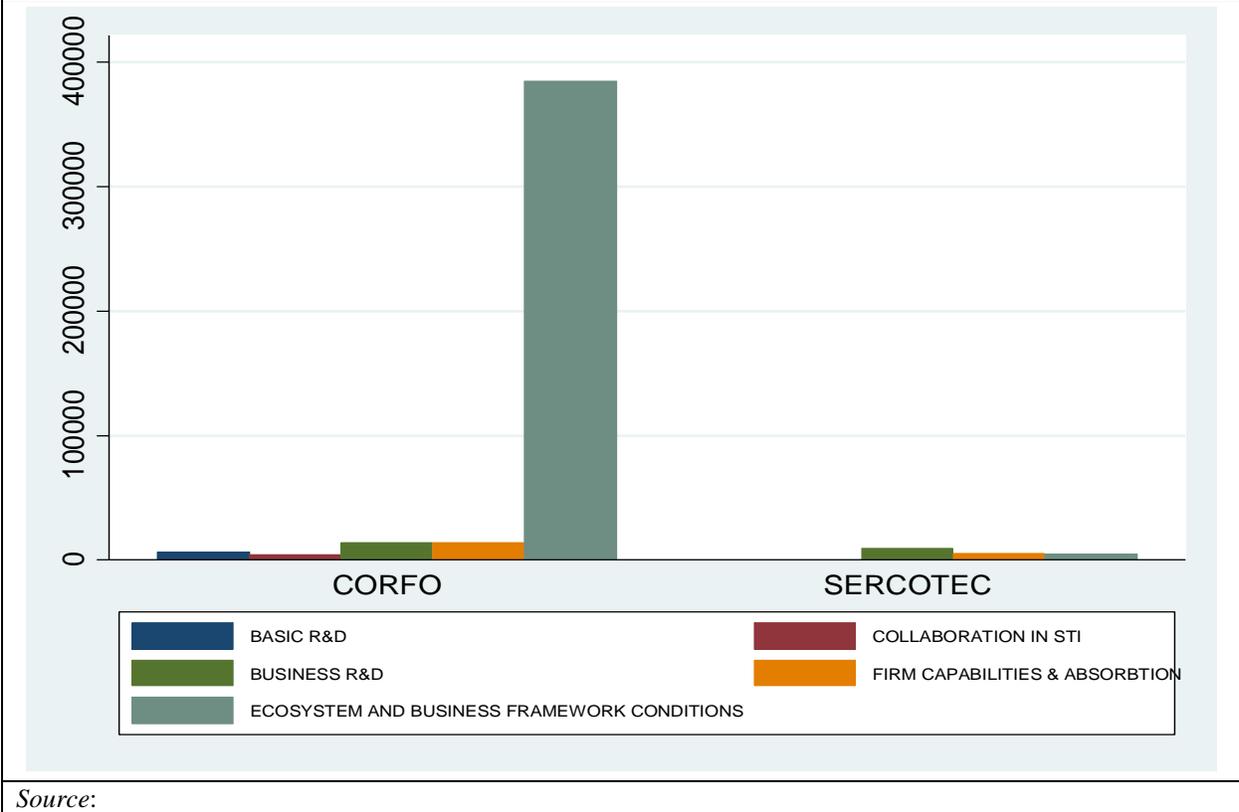
Source:

Figure A2.3: Budget allocation over the life cycle



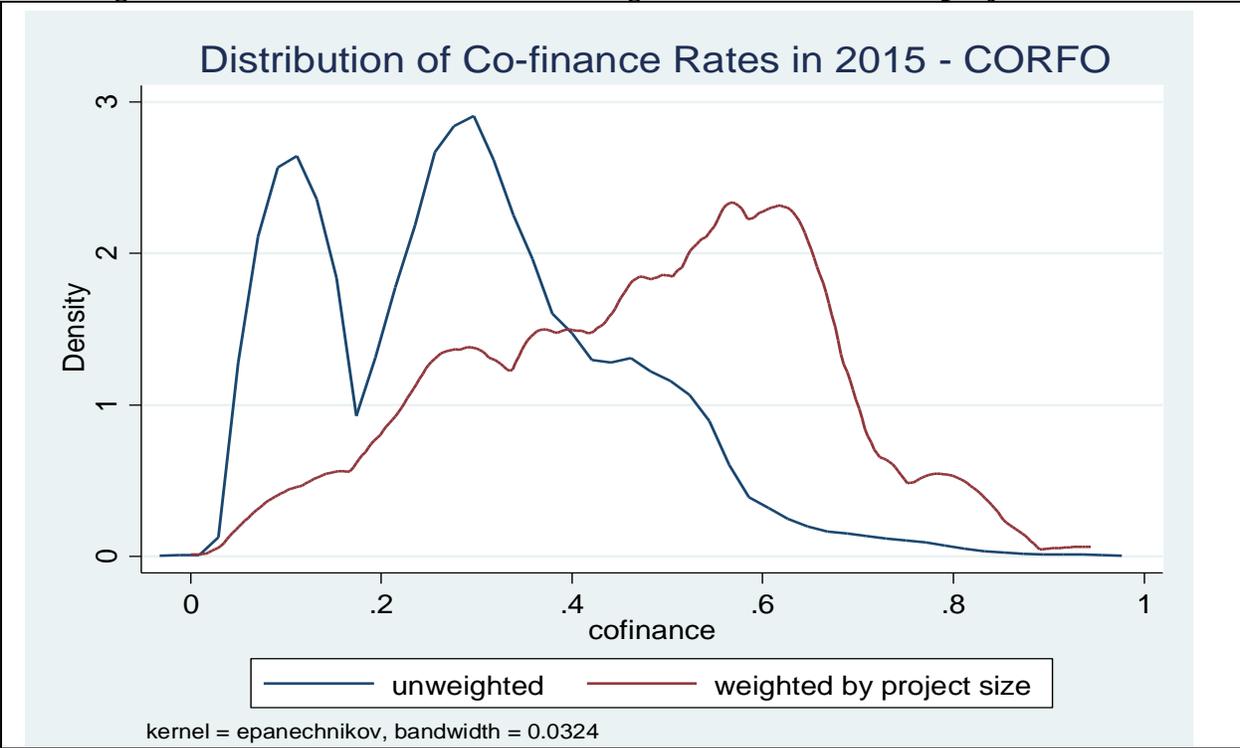
Source:

Figure A2.4: Budget allocation by intermediate outcome



Source:

Figure A2.5: Distribution of co-financing rates across CORFO projects in 2015



Source:

Annex 2.2 Redundancy analysis across instruments - CORFO

Table A2.1: Redundancy Analysis Across Instruments – CORFO

Set of instruments subject to scrutiny	Directorate	Key differences	Size in 1 st semester of 2016	Conclusions
<ol style="list-style-type: none"> 1. B11 Corfo Inversión - Modalidad B11 2. B14 Corfo Inversión - Modalidad B14 3. B15 Corfo Inversión - Modalidad B15 	Investment and Finance	No information available	Na. (information available only for 2010)	No expenditure in 2016, and no information regarding the scope available, therefore no case for consolidation.
<ol style="list-style-type: none"> 1. B21 Corfo Exportación - Comprador Extranjero 2. B22 Corfo Exportación - Modalidad Insumos Producción 	Investment and Finance	No information available	Na (information available only for 2010).	No expenditure in 2016, and no information available regarding the scope of the instrument, therefore no case for consolidation.
<ol style="list-style-type: none"> 1. Fondos de garantía a instituciones de garantías recíprocas, IGR 2. Fondos de garantía a instituciones de garantías recíprocas, IGR III 	Investment and Finance	No information available	(2) Chp 1,8 billion (p80.7)	Information only available for (2) in 2016, but no information available regarding the scope of the instruments, therefore no case for consolidation.
<ol style="list-style-type: none"> 1. Fortalecimiento de la asociatividad, Fondo de Ferias libres 2. fortalecimiento de la asociatividad, fondos para barrios comerciales 3. fortalecimiento de la asociatividad, fondos para fortalecimiento gremial y cooperativo 4. Fortalecimiento de la asociatividad, fondos para negocios asociativos 	Programs	'(1) and (2), as well as (3) and (4) seem to have similarities with each other in terms of goals. Both, (1) and (2) seek to upgrade existing businesses, and (3) and (4) seek to diversify businesses. However, unlike (1), (2) aims to develop skills, and does not seek collaboration as (1) does. (3) and (4) aim at diversification, and the business environment. However, (3) also seeks collaboration. Unlike (3), (4) seeks to improve existing businesses. In addition, in terms of use of funds, (1), (2), (3) and (4), present an heterogeneous functionality. For example, (4) funds pre-feasibility studies. Many of these instruments present specialised uses, and target many different sectors.	'(1) Chp 1.8 billion (p80.7), (2) Chp 3.9 billion (p89.7), (3) Chp 780 million (p60.2), (4) Chp 2.1 billion (p84.6)	Considering the scale of all programs, and the variety of scope, in terms of objectives, use of funds and target groups, we conclude there is not a clear case for further consolidation.
<ol style="list-style-type: none"> 1. Gestión de empresas, Fondo de asesorías empresariales 2. Gestión de empresas, promoción y canales de comercialización 	Programs	All four instruments present heterogeneity in terms of goals, use of funds, and target groups. In terms of goals, (1) and (3) seem to have commonalities, as they both seek upgrade of existing business, while (2) and (4) seek diversification. However, in terms of use	'(1) Chp 380 million (p47.4), (2) Chp 420 million (p48.7), (3) Chp 360	Considering the scale of all programs, and the variety of scope, in terms of objectives, use of funds and target groups, we conclude there is not a

3. Gestión de empresas, Formación empresarial 4. Gestión de empresas, redes de oportunidades de negocios		of funds, there is no common pattern between these pairs. Also, (1) targets primary sector, and small growing enterprises, while (3) and (4) target all sectors, but aim at firms in different cycles.	million (p44.8), (4) Chp 260 million (p39.7)	clear case for further consolidation.
1. Bienes Públicos Estratégicos Para La Competitividad 2. Bienes Públicos Para La Competitividad	Innovation	Unlike its comparator (2), the (1) seeks to promote association across firms and to outreach key beneficiary groups. In addition, it has a vertical strategy unlike (2) which features a horizontal scope.	(1) Chp 910 million (p64.1) and (2) Chp 340 million (p42.3)	The (1) seems to be the newest generation, as it featured a budget only for 2015, whereas (2) had disbursed every year since 2011. There is not enough evidence to conclude on redundancy.
1. Consorcios Tecnológicos Empresariales 2. Consorcios Tecnológicos Para La Innovación	Innovation	Unlike (2), the (1) provides financing to firms. Also, (2) requires a higher copayment rate from beneficiaries (50%) when compared to (1), which commands only 30%. In addition, (1) presents a vertical scope, targeting manufacturing and services, while (2) remains horizontal.	(1) 0 and (2) Chp 1.6 billion (p75.6)	Before 2016, both instruments have been implemented simultaneously, although (2) with a significantly bigger budget. In 2016, (1) disappeared, and (2) was still present. No case for further consolidation.
1. Gestión De La Innovación 2. Gestión De La Innovación - Desafío De Innovación Abierta 3. Gestión De La Innovación - Desarrollo De Capacidades 4. Gestión De La Innovación - Gestión De Portafolio 5. Gestión Innovación Pymes	Innovation	(5), is the only instrument that shows association as a strategy to achieve productive improvements. (1,2,3 and 4) present the same goals. In terms of intermediate indicators, only (5) shows difference when compared to the other 4, by intervening the entrepreneurial environment. Unlike the other 4 instruments, (5) also delivers assistance through intermediaries. (5) also stands out as being the only one offering marketing research and commercial technical assistance. Only (2) and (5) cover costs for information systems. (1,2,3,4) aim at the same segment, while (5) focuses in the middle (small and medium)	(1) and (2) Chp 0 (3) Chp 61million(p20.5), (4) 550 Chp million (p55.1), and (5) Chp 0	(2,3,4 and 5) featured only in 2015. (1) and (2) were phased out. However, it is worth exploring further consolidation of (3) and (4), provided they indeed represent separate instruments.
1. Programas De Difusión Tecnológica 2. Programas De Difusión Tecnológica Nacional	Innovation	All objectives and scope remain the same.	'(1) 490 million (p50), (2) 0	Instruments seem to have been consolidated in 2016, under (1). Expenditure level remained at 50 percentile in 2016. No need to further address redundancy
1. Prototipos De Innovación Empresarial 2. Prototipos De Innovación Regional 3. Prototipos De Innovación Social	Innovation	(1) and (2) support enterprise projects, particularly existing businesses, while (3) focuses on inducing partnerships and association. (1) and (2) focus applied generating research, while (3) focuses on improving the entrepreneurial environment. All three present different co-financing requirements, ranging from 20-50%. The range of uses of support differs quite a bit, with (1) and (2) focusing on direct support to business R&D, unlike (3). Finally, the beneficiary groups, with	(1) Chp 27 million (p8.9), (2) 190 million (p32), and (3) 40 million (p11.5).	Sources of financing for these instruments are also different, with (2) being financed by regional funds. The differences identified in terms of objectives, cycle of support, scope, eligible expenditures, and financing sources, do not present an obvious case for consolidation. However, the relative size of

