IMF Working Paper

Long-term Gain, Short-Term Pain: Assessing the Potential Impact of Structural Reforms in Chile

by Marika Santoro

INTERNATIONAL MONETARY FUND

IMF Working Paper

Western Hemisphere Department

Long-Term Gain, Short-term Pain: Assessing the Potential Impact of Structural Reforms in Chile

Prepared by Marika Santoro[1]

Authorized for distribution by Roberto Cardarelli

December 2015

Abstract

In this paper, I study the potential economic impact of the 2015-18 structural reform agenda in Chile, using the IMF dynamic general equilibrium model (GIMF). I find that the agenda has the potential to significantly increase Chile's long-run GDP, although it may have some negative effects in the short term. Ensuring a smooth transition to a higher productive potential depends on three key dimensions: the credibility of the reforms, their effectiveness in closing structural gaps, and their speed of implementation. Badly designed reforms that remove only a very small fraction of the existing structural gaps, at a slow speed, and with little credibility, can greatly reduce the positive impact of the reform agenda on GDP.

<div align="right">

Contents   Page

</div>

1   Introduction

In March 2014, the Chilean government launched an ambitious economic and structural reform agenda, with the objective to foster stronger and more inclusive growth. The agenda spans a wide range of areas, including changing the tax regime, boosting Chile's infrastructure network (primarily energy, transportation, and telecommunication), and improving the quality of human capital through a comprehensive reform of the education system.

In this paper, I study the potential economic impact of these structural reforms, using the IMF multi-country dynamic general equilibrium model (GIMF). GIMF features optimizing behavior by households and firms; tradable and nontradable goods sectors; nominal and real rigidities; liquidity-constrained households and households who optimize their savings and macro-financial linkages. The incorporation of a variety of non-Ricardian features makes fiscal measures non-neutral, yielding relatively large fiscal multipliers.

I calibrate the model to the Chilean economy and simulate the 2014 tax reform, the education reform, and the infrastructure plan.[1] I find that while the agenda has the potential to increase Chile's long-run productivity and output, a smooth transition to a higher long-run productive potential depends on three key dimensions: the credibility of the reforms, their effectiveness in closing structural gaps, and their speed of implementation. The impact of the reforms in the medium run lies within a wide range of -0.2 and 6 percent of GDP, determined by the combination of those three factors. The median results point to an increase of GDP by 2 percent in 2020 and 8 percent in the long run.

The wide range of results underscores the uncertainty surrounding the impact of Chile's structural reforms on productivity and GDP. Recent IMF surveys show that even in the case of program countries, structural reforms are implemented only in about 50 percent of the cases (IMF, 2015b). Additionally, in the case of education reforms, there is great uncertainty not only on the implementation lags but also about the impact of the specific policies on education quality and human capital accumulation. The Chilean education reform comprises a wide range of measures, spanning from the changes to the existing voucher system, the improvement of school infrastructure and teacher curricula, and free access to tertiary education. Most of these measures are likely to generate improvements in education quality and will have a positive impact on human capital accumulation.

However, while the changes to Chile's school voucher system introduced in January 2015 mainly aim at improving the quality of education by reducing segregation (the fact that access to high quality education depends on children's socioeconomic status), it is still an open question whether segregation and lower education outcomes in Chile are indeed exclusively a product of its voucher system.[2]

---

[1] While the government's 2015-18 reform agenda comprises many other measures, including reforms of the labor market, the constitution, and social security, this paper focuses only on policies that most directly affect Chile economy's growth potential. In particular, I will consider the tax and education reforms, and the infrastructure plan within the broader *Agenda de Productividad, Innovacion y Crescimiento* that was announced by the government in early 2014, and started being implemented in the 2014 Budget Law. Also, this chapter does not address the potential impact on GDP from reduced inequality in the income distribution, an important objective of the reforms (see IMF, 2014).

[2] An OECD (2010) report on the education system in Chile links the voucher system to increased education inequality. In contrast, Gallego (2013) finds that Chile's education system became more unequal and segregated not because of the introduction of the voucher system in the early 1980s, but because of the

To account for both the large uncertainty that affects results and trade-offs between short and long run, I calibrate a wide range of shocks. In particular, I calculate Chile's infrastructure and human capital gaps relative to OECD countries and quantify the shocks which are required to close those gaps. I simulate an increase in capital income and consumption taxes from the 2014 tax reform, which was designed to increase structural revenue by 3 percent of GDP and help finance the education reform. Preliminary estimates by the Chilean Internal Revenue Service (SII) suggest that, under the new tax regime, the effective marginal tax rate on capital income would increase by 3 percentage points by 2018. In GIMF, higher capital taxation reduces the return on capital, inducing firms to invest less, and lowers private consumption as household income falls. Thus, while the infrastructure and education reforms are expected to boost productivity and output, the tax reform will reduce output mainly by reducing investment.

The general equilibrium analysis shows that in most of the simulation scenarios, the net outcome of the government reform agenda is positive, especially in the long run. However, in the short and medium run, the impact of the reforms on Chile's productive potential depends on their credibility, effectiveness in closing the structural gaps, and speed of implementation. Badly designed reforms that remove only a very small fraction of the existing structural gaps, at a slow speed, and with little credibility, can greatly reduce the positive impact of the reform on GDP.

This paper relates to the literature on assessing the macroeconomic impact of structural reforms, including Bouis and Duval (2011); Barnes, Bouis, Briard, Dougherty, and Eris (2013); Lusinyan and Muir (2013) and Gomes, Jacquinot, Mohr and Pisani (2013). Bouis and Duval (2011), and Barnes et al. (2013) study the impact of product and labor market reforms in Europe using a growth accounting framework largely based on reduced-form equations. Using a general equilibrium approach, however, could help capture all the interaction among several channels of transmission from the structural reforms and avoid the risk of double counting some of their effects. Lusinyan and Muir (2013) and Gomes et al. (2013) use a general equilibrium approach to analyze product and labor market reforms in Italy and the euro area. While their approach is similar to the one used in this paper, here I study explicitly the contribution of each of the three dimensions that affects the outcome of reforms and construct a range of potential impacts of the reforms on GDP.

This paper also relates to the literature on the contribution to growth from infrastructure building and human capital accumulation. I draw on the analysis by Calderon and Serven (2004) and Calderon, Moral-Benito and Serven (2014) on the contribution of infrastructure to output, while I rely on studies by Bills and Klenow (2000) and Psacharopoulos (2004) to assess the potential impact on human capital from reforms that increase schooling levels.

Finally, this paper relates to the literature on the impact of taxes on the real economy. Hassett and Hubbard (2002) survey the literature on the impact of taxes on both the level and dynamic path of investment. Chang (1995) and Santoro and Wei (2011) show that capital income taxes in general, and corporate income taxes in particular, tend to decrease investment and exacerbate the volatility of consumption and investment. In GIMF, higher capital taxes affect investment and the accumulation of capital by reducing the shadow value of investment or marginal q.

---

absence of voucher schools in some geographical areas.

The rest of the paper is organized as follows. In Section 2, I analyze the main infrastructure and human capital gaps and, in Section 3, I describe Chile's 2014 reform agenda. Section 4 presents both the main feature of GIMF and the simulation approach used in this study. In Section 5, I discuss the main results and, in Section 6, I draw some concluding remarks.

2 Chile's structural gaps and the 2015-18 reform agenda

The structural reform agenda launched in March 2014 spans a wide range of areas (Table 1), including boosting Chile's infrastructure network (primarily energy, transportation, and telecommunication) and improving the quality of human capital through a reform of the education system. The agenda has the potential to lift the country to a higher-growth path over the next few decades. Previous studies have shown that Chile suffers from an infrastructure gap relative to OECD economies (Calderon and Serven, 2004; ECLAC, 2014). Chile also displays a gap in the quality of human capital, as measured by lower average schooling years of its labor force and lower PISA scores relative to the OECD average. These structural weaknesses could have contributed to the slowdown in total factor productivity growth observed during the last decade, as highlighted by Corbo (2014).

2.1 Infrastructure gaps

In this section, I examine the main weaknesses in three of the infrastructure pillars: electricity, transportation and telecommunication. Electricity is mostly produced by thermal and hydro plants. As measured by installed generating capacity per worker, electricity potential in Chile is about 55 percent below OECD average (Figure 1, Panel A and Table 2). In addition to constraints to generation capacity, there are weaknesses in the electricity transmission system. The electricity distribution is organized around two main grids: 1) the Northern Interconnected System (SING), which serves the mining regions and accounts for about 20 percent of the total installed capacity; 2) the Central Interconnected System (SIC), which supplies energy to the central part of the country and to most of the population (93 percent), accounting for about 70 percent of the generating capacity. There are other two minor grids in the south, accounting for the remaining generation capacity. The SING relies mostly on thermal generation and suffers from overcapacity, while the hydro-dominated SIC has been subject to rationing in dry years. The distance and lack of interconnection between the two main grids has made it difficult to optimize on energy generation and distribution in different parts of the country and from different energy sources. Electricity constraints translated into electricity costs among the highest in Latin America and among OECD countries (Figure 1, Panel B).

