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The nexus between fiscal policy and sustainable development: Insights for developing countries from the case of Chile

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The nexus between fiscal policy and sustainable development: Insights for developing countries from the case of Chile

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Abstract

This paper hypothesizes that fiscal policy is one important factor determining whether or not environmentally and socially sustainable economic growth is possible. We postulate that tax policies affect the incentives to make the economy more or less dependent on natural resources and the environment as factors of production. So-called pro-growth tax policies consisting on a low tax burden, low direct taxes but high indirect ones, affect the composition of factor endowment, often inducing over investment in physical capital and under investment in human capital including education and health. These policies in part explain a structure of production heavily dependent on natural resource-based and environmentally-dirty industries. Also, these tax policies induce high levels of inequality that ultimately may render economic growth socially and politically unsustainable. This analysis has important implications for Chile and other developing countries especially in Latin America which are highly dependent on natural resources and have unequal income distribution.

Keywords: sustainable development; tax policies; unbalanced growth; inequitable growth; natural resource and environmentally dirty industries.

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1. INTRODUCTION

The central hypothesis of this paper is that fiscal policy is one important factor determining whether or not environmentally and socially sustainable economic growth is possible.[1] We postulate that tax policies affect the incentives to make the economy more or less dependent on natural resources and the environment.[2] The so-called pro-growth tax policies (as defined by Kakwani and Pernia, 2000) consisting on a low tax burden, low direct taxes but high indirect ones, affect the composition of factor endowment, often inducing over investment in physical capital and underinvestment in human capital including both education and health.[3]

We postulate that credit and environmental market failures are key structural deficiencies explaining social and environmental lack of sustainability in many developing countries. The alleged pro-growth tax policies, far from mitigating such market deficiencies, tend to exacerbate their negative effects on development. We illustrate these ideas using the case of Chile. The experience of Chile over the last few decades is important because it has been hailed as a highly successful case of economic growth (IMF, 2014). Canonical economists have enthusiastically endorsed its pro-growth tax policies arguing that it has been a key factor underlying its apparent economic success (Hsieh and Parker, 2007; Büchi, 2006). Here we show that the type of growth induced by these policies has been both socially and environmentally expensive, has exacerbated inequality and that such growth can hardly be expected to be sustained over the long run. Our analysis has important implications not only for Chile but also for other developing countries especially in Latin America, which as Chile have economies highly dependent on natural resources and historically unequal income distribution.

Below we present specific hypotheses regarding the effects of the pro-growth tax policies as defined by Kakwani and Pernia (2000) on environmental and socio-economic sustainability.

[1] Several other policies affect sustainable growth, including trade, environmental and industrial policies. Here we focus on the role of fiscal policy which has been mostly neglected in the analysis of sustainable development.

[2] The dematerialization of economic output and the decoupling of development from growth have been emphasized by several authors including Steinberger *et al*. (2013), Ayres and van den Bergh (2005) and Cole (1999).

[3] Other authors have emphasized other practical and philosophical aspects of pro-growth economic policies (Khan, 2015 and Hopwood *et. al*, 2005).

1.1 *Pro-growth tax policies worsen underinvestment in human capital and stimulates over investment in physical capital thus inducing unbalanced growth*

The low tax revenues deprive the government of the financial resources needed to spend more on education, R&D, provision of technical skills and health care which the market tends to under supply. Also, high indirect taxes further reduce the income of the low and middle income groups thus deepening their liquidity constraints affecting their investment in human capital. All this magnifies the under investment in human capital originated in credit market failures among the vast majority of the population that is forced to depend on the state to access education and health care. The perpetuation of low skills and poor human capital of the labor force becomes a binding constraint to the expansion of skilled-intensive industries. On the other hand the tax system is almost single-mindedly directed to provide large incentives to investment in physical capital, particularly for the most traditional resource-dependent and environmentally-dirty industries. The net effect is unbalanced growth by stimulating over specialization in capital-intensive, resource-intensive and environment-demanding industries.

1.2 Pro-*growth tax policies contribute to exacerbate inequality*

The low income tax revenues are in part compensated by high indirect taxes, especially the value-added tax (VAT), which means that a high portion of the total tax burden is shouldered by middle and low income groups thus accentuating liquidity constraints affecting them due to credit market imperfections and worsening social inequality.

1.3 Low taxes on economic rents and environmental externalities cause excessive environmental degradation and hinder the emergence of new industries

The lack of royalties for the use of natural resources and of environmental taxes prevent the government from raising tax revenues using instruments that are more efficient than most other taxes used. The lack of environmental taxes prevents the internalization of environmental costs and worsens environmental degradation. The fact that producers using natural resources and the environment are not required to pay for these important factors of

production entails an implicit discrimination against sectors that are not resource-dependent and are environmentally clean such as high tech, knowledge-based and human capital-intensive activities which have to pay market prices for all their inputs.

1.4 The slow growth of human capital and natural capital degradation in part due to the "pro-growth" tax policies negatively impinge upon total factor productivity growth

Declining total factor productivity (TFP) over a prolonged period of time is a clear early warning sign of the lack of sustainability of economic growth. An adequate expansion of human capital is a pre-condition to the development of new ideas and critically affects the investment in R&D and its efficacy in adapting or creating new technologies. Also, to the extent that TFP refers to the productivity of man-made factors of production, declining natural capital often leads to lower measures of TFP because natural capital and man-made assets are complementary in production. Thus, if tax policies negatively affect human and natural capital one may expect that such policies will eventually cause TFP to decline.

In the following sections we provide empirical support to the hypotheses just formulated. While the existing data is clearly insufficient to rigorously show the validity of these hypotheses, we provide suggestive empirical facts consistent with them.

2. UNBALANCED GROWTH AND INEQUALITY

2.1. Unbalanced growth: High reliance on traditional resource-intensive and dirty industries

An indicator of the lack of balance of the Chilean economy and its excessive dependence on resource-intensive and raw material sectors is given by the inordinately low share of the service sector in GDP, given the country's level of per capita income. Table 1 shows that the share of the service sector in GDP has been below 60% throughout most of the last decade. As shown in Table 1, over the period 2005-2014 Chile had the lowest share of the service sector among comparable countries in Latin America, including Argentina, Brazil, Mexico and Costa Rica. Also, Table 1 provides comparisons with middle income OECD countries showing that Chile`s share of the service sector is also much lower than in these

countries. Thus, Chile has a relatively underdeveloped service sector and concomitantly over-grown resource-based industrial and primary sectors. During 2005-2014 period, data from the Central Bank of Chile show that the average participation of the primary sectors (agriculture, fishing, forestry and mining) in GDP has been above 20%, much higher than that of most middle income countries. The participation of more knowledge-based and technologically sophisticated activities has been practically negligible.

Table 1
Selected Latin American countries and OECD: Service Sector as % of GDP; 2005-2014

COUNTRY	2005-2009	2010-2014
Greece	77.0	82.3
Estonia	67.4	67.7
Hungary	65.3	65.4
Poland	64.1	63.6
OECD (a)	73.1	74.3
Brazil	67.4	69.2
Costa Rica	63.1	68.3
Argentina	58.7	62.5
Mexico	60.9	61.3
LA AVERAGE (b)	60.2	62.2
Chile	55.7	59.6

(a) All OECD member countries; (b) All Latin American countries
Source: Own elaboration with data from WDI, World Bank (2015).