		(3) supporting NGOs, and government agencies, and (1) and (3) allowing for seed and pre-seed support.		expenditures of (1) and (2) in the first half of 2016 implies a case for consolidation due to limited scale
1. Programa Innovación Tecnológica Empresarial - Innovación En Productos Y Procesos (Prototipo) 2. Programa Innovación Tecnológica Empresarial - Validación Y Empaquetamiento De Innovaciones	Innovation	(1) presents an additional objective to (2) which is to adapt new technology. It also allows for prototype support, while (2) allows for additional expenditures such as legal, business support and software licensing.	(1) Chp 2 billion (83.3) and (2) 2.8 billion (p87.1)	Both instruments feature for the first time in year 2014. In 2016, these instruments featured sizable budgets (p83.3 and p87.1 respectively). However, based on the information analyzed, and on the fact that they seem to support different objectives, the case for integration is unclear. They should remain separate.
1. Oficinas De Transferencia Y Licenciamiento - Consolidación 2. Oficinas De Transferencia Y Licenciamiento - Formación	Technological capabilities	Differences stand to be in the requirement for co-financing, where (1) presents a higher 40 % and (2) presents a lower 20 %. In addition, while both offer a variety of technical support, only (2) allows for legal studies. These differences seem minimal.	(1) Chp 1,000 million (p67.8) and (2) 520 million (p52.5)	Both instruments feature for the first time in year 2015, with significant budgets (p67.8 and p52.5 respectively). Based on the information provided, it may be worth to explore consolidation of both instruments into one.
1. Programa de I+D Línea 1, Perfil De I+D Aplicada 2. Programa de I+D Línea 2, Proyecto De I+D Aplicada 3. Programa de I+D Línea 3, Valorización Y Protección P.I. 4. Programa de I+D Línea 4, Empaquetamiento Y Transferencia De I+D	Technological capabilities	Unlike (3) and (4), (1) and (2) focus on supporting existing business models. Instrument (4) demands higher co-financing (30-50%) than the rest (@ 20%). All instruments show differences on uses of financial support: (4) is the only one funding prototype, (2) and (4) fund legal studies, and more in the way of operational costs during implementation, equipment, software, and patents. (1) remains provides more support to project preparation. Only (3) and (4) also support individuals and they all support firms.	(1), (3), (4) presented 0 budget, (2) Chp 240 million (p38.4)	All instruments were consolidated in 2015 under de I+D Línea 2, Proyecto De I+D Aplicada. Based on the information provided, all redundancies were addressed in 2015.
1. Programas Tecnológicos 2. Programas Tecnológicos de Diversificación Acuicola	Technological capabilities	Objectives of (1) and (2) are equal. However, (2) allows for higher co-financing rates (30%) versus (1) @ 20%. (2) also seem to focus more on the preparatory phase of support, allowing for legal, prospecting and feasibility studies, while (1) focuses more on implementation allowing for equipment, consultancies, and technical assistance. Also, (1) is an horizontal instrument, while (2) is vertical (aquaculture)	(1) and (2) Chp.	(1) Both instruments had been active since 2015, however, no allocation was present in 2016. Based on the information provided, No further consolidation seems relevant.
1. Subsidio Semilla de Asignación Flexible para el apoyo de emprendimientos de Desarrollo 2. Subsidio Semilla de Asignación Flexible para el Apoyo de Emprendimientos de Innovación	Entrepreneur ship	Unlike (1), (2) and (3) also include support at the level of the ecosystem; and (1) also focuses on enabling technology absorption. (3) Allows for technical assistance in matters of technology transfer. In terms of target, (1) focuses on traditional enterprises, while	(1) Chp 69 million (p21.7) (2) Chp 1.5 billion (p71.7), and (3) Chp 30 million (p10.2).	All three instruments are current since 2012, and (3) 2016 expenditure is relatively small (p10.2). It may be worth to explore potential consolidation of (2) and (3) only,

3. Subsidio Semilla de Asignación Flexible para Emprendimientos de Innovación Social		(2) and (3) aim support to firms with high potential for growth.		leaving (1) as a standalone instrument.
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Conclusion: There are few opportunities for further program rationalization within the portfolio of instruments for potential efficiency gains.

Starting from the base of all active instruments in 2015, we revised their profile and made a shortlist of 40 instruments on the basis of their general name and stated scope. Within this list of 40 candidates, we look at similarities and differences in terms of objectives, sought outcomes, strategies, scope of support, and sources of funding. We adjusted for those instruments that seem were on the way out, with no residual budgets for the first semester in 2016. Thus, we looked at 14 cases comprising the 40 instruments-, of which, only 3 (cases) presented opportunities for consolidation. Within these 3 cases, 6 instruments reveal a situation that warrant further scrutiny. If this analysis proved feasible, 6 instruments could be consolidated into other instruments, reducing a total of 6 candidates to 3 consolidated instruments.

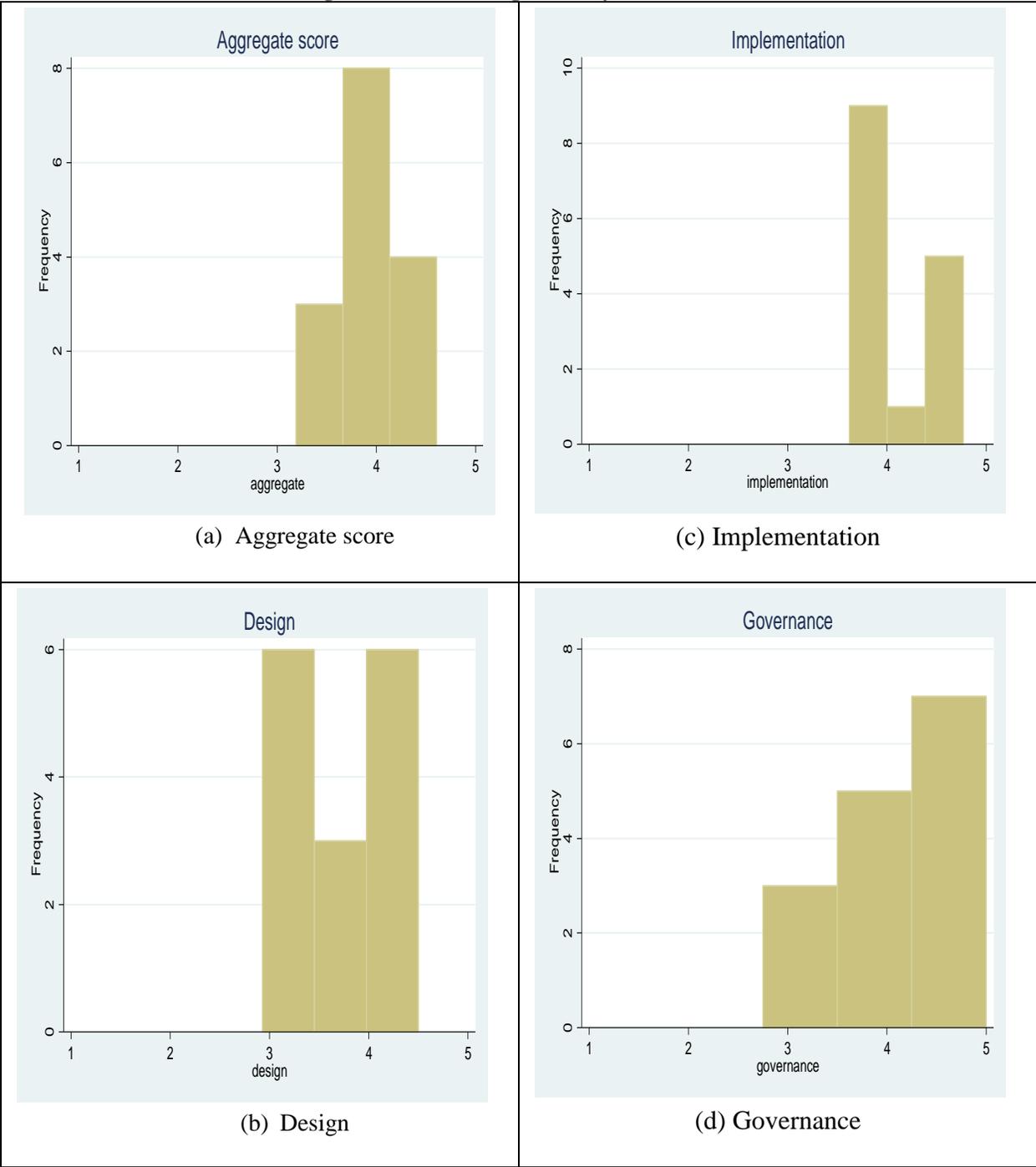
Summary of potential programmatic rationalization

Candidate cases

Case #	Directorate	Set of instruments subject to scrutiny	Case for consolidation			
			Strong	Uncertain	Non applicable	
1	Investment and finance	(1) B11 Corfo Inversión - Modalidad B11 (2) B14 Corfo Inversión - Modalidad B14 (3) B15 Corfo Inversión - Modalidad B15			x x x	
2	Investment and finance	(1) B21 Corfo Exportación - Comprador Extranjero (2) B22 Corfo Exportación - Modalidad Insumos Producción			x x	
3	Investment and finance	(1) Fondos de garantía a instituciones de garantías recíprocas, IGR (2) Fondos de garantía a instituciones de garantías recíprocas, IGR III			x x	
4	Programs	(1) Fortalecimiento de la asociatividad, Fondo de Ferias libres (2) fortalecimiento de la asociatividad, fondos para barrios comerciales (3) fortalecimiento de la asociatividad, fondos para fortalecimiento gremial y cooperativo (4) Fortalecimiento de la asociatividad, fondos para negocios asociativos		x x x x		
5	Programs	(1) Gestión de empresas, Fondo de asesorías empresariales (2) Gestión de empresas, promoción y canales de comercialización (3) Gestión de empresas, Formación empresarial (4) Gestión de empresas, redes de oportunidades de negocios		x x x x		
6	Innovation	(1) Bienes Públicos Estratégicos Para La Competitividad (2) Bienes Públicos Para La Competitividad		x x		
7	Innovation	(1) Consorcios Tecnológicos Empresariales (2) Consorcios Tecnológicos Para La Innovación			x x	
8	Innovation	(1) Gestión De La Innovación (2) Gestión De La Innovación - Desafío De Innovación Abierta (3) Gestión De La Innovación - Desarrollo De Capacidades (4) Gestión De La Innovación - Gestión De Portafolio (5) Gestión Innovación Pymes	x x		x x x	
9	Innovation	(1) Programa Innovación Tecnológica Empresarial - Innovación En Productos Y Procesos (Prototipo) (2) Programa Innovación Tecnológica Empresarial - Validación Y Empaquetamiento De Innovaciones			x x	
10	Innovation	(1) Prototipos De Innovación Empresarial (2) Prototipos De Innovación Regional (3) Prototipos De Innovación Social		x x x		
11	technological capabilities	(1) Oficinas De Transferencia Y Licenciamiento - Consolidación (2) Oficinas De Transferencia Y Licenciamiento - Formación	x x			
12	technological capabilities	(1) Programa de I+D Línea 1, Perfil De I+D Aplicada (2) Programa de I+D Línea 2, Proyecto De I+D Aplicada (3) Programa de I+D Línea 3, Valorización Y Protección P.I. (4) Programa de I+D Línea 4, Empaquetamiento Y Transferencia De I+D			x x x x	
13	technological capabilities	(1) Programas Tecnológicos (2) Programas Tecnológicos de Diversificación Acuícola			x x	
14	Entrepreneurship	(1) Subsidio Semilla de Asignación Flexible para el apoyo de emprendimientos de Desarrollo (2) Subsidio Semilla de Asignación Flexible para el Apoyo de Emprendimientos de Innovación (3) Subsidio Semilla de Asignación Flexible para Emprendimientos de Innovación Social	x x		x x	
Total		40 Instruments	6 to 3		14	23
		Cases		3	4	7

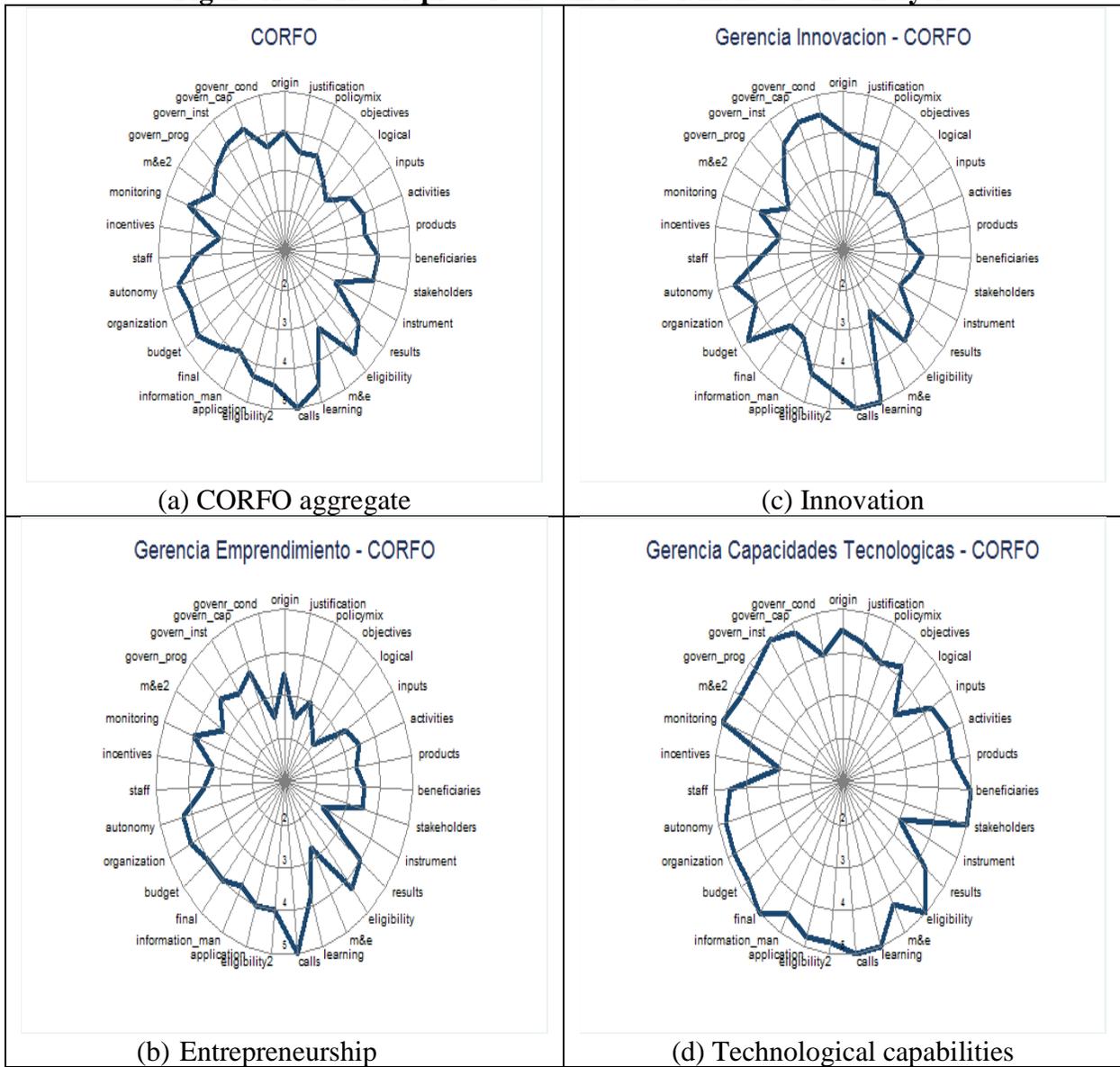
ANNEX 3. Tables and Figures Functional Analysis