Transportation in Chile is mostly by road. The road system is organized around one main highway, the Panamerican Highway, which connects the county from North to South, and a series of regional and provincial roads. Road infrastructure has not kept pace with rapid economic motorization and freight traffic growth rate.[3] In terms of km of roads per worker, Chile is 67 percent below OECD average (Figure 2, Panel A and Table 2) and using

---

[3]This is partly related to the mountainous nature of the territory and the resulting diffculty to connect main highways with local roads.

other measures of transportation infrastructure, such as km of railroads, Chile still ranks way behind OECD peers (Figure 2, Panel B). Besides being a potential obstacle to growth, deficits in basic transportation infrastructure, such as roads, may also lead to greater economic and social inequality. It may leave certain segments of the population isolated and unable to participate to general social and economic activities and to the labor market.

Chile telecommunication infrastructure is one of the most mature in Latin America. Chile's telecommunications sector is completely privatized since 1988. Since the privatization, large infrastructure investments have been made by the private sector and as a result, Chile telecommunication industry grew an average of 20 percent annually over the last decade. Mobile telephony is the fastest growing segment in the telecommunications market. As a result, Chile is broadly in line with OECD average in terms of telecommunication infrastructure, measured as number of landlines and cell phones per worker, and largely above Latin American countries (Figure 3).

To estimated a composite infrastructure gap, which accounts jointly for the gaps in the three main infrastructure pillars, I follow the approach by Calderon and Serven (2004) and Calderon, Moral-Benito and Serven (2014) and consider infrastructure capital as one of the factors that explains cross-country differences in GDP. A composite indicator of the infrastructure gap can be estimated as the principal component of electricity (Υ), transportation (Ω), and telecommunication (Θ) indicators. Using a panel of 65 countries, I find that a composite indicator of infrastructure (Z) has the following shape:[4]

$$logZ_t = 0.4log\Upsilon + 0.4log\Omega + 0.3log\Theta \tag{1}$$

Based on this indicator, Chile 10-year average infrastructure capital is about 50 percent below the OECD average, but is above the average for Latin American countries (Table 3).

2.2 Human capital gap

In this section, I analyze the stock of human capital in Chile and compare it to other peers. Following Bills and Klenow (2000), human capital can be seen as an increasing function of educational attainment and therefore also depends on the quality of education system.

2.2.1 The education system in Chile

For primary and secondary education, the current education system is organized in public (municipal), subsidized (through a voucher system) and private schools. About 47 percent of the students go to municipal schools, 47 percent to private subsidized schools and 6 percent to non-subsidized schools. For tertiary education, 80 percent of the students are enrolled in private universities or technical institutions. The strong presence of private providers has resulted in a highly segregated education system, especially at the primary and secondary levels, where the distribution of students is strongly dependent on socioeconomic status (Figure 4). Since the introduction of the current vouvher system in 1981, not only education segregation has increased but has also not translated into higher aggregate education quality, as measured both as cross-country comparison and as change in education performance

---

[4]This result is very similar to Calderon, Moral-Benito and Serven (2014).

after the introduction of the voucher system (OECD, 2010; Hsieh and Urquiola, 2006). However, it still remains unclear whether it was the voucher system per se that generated higher segregation or other factors contributed to that increase. Gallego (2013) finds the introduction of the voucher system did not increase educational inequality in Chile but that instead the education system became unequal or segregated because of the absence of voucher schools in some geographical areas.

2.2.2 The human capital gap

Chile shows a significant gap relative to OECD standards in terms of human capital. As of 2010, the average years of schooling of Chiles labor force was about 12 percent below OECD level, using Barro and Lee (2014) (Figure 5). Based on the 2012 PISA scores (widely used as a measure of education quality and cognitive skills of the labor force), Chile ranks 15 percent below the OECD average. Lower human capital affects GDP through its impact on labor productivity, as shown in the seminal work by Mincer (1974). The productivity-augmenting effect of higher human capital has been traditionally measured through estimating the relationship between an individual's schooling and his labor earnings (Bills and Klenow, 2000).

2.3 Main reforms and measures in the 2015-18 agenda

Table 1 illustrates the main structural reforms analyzed in the paper. While in 2014 the government announced many other measures that are still under discussion, including a reforms of the labor market, the constitution, and social security, this paper focuses only on policies that have a clear program or are already passed by the Congress. In particular, I will consider the tax and education reforms, and the infrastructure plan within the broader Agenda de Productividad, Innovacion y Crescimiento that started being implemented in the 2014 and at the beginning of 2015. Also, it's not the objective of this paper to analyze the potential impact on GDP from lower inequality in the distribution of income that some of those measures bring about.

2.3.1 Energy

The economic agenda announced in 2014 aims at reducing electricity marginal costs and increasing generating capacity. To do so, the agenda involves improving the connectivity between the two main national grids (SING and SIC); boosting incentives to utilize renewable sources (so that they represent 45 percent of the electricity generation capacity over the next decade); and facilitate the involvement of private sector by easing the regulatory practices behind the release of permits (with spot marginal costs lowered by a more competitive tender process among distributing firms). Those progresses are estimated to decrease energy cost and increase electricity generation capacity (by more than 40 percent by 2020), according to data by the Ministry of Energy on projects already approved.

2.3.2 Transportation and telecommunication

The agenda aims at strengthening urban and intercity connectivity and port infrastructure (including through the construction of a large port in the central area of the country), by direct investment and also by incentivizing the direct involvement of the private sector, through new and expedite procedures for public-private partnership (PPP). For telecommunication, the agenda aims at boosting internet access, data transmission, and coverage of the fiber optic national network, including through establishing a Fondo de Desarollo de Telecommunicaciones.

2.3.3 Education

Three main pillars (*Ley de Inclusion*) of the reforms agenda for primary and secondary education have been passed in January 2015: i) the abolition of co-payments that allowed families to send their children to more expensive schools, ii) the repeal of for-profit subsidized schools (by 2018), and iii) the end of early-education selection entry-tests. Private co-payments will be replaced by public resources, expanding the possibility of lower income families to choose the optimal school for their children. For tertiary education, authorities program is to ensure free tertiary education for students in the bottom 60 percent of the income distribution attending universities, both public (16) and private (9), belonging to the so called *Consejo de Rectores* or other professional institutions meeting similar standards. However, large uncertainty still surrounds this plan, on how it can be implemented in the case of private universities and on future extensions of free education to larger fringe of the society. The reform agenda also contemplates greater spending on public education, including on teachers formation, schools infrastructure, and child care facilities.

2.3.4 Income tax

To help finance the cost of the reforms (in particular, the education reform) the authorities completed a fundamental tax reform in September 2014, which changed Chile income tax system. The new tax law introduced several changes, including by i) gradually increasing corporate tax rates, and ii) offering firms the choice between an integrated tax system which is less generous than the old one mainly because dividends are now taxed when accrued, independently if distributed or not, and a new semi-integrated regime, where dividends are taxed only when distributed but at a higher rate and shareholders can only partially deduct that tax from their final taxes.

In both new regimes, marginal tax rates on capital will increase (De Gregorio, 2014). While matching the increase in outlays with new permanent revenues is prudent, higher taxes on capital income might have a dampening effect on corporate savings and investment (Santoro and Wei, 2012).

3 Quantitative analysis

This section illustrates the main quantitative analysis of the paper. The section also provides a description of the main features of the model used as a laboratory to study the macroeconomic

effects of Chile's 2015-18 structural reforms.

3.1 The model

This section provides an overview of the structure of the IMF's Global Integrated Monetary and Fiscal (GIMF) model. The GIMF model is a multi-country dynamic general equilibrium model with optimizing households and firms, and with a public sector that defines fiscal and monetary policies in each country. The model features a financial accelerator and several layers of production, which makes it suitable for addressing a wide range of research questions.[5] In this section, we describe present relevant features of the model that fit the topic of the present paper. For a comprehensive description of the theoretical structure of the model, see Kumhof et al. (2010).

3.1.1 Households

Each country is populated by two types of households, optimizing agents with a finite time horizon and liquidity-constrained, respectively in measure $(1 - \psi)$ and ψ. The optimizing agents are overlapping generations (OLG) households with finite planning horizons as in Blanchard (1985), whose horizon is determined by some degree of myopia. In each instance, an index a denotes household's age and an index t denotes a time period and each period corresponds to one year. Each of these agents faces a constant probability of death in each period, at which point they are replaced by new households so that the proportion of households in the economy remains constant.