2.2.Inequality

López *et al.* (2015) recently showed that by far the largest source of inequality in Chile is given by the incomes at the very top of the distribution. The share of the richest 1% of the taxpayers in the country's total income averaged about 30% over the period 2004-2013, which makes Chile the country with the worst income distribution among the countries for which there exist similar studies (such as those of Atkinson and Piketty 2007 and 2010, and Atkinson *et al.* 2011). This high concentration of income in the very top echelons of the

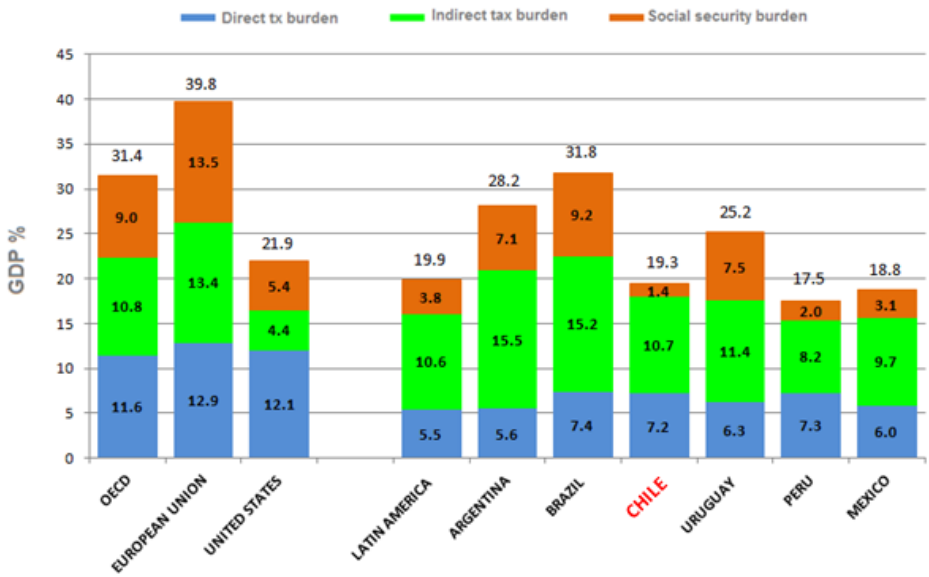
distribution is also valid for other Latin American countries including Colombia (Alvaredo and Londoño, 2013) and Uruguay (Burdin et.al, 2013).

3. TAX POLICIES AND INEQUALITY

3.1. Low tax revenues

Chile has the lowest tax revenue per dollar of GDP among all OECD countries. In the period 2012-2014 total tax receipts amounted to 19.4% of GDP compared to an average of 31.2% for all OECD countries (Figure 1). Even within Latin America, Chile's tax revenues as a proportion of GDP are much lower than those of the other most developed countries in the region, including Brazil (31.8%), Argentina (28.1%) and Uruguay (25.2%). Also, the tax burden of Chile is even below the average for all of Latin America. These low tax revenues impose a tight binding constraint on the scope of public expenditures (López and Miller, 2007).

Figure 1
International Comparison of the Tax Burdens as % of GDP; 2012/2014



Note: Data of 2014 for the EU; of 2013for Latin America and all its countries and of 2012 for USA.
Source: Own elaboration with data World Bank (2015) and Eurostat EC (2015).

3.2. High reliance on indirect taxes

The tax structure of Chile is heavily reliant on indirect taxes while income taxes provide a much smaller fraction of all revenues and constitute a low proportion of GDP. In the period 2013-2014 only 38% of the total tax revenues were originated in income taxes while about 56% came from indirect taxation (Mardones, 2014). This dependence on indirect taxation is almost 40% higher than the average in OECD countries where it is 35% of total tax revenues (Figure 1). While other Latin American countries at similar levels of development also exhibit a high share of indirect taxes, this share is not as high as in Chile. For example, 55% of the tax revenues in Argentina correspond to indirect taxes, 48% in Brazil and 45% in Uruguay. Also, the average dependence on indirect taxes in Latin American countries, at 53% is lower than that of Chile.

3.3. Low corporate income taxes

Corporate income tax revenues have remained at 3.3% of GDP over the period 2009-2013, which implies a very low effective tax rate for corporations (Mardones, 2014). Using the well accepted lower bound estimate for the share of capital in GDP at 50% (World Bank, 2011b, 2006) this would yield an effective tax rate on profits equal to about 6.6%, well below Chile's legal corporate rate of 20%.

3.4. Large tax expenditures or legal loopholes

Tax expenditures have been extremely high over recent years, reaching 4.5 % of GDP and more than 21% of all tax revenues in 2011 (Jorratt, 2012). About 80% of the tax loopholes consisted on income tax exemptions. These large tax loopholes not only subtracted tax revenues to the state but also are greatly regressive, since more than 80% of the income tax loopholes benefited the wealthiest 5% of the population, and 60% the richest 1% of the population. The wealthiest 1% receives an annual transfer equivalent to 2% of GDP via tax expenditures.

3.5. High rates of income tax evasion

Tax evasion rates are relatively low for indirect taxes but high for income taxes. The rate of income tax evasion is quite high reaching almost 50% (Jorratt, 2009) and comparable to several countries in Latin America including Argentina (50%), Mexico (46%), Peru (51%) and El Salvador (51%) (Gómez Sabaini, 2010). Jorratt (2009) estimated income tax evasion at about 4% of GDP. A reason for the high level of income tax evasion may be associated with large gap between personal and labor income tax rates (with a maximum rate of 40%) and capital income (taxed at a 17% rate during most of the period considered).

In Chile, like in most Latin America, income taxes affect mainly the upper 10% to 15% of the population (de Ferranti *et al.,* 2002). Therefore, most tax evasion benefits the richest segments of the population that rely on non-wage revenues as their primary source of income. So we can expect that income tax evasion is at least as regressive as legal tax loopholes.

3.6. Negligible royalties on rents to natural resources

In general distinguishing between rents and normal returns to capital is difficult. However, data for the large copper firms in Chile suggest that the rates of return to capital are so high that it would be hard to argue that parts of these returns do not in fact correspond to economic rents. The pre-tax average annual rate of return to the patrimony of the large private copper companies in Chile over the 2005-2013 period was in excess of 80% and the after-tax return was about 54% (Titelman, 2010 and own estimates for 2010-2013). These figures suggest very large economic rents that the state has failed to capture. Estimates of annual resource rents from mining and a few other resource-based sectors for which there is data amount to USD 15,1 billion, for the period 2007-2010, or 10.1% of the country's average GDP (Table 2).

Table 2
Chile: Average annual economic rents generated by natural resources
in selected industries; 2007-2010

		ANUAL RENTS	SHARE OF CALCULATED RENTS	SHARE OF GDP[a]
		(million USD)	(%)	(%)
FISHING	Private	200	1.3	0.1
FOREST	Private	750	5.0	0.5
MINING	Private non-copper	910	6.0	0.6
	Private copper	8,300	54.9	5.5
	Public copper	3,600	23.8	2.4
WATER	Private water/sanitation	160	1.1	0.1
	Private hydropower	1,200	7.9	0.8
	Total	**15,120**	**100.0**	**10.1**

a: average annual GDP of USD 150 billion for the period.
Source: own calculations based on COCHILCO, CODELCO and companies' annual reports.