Figure A3.1: Histograms by dimension



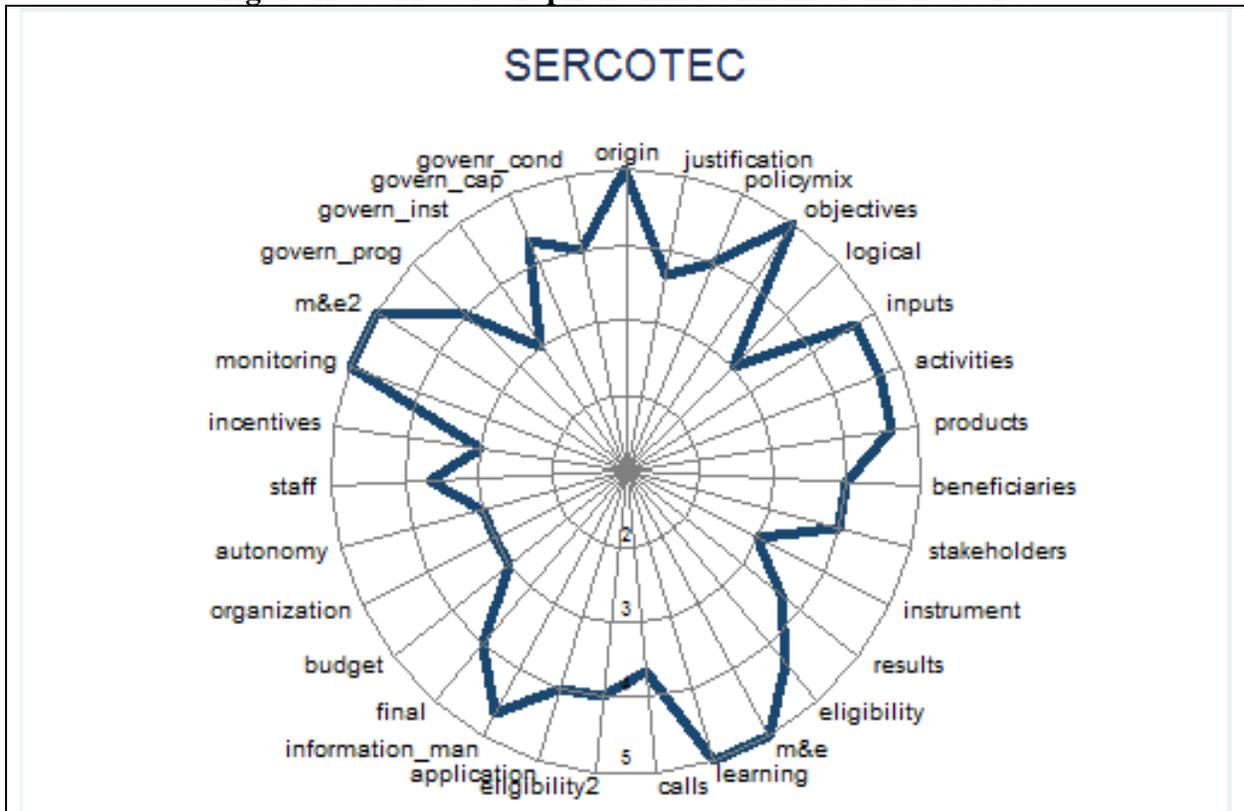
Source:

Figure A3.2: Radar plot of the different elements of the analysis



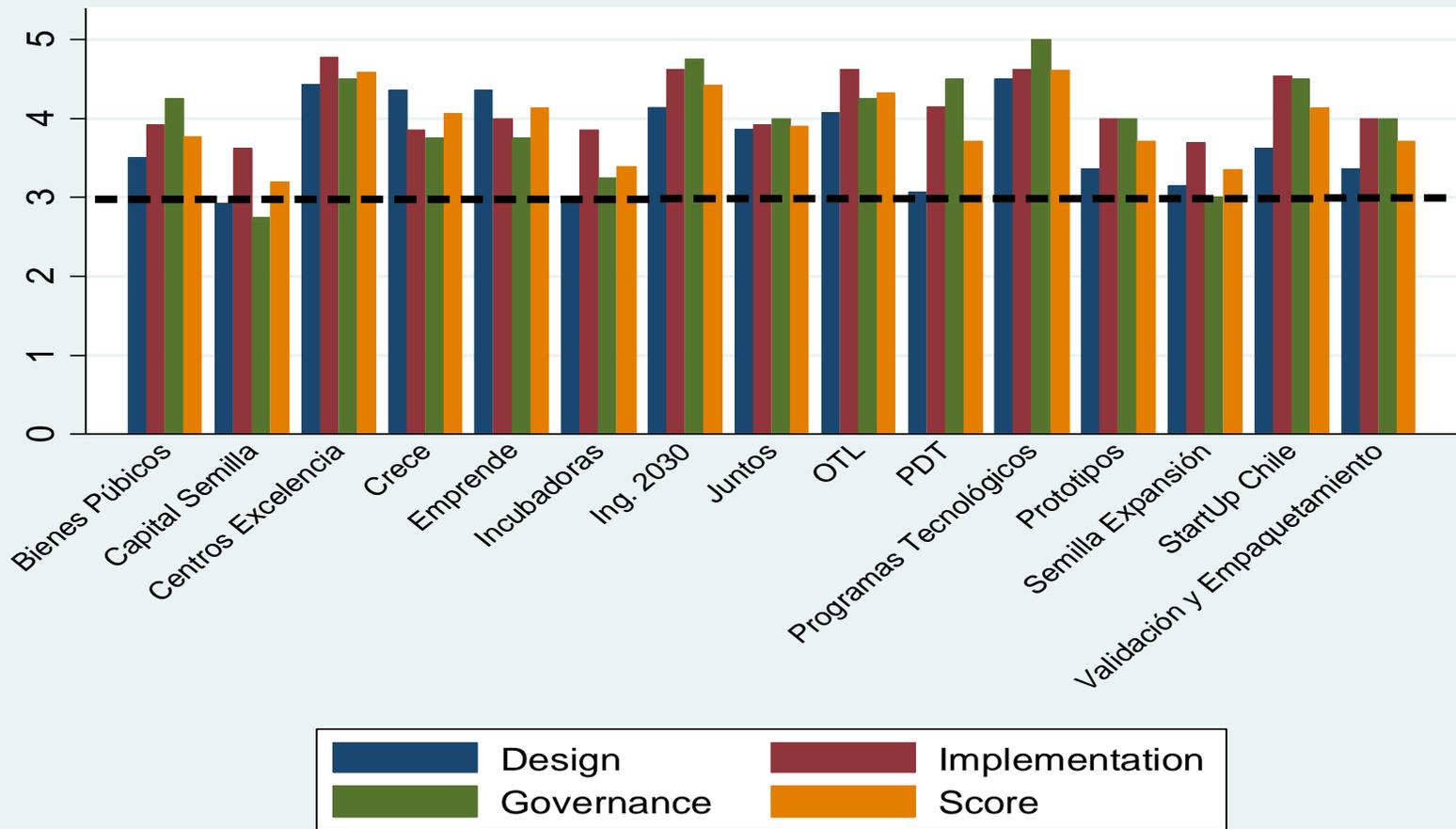
Source:

Figure A3.3: Radar Graph of SERCOTE Instrument Scores



Source:

Figure A3.4: Individual Instruments



Source:

Annex 3.1 Methodology Public Expenditure Review in Science Technology and Innovation

The Chile PER follows the methodology of Correa (2014) based on the rationale of the logical framework of STI interventions. There are four key areas that need to be evaluated when assessing the process by which the public expenditure in STI has an impact on the economy: i) the general context of the country and its innovation system and the portfolio of programs, ii) the functionality and governance of its institutions and instruments, iii) the efficiency of the system, understood as its ability to produce the expected outcomes with reasonable levels of inputs and activities, and iv) the effectiveness of the system, understood as its ability to generate outputs that cause actual impact. In this report we focus only on the first two areas of the full methodology. For part (ii) we focus on a sample of programs in two government agencies, namely, CORFO and SERCOCTEC. From the first agency, twelve instruments in three divisions of the agency were included and three key programs of the second.¹⁸

The cornerstone of the methodology is the focus at the level of the “instrument” as the unit of observation.¹⁹ It is important to highlight that the level of analysis – the “instrument” - and also the broader evaluation of the different areas of the logical framework are the distinctive features of this methodology compared to more traditional PERs, which tend to focus on more aggregate budgetary units and heavily focus on the efficiency part of the logical framework. Also, in order to gather information about each instrument of public policy in STI, we conducted semi-structured interviews with the managers of each one of the instruments included in the sample. While our methodology is more resource intensive than traditional analysis, the advantage of focusing in the different areas of the logical framework is that it allows us to conduct an in-depth diagnostic and to provide recommendations on how to improve STI policies and investments. For example, focusing on efficiency and effectiveness only, may impede the identification of the root causes of lack of impact or inefficient implementation. This is especially important for STI, since quite often programs are imitated in design from one country to the other and also some of the impacts expected are longer term so they can be measured only after several years of implementation.

The functional analysis evaluates the three main dimensions in public management of each instrument: design, implementation and governance. The design dimension covers 14 areas, implementation covers 13 and governance includes the remaining 4. An interview protocol and a scoring matrix based on best practices, that were developed in a previous application of the methodology in Colombia was used for this case. The interview protocol allowed the collection of very detailed information about each instrument via a semi-structured interview with the manager of each of the instruments. Two interviewers conducted each interview, each scoring the program independently, relying on the scoring matrix and the review of pertinent documentation to score

¹⁸ These instruments were selected by the institutions based on their relative importance within each directorate and institution, and strategic value. They represent almost half of the budget of instruments in 2015.

¹⁹ According to this terminology, an instrument is an intervention that explicitly invokes a specific causal mechanism to produce the expected results. Many documents often use the word “program” as a synonym of “instrument” in our sense while, in other cases, “program” refers to a collection of instruments that may or may not be part of the same budget line. For consistency, we will use the term “instrument” to indicate specific interventions and our unit of analysis.

each practice on a scale of 1 – 5, where each scoring level indicated specific approximations or deficiencies with respect to international best practices. Then a consolidated score was discussed and agreed by the two interviewers. Specifically, the objectives of the functional analysis are:

- i. Aide in the process of developing a strategic vision for STI public policy by using the information of public expenditure and investment in STI.
- ii. Establish key features of the functionality of the STI instruments and their governance using concrete and detailed evidence of each instrument focusing especially on the coherence of intervention instruments used and the expected outcomes; the quality of the design and implementation process; the quality of the monitoring and evaluation system; and, the assessment of gaps, redundancies and complementarities of the instruments both within and across institutions;
- iii. Formulate policy recommendations to bridge identified gaps, eliminate unnecessary redundancies and leverage complementarities across the portfolio, and adopt best practices of design and implementation in public management.

Annex 3.2 Cluster Analysis of Instrument Functional Scoring

The analysis of the management practices scores included a cluster analysis to find hidden patterns of performance in groups of instruments. The distance between instruments to perform the clustering was the Canberra distance, which is often used for positive measures that do not range across several orders of magnitude. Specifically, the measure is defined as

$$d^{CAD}(i, j) = \sum_{k=0}^{n-1} \frac{|y_{i,k} - y_{j,k}|}{|y_{i,k}| + |y_{j,k}|}$$

where “y” represents the scores for cases “i” and “j” for variable “k”. The clustering algorithm was Ward hierarchical that assigns cases to groups by minimizing the internal variance of each group that is formed. A second clustering was performed on the variables (i.e. management practice dimensions) using correlation as a measure of proximity and the same Ward algorithm to create the clusters.