Labor productivity declines at a constant rate over the lifetime of both types of households. Both households pay direct taxes on labor income, indirect taxes on consumption spending, and a lump-sum tax. Additionally, they receive transfers from the government. They optimally choose consumption, savings, and labor supply to maximize the following lifetime utility function:

$$E_t \sum_{s=0}^{\infty} (\beta\theta)^s \left[\frac{1}{1-\gamma} \left(\left(\frac{c_{a+s,t+s}^{OLG}}{[C_{t+s-1}]^\nu} \right)^\eta \left(S_t - l_{a+s,t+s}^{OLG} \right)^{1-\eta} \right)^{1-\gamma} \right], \qquad (2)$$

where θ is the degree of myopia, $\gamma > 0$ is the coefficient of relative risk aversion, η is the preference parameter for consumption, and β is the discount factor, which accounts also for the probability of dying. In equation (2), $(S_t - l_{a,t}^{OLG})$ is the available time for leisure of the OLG households of age a in period t, where S_t is the total available time and $l_{a,t}$ is the time resource devoted to labor supply. In turn, $c_{a,t}^{OLG}$ denotes the2 consumption of the OLG household of age a in period t and is given by a CES aggregate over final retailed

---

[5]Different layers of agents in the production side of the economy are also useful to address the complexity of computational aggregation.

consumption varieties $c_{a,t}^{OLG}(i)$, with elasticity of substitution σ_R:[6]

$$c_{a,t}^{OLG} = \left(\int_0^1 \left(c_{a,t}^{OLG}(i) \right)^{\frac{\sigma_R - 1}{\sigma_R}} \, \mathrm{d}i \right)^{\frac{\sigma_R}{\sigma_R - 1}} \tag{3}$$

Preferences in equation (2) allow for external habit persistence on previous aggregate consumption, where the intensity of the persistence is governed by ν. The maximization is constrained by the following household's budget identity:

$$P_t^R c_{a,t}^{OLG}(1 + \tau_{c,t}) + P_t \tau_{a,t}^{ls,OLG} + \sum_{j=G,N,T} B_{a,t}^j + \epsilon_t F_{a,t} = \frac{1}{\theta} \left[i_{t-1} B_{a-1,t-1}^G \right.$$

$$+ i_{t-1}(1 + \eta_{t-1}^b) B_t^{j=N,T} + i_{t-1} \epsilon_t F_{a-1,t-1}(1 + \xi_{t-1,f}) \Big] + W_t \Phi_{a,t} l_{a,t}^{OLG}(1 - \tau_{L,t}) \tag{4}$$

$$+ \sum_{y=firms,unions} \int_0^1 D_{a,t}^y(i) \, \mathrm{d}i + P_t \, bm_{a,t} + P_t \Upsilon_{a,t}^{OLG}$$

where P_t is the price of consumption goods, used as a numeraire, P_t^R is the retailer price, W_t is the nominal wage, i_t is the nominal interest rate, $\tau_{L,t}$ is the tax rate on labor income, $\Upsilon_{a,t}^{OLG}$ are the lump-sum transfers that OLG households of age a receive from the government, $\tau_{a,t}^{ls,OLG}$ is a net lump-sum taxes tax paid to the government by an households of age a, $B_{a,t}^G$, $B_{a,t}^N$, and $B_{a,t}^T$ are age a household's holdings of bonds issued respectively by the government, the banks lending to the nontradables and tradables sectors, $F_{a,t}$ is age a household's holdings of foreign bonds denominated in foreign currency, and converted at the nominal exchange rate ϵ_t. The interest rate paid on domestic bond accounts for the domestic risk-premium $\xi_{t,b}$, with a value of $\xi_{t,b} < 0$ indicating that the private sector faces a larger marginal funding rate than the public sector. Likewise, for foreign bond holdings, the interest rate is adjusted to account for a foreign exchange risk-premium, $\xi_{t,f}$.

The liquidity-constrained households decide how much to consume and how much to work but they do not have access to credit markets. Their decision does not aim to smooth consumption and therefore they are constrained to consume their after-tax income in every period. Their objective function is similar to the utility function of the OLG households, but we can ignore generations in this case, since they all behave identically given that they do not save:

$$E_t \sum_{s=0}^{\infty} (\beta\theta)^s \left[\frac{1}{1-\gamma} \left(\left(\frac{c_{t+s}^{LIQ}}{[C_{t+s-1}]^\nu} \right)^\eta \left(S_t - l_{t+s}^{LIQ} \right)^{1-\eta} \right)^{1-\gamma} \right], \tag{5}$$

where c_t^{LIQ} features preferences for variety as in equation (3). Optimization is subject to the following budget constraint, which outlines their dependence on current income:

$$P_t^R c_t^{LIQ}(1 + \tau_{c,t}) + P_t \tau_t^{ls,LIQ} = W_t \Phi_t l_t^{LIQ}(1 - \tau_{L,t}) + P_t \Upsilon_t^{LIQ}. \tag{6}$$

---

[6]The model also yields a money demand function by incorporating a separable preference for money. However, since money enters the utility function in a separable fashion and monetary policy is specified as an interest rate rule, inflation has no distortionary effect on consumption and savings plans hence the money demand equation is redundant, and we skip the full-fledged version of the preferences with money in the utility function. For more details see Kumhof et al. (2010).

The model allows to treat the labor supply decision of the liquidity constrained as exogenous, in which case their decision problem boils down to setting consumption equal to after-tax income.

3.1.2 Production

In the model, the production process takes place in several layers. In each layer of production, except for distribution, agents face competitive input markets and monopolistically competitive output markets. First, there is a continuum of manufacturing firms, indexed by $z \in [0,1]$, that produce tradable and nontradable goods, using capital from capital goods producers and labor from unions, in a CES fashion:

$$F(K_t(z), L_t(z)) = A_t \left((\alpha)^{\frac{1}{\xi_Z}} K_t(z)^{\frac{\xi_Z-1}{\xi_Z}} + (1-\alpha)^{\frac{1}{\xi_Z}} (T_t L_t(z))^{\frac{\xi_Z-1}{\xi_Z}} \right)^{\frac{\xi_Z}{\xi_Z-1}}, \tag{7}$$

where A_t is a country-specific total factor productivity (TFP) shock, $K_t(z)$ is the capital used by manufacturing firm z and $L_t(z)$ is its labor demand, α is the capital share in the production function, ξ_Z represents the elasticity of substitution between capital and labor, and T_t is the labor-augmenting productivity level. Trend growth productivity can be defined as $g = T_t/T_{t-1}$. Manufacturing firms are subject to nominal rigidities in price setting, and real rigidities in their labor hiring. The production of capital stock K_t is subject to quadratic adjustment costs $G_{I,t}(I_t, I_{t-1})$, which depend positively on the deviation of investment I at time t from of investment at $t-1$. The presence of adjustment costs causes the shadow value of capital or marginal q to deviate from a simple price in terms of consumption goods. Thus, the marginal q is a function of the adjustment costs, the capacity utilization (u_t), the interest rate (r_t), the marginal product of capital (MPK) and the tax rate on capital income $(\tau_{K,t})$.

$$q_t = f(r_t, u_t, MPK, \tau_{K,t}, G_{I,t}(I_t, I_{t-1})) \tag{8}$$

where $\frac{dq}{d\tau_K} < 0$.

Manufacturing firms sell intermediate tradable and nontradable goods to domestic distributors, and intermediate tradable goods to import agents in foreign countries, who in turn sell to distributors in those countries. There are three layers of distributors until the last one that produces final consumption and investment goods, respectively, combining domestic and foreign final output. Their price setting is subject to nominal rigidities and changes in the volume of their imports are subject to quadratic adjustment costs.

The final consumption good is sold to retailers and to the government. The final investment good is sold to capital goods producers and to the government. Retailers sell their output to households in a monopolistic competitive market and they are subject to real price rigidities. Finally, capital goods producers produce the capital input used by manufacturing firms and are subject to investment adjustment cost. The financial accelerator mechanism, in the spirit of Bernanke, Gertler and Gilchrist (1999), enters at this layer of the model.

3.1.3 Fiscal and monetary policy

The primary purpose of the fiscal policy is to ensure a a stable government debt-to-GDP ratio in the long run, thus excluding the possibility of sovereign default. At the same time,

Chile fiscal rule allows for some flexibility to respond to the business cycle, by performing countercyclical fiscal policy:[7]

$$\left(\frac{\Sigma}{Y}\right)_t = \left(\frac{\Sigma}{Y}\right)^{SS} + d^B \left[\left(\frac{B}{Y}\right)_t - \left(\frac{B}{Y}\right)^{SS}\right] + d^Y \left(\frac{Y_t}{Y^{SS}}\right), \tag{9}$$

where $\left(\frac{\Sigma}{Y}\right)_t$ is the budget surplus as a share of GDP, $\left(\frac{\Sigma}{Y}\right)^{SS}$ is the equivalent long-run ratio, $\frac{B}{Y}$ is the debt-to-GDP ratio and $\frac{Y_t}{Y^{SS}}$ is the output gap. The parameters d^B and d^Y govern the strength of the stabilization channels, through a reaction to deviations of debt and to the output gap.

Fiscal policy is conducted using a variety of fiscal instruments related to taxation and spending, and through the issuance of government debt. The sources of tax revenues are labor income tax, consumption taxes, taxes on the return to capital, and lump-sum taxes. Government spending takes the form of consumption and investment expenditures, and lump-sum transfers to all households.