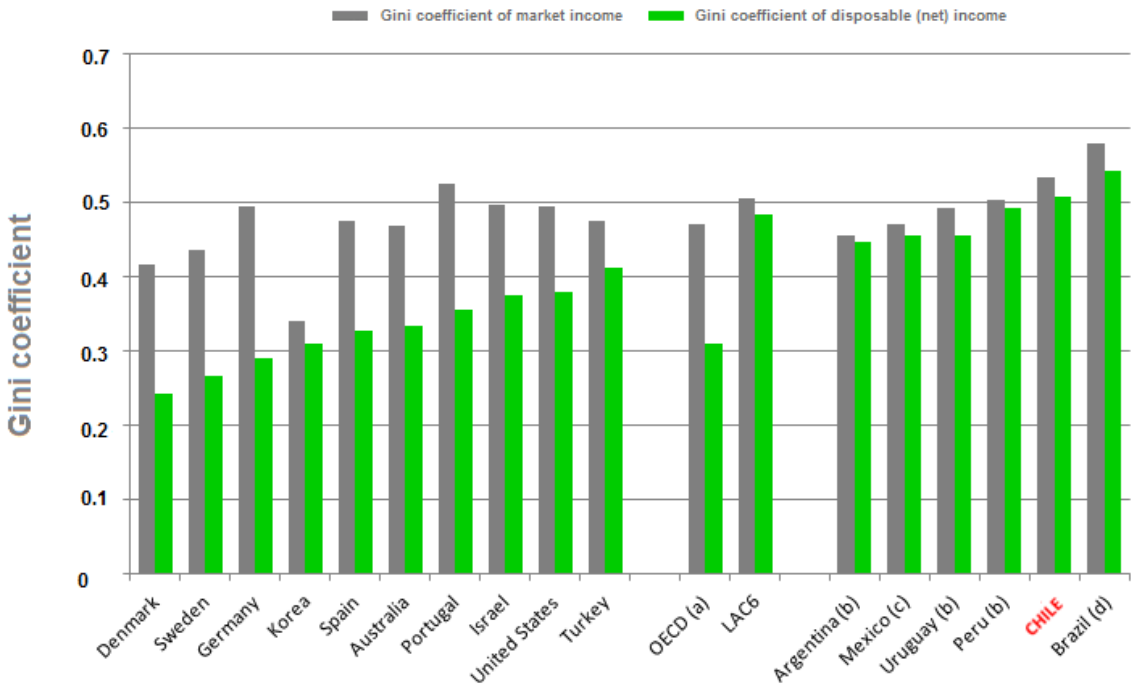
The government has given rights of exploitation of most natural resources for free to large foreign and domestic corporations although a small royalty has been charged to copper resources since 2005. Given that the state has given away the rights to exploit natural resources, one may expect that the corporations that exploit such resources be required to pay a royalty for them over and above the normal taxation. Since these rents are returns over and above the normal returns to capital, taxing them would entail no efficiency losses.

Most resource-rich advanced countries have established a variety of mechanisms to tax a significant part of resource rents. Australia uses especial taxes on the rents of mining firms that imply an effective net income tax equivalent to more than twice the rate paid in Chile (CENDA, 2010). A recent study showed that in the oil and gas sector, for the period of 1995-2002, Alaska captured 99% of the economic rents generated in the sector, Norway 88% and five Canadian Provinces 74% (Taylor *et al.* 2004).

3.7 Taxes do little to reduce inequality

Compared to other OECD countries, in Chile the after-tax income distribution is not very different from the pre-tax distribution (see Figure 2). Across OECD countries, public cash transfers together with income taxes and social security contributions reduce income inequality (measured by the Gini coefficient) by an average of about 34%. In Chile the Gini coefficient decreased by only 5.4%.

Figure 2
OECD: Inequality (Gini coefficient) of market income and disposable (net) income; 2005-2012.

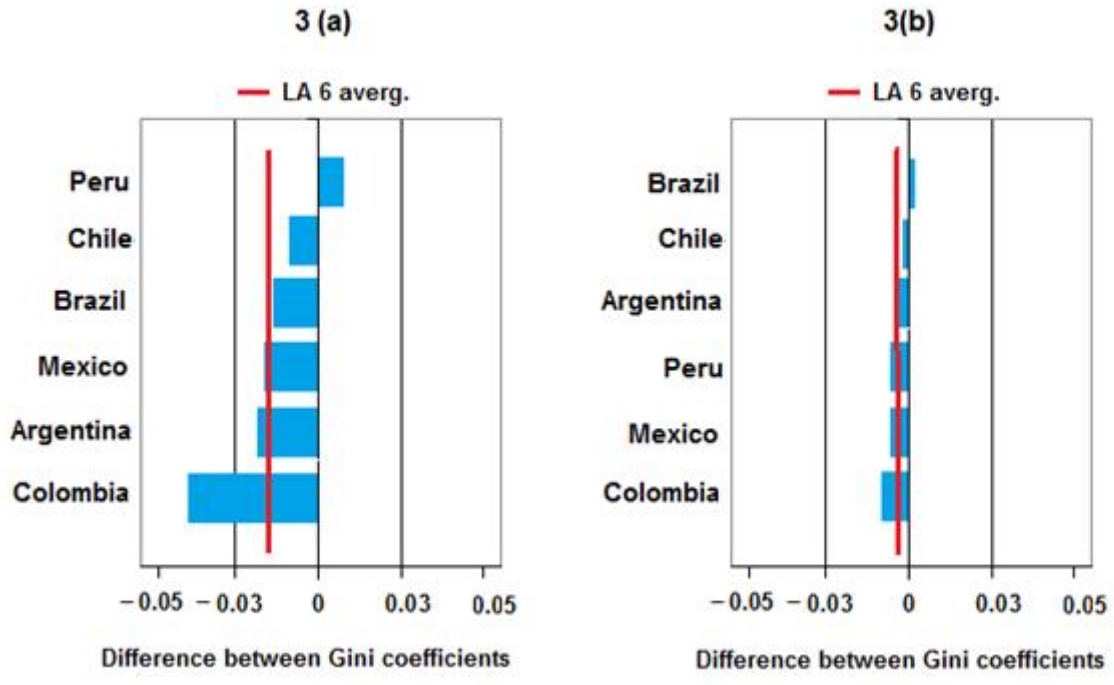


(a) OECD average calculated for the 34 current member countries (including Chile and Mexico).
(b) Figures for 2009
(c) Figures for 2008-2012
(d) Figures for 2008-2009
Source: Own elaboration with data from OECD (2015) and World Bank (2014).

The role of taxes to reduce inequality is low in Chile even when compared with that of other large Latin American countries of comparable per capita income (Figure 3). The panel (a) of Figure 3 shows the difference in Gini between the *post-tax income* (defined as

income after both transfers as well as direct and indirect taxes) and the *market income* (defined as the income before any government transfer or taxes). As can be seen in the figure, taxes and government transfers in Chile improve income distribution as shown by the reduction of the Gini coefficient. However, with the exception of Peru, Chile is the country where the difference in Gini is the smallest and is also lower than the Gini difference for the average country in the sample. That is, while taxes and transfers in other Latin American countries do little to improve income distribution, government intervention in Chile does even less.

Figure 3
Selected Latin American countries: Differences between Gini coefficients of post-tax and market income (panel a) and of disposable and gross income (panel b); 1999-2006



Source: Own elaboration with data for the period 1999-2006 from Goñi *et al.* (2008) and World Bank (2015).

In its panel (b), Figure 3 shows the difference between the Gini of *disposable income* (defined as income after income taxes) and the Gini of *gross income* (defined as the market income plus government transfers) to illustrate the pure effect of direct taxes on inequality. This difference is small in all the countries in the sample but it is even smaller in Chile than

in four of the five comparable countries. The main reason for this is that in most Latin American countries including Chile income taxes are low and, as we discussed earlier, the rate of income tax evasion is high.