The clustering was carried out in two stages because one of the programs was determined to be an outlier, namely, StartUp Chile. This program had a second feature that made it different from all other programs: it was the only one in which the consideration of alternative instruments was not meaningful, producing a missing score. Therefore, in order to have a full matrix of measures to compute similarity distances, a value had to be imputed to the missing score. In order not to alter the relationship across variables, the mean of the variable was imputed to explore the relationship across cases. Only the results of the second stage are shown in Tables A3.1, A3.2. and A3.3.

When the StartUp Chile case was excluded, the practice of incentives for staff based on results became constant (zero variance) so it was also excluded because it could not affect the similarities across practices or cases. The first observation is that the groups of instruments have not changed with respect to the first stage (not shown). They are robust to the exclusion of the outlier so the lessons we have derived so far have not changed. The second observation is that the groups of practices have suffered some changes. There are six groups instead of five and a few variables have changed group membership revealing that they were close to the boundaries of the groupings. The ones that still remain together are more closely related to each other.

Table A3.1: Variable Similarity Clusters (Second Stage)

Practice Variable	Category	Group
Origin	Design	1
Objectives	Design	1
Inputs	Design	1
Activities	Design	1
Products	Design	1
M&E by Design	Design	1
Finalization	Implementation	1
Monitoring of Processes	Implementation	1
M&E in Implementation	Implementation	1
Program Relationships	Governance	1
Justification	Design	2
Results	Design	2
Eligibility	Design	2
Eligibility in Implementation	Implementation	2
Information Management	Implementation	2
Policy Mix	Design	3
Logic Model	Design	3
Instrument	Design	3
Beneficiaries	Design	4
Stakeholders	Design	4
Staff	Implementation	4
Learning	Implementation	5
Jurisdictions (Capabilities)	Governance	5
Jurisdictions (Constraints)	Governance	5
Funding Calls	Implementation	6
Application	Implementation	6
Budget	Implementation	6
Organization	Implementation	6
Autonomy	Implementation	6
Institutional Relationships	Governance	6

Source:

The grouping of cases across performance similarity measures nicely validates our preliminary impression that instrument performance is tied to the directorate and institution in which they belong. The clustering grouped all the instruments in Technological Capabilities together, three of the four in Entrepreneurship and split the instruments from Innovation into two groups of two. StartUP Chile, which belongs in Entrepreneurship was classified as an outlier. This last result is not surprising since we had already observed that by being housed outside of the main office, it had developed a managerial style of its own.

Table A3.2: Groups of Instruments by Similarity of Performance (Stage Two)

Instrument	Directorate	Group
PDT	Innovation	1
Bienes Públicos	Innovation	1
Capital Semilla	Entrepreneurship	2
Semilla Expansión	Entrepreneurship	2
Incubadoras	Entrepreneurship	2
Prototipos	Innovation	3
Validación y Empaquetamiento	Innovation	3
Centros de Excelencia	Technological Capabilities	4
OTL	Technological Capabilities	4
Ing. 2030	Technological Capabilities	4
Programas Tecnológicos	Technological Capabilities	4
Emprende	SERCOTEC	5
Crece	SERCOTEC	5
Juntos	SERCOTEC	5

Source:

Table A3.3: Two Way Clustering of Practices and Instruments (Second Stage)

Practices Instruments	3	1	4	2	6	5	Overall Average
2	2.55	3.13	3.33	3.53	4	3	3.398
1	2.5	2.95	3.83	4.4	4.58	5	4.152
3	4	3.5	3	3.4	4.33	4.33	3.712
5	3.33	4.7	3.89	4.07	3.28	4.44	4.076
4	3.42	4.58	4.83	4.55	4.83	4.58	4.674
Overall Average	3.16	3.772	3.776	3.99	4.204	4.27	

Source:

The two way clustering table shows some clear opportunities for improvement in the upper left corner of the table. Group 3 of variables focusing on the policy mix, logic model and instrument selection shows a sharp opportunity for improvement for groups of instruments 1 (two instruments from the directorate of Innovation) and 2 (three instruments from the directorate of Entrepreneurship). To a certain extent, case groups 4 and 5 (all instruments from Technological Capabilities and the remaining instruments of the directorate of Innovation, respectively) are also shown to have opportunities for improvement on these three practices, as we had seen from simple inspection.

Variable group 4 also sharpens the focus on the relationship between beneficiaries, stakeholders, considered in design and the adequacy of staff. These practices are less than excellent across most groups, except the instruments in the directorate of Technological Capabilities.

Instruments from SERCOTEC, in group 5, perform very well in the first group of practices (across design with monitoring dimensions of implementation) and have most of the improvement

opportunities with the group 6 of practices, that relates Funding Calls, budget, organizational structure, autonomy of staff, all in implementation, with institutional relations in governance.

As we had already noted, programs in the Directorate de Technological Capabilities have superior performance across all dimensions. Groups of practices 4 and 5 have high average scores across most groups of instruments, except two cases we noted above. The dimensions with most opportunities for improvement have to do with key dimensions of design (policy mix, logic models and alternative instruments) and with the key design specifications, especially M&E with the cascading effects in implementation. The last practices are improvable mostly in Entrepreneurship and Innovation.

Annex 3.3 Cluster Analysis of the Policy Mix

The policy mix analysis was carried out with the 68 programs receiving funding as of 2015. A double cluster analysis was performed on the data to find relationships across variables and across programs. The relationships across variables using correlation as similarity measure show how features of the policy instruments may co-vary in ways that mere logical classification might not reveal. The relationships across programs using a binary measure of similarity, given that the feature variables are simple binary classification items, show how programs may have features in common across many categories that are rarely considered together when designing individual programs.

The analysis used only program features (variables) that had complete information and had variance across the programs with funding in 2015.

Groups of Programs

The clustering algorithm used a binary measure (distance between two programs is the proportion of features that are different, i.e. one has a 1 and the other a 0) shows 9 groups. The 9 groups actually map almost exactly onto four larger groups that coincide with the three CORFO sub-directorates, namely, Technological Capabilities, Entrepreneurship and Innovation and SERCOTEC as the fourth. The 9 groups arise by dividing Technological Capabilities in two, Entrepreneurship in three, Innovation in two and SERCOTEC in two. There is only one exception to the perfect fit of the groups to the sub-agencies: two programs belonging in the Innovation sub-directorate are classified with the first group of Entrepreneurship. These are “Programas de difusión tecnológica” and “Prototipos de Innovación Social”.

In order to characterize the groups of programs we use a clustering of program features (variables) to reduce the number of feature items to compare.

Groups of Features:

The 76 features that remained in the analysis were clustered into 18 groups cutting the groups at height 1, using a ward minimum variance hierarchical clustering algorithm. The groups of variables included the following features in each:

Group 1: Subsidies, company absorption improvement, entrepreneurship and innovation competency improvement and support and technical assistance goods and services.

Group 2: Several dimensions of business type supported (small, medium large, non-innovating, growth, consolidating and mature, ecosystem level improvements and businesses as a target.

Group 3: Business project financing, design and prototyping projects, licenses, certifications, patent application financing.

Group 4: Direct (DIRECTO?), vouchers, natural persons and productivity improvements in existing businesses

Group 5: New business for productive diversification, space and rent, meetings for diffusion and sector dialogue, business operations, and having an impact evaluation.

Group 6: Research and adoption of new technologies, S&T collaboration, company applied R&D, knowledge organizations, applied research and FIC source of funding.

Group 7: Collaboration to improve business productivity, public goods for innovation and entrepreneurship, information systems and web sites, FIE source of funding.

Group 8: Collaboration to improve supply by means of associativity, association instruments, business consortia, business organizations, NGOs.

Group 9: Strategic beneficiaries, basic research for innovation, ENI source of funding.

Group 10: Business environment for entrepreneurship, Intermediaries, Marketing and promotion, Seed funding, Business startup, micro enterprises.

Group 11: Feasibility studies, market research, exploratory studies.

Group 12: Social and environmental impact studies, Regional resources, Emergency funds.

Group 13: Consulting for technology absorption and for commercialization of technology, government entities.

Group 14: Assistance with processes and business models, equipment and machinery.

Group 15: Missions to fairs and expositions, basic research

Group 16: Primary sector, manufacturing and services sectors

Group 17: Horizontal instruments, General sector reach, Potentially innovative firms, Highly innovative firms, and high growth potential firms.

Group 18: Women entrepreneurs, Traditional firm and Regionally focused.

The groups of programs differ significantly in emphasis across these groups of features. Table 3.4 shows the proportion of features that programs in each group contain for each group of features. Both groups in Technological Capabilities (groups 1 and 2) have strong emphases in groups of features 1, 6 and 17. This is not surprising since group 1 contains competency variables, group 6 development of competencies through research and collaboration and group 17 indicates sector independence and high potential for innovation and growth, insofar as businesses are targeted. The differences between these two groups inside the same sub-directorate appears to be due to the greater emphases on the features of groups 3 and 8 for the second group of programs. Business projects, licensing and patent application financing are a greater feature of this second group of programs. In addition, this group also targets business association activities.

The patterns of the groups of programs 3, 4 and 5, belonging in the sub-directorate of Entrepreneurship (except for two Innovation programs) are much more heterogeneous. There seem to be fewer similarities across programs. The two groups of features that seem to create the greatest contrast are groups 2 and 3, especially between the groups of programs 3 and 4. The group 3 of programs seems to have the greatest emphasis on multiple mechanisms of support for businesses of various types and the business environment while the group 4 of programs is more focused on business projects, licensing, and the like. These are complementary means of business support that the programs in this sub-directorate seem to be aiming for. The programs' group 5 consists in only 3 programs of which one, StartUp is very large. Looking at the emphasis of this program for the group, the highlight seems to be on the variables of group 5, all variables related to the daily operational challenges of new business creation. Groups 3 and 4 of programs also have strong emphases on group 10 of variables, which contains several dimension of support for entrepreneurship and new business on the marketing and commercialization side of things. Groups of variables 17 and 18 also have similar patterns, but this pattern is true of the entire CORFO organization and only changes when comparing with SERCOTEC programs.

The large program from the Innovation directorate, namely, "*Programas de Difusion Tecnologica*", has the same two emphases on the variables in groups 2 and 10 as the rest of the programs of group 3 in Entrepreneurship. The fact that this program is one of the largest and is easily confounded with a large group of programs from the other sub-directorate calls for a more careful consideration of how the program interacts with the whole group and how it contributes to the desired division of labor between offices. The second program from Innovation that is in this group is rather small, oriented to social innovation. The rather recent introduction of social innovation into the set of innovation policy tools internationally may explain the difficulty in placing this instrument clearly in the policy mix.

The next two groups of programs, 6 and 7, belong in the sub-directorate Innovation. Both have similar strong emphases on groups of variables 1 and 2, targeting innovation competencies, technology absorption, use of subsidies, support for several types of businesses and the business environment.

Table A3.4: Groups of Programs in Rows and Groups of Features in Columns

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	0.81	0.07	0.07	0.33	0.42	0.91	0.11	0.02	0.44	0	0.7	0	0.6	0.56	0.39	0.06	0.91	0
2	0.75	0.14	0.42	0.44	0.38	0.98	0.03	0.58	0	0.02	0.46	0	0.29	0.38	0.13	0.16	0.88	0
3	0.68	0.86	0.05	0.14	0.55	0.06	0.16	0.35	0.03	0.79	0.09	0.06	0.76	0.32	0.14	0	1	0.03
4	0.63	0.47	0.85	0.16	0.6	0.08	0	0.05	0	0.9	0.96	0.17	0.42	0.31	0.13	0	0.98	0.13
5	0.83	0.38	0.33	0.33	0.73	0.11	0.17	0.07	0	0.5	0	0	0.22	0.17	0.5	0	1	0.11
6	0.65	0.98	0.1	0.35	0.24	0.47	0.5	0.64	0.07	0.5	0.73	0.07	0.2	0.1	0	0.55	0.76	0.07
7	0.77	0.97	0.23	0.75	0.07	0.33	0.09	0.07	0.05	0.35	0.36	0.02	0.26	0.21	0	0	1	0.02
8	0.56	0.28	0.17	0.5	0.25	0.13	0.07	0.4	0.08	0.42	0	0	0.08	0.75	0.25	0.81	0.2	0.75
9	0.71	0.38	0.08	0.67	0.13	0	0.04	0.1	0	0.47	0.06	0	0.22	0.25	0.33	0.54	0.33	1

Source:

Some contrasts between the two groups in this sub-directorate appear to be in groups of features 4, 8 and 16. In group 4, the main difference has to do with the fact that group 6 targets organizations and group 7 targets natural persons. In group 8, in direct connection to the targeting of organizations, there is an emphasis on inter-organizational collaboration and associativity that is not part of the second larger group of programs. Group 16 of variables is emphasized by group 6 of programs having to do with sectors, primary, manufacturing and services that are reached through the support of organizations rather than natural persons.

SERCOTEC also shows significant heterogeneity in its patterns of emphasis across features. There is one significant feature of all SERCOTEC programs, in both groups of programs 8 and 9, and it has to do with the full score on variables of group 18. All SERCOTEC programs target women in business, traditional businesses and have a regional focus. This is in contrast with CORFO that has very little if anything in these features for all three of the sub-directorates. Variables in group 16, especially its targeting of single sectors and of services, also distinguishes SERCOTEC programs from almost all others. The programs that target organizations, group 8, also offer support on business models and acquisition of equipment (variable group 14), which contrasts with the instruments in group 9 that target natural persons and generally do not.

It is also important to notice what SERCOTEC does not do at all: features represented in variable groups 6, 7, 9, 11 and 12. All of these involve some sort of R&D, studies, and collaborative activities for knowledge purposes. SERCOTEC does not focus on these areas at all.