Regarding monetary policy, we consider a central bank that follows a strict inflation targeting regime, in order to capture the case of Chile. In this case, the monetary authority varies the policy rate in order to achieve a stable target rate of inflation over time, using a Taylor rule of the following type:

$$i_t = (i_{t-1})^{\delta_i} E_t \left[\left(\frac{\pi_t^{\delta_p} \pi_{t+1}^{1-\delta_p}}{\pi^*}\right)^{(1-\delta_i)\delta_\pi} \left(\frac{Y_t}{Y^{SS}}\right)^{(1-\delta_i)\delta_Y} \left(\frac{\eta_t}{\eta^*}\right)^{\delta_\eta}\right], \tag{10}$$

where i_t is the policy rate, which depends on: (i) previous period rate i_{t-1} with intensity δ_i; (ii) a weighted average of present and forward inflation π (with weight δ_p) and its deviation from target inflation level π^*, with intensity δ_π; (iii) the deviation of GDP from its steady-state (non-inflationary) level; (iv) the depreciation of the nominal exchange rate η from some reference level η^* with intensity δ_η.

3.2 Calibration

In this section, I describe the baseline model specification and calibration assumed for the quantitative exercise. Throughout the paper, we simulate policy experiments using a three-country version of the GIMF model. The domestic economy is Chile, whose GDP accounts for a very small fraction of the world GDP (0.6 percent), the other two countries are the Emerging Asia (EA) and the Rest of the World (RW), which represent respectively 17.4 percent and 82.0 percent of world GDP. Table 4 displays the key macroeconomic aggregates in steady state and Table 5 the key parameters for the three countries.

3.2.1 Macroeconomic aggregates

Table 4 displays the expenditure-to-GDP ratios for the three economies. The most important feature of Chile is the high external dependence. The domestic economy is highly reliant on

---

[7]see IMF (2015a)

imports of final goods (about 25 percent of GDP versus 12.6 in the case of the EA and 4.4 in the case of the RW) and, in particular, of investment goods (7.6 percent of GDP) relative to EA (3.4 percent) and the RW (1.1 percent). At the same time, the exports are considerably concentrated in terms of intermediate goods, given the strong reliance on copper exports (15 percent of GDP in intermediate goods versus 8 percent in final goods). I set the import and export shares for distributors in the domestic economy to hit the ratios of imports-to-GDP and exports-to-GDP for each of the intermediate and final goods.

Private consumption is set to 63 percent of GDP, and total investment at 22 percent, roughly comparable with the EA and the RW. Chile government net debt-to-GDP ratio of about -5 percent (an average level in 2013 and 2014) is the lowest among the three regions, with the EA ratio at 33 percent and and the RW at 50 percent. Chile public spending at 14 percent of GDP is lower than in the EA (18 percent) and in the RW (20 percent). The tax rates on labor income, capital income and consumption are calibrated based on average tax rates in Chile in 2014 at 27.7, 12.9 and 17.1 percent, respectively.

3.2.2 Main parameters

Most of the parameters are calibrated according to Kumhof et al. (2010) for the case of the US, except for some parameters that are key to pin down the specific behavior of the Chilean economy, reported in Table 5. Given the strong reliance of Chile on imports of final goods, the domestic economy is characterized by higher levels of real adjustment costs to imported final goods (1.5 for Chile versus 1 for the other two regions, following Kumhof et al., 2010). This captures the fact that in small open economies agents cannot quickly substitute imported goods with domestic goods, as the economy's production scale and variety is limited and this gives rise to high adjustment costs. Consistently, the share of tradable goods on real income is 50 percent, higher in Chile than in the RW (40 percent).

For simplicity and tractability, the CES parameter is set to $\xi_Z=1$ so that the equation (7) collapses to a Cobb-Douglas:

$$F(A,T;K_t,L_t) = A_t \left(K_t^{\alpha} + (T_tL_t)^{(1-\alpha)} \right), \tag{11}$$

I set the capital factor share parameters α to 0.52 percent, in the tradable sector, and of 0.38 percent in the nontradable sector, higher than in the RW (0.45 for the tradable and 0.30 for the nontradable sectors) to capture both the high intensity of capital in the mining sector and high inequality in the distribution of assets and income in Chile.[8] I calibrate the time preference parameter β to be consistent with a capital-to-GDP ratio of 179 (this implies $\beta = 0.966$).

The share of liquidity constrained agents in the economy (ψ) is parametrized to 0.5, higher than in the RW (0.3). This is intended to capture some difficulty to access credit in Chile due to high income inequality and therefore a skewed distribution of collaterals.

Regarding fiscal policy, the particular design of the fiscal rule allowed Chile in the past to use some degree of countercyclical policy behavior. Chile's fiscal policy does not target a specific debt-to-GDP ratio. The coefficient that regulates the reaction of fiscal surpluses to

---

[8]At 0.52, the income Gini coefficient for Chile points at an inequality at least 20 percent higher than in advanced countries.

the output gap d^Y is set at 0.25 as in Kumhof et al. (2010) for EA, while the coefficient that regulates the reaction of fiscal policies to the debt-to-GDP ratio is instead set at 0.

The objective of the monetary authority in Chile is to target a given long-run level of inflation, with a single mandate. The coefficients on $t-1$ interest rate, and on the deviation from inflation target for the Taylor-type reaction function are set similar to the case of the euro area as in Kumhof et al. (2010) at 0.3 and 1.5, respectively. The coefficients that govern the response for the policy rate to the output gap and to the exchange rate are set to zero given that the Chile's central bank follows a single mandate.

4 Simulations

Calibrating the impact of the structural reforms described in section 3 on productivity and long-term GDP is subject to a great deal of uncertainty. There are several factors underlying such an uncertainty. Recent IMF surveys show that even in the case of program countries, structural reforms are implemented only in about 50 percent of the cases (IMF, 2015 add reference). Additionally, in the case of education reforms, large uncertainty surrounds not only the implementation lags but also the impact of the specific measures on education quality and human capital accumulation.

In the specific case of Chile's 2015-18 agenda, on the one hand, the increase in resources devoted to foster teachers' quality will certainly have an impact on human capital. On the other hand, though, the Chilean education reforms already passed mainly aim at reducing segregation through the abolition of the voucher system. Now, while the impact of removing segregation is generally pointing to an increase in aggregate human capital formation, productivity and output (Benabou, 1993 and 1994; Hsieh, Hurst, Jones, and Klenow, 2013), it still remains an open question whether the introduction of the voucher system in Chile in 1981 contributed to an increase in segregation and therefore to lower student outcomes. For instance, Gallego (2013) finds the introduction of the voucher system did not increase educational inequality in Chile per se but that instead the education system became unequal or segregated because of the absence of voucher schools in some geographical areas.

Given the range of uncertainty, I calibrate a wide range of shocks in both the case of infrastructure and education reforms with accordingly different impacts on productivity and GDP. All the policies simulated in this paper imply changes in macroeconomic variables, and thus in public finances, both during the transition path and in the new steady state of th economy. For example, if a fundamental tax reform generates an increase in tax rates on capital, revenues from income taxes will increase. To offset that increase in revenue, I assume that other fiscal instruments would change accordingly.

In all simulations in the paper, I assume that government spending adjusts to honor a certain budget target and stabilize debt, for two main reasons. First, the government 2015-18 agenda not only comprises a series of product market reforms but also direct increase in spending in the education and infrastructure areas, to be financed with the increase in revenues from the tax reform. In addition, since the objective of the paper is to study the impact of the reforms on the macroeconomic variables, refraining from considerations on the impact on welfare, I abstract from the specific analysis of redistribution policies.