3.8. Tax structure

A key problem with Chile's tax system is its highly unbalanced nature: it is highly dependent on very high VAT taxes while it applies very low effective rates to corporations and exempts capital gains almost completely. VAT taxes have often been advocated as "efficient" presuming that they would cause fewer distortions than income and profit taxes. However, in highly unequal countries such as Chile and other Latin American countries, a large portion of the population may face severe liquidity constraints as a consequence of their low incomes and of the existence of credit market imperfections.[4] Liquidity constraints become a binding factor limiting investments by the poor and the middle classes in both physical and especially human capital, despite that those investments may have high rates of return. VAT may exacerbate liquidity constraints among the poor and middle income groups, thus reducing their capacity to finance investment in human capital. Forcing those that are most affected by liquidity constraints (i.e., the poor and most middle groups) to pay VAT rates as high as 19% can only worsen such constraints, further impairing their capacity to self-finance socially profitable investments and thus exacerbating economic inefficiency.

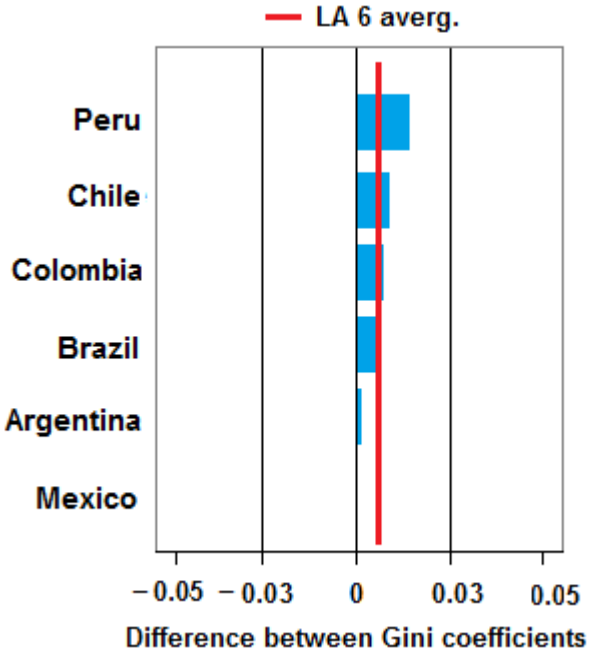
Thus, VATs also cause deadweight losses. These deadweight losses may be larger than those caused by equivalent income, profit or capital gain taxes that exempt middle and low income groups. The implication then is that a tax system that strives to minimize deadweight losses should strike a better balance between direct taxes and VAT.

A measure of the pure impact of indirect taxes on income inequality can be obtained as the difference between the Gini of post-tax income and disposable income (Figure 4). As can be seen in the figure, indirect taxes worsen income distribution in all countries in the sample with the exception of Mexico, where is neutral. Among the six countries, Chile`s increased Gini of 1 percentage point is the second highest after Peru. The main reason is that

[4] Recent empirical literature has shown that credit market failure and liquidity constraints are pervasive affecting a large portion of households in both poor countries (Haque and Montiel, 1989) and even in rich ones (Attanasio *et al.*, 2008; Grant, 2007; Jappelli, 1990).

indirect taxes in Chile are high and identically affect practically all items, whether they are luxury goods or necessities, in which the low income classes spend most of their income.

Figure 4
Selected Latin American countries: Difference between Gini coefficients of post-tax income and disposable income: 1999-2006



Source: Own elaboration with data for the period 1999-2006 from Goñi *et al.* (2008) and World Bank (2015).

4. PUBLIC SPENDING HAS CONTRIBUTED TO REDUCE POVERTY BUT NOT INEQUALITY

As a result of the very low tax revenues prevailing in Chile, public spending has been meager. The share of total public spending in GDP was consistently below 22% over the last twenty years, one of the lowest spending ratios among the middle income countries in Latin America and among the OECD countries (Table 3).[5]

[5] The public spending composition emphasizes the provision of goods that are complementary with private spending rather than substitute. As López and Galinato (2007) have shown, this is precisely the role of government spending which has contribute to drastically reduce poverty in the 1987-2013 period.

Table 3
Chile: Government Expenditure by Function; 1990-2013

	1990-1997	1998-2005	2006-2009	2010-2013
	(% of GDP)			
Government and Public Services	2.0	1.4	1.2	1.5
Defense and Economic Affairs	4.3	4.2	4.3	4.0
Public Order and Safety	1.0	1.3	1.4	1.5
Social Expenditure *	12.7	14.4	13.8	14.5
Total	20.0	21.3	20.7	21.6

* Includes expenditures on education, health, housing, social protection, recreation and culture and environmental protection.
Source: Own elaboration with data from DIPRES (2011, 2015).

Moreover, as column one of Table 4 shows, for the period 2005-2013 total social spending in Chile at 13.8% of GDP was lower than the average for the 5 comparable Latin American countries (18,9%), and also much lower than the average for OECD countries (19.6). The Chilean government spent only 3.9% of GDP in education, well below the 4.6% spent by OECD countries and even less than comparable countries (4.4%). The gulf between Chile's public expenditures in health and comparable countries is even deeper than that of education. Public spending in health was only 3.3% of GDP in Chile, while the OECD average was 5.9 % and the average for the 5 comparable Latin Americas countries was 4% of GDP.

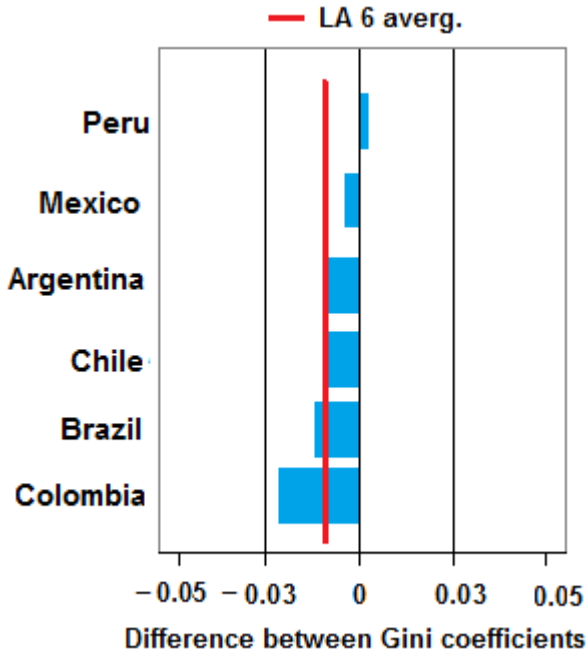
Table 4
Selected Latin American countries and OECD: Social Public Expenditures as % of GDP; 2005-2012

	TOTAL	EDUCATION	HEALTH
	% of GDP		
Argentina	23.1	5.6	5.0
Brasil	24.4	5.1	4.7
Chile	**13.8**	**3.9**	**3.3**
México	10.4	3.6	2.6
Uruguay	22.7	3.7	4.7
LATIN AMERICA[a]	18.9	4.4	4.0
OECD[b]	19.6	4.6	5.9

(a) Calculated for the 5 Latin American countries included
(b) Calculated for the period 2005-2013
Source: Own elaboration with data from ECLAC (2015) and OECD (2015).

The low potency of public social transfers to reduce income inequality is illustrated by the difference between the Gini coefficients of market income (income excluding government transfers) and gross income (income including government transfers). Figure 5 shows this comparison across the six Latin American countries. This difference is small in all countries in the sample with the exception of Colombia where it is equal to about 4 percentage points. In Chile is also negative but lower than in Colombia and Brazil, of the order of 1 percentage point, similar to Argentina`s and slightly better than in Mexico. Thus, Chile`s social transfers have had little effects on income inequality. This feature is shared by the comparable Latin American countries with the exception of Colombia.