One significant conclusion of this picture is that there seems not to be very significant duplication of effort. The fact that the groups fall under each of the organizational entities shows that the planning leads to an institutionalized division of labor. However, it is not clear that the focus of each of these institutional boundaries is clear enough to achieve important strategic objectives. Some areas seem to get very little coverage at all and in some cases complementarities should be sought but the division of labor is too strict to allow it. An example of the first problem, unclear foci, is the heterogeneous patterns of Entrepreneurship and SERCOTEC. They do not seem to have clear connection to strategic goals of the system and operate at low level individual level project objectives which shows up in the clustering exercise as a scatter of aims without clear emphases. An example of the second is the almost non-existent focus on knowledge creation in anything other than Technological Capabilities (variable group 6). Innovation only supports “encouragement of business R&D” and its only connection to knowledge organizations is through the recent creation of extension centers.

The main problem of the policy mix seems to be the lack of synergy rather than unnecessary duplication and overlap.

Annex 3.4 Summary of Results and Recommendations

Design	
Origin	The origin of interventions is generally documented and formal. However, the diagnosis that leads to an intervention often lacks a specific connection to the instrument target and comes from a loose interpretation of a country level general diagnostic. This latter connection must be done analytically.
Justification	Each instrument needs a clear specific diagnostic that: Identifies the market failure to be addressed Attempts to quantify extent of the failure and rationales for the intervention Provides some review of evidence of impact of similar instruments in other countries or best practices Analytically connects differences in context to the operation of each instrument
Relation with Policy mix	Each instrument needs to justify how this instrument complements existing instruments or fills a gap. This has to go beyond the institution and it has to demonstrate that it does not overlap with and undermine other instruments. The existing sub-committees must be continued and strengthened in their capacity to provide justification for each intervention.
Instrument and mechanism design	Creation of a unit of “intelligence” and planning that: Provides support in designing instruments Tests experimental designs and collects M&E and Impact evaluation information. Disseminates best practices and international evidence
Instrument objectives	Each instrument needs to specify objectives, which need to be clear, measurable and with clear targets. The connection of the instrument objectives with the change needed at the system level that comes from the diagnosis must be specified, otherwise there is no clear theory of change associated with the instrument.
Logic Model	Each instrument needs a fully specified logic model of the intervention. This will support the M&E framework and can be aggregated at the level of program for DIPRES. Rather than use the DIPRES requirement to produce the logic model, it is recommended that a full logic model be developed with agency criteria and the DIPRES requirement be satisfied as an easy summary of the main model.
Inputs, Activities and Products	We suggest that the model used by SERCOTEC deserves to be imitated on these practices.
Beneficiaries and Stakeholders	The connection of beneficiaries and stakeholders to the overall objectives of the instrument is the weak link for programs in the Directorate of Innovation and Entrepreneurship. In this regard, we suggest: Connecting beneficiary selection to system goals, especially when the main intervention is co-financing. Stakeholder analysis should include banks and financial institutions that is supposed to support innovation more than it is at present The connection of these dimensions to staffing is related to the cascading effect on follow up, especially in the regions, where more staff would be necessary to do so.

Expected results and impacts	Results and impacts are generally not well defined, especially the connection of project level measures performance with program level performance related to the changes that are needed in the system. This connects to the logic model, the nature of the diagnosis used to justify the program and the consideration of alternative instruments. It reveals the lack of an articulated theory of change that needs to be formulated.
Eligibility criteria	They work well in SERCOTEC and Technological capabilities but can be improved in the rest, especially in the connection that they have with the justification of the program and the definition of results. They operate adequately in program management but the logic of the targeting to results and market failure are not as clear in Entrepreneurship and to a lesser extent in Innovation.
Monitoring and Evaluation	Instruments in CORFO mostly lack and M&E framework. The agency seems to be working on one, and it is important that it has some uniform features across the agency, with similarly defined indicators linkable to the logic model of any instrument so that performance comparisons can be carried out across the policy mix. SERCOTEC has a stronger M&E system but it is important that they develop full logic models to provide the basis for interpretation of the monitoring they do. Planning for future impact evaluation must be carried out ahead of time to develop baselines for counterfactual analysis.

Implementation	
Learning and adjustments	There are best practices of learning for most instruments. A schedule of consultations and feedback from beneficiaries would be an important addition, using focus groups and revisions mid-term through the life of the instrument. Keeping full documentation is advised.
Eligibility in implementation	Some programs require better targeting. An improvement could be to monitor variables that are key to predicting success in order to improve instrument fine tuning and targeting – some of this work regarding data collection is already ongoing in SERCOTEC, but more analysis is needed to better refine selection criteria.
Application process	There are no significant problems with applications. A good practice seen in several instruments is the use of surveys of applicants to improve the application process by identifying bottlenecks and obstacles.
Information management	SERCOTEC and some CORFO instruments have very good information management. A bottleneck seems to be the splintering of information systems in CORFO since the central system seems not to be useful to all program managers, especially for M&E and process monitoring. They must be integrated seamlessly.
Participation and instrument finalization	There are clearer rules for finalization of beneficiary participation than there are for the end of the need for the instrument itself. Recommendation:

	Together with system goals in design, have clear implementation rules for gauging the need for an instrument when it either doesn't work anymore or the market failure no longer exists.
Budgets	Budgets seem adequate in CORFO, at least as far as program managers are concerned. No sub-execution is detected. However, SERCOTEC sees a large unmet demand that limits the reach of program in relation to its potential. Recommendation: Analyze the relation of the reach or coverage of the program to its desired effectiveness and adjust the budget accordingly.
Organization structure	Organization structures if relatively flat and adaptable, especially in CORFO. Staffing constraints in SERCOTEC pose a challenge. Recommendation: Analyze the dimension of organization, staffing and budgets related to SERCOTEC coverage needs in order to be effective at the system level.
Roles and autonomy	Most managers in CORFO have a sense of autonomy in making decisions that keep the program on target. Managers in SERCOTEC feel more constrained in this regard and an analysis of how their roles and autonomy could be enhanced in relation to the effectiveness of the program is recommended. The cluster analysis revealed that this is tied to the limitation in potential coverage of the program as well.
Staff and training	Staff are competent and have training opportunities but often have to cover many instrument obligations and are limited in their reach. Many issues arising in the regions are not as well covered. This is especially true in the case of SERCOTEC. Recommendation: Analyze the staffing assignments in relation to instrument goals and consider assigning more staff to the regional challenges and follow up needs of programs.
Incentives	Incentives are not aligned with instrument results, even if they are not purely financial in nature. Recommendation: Consider more targeted assignments and incentives related to instrument performance.
Process monitoring	Process monitoring is in place across instruments. However, the lack of a logic model and of an M&E system for program level results may undermine its effectiveness. Recommendation: Derive process monitoring criteria and indicators from a fully articulated logic model and integrated it in a seamless performance tracking system
M&E	A system to implement M&E design decisions must be in place and a unit to coordinate practices and use of information would insure consistency in content and time.

System Level Governance and Relations with other Instruments	
Relations across instruments	An instance or forum to have technical deliberations among program managers and supervisors that cover similar areas in different units and agencies could have a significant improvement impact.
Relations across agencies	Relations across agencies have instances that allow for coordination, such as the sub-committees in each directorate and the consultations between CORFO, SERCOTEC, the Ministry of the Economy and CONICYT. A formal role is also

	<p>played by the National Innovation Council. Some technical and operational issues have relatively informal channels for coordination that could be dealt with more systematically. Recommendation:</p> <p>Consider the formalization of coordination across agencies with periodical consultations at the operational level</p> <p>The meeting of sub-committees could be a venue for putting inter-agency coordination issues on the agenda</p>
<p>Jurisdiction interactions (capabilities)</p>	<p>There is some awareness of constraints due to general rules, such as the need to set guarantees, among other things. However, they are not always fully articulated nor understood as far as their effect on instrument goals is concerned. Furthermore, the ability to influence some of these was often underestimated, with the exception of SERCOTEC, which successfully influenced the rules on cooperatives. Recommendation:</p> <p>Analyze the overall effect of jurisdictional constraints on programs as part of the contextual diagnosis and define the “ideal” conditions for the effectiveness of the instrument</p> <p>Determine what can and cannot be influenced from the agency’s role and perspective</p>
<p>Jurisdiction Interactions (external constraints)</p>	<p>The comments from the previous item apply here except for including ways to adapt instruments for optimal performance given fixed constraints.</p>

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Appendix A.1.

Table A1.1 Chile Central Government Expenditures (CLP million; Current Prices) by Administrative Classification

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
01 OFFICE OF THE PRESIDENT	7,552	10,150	10,317	12,689	15,993	16,882	16,141	14,904	16,060	18,179	19,170
02 NATIONAL CONGRESS	55,011	60,700	65,476	73,298	82,905	86,589	87,739	99,297	102,888	112,891	118,161
03 JUDICIARY	171,580	192,404	219,653	243,549	316,514	328,806	341,658	354,470	361,432	392,375	505,178
04 GENERAL CONTROLLER	25,909	29,160	31,831	39,449	47,834	50,077	56,876	61,047	67,055	76,097	81,852
05 MINISTRY OF THE INTERIOR AND PUBLIC SECURITY	378,562	451,985	557,257	814,100	918,002	1,060,190	1,087,313	2,212,644	2,329,736	2,718,862	2,991,411
06 MINISTRY OF FOREIGN AFFAIRS	117,364	102,267	123,224	132,616	170,758	173,957	163,596	158,297	174,776	200,324	231,184
07 MINISTRY OF ECONOMY, INVESTMENT AND TOURISM	146,643	202,466	205,642	252,141	309,532	312,680	310,860	335,615	359,357	434,813	523,572
08 MINISTRY OF FINANCE	192,826	220,394	246,417	294,718	336,567	359,890	354,982	358,786	369,132	392,667	447,571
09 MINISTRY OF EDUCATION	2,170,753	2,391,363	2,772,198	3,465,350	4,086,814	4,444,065	4,686,908	5,290,791	5,865,506	6,430,187	7,466,772
10 MINISTRY OF JUSTICE	311,372	364,884	440,730	506,545	606,740	646,398	712,548	774,506	804,569	919,912	1,050,431
11 MINISTRY OF DEFENSE	1,274,132	1,325,500	1,469,245	1,583,122	1,818,835	2,035,725	2,151,638	1,337,310	1,408,441	1,505,886	1,623,475
12 MINISTRY OF PUBLIC WORKS	901,654	987,231	1,119,338	1,293,482	1,534,261	1,508,713	1,627,309	1,674,677	1,782,269	1,949,637	2,257,041
13 MINISTRY OF AGRICULTURE	177,054	193,157	227,131	271,336	295,770	307,467	329,671	360,129	379,282	422,396	447,080
14 MINISTRY OF NATIONAL GOODS	7,742	9,585	13,595	13,336	29,147	27,322	26,124	20,785	24,015	22,077	21,562
15 MINISTRY OF LABOR AND SOCIAL PROTECTION	2,927,711	3,146,999	3,304,776	3,715,802	4,246,833	4,587,662	4,853,765	5,152,416	5,320,656	5,643,296	6,136,010
16 MINISTRY OF HEALTH	1,712,942	2,008,563	2,378,656	2,769,501	3,438,389	3,768,907	4,070,500	4,547,729	4,987,988	5,693,703	6,673,053
17 MINISTRY OF MINING	22,358	24,992	32,726	40,736	53,692	34,292	32,454	38,595	36,747	39,904	44,672
18 MINISTRY OF HOUSING	544,683	581,975	708,943	950,168	1,186,563	1,317,100	1,502,475	1,568,645	1,471,997	1,573,386	1,706,224
19 MINISTRY OF TRANSPORT AND TELECOMMUNICATIONS	59,326	70,896	137,308	101,513	285,637	610,754	647,614	624,250	625,935	730,849	844,283
20 MINISTRY THE SECRETARY GENERAL	43,674	45,920	65,982	101,759	88,324	110,654	118,833	137,783	130,126	46,493	31,339
21 MINISTRY OF SOCIAL DEVELOPMENT	140,770	151,133	175,999	198,528	233,438	206,689	317,518	353,702	381,247	414,120	491,132
22 MINISTRY OF THE SECRETARY GENERAL OF THE PRESIDENT	17,462	19,511	22,462	28,297	36,213	29,242	7,188	7,546	8,541	12,249	14,555
23 PUBLIC MINISTRY	68,162	76,507	76,983	90,147	102,118	109,191	111,593	116,123	123,828	139,030	148,551
24 MINISTRY OF ENERGY	-	-	-	-	-	19,705	39,262	37,345	69,273	100,257	123,943
25 MINISTRY OF ENVIRONMENT	-	-	-	-	-	8,814	27,797	32,360	37,240	39,023	46,154
26 MINISTRY OF SPORTS	-	-	-	-	-	-	-	-	-	79,854	99,857
50 TREASURY	1,137,795	1,640,296	(440,029)	1,552,344	1,634,621	1,444,471	1,378,709	1,610,910	1,812,481	2,117,731	2,322,638
Total	12,613,037	14,308,037	13,965,858	18,544,527	21,875,498	23,606,243	25,061,070	27,280,662	29,050,578	32,226,199	36,466,869

Source: BOOST database on the basis of data obtained from DIPRES (February 5, 2016). Note: Executed amounts.