4.1 Infrastructure and human capital shocks

In this section, I calibrate the shocks generated by the reforms in the areas of infrastructure and education. The quantification of the shock is determined by assuming that part of the structural gaps are eliminated and this has an impact on productivity. Following the general approach by Hall and Jones (1999) and the specific framework laid down by Calderon and Serven (2004), I extend the production function in equation (11) to incorporate the contribution of infrastructure:

$$F(\Xi, Z, T; K_t, L_t) = (\Xi_t Z_t^\phi) \left(K_t^\alpha (T_t L_t)^{(1-\alpha)} \right), \tag{12}$$

where I decompose the TFP (A_t) from equation (11) into a bundle of a country specific factor Ξ and the network effect of infrastructure, captured by Z_t. Using a panel of 88 countries, Calderon, Moral-Benito and Serven (2014) find that $\phi = 0.1$. Knowing the value of this parameter, a growth accounting exercise would allow to calibrate the shock of an improvement of infrastructure able to close the gap with OECD countries. The shock will be computed from the following relation:

$$\frac{F(\Xi, Z_{CHL}, T; K, L)}{F(\Xi, Z_{OECD}, T; K, L)} \tag{13}$$

calibrated as a TFP shock.[9] To measure the impact on GDP and calibrate the shock implied by closing part of the human capital gap, following Bills and Klenow (2000), the term T_t in equation (12) can be specified as:

$$T_t(s) = \frac{\kappa}{1-\mu} s^{1-\mu} \tag{14}$$

where s is the level of education or quality of human capital expressed as the number of schooling years, where I set $\kappa = 0.32$ and $\mu = 0.58$, following the point estimates by Bills and Klenow (2000).[10] To calibrate the shock that better educational attainment as a result of the reform will generate in terms of human capital, I use an approach similar to the one used in the case of infrastructure. I assume that the reform is able to improve school quality and the improvement helps closing some fraction of the gap with OECD. The shock is then calculated as labor-augmented productivity of a magnitude given by the following relation:

$$\frac{F(\Xi, Z, T_{CHL}; K, L)}{F(\Xi, Z, T_{OECD}; K, L)} \tag{15}$$

4.2 Tax shocks

I also simulate an increase in taxes on capital income and consumption from the 2014 tax reform, as a form of financing some of the structural reforms. Preliminary estimates by the

---

[9]Government spending in the model is both consumption and investment. Government investment spending augments directly the stock of publicly provided infrastructure capital, which is used in the production of the final output. I chose to calibrate the shock in infrastructure areas as a TFP shock because its nature is mostly related to a product market reform, which incentivizes private investment, especially in the energy and transportation sectors.

[10]Using one of the specification by Cubas, Ravikumar and Ventura (2013) yields similar results.

Chilean Internal Revenue Service (SII) suggest that, under the new regime, the effective marginal tax rate on capital income increases by 3 percentage points by 2018, from an initial steady-state level of about 13 percent (Table 4).

In GIMF, higher capital taxation reduces the return on capital, inducing firms to invest less and also weakening private consumption as household income falls. In addition, the 2014 tax reform increases taxes on consumption, by extending the VAT tax base (including on real estate) and increasing excise taxes on a series of non-primary goods (such as tobacco and alcohol). In GIMF, this is modeled as an increase in lump-sum taxes and in consumption tax rates so that the overall increase in fiscal revenues from the full 2014 tax reform is 3 percent of GDP.

4.3   Dimensions affecting the outcome of reforms

In this section, I study the dimensions that could affect the transition path after the announcement of the reforms. To account for the large uncertainty that affects results in the short and long run, I simulate the infrastructure and education reforms under several scenarios of key factors that can potentially affect the impact of the reforms. Table 6 presents the summary of the scenarios comprising the following dimensions:

1. The *effectiveness* of the reforms in closing the gaps: I simulate three different scenarios in which the structural measures manage to close 20, 50 and 80 percent of Chiles human capital and infrastructure gap, respectively.

2. The *speed* at which the gaps are closed: for the infrastructure gap, I consider three scenarios in which the gap is closed (to the extent specified above) after 5, 10, 15 years, respectively. For the human capital gap, considering the longer time needed for education reforms to yield their fruits, I consider three scenarios, in which the gap is closed in 10, 15 and 20 years, respectively.[11]

3. The *credibility* of the reforms: economic agents in the model may react to the reforms (or their announcement) with some delay, depending on the extent to which they internalize (and anticipate) future income changes. This has an impact on how rapidly the productivity and human capital shocks affect private investment in the model. We thus consider three different scenarios, one with fully credible (and thus immediately effective) policies, one where policies are completely internalized by agents after 2 years, and one where this happens after 4 years.[12]

---

[11]Within each time span, gaps are closed linearly with the exception of energy. Given the speed at which capacity has already been built up in 2015 (Bachelets speech, May 21), we assume that 40 percent of energy generation gaps are closed within the first 5 years. This implies that almost 30 percent of the overall infrastructure gap is closed in the first 5 years. The education gap is closed linearly but only after the first 5 years (that is, it begins to be closed only after 5 years) in order to capture the fact that education reforms generally have an impact on the quality of the labor force only after a number of years. I assume that at least they start accruing after students have finished one full cycle of secondary school.

[12]Simulations consider a range of scenarios determined by independent combinations of credibility, effectiveness and speed of reforms. However, there could probably exist interactions between these three dimensions. For instance, for a given level of effectiveness and credibility, highly effective reforms could endogenously induce even higher levels of credibility or viceversa.

4.4 Results

Model simulations confirm that the net impact of the reforms is subject to a great range of variation. The tax reform affects negatively investment and consumption decisions both in the short and long run, while the fruits from both infrastructure and human capital policies will build up only gradually.

4.4.1 The reforms dimensions: credibility, effectiveness and speed

In the long run, the net impact of the reforms mainly depends on their effectiveness, whereas, in the short and medium run, the degree of credibility and speed of implementation are more important. Figure 6, Panel A, shows two paths for a *medium effectiveness* scenario, in which 50 percent of both infrastructure and human capital gaps are closed at a *medium speed* in implementation (10 years for infrastructure and 15 years for human capital). While the long-run results are identical, the level of real GDP after 5 years is 2-3 percentage points lower in a *low credibility* scenario relative to the *high credibility* scenario.

Figure 6, Panel B shows the same *medium effectiveness* scenario under a *high credibility* scenario. Again, while the long-run results are the same, real GDP is 3 percentage point lower after 5 years when infrastructure and human capital gaps are closed at a *low speed* (after 15 and 20 years, respectively) relative to when the gaps are closed at *high speed* (in 5 and 10 years).

Under the worst possible scenario, with a combination of *low effectiveness*, *low credibility*, and *low speed*, real GDP immediately falls relative to the no-reform baseline and is still -0.6 percent below baseline by 2020 and only marginally above by 2025 and in the long run. Under the most optimistic scenario, GDP immediately increases by 1.3 percent and is about 15 percent above baseline by 2025 (Figure 7).

4.4.2 The median scenario

A close look at the median scenario will help us unveil the forces at work in the simulation of the reforms. The scenario underscores that the measures to boost infrastructure will be able to close 50 percent of the present gap in 10 years and that the policies to improve education will help closing 50 percent of the human capital gap in 15 years. The public is assumed to only believe that the policies will be effective after two years (black line in Figure 7).[13]

This scenario achieves an increase of real GDP by about 6 percent in 2025 and 8 percent in the long run, with a small negative impact during the first two years. Private investment declines by about 2 percent in the first two years, reflecting higher taxes on capital income. However, the impact on real GDP in the short term is small, with real GDP only slightly (by 0.3 percent) below its no-reform baseline level in 2015 and about 0.4 percent in 2016.

---

[13]This scenario is quite realistic if we consider that energy projects in the pipeline at the Chiles Ministry of Energy promise to increase the generation capacity by more than 40 percent already by 2020. Also medium credibility seems to be underscored by business confidence being protectedly low for 2014 and 2015 and that this outcome has been connected to the state of uncertainty surrounding reforms. In general, this median scenario is consistent with characteristics and impacts of many of the structural reforms surveyed by Barnes et. al (2013), Lusinyan and Muir (2013) and Varga and in t Veld (2014).

There are a few reasons why in GIMF the short-term impact of higher taxation is relatively small. First, weaker private demand prompts firms to demand less labor, which lowers the marginal cost of production and thus the price for domestically produced goods. The resulting fall in inflation leads the monetary authority to reduce the nominal policy rate. The resulting lower real interest rate reduces the cost of capital, offsetting the initial impact of higher taxation. Lower real interest rate also leads to a depreciation of the real effective exchange rate (REER), which boosts net exports. In addition, the higher revenue from the tax reform that gradually accrues is used to financed higher government spending (equivalent to 3 percent of GDP), which supports aggregate demand. This is consistent with the government's plan, contemplated by the government 2015-18 agenda to use the higher structural revenue from the tax reform to finance higher education spending.

By 2020, as the positive effects of the structural reforms are fully internalized by agents, real GDP will be about 2 percent higher than in our no-reform baseline, with TFP growth increasing by percent. Investment and consumption would be 3 and 0.4 percent higher than the baseline case by 2020, respectively, and exports are 1 percent higher as the REER further depreciates with reforms increasingly bearing fruits.

5   Conclusions

In this paper, I study the potential economic impact of the 2015-18 structural reforms agenda in Chile, using the IMF dynamic general equilibrium model (GIMF). I identify three key areas that can potentially affect their outcomes: credibility, effectiveness and speed of implementation. I find that the agenda has the potential to increase long-run GDP, but the design, credibility and speed of the reforms are crucial for a smooth transition to a higher productive potential of the Chilean economy in the long run.

Chile has accumulated gaps in infrastructure and human capital relative to average OECD economies. Some of those gaps have constrained productivity growth, including through high energy costs, transportation bottlenecks, and a range of inefficiencies in as few key network industries. Removing these gaps has the potential for a sharp improvement in the level of GDP.

Despite the large range of uncertainty on the quantification of the reform agenda, model simulations shows that the negative impact on GDP from higher taxes on capital income is likely to be minor and soon offset but the positive effects of the structural reforms on productivity. But badly designed reforms that remove only a very small fraction of the gaps, at a slow speed, and with little credibility can greatly reduce the positive impact on GDP.