Figure 5
Selected Latin American countries: Difference between Gini coefficients of gross income and market income; 1999-2006

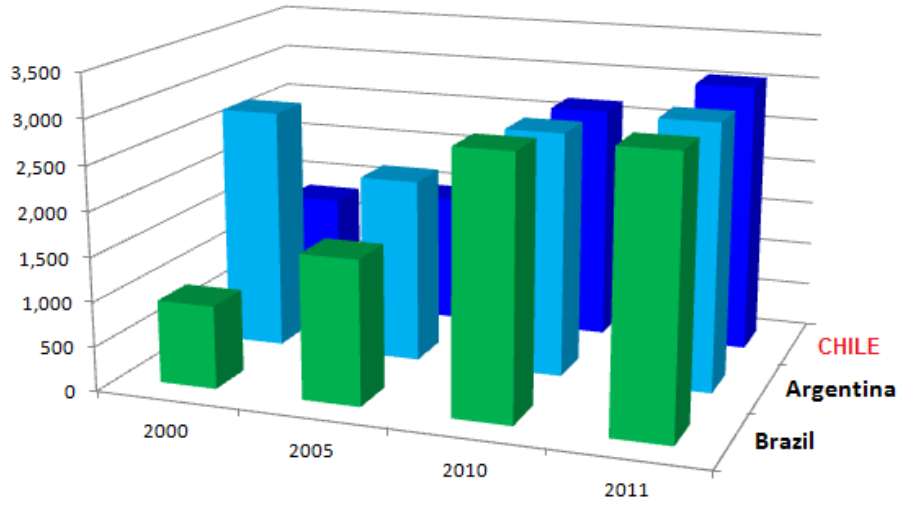


Source: Own elaboration with data for the period 1999-2006 from Goñi *et al.* (2008) and World Bank (2015).

In terms of the absolute government spending in education per pupil, Figure 6 compares spending per student in PPP USD for Argentina, Brazil and Chile for the period 2000 to 2011. Chile has spent considerably less than its comparable neighbors during much of the period and only in 2011 it was able to fully catch up with them.

Also, more than 90% of the primary and secondary student population in Chile is enrolled in public or government-subsidized schools despite that they provide a much inferior quality of education than private schools (Missoni and Solimano, 2010). Also, more than 70% of the population must use the public health system despite the often long waiting lists for much pathology, and 10% of the population simply has no access to any health care (Hoffmeister, 2010).

Figure 6
Argentina, Chile and Brazil: Total annual government expenditure per student in absolute terms (PPP USD/student/yr). 2000-2011.



Source: Own elaboration with data from UIS (2015).

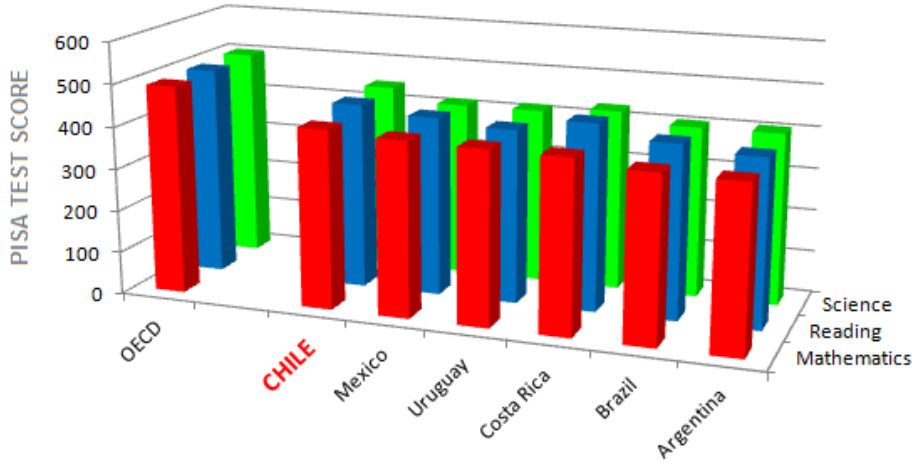
5. OUTCOMES: EDUCATION AND HEALTH INDICATORS

5.1 Education achievements

So far we have provided data on public inputs to the schooling system. We now focus on quality indicators of schooling using international tests. In general Latin American students tend to perform poorly in these tests and Chile is no exception. Figure 7 shows the scores of the most recent PISA test (2012) in mathematics, reading and science. As can be seen, the performance of Chilean students is quite similar to other students in the region, but is well below the average for OECD countries. While Chile`s performance is slightly better than in most of the other participant Latin American countries it is almost identical to students in Costa Rica, a country significantly poorer than Chile.

Figure 7

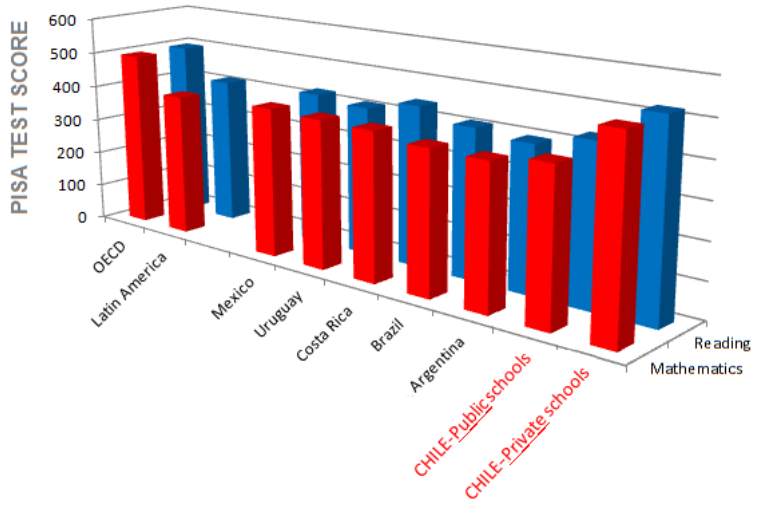
Selected Latin American Countries: 2012 Pisa Test Scores in mathematics, reading and science.



Source: Own elaboration with data from OECD (2014).

Moreover, the performance of students in the public and publicly-subsidized schools which cover 90% of the student population is well below the national average (see Figure 8). By contrast, the performance of students in the private school sector is extremely high, just slightly lower than the average for OECD in mathematics and at par in reading tests. It is important to emphasize the fact that the average per-pupil expenditure in the private schools is almost three times higher than in the public and publicly-subsidized sectors (Mizala et al. 2005). This shows that the deficiencies of the schooling performance Chile`s students is mostly due to insufficient government expenditures in public schools and possibly also to inefficiencies prevailing in the public schooling sector.

Figure 8
Selected Latin American Countries: Pisa Test Scores in mathematics and reading; 2012.



Source: Own elaboration with data from OECD (2014).

5.2 Health[6]

Table 5 shows data on public resources devoted to health care and some outcome indicators for several Latin American countries and averages for OECD countries. While life expectancy in Chile is the highest in Latin America (albeit one of the lowest among OECD countries) other indicators for Chile are more problematic. Thus, there are only 1.1 doctors per 1,000 population compared to 2.8 in the average OECD country, 2.1 in Mexico and 1.8 in Brazil. Chile, with only 0.5 practicing nurses per 1,000 people is among the lowest in a sample of 60 countries including OECD and non-OECD countries (OECD, 2011). This is lower than countries such as Brazil, Mexico. Also, there are 2.1 hospital beds per thousand people in Chile compared to 4.7 in Argentina, 2.3 in Brazil and 1.5 in Mexico.