Table A1.2 Chile Central Government Expenditures (CLP million; Constant 2015 Prices) by Administrative Classification

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
01 OFFICE OF THE PRESIDENT	10,829	14,189	13,376	15,362	19,633	20,126	18,425	16,763	17,538	18,979	19,170
02 NATIONAL CONGRESS	78,878	84,856	84,891	88,740	101,775	103,227	100,154	111,688	112,357	117,858	118,161
03 JUDICIARY	246,021	268,973	284,786	294,855	388,553	391,989	390,003	398,702	394,693	409,639	505,178
04 GENERAL CONTROLLER	37,150	40,764	41,270	47,760	58,721	59,699	64,924	68,665	73,225	79,445	81,852
05 MINISTRY OF THE INTERIOR AND PUBLIC SECURITY	542,802	631,856	722,500	985,598	1,126,940	1,263,912	1,241,168	2,488,748	2,544,128	2,838,492	2,991,411
06 MINISTRY OF FOREIGN AFFAIRS	168,283	142,965	159,763	160,553	209,622	207,384	186,745	178,050	190,859	209,138	231,184
07 MINISTRY OF ECONOMY, INVESTMENT AND TOURISM	210,265	283,039	266,620	305,257	379,981	372,764	354,846	377,495	392,427	453,945	523,572
08 MINISTRY OF FINANCE	276,484	308,102	319,487	356,803	413,170	429,045	405,212	403,557	403,101	409,945	447,571
09 MINISTRY OF EDUCATION	3,112,541	3,343,026	3,594,234	4,195,359	5,016,975	5,298,024	5,350,105	5,951,001	6,405,273	6,713,116	7,466,772
10 MINISTRY OF JUSTICE	446,461	510,093	571,419	613,253	744,834	770,608	813,373	871,152	878,609	960,389	1,050,431
11 MINISTRY OF DEFENSE	1,826,918	1,852,994	1,904,918	1,916,622	2,232,803	2,426,904	2,456,095	1,504,186	1,538,051	1,572,145	1,623,475
12 MINISTRY OF PUBLIC WORKS	1,292,840	1,380,108	1,451,254	1,565,967	1,883,459	1,798,623	1,857,572	1,883,652	1,946,280	2,035,421	2,257,041
13 MINISTRY OF AGRICULTURE	253,870	270,025	294,482	328,496	363,087	366,548	376,319	405,067	414,185	440,981	447,080
14 MINISTRY OF NATIONAL GOODS	11,100	13,399	17,626	16,146	35,780	32,572	29,820	23,379	26,225	23,048	21,562
15 MINISTRY OF LABOR AND SOCIAL PROTECTION	4,197,908	4,399,372	4,284,737	4,498,572	5,213,415	5,469,214	5,540,572	5,795,359	5,810,284	5,891,601	6,136,010
16 MINISTRY OF HEALTH	2,456,108	2,807,887	3,083,996	3,352,923	4,220,969	4,493,129	4,646,475	5,115,216	5,447,003	5,944,226	6,673,053
17 MINISTRY OF MINING	32,058	34,938	42,430	49,317	65,912	40,881	37,046	43,411	40,129	41,659	44,672
18 MINISTRY OF HOUSING	780,996	813,577	919,165	1,150,330	1,456,626	1,570,190	1,715,075	1,764,388	1,607,456	1,642,615	1,706,224
19 MINISTRY OF TRANSPORT AND TELECOMMUNICATIONS	85,065	99,109	178,024	122,897	350,648	728,115	739,252	702,147	683,536	763,007	844,283
20 MINISTRY THE SECRETARY GENERAL	62,623	64,194	85,548	123,195	108,426	131,917	135,648	154,976	142,100	48,539	31,339
21 MINISTRY OF SOCIAL DEVELOPMENT	201,843	211,278	228,188	240,350	286,569	246,405	362,447	397,838	416,331	432,341	491,132
22 MINISTRY OF THE SECRETARY GENERAL OF THE PRESIDENT	25,038	27,276	29,122	34,258	44,455	34,861	8,205	8,488	9,327	12,788	14,555
23 PUBLIC MINISTRY	97,734	106,953	99,810	109,137	125,360	130,173	127,383	130,614	135,223	145,148	148,551
24 MINISTRY OF ENERGY	1,631,431	2,293,065	(570,510)	1,879,360	2,006,662	1,722,036	1,573,796	1,811,927	1,979,273	2,210,911	2,322,638
25 MINISTRY OF ENVIRONMENT	-	-	-	-	-	23,492	44,817	42,006	75,648	104,668	123,943
26 MINISTRY OF SPORTS	-	-	-	-	-	10,508	31,730	36,398	40,667	40,740	46,154
50 TREASURY	-	-	-	-	-	-	-	-	-	83,368	99,857
Total	18,085,246	20,002,038	18,107,137	22,451,113	26,854,376	28,142,348	28,607,207	30,684,872	31,723,929	33,644,151	36,466,869

Source: BOOST database on the basis of data obtained from DIPRES (February 5, 2016). Note: Executed amounts.

Table A1.3 Chile Central Government Expenditures (percent of GDP) by Administrative Classification

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
01 OFFICE OF THE PRESIDENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
02 NATIONAL CONGRESS	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
03 JUDICIARY	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
04 GENERAL CONTROLLER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
05 MINISTRY OF THE INTERIOR AND PUBLIC SECURITY	0.5	0.6	0.6	0.9	1.0	1.0	0.9	1.7	1.7	1.8	1.9
06 MINISTRY OF FOREIGN AFFAIRS	0.2	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1
07 MINISTRY OF ECONOMY, INVESTMENT AND TOURISM	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
08 MINISTRY OF FINANCE	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
09 MINISTRY OF EDUCATION	3.2	2.9	3.1	3.7	4.2	4.0	3.9	4.1	4.3	4.4	4.8
10 MINISTRY OF JUSTICE	0.5	0.4	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.7
11 MINISTRY OF DEFENSE	1.8	1.6	1.6	1.7	1.9	1.8	1.8	1.0	1.0	1.0	1.0
12 MINISTRY OF PUBLIC WORKS	1.3	1.2	1.2	1.4	1.6	1.4	1.3	1.3	1.3	1.3	1.4
13 MINISTRY OF AGRICULTURE	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
14 MINISTRY OF NATIONAL GOODS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15 MINISTRY OF LABOR AND SOCIAL PROTECTION	4.3	3.8	3.7	4.0	4.4	4.1	4.0	4.0	3.9	3.8	3.9
16 MINISTRY OF HEALTH	2.5	2.4	2.6	3.0	3.6	3.4	3.4	3.5	3.6	3.9	4.2
17 MINISTRY OF MINING	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
18 MINISTRY OF HOUSING	0.8	0.7	0.8	1.0	1.2	1.2	1.2	1.2	1.1	1.1	1.1
19 MINISTRY OF TRANSPORT AND TELECOMMUNICATIONS	0.1	0.1	0.2	0.1	0.3	0.6	0.5	0.5	0.5	0.5	0.5
20 MINISTRY THE SECRETARY GENERAL	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
21 MINISTRY OF SOCIAL DEVELOPMENT	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3
22 MINISTRY OF THE SECRETARY GENERAL OF THE PRESIDENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23 PUBLIC MINISTRY	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
24 MINISTRY OF ENERGY	-	-	-	-	-	0.0	0.0	0.0	0.1	0.1	0.1
25 MINISTRY OF ENVIRONMENT	-	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0
26 MINISTRY OF SPORTS	-	-	-	-	-	-	-	-	-	0.1	0.1
50 TREASURY	1.7	2.0	(0.5)	1.7	1.7	1.3	1.1	1.2	1.3	1.4	1.5
Total	18.3	17.4	15.4	19.8	22.7	21.3	20.7	21.1	21.2	21.8	23.2

Source: BOOST database on the basis of data obtained from DIPRES (February 5, 2016). Note: Executed amounts.

Table A1.4 Chile Central Government Expenditures (real growth, %) by Administrative Classification

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
01 OFFICE OF THE PRESIDENT	31.0	(5.7)	14.8	27.8	2.5	(8.5)	(9.0)	4.6	8.2	1.0
02 NATIONAL CONGRESS	7.6	0.0	4.5	14.7	1.4	(3.0)	11.5	0.6	4.9	0.3
03 JUDICIARY	9.3	5.9	3.5	31.8	0.9	(0.5)	2.2	(1.0)	3.8	23.3
04 GENERAL CONTROLLER	9.7	1.2	15.7	23.0	1.7	8.8	5.8	6.6	8.5	3.0
05 MINISTRY OF THE INTERIOR AND PUBLIC SECURITY	16.4	14.3	36.4	14.3	12.2	(1.8)	100.5	2.2	11.6	5.4
06 MINISTRY OF FOREIGN AFFAIRS	(15.0)	11.7	0.5	30.6	(1.1)	(10.0)	(4.7)	7.2	9.6	10.5
07 MINISTRY OF ECONOMY, INVESTMENT AND TOURISM	34.6	(5.8)	14.5	24.5	(1.9)	(4.8)	6.4	4.0	15.7	15.3
08 MINISTRY OF FINANCE	11.4	3.7	11.7	15.8	3.8	(5.6)	(0.4)	(0.1)	1.7	9.2
09 MINISTRY OF EDUCATION	7.4	7.5	16.7	19.6	5.6	1.0	11.2	7.6	4.8	11.2
10 MINISTRY OF JUSTICE	14.3	12.0	7.3	21.5	3.5	5.5	7.1	0.9	9.3	9.4
11 MINISTRY OF DEFENSE	1.4	2.8	0.6	16.5	8.7	1.2	(38.8)	2.3	2.2	3.3
12 MINISTRY OF PUBLIC WORKS	6.8	5.2	7.9	20.3	(4.5)	3.3	1.4	3.3	4.6	10.9
13 MINISTRY OF AGRICULTURE	6.4	9.1	11.6	10.5	1.0	2.7	7.6	2.3	6.5	1.4
14 MINISTRY OF NATIONAL GOODS	20.7	31.6	(8.4)	121.6	(9.0)	(8.4)	(21.6)	12.2	(12.1)	(6.4)
15 MINISTRY OF LABOR AND SOCIAL PROTECTION	4.8	(2.6)	5.0	15.9	4.9	1.3	4.6	0.3	1.4	4.1
16 MINISTRY OF HEALTH	14.3	9.8	8.7	25.9	6.4	3.4	10.1	6.5	9.1	12.3
17 MINISTRY OF MINING	9.0	21.4	16.2	33.6	(38.0)	(9.4)	17.2	(7.6)	3.8	7.2
18 MINISTRY OF HOUSING	4.2	13.0	25.1	26.6	7.8	9.2	2.9	(8.9)	2.2	3.9
19 MINISTRY OF TRANSPORT AND TELECOMUNICATIONS	16.5	79.6	(31.0)	185.3	107.6	1.5	(5.0)	(2.7)	11.6	10.7
20 MINISTRY THE SECRETARY GENERAL	2.5	33.3	44.0	(12.0)	21.7	2.8	14.2	(8.3)	(65.8)	(35.4)
21 MINISTRY OF SOCIAL DEVELOPMENT	4.7	8.0	5.3	19.2	(14.0)	47.1	9.8	4.6	3.8	13.6
22 MINISTRY OF THE SECRETARY GENERAL OF THE PRESIDENT	8.9	6.8	17.6	29.8	(21.6)	(76.5)	3.5	9.9	37.1	13.8
23 PUBLIC MINISTRY	9.4	(6.7)	9.3	14.9	3.8	(2.1)	2.5	3.5	7.3	2.3
24 MINISTRY OF ENERGY	40.6	(124.9)	(429.4)	6.8	(14.2)	(8.6)	15.1	9.2	11.7	5.1
25 MINISTRY OF ENVIRONMENT						90.8	(6.3)	80.1	38.4	18.4
26 MINISTRY OF SPORTS						202.0	14.7	11.7	0.2	13.3
50 TREASURY										19.8
Total	10.6	(9.5)	24.0	19.6	4.8	1.7	7.3	3.4	6.1	8.4

Source: BOOST database on the basis of data obtained from DIPRES (February 5, 2016). Note: Executed amounts.