References

[1] Barnes Sebastian, Romain Bouis, Philippe Briard, Sean Dougherty, and Mehmet Eris (2013), The GDP impact of reforms: A simple simulation framework, OECD Economics Department Working Papers No. 834.

[2] Bouis Romain and Romain Duval (2011), Raising potential growth after the crisis. A quantitative assessment of the potential gains from various structural reforms in the OECD area and beyond, OECD Economics Department Working Papers No. 835.

[3] Barro, Robert and Jong-Wha Lee (2010), A new dataset of educational attainment in the world, 1950-2010, *Journal of Development Economics*, 104, pp.184-198.

[4] Benabou Roland (1993), Workings of a city: Location, education, and production, *The Quarterly Journal of Economics*, vol. 108(3), pp619-652.

[5] Benabou Roland (1994), Human capital, inequality, and growth: A local perspective, *European Economic Review*, vol. 38(3-4), pp 817-826.

[6] Bernanke Ben S., Mark Gertler and Simon Gilchrist (1999), The financial accelerator in a quantitative business cycle framework, In: Taylor John and M. Woodford (Eds.), *Handbook of Macroeconomics*, Elsevier.

[7] Bils Mark and Peter J. Klenow (2000), Does schooling cause growth?, *American Economic Review*, 90(5), pp. 1160-1183.

[8] Blanchard Olivier (1985), Debt, deficits, and finite horizons, *Journal of Political Economy*, 93(2), pp. 223-247.

[9] Caldern Csar, Enrique Moral-Benito, and Luis Servn (2014,) Is infrastructure capital productive? A dynamic heterogeneous approach, *Journal of Applied Econometrics*, 30(2), pp. 177-198.

[10] Caldern Csar, and Luis Servn (2004), The effects of infrastructure development on growth and income, Central Bank of Chile Working Paper, no. 270.

[11] CEPAL (2011), The economic infrastructure gap in Latin America and the Caribbean, *FAL Bulletin*, issue 293, n.1

[12] Chang Ly-June (1995), Business cycles with distorting taxes and disaggregated capital markets, *Journal of Economic Dynamics and Control*, 19 (57), pp. 985 1009.

[13] Corbo Vittorio (2014), *Growth opportunities for Chile*, Editorial Universitaria, Chile.

[14] Cubas German, B. Ravikumar, and Gustavo Ventura (2013), Talent, labor quality, and economic development, Federal Reserve Bank of St. Louis Working Papers 2013-027.

[15] De Gregorio Jose (2014), Notas sobre la reforma tributaria, Universidad de Chile, mimeo.

[16] Gallego Francisco (2013), When does inter-school competition matter? Evidence from the Chilean voucher system, *The B.E. Journal of Economic Analysis and Policy*, Advances, vol 13(2), pp 525562.

[17] Gomes Sandra, Pascal Jacquinot, Matthias Mohr and Massimiliano Pisani (2013), Structural reforms and macroeconomic performance in the euro area countries: A model-based assessment, *International Finance*, vol. 16(1), pp 2344

[18] Hall Robert and Charles Jones (1999), Why do some countries produce so much more output per worker than Others?, *The Quarterly Journal of Economics*, 114, pp. 8316.

[19] Hanushek Eric and Ludger Woessmann (2008), The role of cognitive skills in economic development, *Journal of Economic Literature*, 46 (3), pp. 607668.

[20] Hanushek Eric and Ludger Woessmann (2012), Do better schools lead to more growth? Cognitive skills, economic outcomes, and causation, *Journal of Economic Growth*, 17, pp. 267321.

[21] Hassett Kevin and Glenn Hubbard (2002), Tax policy and business investment. In: Auerbach Alan, and Feldstein Martin (Eds.), *Handbook of Public Economics*, vol. 3., North-Holland, Amsterdam.

[22] Hsieh Chang-Tai, Erik Hurst, Chad Jones, and Peter Klenow (2015), The Allocation of talent and U.S economic growth, *Econometrica*, forthcoming.

[23] Hsieh Chang-Tai and Miguel Urquiola (2006), The effect of generalized school choice on stratification and achievement: evidence from Chiles school voucher program, *Journal of Public Economics*, 90(89), pp. 14771503

[24] IMF (2015a), October 2015 Fiscal Monitor, International Monetary Fund, Whashington DC

[25] IMF (2015b), 2015 Risk Report, International Monetary Fund, Washington DC

[26] Kumhof Michael, Douglas Laxton, Dirk Muir, and Susanna Mursula (2010), The Global Integrated Monetary and Fiscal Model (GIMF) Theoretical Structure, IMF Working Paper no. 10/34

[27] Lusinyan Lusine and Dirk Muir (2013), Assessing the macroeconomic impact of structural reforms: The case of Italy, IMF Working Paper no. 13/22

[28] Jacob A. Mincer (1974), *Schooling, experience, and earnings*, NBER Books, National Bureau of Economic Research, Inc

[29] OECD (2015), Education policy outlook 2015: Making reforms happen, OECD Publishing

[30] Psacharopoulos George (2004), Returns to investment to education: A global update. *World Development*, 22, 13251343.

[31] Psacharopoulos George, and Harry Patrinos (2004), Returns to investment in education: A further update, *Education Economics*, 12(2), pp. 111-133.

[32] Santoro Marika and Chao Wei (2011), Taxation, investment and asset pricing, *Review of Economic Dynamics*, 14(3), pp. 443-454.

[33] Varga Janos and Jan in 't Veld (2014), The potential growth impact of structural reforms in the EU. A benchmarking exercise, European Commission Economic Papers 541.

Table 1: The government 2015-18 economic agenda

Reforms areas	Main measures	Status reform
Tax reform	capital income tax	Passed
	excise and broadening VAT base	Passed
Education	repeal private co-payments	Passed
	repeal for-profit institutions and tests	Passed
	increase teaching quality	Passed
	improve early education	Passed
	universal tertiary education	Announced
Energy	ease permits	Passed
	incentives to renewable energy	
Transportation	foster PPP	Announced
	improve connectivity	
	new transportation lines	
Telecommunication	reduce digital divide	

Table 2: Electricity, transportation and telecommunication gaps

Chile: % difference from

year	US	OECD	LAC
A. *Electricity: KW per 1000 workers*			
1992-2012 (avg)	-73.9	-61.2	33.1
2002-2012 (avg)	-70.8	-55.8	55.7
2012	-68.0	-53.3	66.7
B. *Transportation: km of roads per 1000 workers*			
1992-2012 (avg)	-71.5	-61.3	-8.2
2002-2012 (avg)	-73.4	-65.5	-15.1
2012	-77.8	-67.2	-14.3
C. *Telecommunication: number of lines per 1000 workers*			
1992-2012 (avg)	-30.2	-32.4	26.7
2002-2012 (avg)	-10.7	-21.6	21.5
2012	9.4	-3.8	13.0

Table 3: Total infrastructure gap

Chile: % difference from

year	US	OECD	LAC
A. 1992-2012			
Z	-61.7	-52.5	17.7
B. 2002-2012			
Z	-57.3	-49.2	19.9
C. 2012			
Z	-54.9	-45.0	20.0

Table 4: Macroeconomic Aggregates (% of GDP)

	Chile	Emerging Asia	Rest of the World
Panel A: National Accounts (% of GDP)			
Consumption	62.2	57.2	60.0
Investment	22.4	25.0	20.0
Exports	30.3	27.9	5.6
Final goods exports	14.3	21.3	2.7
Intermediate goods exports	16.0	6.6	2.9
Imports	27.0	26.4	5.8
Consumption goods imports	7.2	9.2	3.2
Investment goods imports	7.6	3.4	1.1
Intermediate goods imports	13.2	13.7	1.4
Panel B: Public Sector (% of GDP)			
Government debt (net)	-5.0	33.3	50.0
Government spending	14.4	17.9	20.0
Tax Rates			
Labor	27.7	8.7	25.9
Capital	12.9	16.1	18.0
Consumption	17.1	18.0	11.7

Table 5: Parameter values for the baseline calibration

	Chile	Emerging Asia	Rest of the World
Real adjustment costs of imports	1.5	1.0	1.0
Capital share in production (in %)			
Tradable sector	50.0	47.2	45.0
Non-tradable sector	36.0	38.5	30.0
Discount factor (β)	0.966	0.968	0.967
Share of liquidity-constrained households (ψ)	0.5	0.5	0.3
Coeff. on output gap d^Y (fiscal rule)	0.25	0.25	0.4
Coeff. on $t-1$ interest rate δ_i (monetary rule)	0.3	1.0	0.3
Coeff. on deviation from inflation target δ_π (monetary rule)	1.5	0.0	1.2
Weight on current inflation δ_p (monetary rule)	0.25	0.0	0.25