[6] The data provided in this section correspond to the most recent statistics available from OECD sources.

Table 5

Selected Latin American Countries: Resources and Health indicators. Most recent year for the period 2007-2013.

	RESOURCES				HEALTH INDICATORS			
	Health expenditure	Hospital beds	Physicians	Nurses and midwives	Life expectancy at birth	Births attended by skilled health staff	Smoking prevalence	Diabetes prevalence
	(USD PPP/per capita)	(per 1,000 people)			(years)	(% of total births)	(% adult population)	(% population ages 20-79)
Argentina	1,724.6	4.7	3.9	0.5	76.2	98.2	26.3	5.7
Brazil	1,453.9	2.3	1.9	7.6	73.9	98.1	16.7	8.7
Chile	1,677.6	2.1	1.0	0.5	79.8	99.9	39.6	11.2
Costa Rica	1,369.0	1.2	1.1	0.8	79.9	99.1	14.5	9.5
Colombia	842.7	1.5	1.5	0.6	74.0	99.1	12.1	7.3
Mexico	1,061.1	1.5	2.1	2.5	77.4	96.0	15.5	12.6
Peru	626.2	1.5	1.1	1.5	74.8	86.7	8.2	6.5
Latin America	1,132.9	2.0	2.0	4.2	74.9	92.6	17.7	9.1
OECD	4,579.0	3.8	2.8	7.8	80.0	99.5	23.6	7.9

Source: Own elaboration with data from the World Bank (2015) and OECD.

The rate of cancer mortality in the period 1970-2011 has fallen by only 11% compared with reductions of 14% for the average OECD country, 13% in Mexico. The rapidly increasing rates of obesity and diabetes in Chile are also a reflection of insufficient attention to public health. Also, Chile has one of the highest rates of smoking, especially of young people, among all OECD countries.

While total spending in health care in Chile as percentage of GDP is not too different from the average OECD country, only 50% of those expenditures come from the public sources compared to 72% in the OECD. Similarly, direct health payments by households amount to 30% of the total health spending compared to only 20% in the average OECD country. This structure of health expenditures is not conducive to reduce deleterious health habits such as smoking and junk food eating as private spending is rarely directed to these themes.

In summary, while Chile ranks well in indicators such as life expectancy and infant mortality, several health measures such as diabetes and smoking appear to be extremely poor compared to countries of similar levels of income. Additionally, the country suffers from dramatic shortages of physicians and especially nurses compared even to countries of much lower per capita incomes.

6. OUTCOMES: ENVIROMENTAL LACK OF SUSTAINABILITY

An important implication of the patterns of economic growth and distribution which is due to the high dependence on dirty outputs and physical capital in part due to the fiscal policy as discussed earlier is the poor environmental performance of the country over the last two decades. Here we provide evidence in this respect using the emission trends of seven key pollutants: carbon dioxide (CO2), methane (CH4), nitrous oxide (NO2), sulfur dioxide (SO2), carbon monoxide (CO), PM10 and PM2.5. Table 6 compares the evolution of the first three of these indicators of environmental degradation over the period 1990-2010 with those of other comparable countries in Latin America. Chile's emission trends are by far the worse for methane and nitrous oxide and are the second worst for CO2 emissions.

Grether *et al.* (2009) find that Chile`s emission of SO2 is among only three countries in the world that experienced significant increases in SO2 emissions of manufacturing production over the 1990-2000 period. This is largely due to the great dependence of the Chilean economy on production of primary commodities, particularly copper (smelting) and pulp and paper activities that produce large amounts of SO2 as byproducts. However, as we show below, in more recent years the emissions of SO2 appear to have been reduced specially since 2007 when they reached its historical maximum.

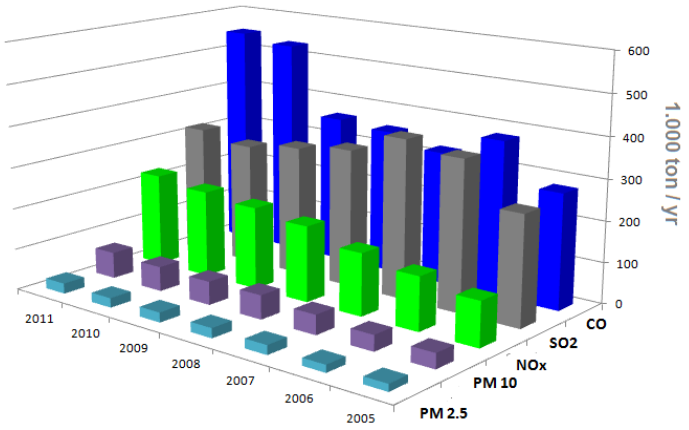
Table 6
Selected Latin American countries: Pollution emission trends; 1990-2010

CO2 emissions (1,000 tons/yr)						
	ARGENTINA	**BRAZIL**	**CHILE**	**COLOMBIA**	**MEXICO**	**PERU**
1990	112,614.0	208,887.0	34,143.0	57,337,0	314,416.0	21,170.0
2010	180,512.0	419,754.0	72,258.0	75,680.0	443,674.0	57,579.0
Change	60.3%	100.9%	111.6%	32.0%	41.1%	172.0%
METHANE emissions (1,000 tons CO2e/yr)						
	ARGENTINA	**BRAZIL**	**CHILE**	**COLOMBIA**	**MEXICO**	**PERU**
1990	102,040.0	319,602.7	11,976.7	50,259,2	98,351.4	13,569.5
2010	86,734.0	443,289.0	18,001.0	66,694.0	115,858.0	18,943.0
Change	-15.0%	38.7%	50.3%	32.7%	17.8%	39.6%
NITROUS OXIDE emissions (1,000 tons CO2e/yr)						
	ARGENTINA	**BRAZIL**	**CHILE**	**COLOMBIA**	**MEXICO**	**PERU**
1990	38,449.8	155,837.8	5,101.2	20,178,2	40,124.7	5,560.5
2010	52,061.0	207,576.0	8,774.0	25,142.0	43,134.0	8,313.0
Change	35.4%	33.2%	72.0%	24.6%	7.5%	49.5%

Source: Own elaboration with data from World Bank (2011a)

Regarding the emissions of other pollutants, Chile`s performance over the period 2005-2011 has also been quite dismal. In fact, as Figure 9 shows, the total levels of emissions of PM 2.5, PM 10, NOx, SO2 and CO over the period 2005-2011 have continuously increased; some of them have more than double throughout the period despite the fact that the period considered includes the years 2009 and 2010 in which the economy`s growth dramatically slowdown as a consequence of the great world recession. The only exception is SO2 emissions, which after 15 years of fast increases, have finally begun fallen since 2007.

Figure 9
CHILE: Total annual emissions of five criteria air pollutants; 2005-2011.
(1.000 ton / yr)



Source: Own elaboration with data from RETC, Ministry of Environment-Chile (MMA, 2012).