Table A1.5 Chile Central Government Expenditures (percent of total expenditure) by Administrative Classification

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
01 OFFICE OF THE PRESIDENT	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
02 NATIONAL CONGRESS	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3
03 JUDICIARY	1.4	1.3	1.6	1.3	1.4	1.4	1.4	1.3	1.2	1.2	1.4
04 GENERAL CONTROLLER	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
05 MINISTRY OF THE INTERIOR AND PUBLIC SECURITY	3.0	3.2	4.0	4.4	4.2	4.5	4.3	8.1	8.0	8.4	8.2
06 MINISTRY OF FOREIGN AFFAIRS	0.9	0.7	0.9	0.7	0.8	0.7	0.7	0.6	0.6	0.6	0.6
07 MINISTRY OF ECONOMY, INVESTMENT AND TOURISM	1.2	1.4	1.5	1.4	1.4	1.3	1.2	1.2	1.2	1.3	1.4
08 MINISTRY OF FINANCE	1.5	1.5	1.8	1.6	1.5	1.5	1.4	1.3	1.3	1.2	1.2
09 MINISTRY OF EDUCATION	17.2	16.7	19.8	18.7	18.7	18.8	18.7	19.4	20.2	20.0	20.5
10 MINISTRY OF JUSTICE	2.5	2.6	3.2	2.7	2.8	2.7	2.8	2.8	2.8	2.9	2.9
11 MINISTRY OF DEFENSE	10.1	9.3	10.5	8.5	8.3	8.6	8.6	4.9	4.8	4.7	4.5
12 MINISTRY OF PUBLIC WORKS	7.1	6.9	8.0	7.0	7.0	6.4	6.5	6.1	6.1	6.0	6.2
13 MINISTRY OF AGRICULTURE	1.4	1.3	1.6	1.5	1.4	1.3	1.3	1.3	1.3	1.3	1.2
14 MINISTRY OF NATIONAL GOODS	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
15 MINISTRY OF LABOR AND SOCIAL PROTECTION	23.2	22.0	23.7	20.0	19.4	19.4	19.4	18.9	18.3	17.5	16.8
16 MINISTRY OF HEALTH	13.6	14.0	17.0	14.9	15.7	16.0	16.2	16.7	17.2	17.7	18.3
17 MINISTRY OF MINING	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
18 MINISTRY OF HOUSING	4.3	4.1	5.1	5.1	5.4	5.6	6.0	5.8	5.1	4.9	4.7
19 MINISTRY OF TRANSPORT AND TELECOMMUNICATIONS	0.5	0.5	1.0	0.5	1.3	2.6	2.6	2.3	2.2	2.3	2.3
20 MINISTRY THE SECRETARY GENERAL	0.3	0.3	0.5	0.5	0.4	0.5	0.5	0.5	0.4	0.1	0.1
21 MINISTRY OF SOCIAL DEVELOPMENT	1.1	1.1	1.3	1.1	1.1	0.9	1.3	1.3	1.3	1.3	1.3
22 MINISTRY OF THE SECRETARY GENERAL OF THE PRESIDENT	0.1	0.1	0.2	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0
23 PUBLIC MINISTRY	0.5	0.5	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4
24 MINISTRY OF ENERGY	-	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.2	0.3	0.3
25 MINISTRY OF ENVIRONMENT	-	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
26 MINISTRY OF SPORTS	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3
50 TREASURY	9.0	11.5	(3.2)	8.4	7.5	6.1	5.5	5.9	6.2	6.6	6.4
Total	100.0										

Source:

Table A1.6 Chile Central Government Expenditures (US\$ Million, Current Prices) by Administrative Classification

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
01 OFFICE OF THE PRESIDENT	13	19	20	24	29	33	33	31	32	32	29
02 NATIONAL CONGRESS	98	114	125	140	148	170	181	204	208	198	181
03 JUDICIARY	307	363	420	466	564	644	706	729	730	688	772
04 GENERAL CONTROLLER	46	55	61	76	85	98	118	125	135	133	125
05 MINISTRY OF THE INTERIOR AND PUBLIC SECURITY	676	852	1,067	1,558	1,637	2,078	2,248	4,548	4,704	4,767	4,573
06 MINISTRY OF FOREIGN AFFAIRS	210	193	236	254	304	341	338	325	353	351	353
07 MINISTRY OF ECONOMY, INVESTMENT AND TOURISM	262	382	394	483	552	613	643	690	726	762	800
08 MINISTRY OF FINANCE	344	416	472	564	600	705	734	738	745	688	684
09 MINISTRY OF EDUCATION	3,878	4,510	5,306	6,633	7,287	8,710	9,690	10,876	11,843	11,274	11,415
10 MINISTRY OF JUSTICE	556	688	844	970	1,082	1,267	1,473	1,592	1,624	1,613	1,606
11 MINISTRY OF DEFENSE	2,276	2,500	2,812	3,030	3,243	3,990	4,449	2,749	2,844	2,640	2,482
12 MINISTRY OF PUBLIC WORKS	1,611	1,862	2,142	2,476	2,736	2,957	3,365	3,443	3,599	3,418	3,450
13 MINISTRY OF AGRICULTURE	316	364	435	519	527	603	682	740	766	741	683
14 MINISTRY OF NATIONAL GOODS	14	18	26	26	52	54	54	43	48	39	33
15 MINISTRY OF LABOR AND SOCIAL PROTECTION	5,230	5,935	6,325	7,112	7,572	8,991	10,035	10,591	10,743	9,894	9,380
16 MINISTRY OF HEALTH	3,060	3,788	4,553	5,301	6,131	7,386	8,416	9,348	10,071	9,983	10,202
17 MINISTRY OF MINING	40	47	63	78	96	67	67	79	74	70	68
18 MINISTRY OF HOUSING	973	1,097	1,357	1,819	2,116	2,581	3,106	3,225	2,972	2,759	2,608
19 MINISTRY OF TRANSPORT AND TELECOMUNICATIONS	106	134	263	194	509	1,197	1,339	1,283	1,264	1,281	1,291
20 MINISTRY THE SECRETARY GENERAL	78	87	126	195	157	217	246	283	263	82	48
21 MINISTRY OF SOCIAL DEVELOPMENT	251	285	337	380	416	405	656	727	770	726	751
22 MINISTRY OF THE SECRETARY GENERAL OF THE PRESIDENT	31	37	43	54	65	57	15	16	17	21	22
23 PUBLIC MINISTRY	122	144	147	173	182	214	231	239	250	244	227
24 MINISTRY OF ENERGY	-	-	-	-	-	39	81	77	140	176	189
25 MINISTRY OF ENVIRONMENT	-	-	-	-	-	17	57	67	75	68	71
26 MINISTRY OF SPORTS	-	-	-	-	-	-	-	-	-	140	153
50 TREASURY	2,033	3,093	(842)	2,971	2,914	2,831	2,851	3,311	3,660	3,713	3,551
Total	22,533	26,982	26,731	35,495	39,003	46,264	51,815	56,079	58,656	56,503	55,749

Source:

Table A1.7 Chile Central Government Expenditures (CLP million; Current Prices) by Economic Classification

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
21 PERSONEL SPENDING	2,517,837	2,756,792	3,107,583	3,550,086	4,210,586	4,660,177	4,946,388	5,409,751	5,893,703	6,510,307	7,208,148
22 GOVERNMENT CONSUMPTION	988,817	1,127,803	1,330,529	1,561,348	1,847,198	1,903,385	2,014,959	2,211,244	2,418,543	2,735,253	3,071,733
23 SOCIAL SECURITY	3,038,880	3,299,626	3,531,261	4,018,996	4,515,691	4,887,177	5,045,250	5,255,187	5,430,015	5,861,194	6,321,757
24 CURRENT TRANSFERS	3,286,323	3,654,494	4,297,895	5,419,973	6,456,903	7,437,649	7,583,023	8,600,583	9,607,881	10,663,073	12,162,331
25 TAX REFUND	11,008	9,956	11,374	13,878	12,449	14,714	16,418	19,718	14,775	25,334	21,133
26 OTHER CURRENT SPENDING	16,183	11,214	16,941	171,211	322,558	35,963	40,578	58,265	27,406	39,529	60,014
29 NON-FINANCIAL ASSET ACCUMULATION	116,032	136,450	180,944	202,743	287,229	260,412	459,756	347,118	281,819	378,398	546,154
31 INVESTMENT INITIATIVES	1,093,206	1,238,282	1,608,842	1,813,012	2,191,372	2,085,033	2,144,484	2,328,361	2,442,446	2,600,745	3,111,710
33 CAPITAL TRANSFERS	1,293,411	1,822,004	-354,419	1,602,080	1,808,289	2,030,247	2,356,180	2,484,993	2,303,164	2,656,445	3,043,727
34 OFBT SERVICE	251,340	251,416	234,907	191,201	223,225	291,485	454,035	565,441	630,827	755,920	920,161
Total	12,613,037	14,308,037	13,965,858	18,544,527	21,875,498	23,606,243	25,061,070	27,280,662	29,050,578	32,226,199	36,466,869

Source: BOOST database on the basis of data obtained from DIPRES (February 5, 2016). Note: Executed amounts.

Table A1.8 Chile Central Government Expenditures (CLP million, Constant 2015 Prices) by Economic Classification

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
21 PERSONEL SPENDING	3,610,209	3,853,880	4,029,071	4,297,946	5,168,918	5,555,663	5,646,301	6,084,806	6,436,065	6,796,761	7,208,148
22 GOVERNMENT CONSUMPTION	1,417,819	1,576,621	1,725,069	1,890,261	2,267,621	2,269,134	2,300,075	2,487,173	2,641,107	2,855,604	3,071,733
23 SOCIAL SECURITY	4,357,308	4,612,739	4,578,382	4,865,636	5,543,465	5,826,283	5,759,152	5,910,954	5,929,707	6,119,087	6,321,757
24 CURRENT TRANSFERS	4,712,105	5,108,830	5,572,345	6,561,743	7,926,498	8,866,846	8,656,019	9,673,805	10,492,037	11,132,249	12,162,331
25 TAX REFUND	15,785	13,918	14,747	16,801	15,282	17,541	18,741	22,178	16,135	26,449	21,133
26 OTHER CURRENT SPENDING	23,205	15,677	21,964	207,279	395,972	42,874	46,320	65,536	29,928	41,269	60,014
29 NON-FINANCIAL ASSET ACCUMULATION	166,372	190,751	234,599	245,453	352,602	310,452	524,811	390,433	307,753	395,047	546,154
31 INVESTMENT INITIATIVES	1,567,497	1,731,067	2,085,911	2,194,941	2,690,130	2,485,687	2,447,928	2,618,905	2,667,210	2,715,178	3,111,710
33 CAPITAL TRANSFERS	1,854,562	2,547,085	-459,515	1,939,573	2,219,856	2,420,374	2,689,579	2,795,082	2,515,110	2,773,328	3,043,727
34 OFBT SERVICE	360,385	351,469	304,564	231,479	274,031	347,496	518,281	636,000	688,878	789,181	920,161
Total	18,085,246	20,002,038	18,107,137	22,451,113	26,854,376	28,142,348	28,607,207	30,684,872	31,723,929	33,644,151	36,466,869

Source: BOOST database on the basis of data obtained from DIPRES (February 5, 2016). Note: Executed amounts.

Table A1.9 Chile Central Government Expenditures (percent of GDP) by Economic Classification

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
21 PERSONEL SPENDING	3.7	3.4	3.4	3.8	4.4	4.2	4.1	4.2	4.3	4.4	4.6
22 GOVERNMENT CONSUMPTION	1.4	1.4	1.5	1.7	1.9	1.7	1.7	1.7	1.8	1.9	2.0
23 SOCIAL SECURITY	4.4	4.0	3.9	4.3	4.7	4.4	4.2	4.1	4.0	4.0	4.0
24 CURRENT TRANSFERS	4.8	4.5	4.8	5.8	6.7	6.7	6.3	6.7	7.0	7.2	7.7
25 TAX REFUND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26 OTHER CURRENT SPENDING	0.0	0.0	0.0	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0
29 NON-FINANCIAL ASSET ACCUMULATION	0.2	0.2	0.2	0.2	0.3	0.2	0.4	0.3	0.2	0.3	0.3
31 INVESTMENT INITIATIVES	1.6	1.5	1.8	1.9	2.3	1.9	1.8	1.8	1.8	1.8	2.0
33 CAPITAL TRANSFERS	1.9	2.2	(0.4)	1.7	1.9	1.8	1.9	1.9	1.7	1.8	1.9
34 OFBT SERVICE	0.4	0.3	0.3	0.2	0.2	0.3	0.4	0.4	0.5	0.5	0.6
Total	18.3	17.4	15.4	19.8	22.7	21.3	20.7	21.1	21.2	21.8	23.2

Source: BOOST database on the basis of data obtained from DIPRES (February 5, 2016). Note: Executed amounts.

Table A1.10 Chile Central Government Expenditures (real growth, percent) by Economic Classification

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
21 PERSONEL SPENDING		6.7	4.5	6.7	20.3	7.5	1.6	7.8	5.8	5.6	6.1
22 GOVERNMENT CONSUMPTION		11.2	9.4	9.6	20.0	0.1	1.4	8.1	6.2	8.1	7.6
23 SOCIAL SECURITY		5.9	(0.7)	6.3	13.9	5.1	(1.2)	2.6	0.3	3.2	3.3
24 CURRENT TRANSFERS		8.4	9.1	17.8	20.8	11.9	(2.4)	11.8	8.5	6.1	9.3
25 TAX REFUND		(11.8)	6.0	13.9	(9.0)	14.8	6.8	18.3	(27.2)	63.9	(20.1)
26 OTHER CURRENT SPENDING		(32.4)	40.1	843.7	91.0	(89.2)	8.0	41.5	(54.3)	37.9	45.4
29 NON-FINANCIAL ASSET ACCUMULATION		14.7	23.0	4.6	43.7	(12.0)	69.0	(25.6)	(21.2)	28.4	38.3
31 INVESTMENT INITIATIVES		10.4	20.5	5.2	22.6	(7.6)	(1.5)	7.0	1.8	1.8	14.6
33 CAPITAL TRANSFERS		37.3	(118.0)	(522.1)	14.5	9.0	11.1	3.9	(10.0)	10.3	9.7
34 OFBT SERVICE		(2.5)	(13.3)	(24.0)	18.4	26.8	49.1	22.7	8.3	14.6	16.6
Total		10.6	(9.5)	24.0	19.6	4.8	1.7	7.3	3.4	6.1	8.4

Source: BOOST database on the basis of data obtained from DIPRES (February 5, 2016). Note: Executed amounts.