Table 6: GIMF simulations: scenarios

	Low	Medium	High
	(in percent)		
Effectiveness			
Infrastructure gaps closed	20	50	80
Human capital gaps closed	20	50	80
	(in years)		
Speed			
Infrastructure	15	10	5
Human capital	20	15	10
Credibility			
Infrastructure	4	2	immediate
Human capital	4	2	immediate

Table 7: GIMF simulations: median scenario

	2015	2016	2020	2030	SS
	(% deviation from baseline)				
GDP	-0.3	-0.4	1.9	7.5	8.0
Consumption	-0.6	-0.9	0.3	3.1	4.4
Investment	-1.6	-1.7	3.2	7.3	5.8
Government spending	-0.2	0.2	11.4	21.3	21.3
Export	0.2	0.2	0.9	7.8	8.2
Import	-0.6	-0.7	2.7	2.3	2.4
REER (+=Deprec)	0.1	0.1	0.4	2.6	2.6

Figure 1: Electricity: Chile versus OECD

Panel A. Electricity. Generating capacity in Khw per 1000 workers, 2012
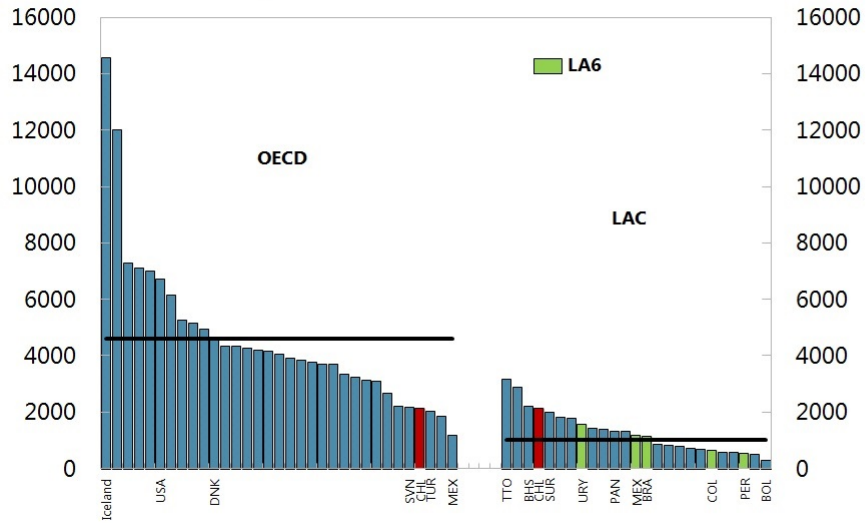
Source: World Development Indicators, 2014

Panel B. Electricity cost: final price, USD per MWh, 2012-13
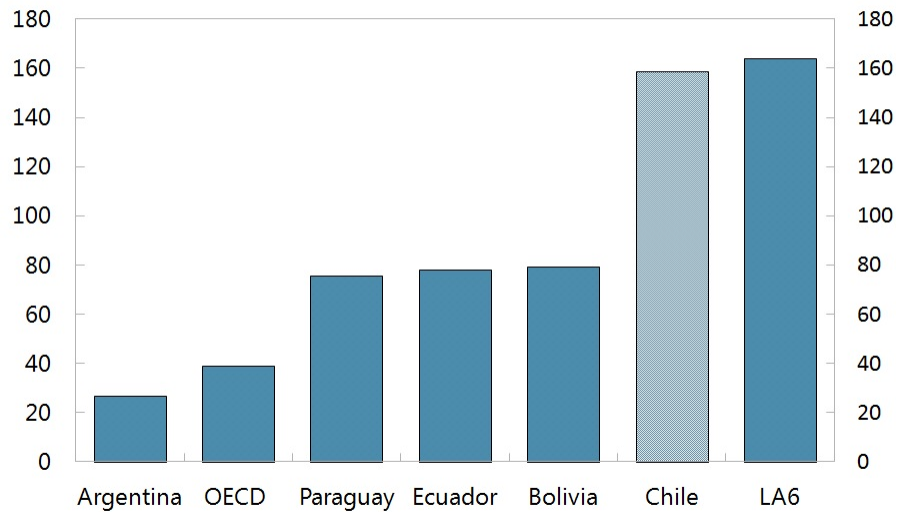
Source: OECD and IMF

Figure 2: Transportation: Chile versus OECD

Panel A. Transportation. Km of roads per 1000 workers, 2012
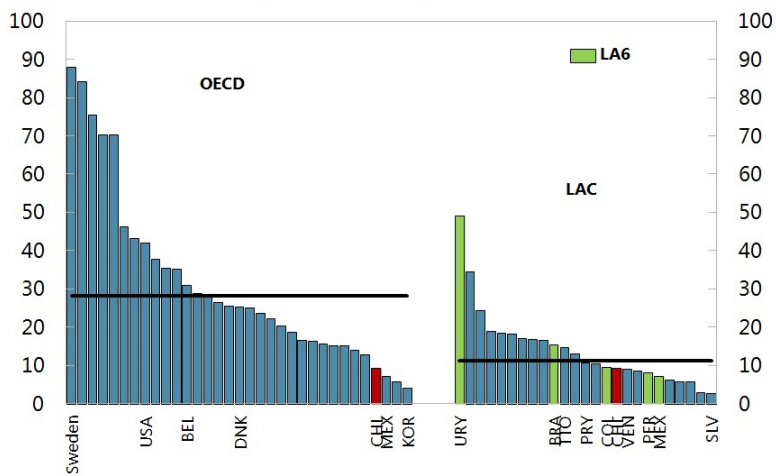
Source: World Development Indicators, 2014.

Panel B. Transportation. Km of railroads per 1000 workers, 2012
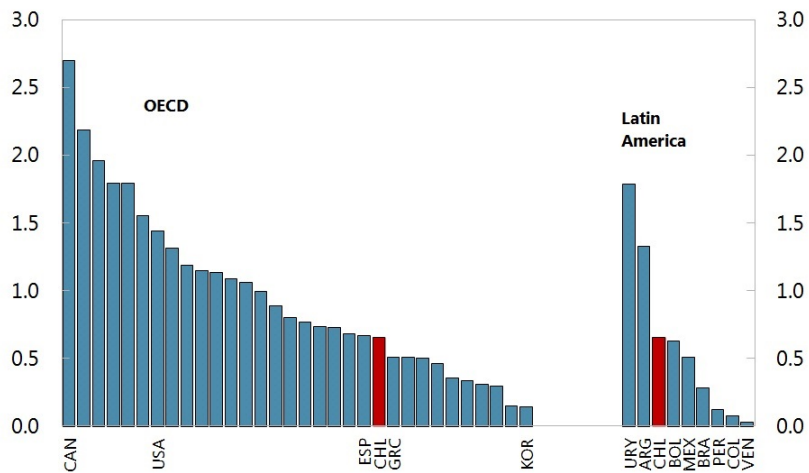
Source: World Development Indicators.

Figure 3: Telecommunication: Chile versus OECD

Panel A. Number of mainlines and cellphones per 1000 workers, 2012
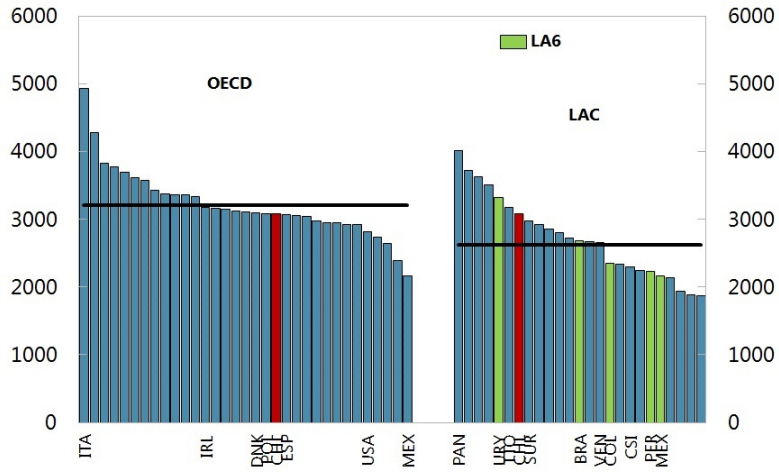
Source: World Development Indicators, 2014.

Panel B. Internet access per 100 people, 2012
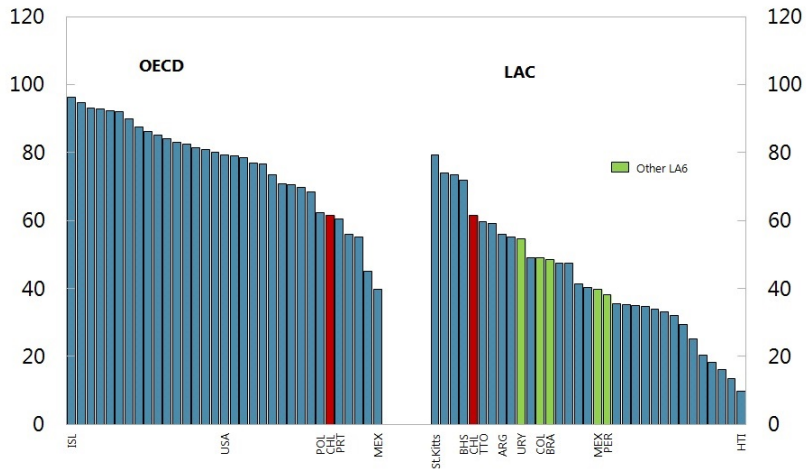
Source: World Development Indicators.