Table 7 and Figure 10 show the total emission intensities (emissions per 100 million dollar of GDP) over the period 2005-2011. Of the five pollutants shown in the table, three of them exhibit increasing or stable trends while SO2 emission intensities have systematically decreased since the year 2007. All other pollutant emission intensities have either remained stable (PM10) or have increased throughout the period (CO, NOx, and PM 2.5). This is significant because while total pollution has tended to increase in most countries, the general trend is to decrease pollution intensities. Thus, just as predicted by our analysis of the structure of the economy and patterns of fiscal incentives, it appears that Chile's pattern of

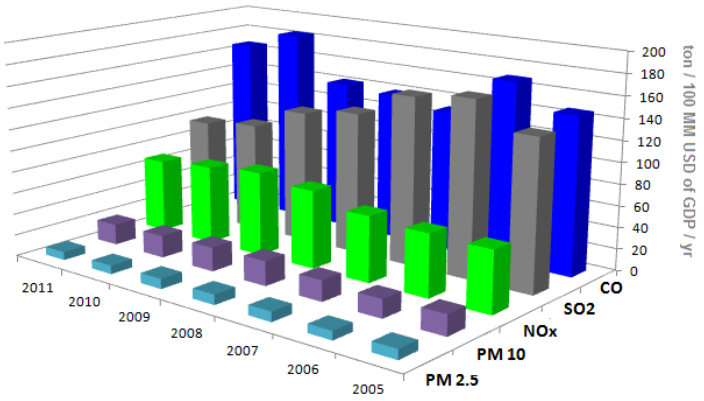
economic growth has been associated with a dismal environmental performance over the last two decades.

Table 7
CHILE: Total annual emission intensities of five criteria air pollutants; 2005-211
(ton / 100 MM USD of GDP /yr)

	2005	2006	2007	2008	2009	2010	2011
CO	146.7	168.8	131.1	139.0	142.1	183.7	166.7
SO2	139.5	163.2	156.6	132.3	124.0	102.7	96.6
NOx	56.6	58.0	61.2	72.7	78.4	73.2	68.9
PM 10	18.9	17.1	19.3	22.9	22.2	20.6	19.4
PM 2.5	9.1	8.0	9.2	9.3	9.3	7.9	7.6

Source: Own elaboration with data from RETC, Ministry of Environment-Chile (MMA, 2012)

Figure 10
CHILE: Total annual emission intensity of five criteria air pollutants; 2005-2011.
(ton / 100 MM USD of GDP /yr)

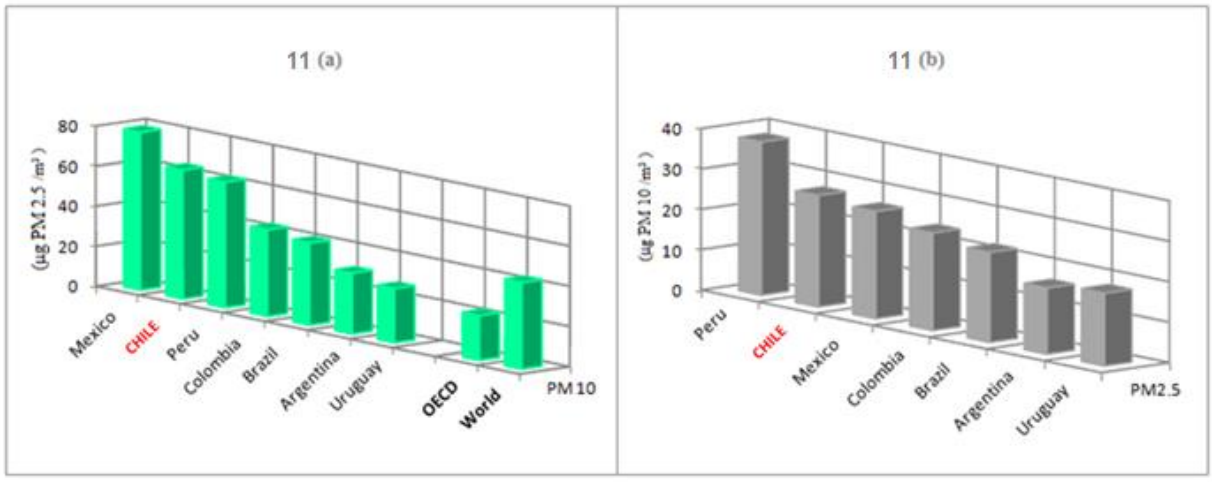


Source: Own elaboration with data from RETC, Ministry of Environment-Chile (MMA, 2012).

Figure 11 compares the levels of urban exposure to PM10 and PM2.5 in Chile with those of other comparable Latin American countries for the years 2011-2012. Exposure to PM10 (panel a) in Chile is the second highest among the seven countries considered after that of Mexico. Also, it is three times higher than in the average OECD country and almost

50% higher than the average for the world as a whole. Similarly, exposure to PM2.5 is also the second highest among the seven Latin American countries considered (panel b in Figure 11). Thus, the analysis in previous sections predicted that the high participation of dirty industries in total output in Chile is likely to be associated with high levels of pollution. This prediction is corroborated by the available data on the seven important pollutants considered in this section.

Figure 11
Selected Latin American countries: Average annual exposure to PM 10 (panel (a)) and PM 2.5 (panel (b)) pollution levels of an average urban resident; 2011 or 2012*
(μg PM /m^3 annual mean)



(*) PM 10 data of 2011 for Chile, Mexico and Peru; and of 2012 for Argentina, Brazil, Colombia and Uruguay. PM 2.5 data of 2011 for Mexico and Peru, and 2012 for the other countries.
Source: Own elaboration with data from WHO (2015) and OECD (2015 and 2013).

7. DISCUSSION

7.1 The dynamics of factor endowments

The poor quality of education for the vast majority of the students caused by the combination of credit market imperfections (i.e., liquidity constraints affecting large segments of the population) and the so-called pro-growth tax policies imply that the development of new productive skills as well as the process of adaptation and creation of new scientific and technological knowledge become more difficult. On the other hand, the tax system which provides for low taxes on corporate profits and generous investment

allowances and tax exemptions creates large incentives to investment in physical capital, especially for corporations that exploit natural resources as well as for other traditional industries. The combination of insufficient expenditures in human capital and generous tax policies that promote investment in physical capital causes factor endowments to become increasingly more biased toward physical capital and against human capital.

In a small open economy like those of Chile and other Latin American countries there is a direct correlation between the structure of factor endowments and the patterns of specialization in production. Countries that fail to develop human skills and to adopt new technologies at the same rate as others are left behind and must increasingly specialize in physical capital-intensive and/or unskilled-intensive industries and, in the case of countries rich in natural resources as Chile, in natural resource-intensive industries as well.

7.2 Increasing specialization in resource-intensive and environmentally-dirty industries

The fact that environmentally-dirty and resource-dependent sectors do not pay or pay only partially for environmental damages and for the natural resources that they extract, and given that they tend to capture most of the large tax breaks available, has given these sectors an unfair advantage that is reflected in the markets for the scarcest factors of production: high skills. While traditional industries are resource and physical capital-intensive they also use high skills, including scientists, engineers and others. The artificial incentives that these industries enjoy imply that the marginal values of the high skilled people employed in them is magnified allowing firms to pay higher wages than what infant high-technology industries can afford. This makes it more difficult for new knowledge-intensive sectors to emerge.

This same process is in part responsible for the retardation of the development of the most skill intensive of all sectors: The academic and scientific research institutions (the knowledge-generating sectors) which produce new knowledge using almost as their sole input scientific and technological skills. This sector has encountered serious difficulties in competing with traditional productive sectors to retain the scarce top scientists and engineers required to develop and disseminate new scientific knowledge, which ultimately leads to practical innovations. To make matters worse, the public academic and research

centers have been subjected to chronic budgetary insufficiencies as part of the overall budgetary restrictions faced by the public education system.

Thus, the traditional sectors of the economy have been able to soak-up most of the scarce supply of technological and scientific skills available in the country leaving both the knowledge-intensive and knowledge-generating sectors at a highly disadvantageous position. This is also one factor that explains the highly unbalanced patterns of growth of the Chilean economy that has been translated in an over-grown physical capital and natural resource-intensive sectors and underdeveloped knowledge-intensive and technology-intensive sectors.