Table A1.11 Chile Central Government Expenditures (percent of total expenditure) by Economic Classification

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
21 PERSONEL SPENDING	20.0	19.3	22.3	19.1	19.2	19.7	19.7	19.8	20.3	20.2	19.8
22 GOVERNMENT CONSUMPTION	7.8	7.9	9.5	8.4	8.4	8.1	8.0	8.1	8.3	8.5	8.4
23 SOCIAL SECURITY	24.1	23.1	25.3	21.7	20.6	20.7	20.1	19.3	18.7	18.2	17.3
24 CURRENT TRANSFERS	26.1	25.5	30.8	29.2	29.5	31.5	30.3	31.5	33.1	33.1	33.4
25 TAX REFUND	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
26 OTHER CURRENT SPENDING	0.1	0.1	0.1	0.9	1.5	0.2	0.2	0.2	0.1	0.1	0.2
29 NON-FINANCIAL ASSET ACCUMULATION	0.9	1.0	1.3	1.1	1.3	1.1	1.8	1.3	1.0	1.2	1.5
31 INVESTMENT INITIATIVES	8.7	8.7	11.5	9.8	10.0	8.8	8.6	8.5	8.4	8.1	8.5
33 CAPITAL TRANSFERS	10.3	12.7	(2.5)	8.6	8.3	8.6	9.4	9.1	7.9	8.2	8.3
34 OFBT SERVICE	2.0	1.8	1.7	1.0	1.0	1.2	1.8	2.1	2.2	2.3	2.5
Total	100.0										

Source:

Table A1.12 Chile Central Government Expenditures (US\$ Million, Current Prices) by Economic Classification

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
21 PERSONEL SPENDING	4,498	5,199	5,948	6,795	7,507	9,133	10,227	11,120	11,900	11,415	11,020
22 GOVERNMENT CONSUMPTION	1,766	2,127	2,547	2,988	3,294	3,730	4,166	4,545	4,883	4,796	4,696
23 SOCIAL SECURITY	5,429	6,222	6,759	7,692	8,051	9,578	10,431	10,803	10,964	10,277	9,664
24 CURRENT TRANSFERS	5,871	6,892	8,226	10,374	11,513	14,577	15,678	17,680	19,399	18,696	18,593
25 TAX REFUND	20	19	22	27	22	29	34	41	30	44	32
26 OTHER CURRENT SPENDING	29	21	32	328	575	70	84	120	55	69	92
29 NON-FINANCIAL ASSET ACCUMULATION	207	257	346	388	512	510	951	714	569	663	835
31 INVESTMENT INITIATIVES	1,953	2,335	3,079	3,470	3,907	4,086	4,434	4,786	4,932	4,560	4,757
33 CAPITAL TRANSFERS	2,311	3,436	-678	3,066	3,224	3,979	4,871	5,108	4,650	4,658	4,653
34 OFBT SERVICE	449	474	450	366	398	571	939	1,162	1,274	1,325	1,407
Total	22,533	26,982	26,731	35,495	39,003	46,264	51,815	56,079	58,656	56,503	55,749

Source: BOOST database on the basis of data obtained from DIPRES (February 5, 2016). Note: Executed amounts.

Table A.13. Chile PER: Public Spending Subject to Analysis

	CLP	% of GDP	% total spending
Ministry of Health	6,673,053	4.2	18.3
- Hospital spending	3,100,000	2.0	8.5
Ministry of Education	7,466,772	4.8	20.5
- Program 1: ICT (<i>ENLACES</i>)	67,120	0.04	0.2
- Program 2: School feeding (<i>PAE</i>)	628,000	0.40	1.7
- Program 3: Textbooks (<i>Textos Escolares</i>)	55,434	0.02	0.1
Ministry of Economy	14,663,397	0.3	1.4
- Innovation & entrepreneurship	5,865,359	0.1	0.6
PER related expenditures	9,715,913	2.6	11.1
Total central government expenditure	36,466,869	23.2	100.0

Source: Staff calculations. Note: percent of nominal GDP in 2015 and percent of total spending in 2015.

Appendix B: Definition of Peer Countries

The Chile PER will feature a systematic benchmarking exercise using a pre-defined set of structural and regional peer countries as well as the OECD. The structural peers were selected using the *MFM Find My Friends Tool* as follows:

Structural Peers

We selected countries with similar economic characteristics to Chile using the following criteria:

- Being a high income OECD country.
- Exporter of natural resources greater than 30% of total export.
- Population greater than 5 million people.
- Having a sovereign wealth fund.

These criteria Deliver 3 countries: Australia, Canada and Norway.

Regional peers

Under this classification, we select countries in the Pacific Alliance, including Colombia, Mexico and Peru given the interest of the Government of Chile in this regional group of peers.

OECD

This includes all 34 member countries.

These criteria deliver the following groups of countries:

Country	Country group by income level ¹	Region ¹	Population Million inhabitants ²	Natural resource exports % of total ³	Sovereign funds ⁴	Fiscal rules ⁴	Exchange rate regime ⁴	Monetary policy regime ⁴	GDP growth 2010-2015 ⁵	Investment % of GDP ²	Per capita GDP US\$ ²
Chile	High income: OECD	LAC	18.0	63.7	Yes	Budget	Free floating	Inflation target	4.1	22.7	13,362
Structural peers											
Australia	High income: OECD	EAP	23.5	65.2	Yes	Expenditures, revenues, Budget	Free floating	Inflation target	2.6	27.3	61,980
Canada	High income: OECD	NAM	35.5	34.2	Yes	None	Free floating	Inflation target	2.3	23.7	50,231
Norway	High income: OECD	ECA	5.1	72.2	Yes	Budget	Free floating	Inflation target	1.5	23.7	97,300
Regional peers											
Colombia	Upper middle income	LAC	47.8	57.7	No	Expenditure, debt	Floating	Inflation target	4.5	25.5	7,904
Mexico	Upper middle income	LAC	125.4	20.1	Yes	Expenditure, debt	Free floating	Inflation target	3.2	21.0	10,326
Peru	Upper middle income	LAC	30.9	71.6	Yes	Expenditure, debt	Floating	Inflation target	5.4	25.9	6,541

Source: (1) WDI; (2) WDI and authorities, Chile (2015), other countries (2014) (3) WITS, average 2006-2012; (4) IMF; (5) Authorities and WEO (April 2016), compound growth.

Appendix C: BOOST Databases and Budget Classification

- 1. The World Bank, in coordination with DIPRES and the Office of the Comptroller General, has developed a BOOST database for Chile to facilitate budget analysis of this PER.** The BOOST initiative is a World Bank collaborative effort launched in 2010 to facilitate access to budget data and promote its effective use to improve government performance and strengthen transparency and accountability. BOOST organizes a country's budget data and presents it in a user-friendly format using a pivot table interface. BOOST uses highly disaggregated budget data for all levels of government drawn from countries' financial management information systems. It can be used to examine trends in the allocation of public resources, investigate possible sources of inefficiencies, and analyze how governments finance the provision of public services. BOOST data are rigorously collected and verified against publicly available sources to ensure quality. The tool has been used in over 40 countries worldwide.
- 2. In the case of Chile, BOOST provides access to expenditure data for the Public Sector (Central and Regional Governments) and revenue and expenditure data for the Municipal Sector.** Data for the Public Sector for the period 2005-2015 were provided by DIPRES. Data for the Municipal Sector for the period 2007-2015 were provided by the Office of the Comptroller General. Given differences in the type and structure of the data, data for the Public Sector and the Municipal Sector are presented in separate databases. BOOST databases in other countries typically (but not always) provide data for all levels of government in a consolidated platform.
- 3. Chile's budget classification system for the Public Sector consists mainly of an administrative and economic classification.** The administrative classification (institutional classification according to the budget classifier) combines administrative entities (*Partida* and *Capítulo*) with government programs (*Programa*). The economic classification (classification by object or nature according to the budget classifier) consists of four levels (*Subtítulo*, *Ítem*, *Asignación*, and *Sub-asignación*) and is consistent with the International Monetary Fund's Government Finance Statistics Manual 2001. Figures are available for the approved, modified, and executed budget. Chile has the particularity of having a budget in Chilean pesos and US dollars. The BOOST database for the Public Sector follows the structure of the Chilean budget classification system. An additional level was added to the economic classification to separate recurrent, capital, and financing expenditures. A variable was added manually to filter intra-governmental transfers (called *consolidables* in Chile).
- 4. A functional classification for the Public Sector exists, but it is developed manually and is not part of the budget classification system.** DIPRES prepares a functional classification for the Public Sector that is broadly consistent with the United Nations Classification of Functions of Government (COFOG). The functional classification is available for the approved and executed budget. Only the latter is published in the DIPRES website and in a report called *Estadísticas de las Finanzas Públicas 2005-2014*. DIPRES does not prepare (or publish) a functional classification for the modified budget. The report also contains a breakdown of executed amounts combining the functional and economic classifications. However, no similar breakdown exists combining the functional and administrative classifications. A sound budget classification system should (at a

minimum) comprise administrative, economic, and functional classification of expenditures.⁸ The absence of a functional classification as part of the budget classification system limits the quality of budget analysis in Chile.

5. Chile’s budget classification system for the Public Sector does not have a classification by source of financing or a geographic classification. These classifications are found in other budget classification systems and provide complementary information that can be used for enhanced budget analysis. Identification of the source of financing, for example, is necessary for a thorough understanding of the flow of funds in the education and health sectors. Despite the absence of a geographic classification, it is possible to trace budget allocations at the subnational level. Regional Governments appear under the Ministry of Interior and Public Security. Similarly, budget allocations to the various Health Services can be found under the Ministry of Health. Budget allocations to Services of Housing and Urbanization (SERVIU) can be found under the Ministry of Housing and Urbanism.

6. For the municipal sector, the budget classification system consists of administrative, economic, and geographic classifications. The Office of the Comptroller General of the Republic publishes monthly revenue and expenditure data for all municipalities in Chile.⁹ The data identifies the name and region of the municipality. The economic classification consists of four levels (*Subtítulo, Ítem, Asignación, and Sub-asignación*). A variable called *Tipo Cuenta* distinguishes between revenue and expenditure data. While there is no functional classification, a variable called *Servicio* identifies whether the expenditure corresponds to municipal management, health, education, or cemeteries. The BOOST database for the Municipal Sector follows the structure of the data published by the Office of the Comptroller General of the Republic, but presents annual, rather than monthly figures. An additional level was added to the economic classification to separate recurrent, capital, and financing expenditures (these are referred to as operational expenditures, expenditures in investment activities, and expenditures in financing activities by the Office of the Comptroller General).

7. Chile may want to consider expanding the budget classification system to include, at the very minimum, a functional classification. A functional classification categorizes the expenditure according to broad objectives or purposes.¹⁰ Other Latin American countries already have a functional classification in their budget classification systems. Data can be extracted from their financial management information systems – at least for the central or national government – for the functional classification without the need of having to develop one manually. A classification by source of financing is also used in other countries. To provide a regional perspective on the use of these classifications, details on the functional classification and the classification by source of financing appears below for Chile’s regional peers (Colombia, Mexico, and Peru). Table A.C.1 provides a summary of the coverage and levels of detail of the classifications.

⁸ Davina Jacobs, Jean-Luc Héris, and Dominique Bouley, “Budget Classification” *International Monetary Fund* (2009), <http://www.imf.org/external/pubs/ft/tnm/2009/tnm0906.pdf>.

⁹ “Bases de Datos” [Sector Municipal] *Contraloría General de la República de Chile* (2016), http://www.contraloria.cl/NewPortal2/portal2/ShowProperty/BEA%20Repository/Portal/Bases/Contabilidad/Sector_Municipal/Base_Datos.html.

¹⁰ Davina Jacobs, Jean-Luc Héris, and Dominique Bouley, “Budget Classification” *International Monetary Fund* (2009), <http://www.imf.org/external/pubs/ft/tnm/2009/tnm0906.pdf>.

Table A.C.1. Functional Classification and Classification by Source of Financing in Regional Peers

	Functional Classification	Classification by Source of Financing
Colombia	<ul style="list-style-type: none"> - Coverage: Only National Government. - Classification: <ul style="list-style-type: none"> o Function Level 1– 12 categories o Function Level 2 – 75 categories o Function Level 3 – 150 categories - Data on this classification is <u>not</u> available to the public in the economic transparency portal (portal de transparencia económica). 	<ul style="list-style-type: none"> - Coverage: Only National Government. - Classification: <ul style="list-style-type: none"> o Source of Financing 1: <i>Fuente Financiación</i> – 2 categories o Source of Financing 2: <i>Recursos Presupuestales</i> – 13 categories - Data on this classification is available to the public in the economic transparency portal (portal de transparencia económica).
Mexico	<ul style="list-style-type: none"> - Coverage: Only Federal Government. - Classification: <ul style="list-style-type: none"> o Function 1: <i>Grupo Funcional</i> –4 categories o Function 2: <i>Función</i> – 27 categories o Function 3: <i>Subfunción</i> – 89 categories - Budget data on this classification is entirely available on the internet (website: transparencia presupuestaria). 	<ul style="list-style-type: none"> - Coverage: Only Federal Government. - Classification: <ul style="list-style-type: none"> o Source of Financing 1: <i>Fuente de Financiamiento</i> –4 categories Budget data on this classification is entirely available on the internet (website: transparencia presupuestaria).
Peru	<ul style="list-style-type: none"> - Coverage: National, Regional and Local Governments. - Classification: <ul style="list-style-type: none"> o Function 1: <i>Función</i> –25 categories o Function 2: <i>División Funcional</i> – 55 categories o Function 3: <i>Grupo Funcional</i> – 126 categories - Some level 2 categories may appear in more than one category under level 1. Categories in level 3 may appear in more than one category under level 2. - Budget data on this classification is entirely available on the internet (website: consulta amigable). 	<ul style="list-style-type: none"> - Coverage: National, Regional and Local Governments. - Classification: <ul style="list-style-type: none"> o Source of Financing 1: <i>Fuente de Financiamiento</i> – 5 categories o Source of Financing 2: <i>Rubro</i> – 8 categories - Budget data on this classification is entirely available on the internet (website: consulta amigable).