Figure 4: Attendance of primary and secondary schools by socioeconomic status
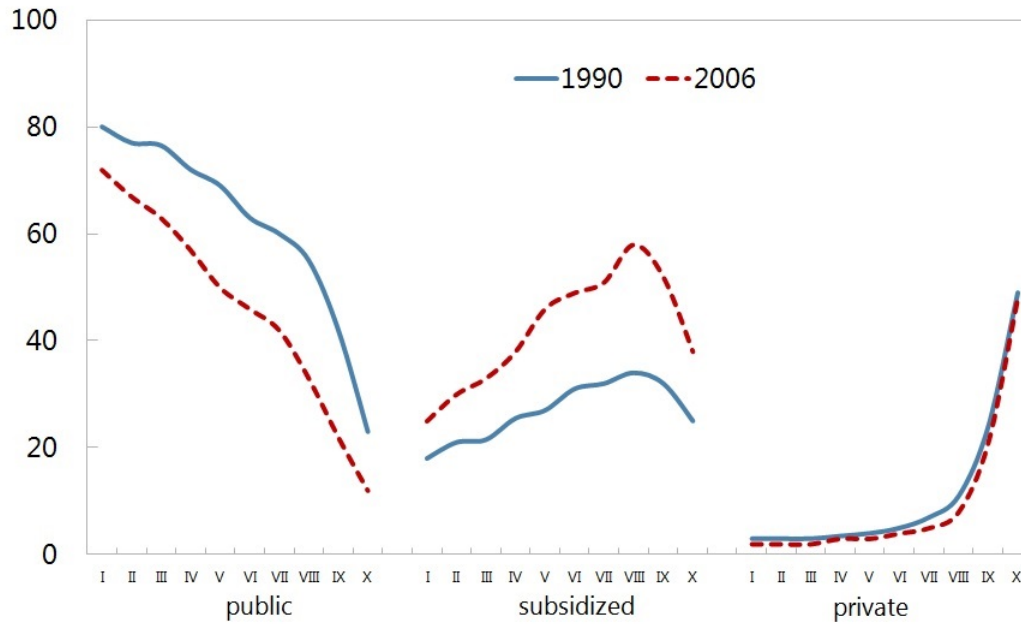
Note: In percent of each income decile. Sources: Ministry of Planning (Mideplan) CASEN Surveys 1990 and 2006 and OECD.
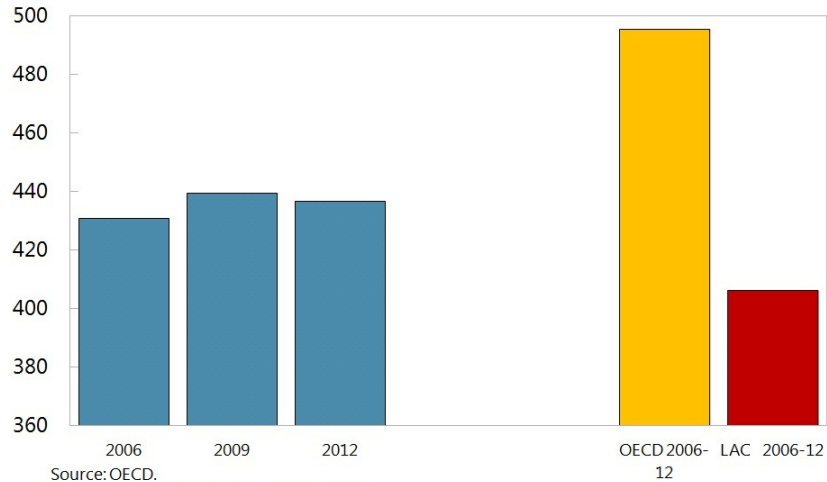
Figure 5: Education gap

Panel A. Average years of total schooling, Barro-Lee 2010
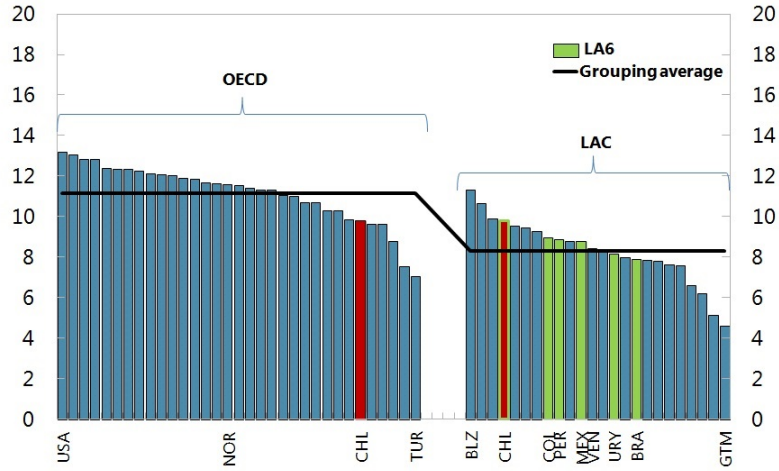
Source: Barro and Lee's database.

Panel B. PISA score: average math, reading, and science

Source: OECD.
Note: LAC includes LA5, ARG, CSI and URY.

Figure 6: Dimensions affecting the outcome of reforms

Panel A. Credible versus non credible policies

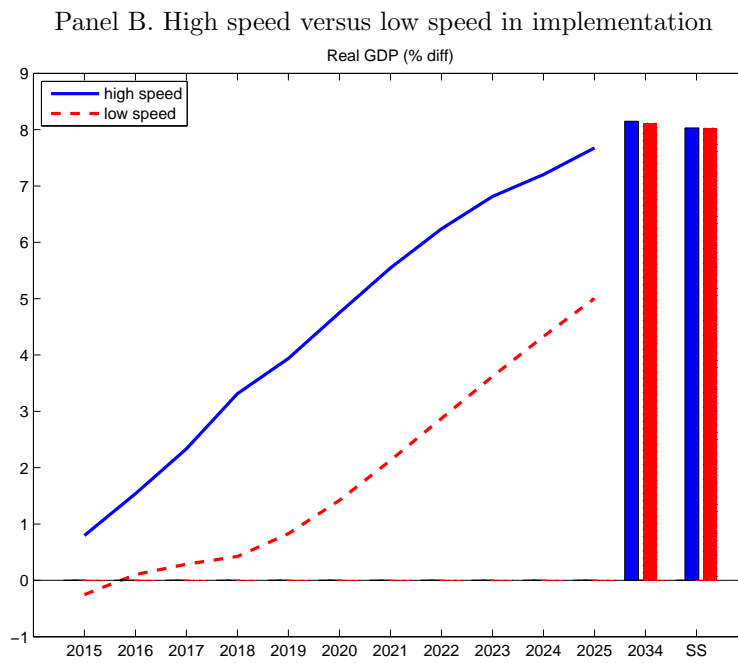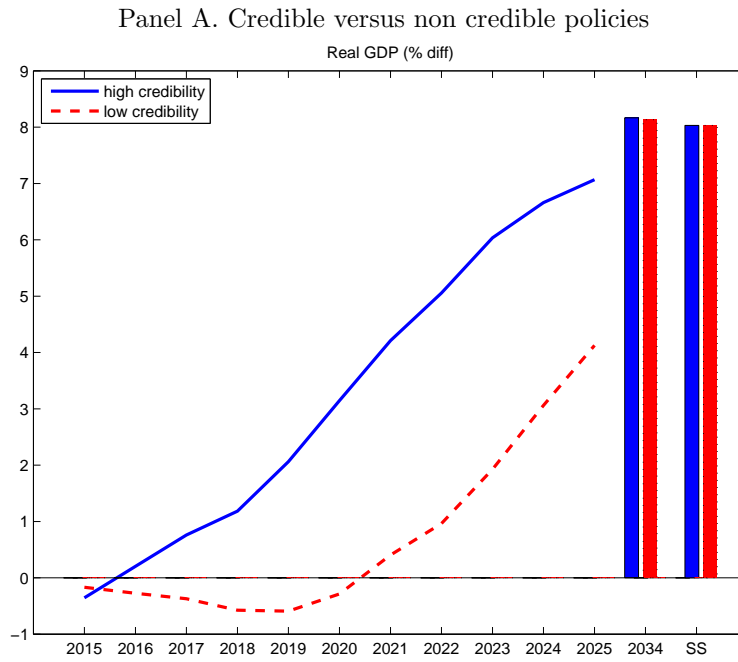Panel B. High speed versus low speed in implementation

Figure 7: Range of possible outcomes: GDP (% difference from baseline)