7.3 Unbalanced growth and economic development

The unbalanced structure of production forces the economy to be ever more dependent on resource extraction and environmental degradation. Physical capital accumulation in these sectors is ultimately affected by diminishing marginal productivity as the scope for economies of scale is smaller than in knowledge-intensive industries. Moreover, the traditional sectors often cause negative inter-temporal resource spillovers (to the extent that a more intensive resource extraction leads to resource depletion affecting future production) and negative environmental externalities.

On the other hand government fiscal policy has contributed to smother the development of knowledge-based and knowledge-generating sectors. Unlike traditional resource and environment-dependent sectors, these under developed sectors produce positive spillovers on the rest of the economy and are often characterized by increasing returns to scale (Feldman, 1999; Fritsch and Franke, 2004). That is, the country foregoes the development of sectors that have the greatest potential for productivity growth and to induce innovation and that are often considered the prime engines of economic development. The underdevelopment of the knowledge-generation sectors perpetuates the undersupply of scientific and technological skills and, hence, causes a vicious circle leading to a model of development that is ever more dependent on traditional resource-intensive industries.

In summary, far from mitigating credit and environmental market failures, fiscal policy has worsened their negative impacts on the economy. It has made the structure of

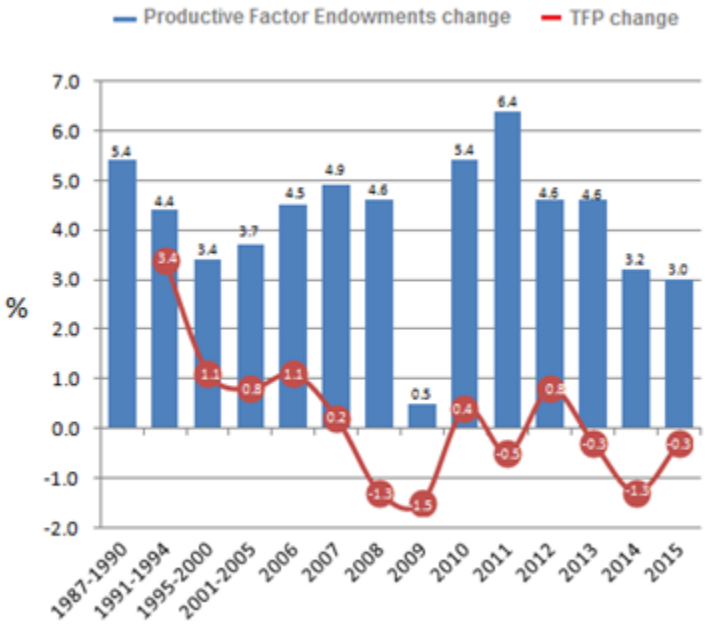
production dirtier, the composition of asset investment biased in favor of physical capital and greater extraction of natural resources on the one hand and against human capital formation, on the other. This has meant that economic growth has been much more environmentally damaging and has induced a more unequal society.

7.4 Declining total factor productivity (TFP)

The conditions described in the previous sections may explain the relatively poor rankings of Chile in terms of development of new scientific patents and publications as shown by international comparisons (Archibugi and Coco, 2003). Moreover, the slow expansion of human capital and the large degradation of the natural capital may explain the debacle in TFP documented by several studies (Di Bella and Cerisola, 2011). In fact, as Figure 12 shows, the level of TFP in Chile has exhibited a sharp decline over the last 10 years despite that capital accumulation has continued at a relatively rapid pace. As a result, the average annual rate of total factor productivity growth fell from about 2.4% in the nineteen nineties to –0.4% in the last decade.

It is possible to argue that one of the reasons for the sharp decline of TFP is the poor quality of human capital and the increasing scarcity of natural resources and other environmental factors that have occurred as a consequence in part of the "pro-growth" fiscal policies implemented since the mid-1980s. The dramatic fall in total factor productivity experienced by Chile over the last decade is perhaps the clearest and earliest manifestation of the lack of economic and environmental sustainability.

Figure 12
Chile: Productive Factor Endowments versus Total Factor Productivity; 1987-1990/2015



Source: Own elaboration with data from CCS (2015).

8. CONCLUSION

Chile`s fiscal policies emphasizing low tax revenues, low income and profit taxes and high indirect taxes have been considered a model for developing countries. However, we have shown here that while pro-growth fiscal policies Chile-style are indeed pro-growth in the short run, they induce certain features of the structure of growth and of economic inequality that may become an obstacle to sustainable development over the long run, and also contribute to perpetuate patterns of extreme social inequality. These policies induce patterns of specialization that are not conducive to sustained productivity-based growth over the long run, and instead lead to make economic growth highly dependent upon the environment and natural resources. Also, this pattern of growth induces underdevelopment of human capital which, in turn, exacerbates social inequality.

Tax and government expenditure policies have caused the knowledge-generation sectors to lag behind as they not only face the general scarcity of highly qualified skills that are vital to their mission and budgetary insufficiency, but also must face the competition

from the traditional productive sectors that are able to attract most of the scarce supply of high skills. Moreover, supply of skills have been limited not only by the liquidity constraints and credit-restrictions faced by most low and middle income segments of the population but also by the low tax revenues that have limited public investment in basic, secondary and tertiary education. This retards productivity growth over the long-run and reduces the future supply of human capital which, in turn, further limits the potential for development of knowledge-intensive productive and research sectors. Thus, a vicious cycle emerges that tends to perpetuate both inequality and the dependence of the economy on natural resource and physical capital-intensive industries with a continuous disincentive to knowledge-intensive and knowledge-generating sectors.

As shown throughout this paper, many of the public policy failures that make sustainable development hard to achieve are shared at various degrees by the majority of the Latin American countries, which as Chile are rich in natural capital and exhibit high social inequality. The degradation of natural capital and social inequality are likely to render economic growth unsustainable for different reasons. These include: (i) the degradation of the environment and the natural resources which reduces the "competitiveness" of resource-dependent industries which are often the backbone of the economy; (ii) the loss of resource rents that are allowed to be retained by foreign firms or by large domestic firms instead of being captured by the state to finance expanding human capital, reducing inequality and diversifying the economy; (iii) the low levels of human capital that restrict the possibility of diversifying the economies into high tech sectors that are not dependent on the falling natural resource base; (iv) social unrest caused by income distribution which is perceived as highly unjust which also entails the risk of the emergence of populists politicians that often exacerbate rather than improve public policy failures.

Given that most Latin American countries seem to follow patterns of growth not much different from those of Chile, the following policy implications may also be relevant to them. First, tax revenues need to be increased so that governments can invest more in social spending, human capital and environmental protection to mitigate credit and environmental market failures. This applies to Chile and other well-managed countries but not to countries such as Brazil and Argentina where governments have already raised taxes

sufficiently but they tend to dilapidate part of these revenues. Second, to reduce inequality taxes should be reoriented to depend more on progressive income taxes and less on indirect taxes. Third, governments should try to capture a larger fraction of pure economic rents specially those arising from the exploitation of natural resources. Fourth, degradation of the environment needs to be arrested through the more widespread use of environmental charges to internalize environmental costs and by promoting a structure of production based more on human capital and knowledge-intensive industries instead of the traditional ones. In the long run this may be achieved by policies that promote a change of factor endowments generating more and better human capital. An increased human capital/physical capital and human capital/available natural capital for production is likely to naturally lead over the long run to a diversification of the economy that makes it less dependent on dirty and extractive industries and more on high technology industries that have a greater potential to increase productivity over time.

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