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Santiago, Octubre 2005

[*] Marcelo Muñoz provided excellent research assistance. Comments by Ramón López and Summeet Gulati are gratefully acknowledged.
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August 4, 2003

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1. Introduction

Since structural reforms in the 1970s and 1980s, the Chilean economy has been praised for high and sustained economic growth and for the reliance of the authorities in non-distorting policies as means to allocate resources and finance public policies (Gallego and Loayza, 2002). Although the main macroeconomic policies remain neutral, distorting policies continue to exert some influence at the sectoral level (e.g., supporting price mechanisms in the agricultural sector) and, more importantly, between different types of investors (e.g., preferential taxes for foreigners under the Foreign Investment Statute).

These asymmetries in the tax treatment of sectors and investors –along with the discretionary allocation of public transfers to groups or industries– can induce substantial differences in the returns to different forms of capital (physical, natural, and human), eventually leading to imbalances that may hamper the sustainable growth path.

The purpose of this paper is to analyze the degree of subsidization of physical capital investment in Chile as supported by government policies and its likely effects on the accumulation of human capital and the conservation of natural resources. The main question to be addressed is whether physical capital is excessively supported by government policies at the neglect of human and natural capital. If physical capital is excessively subsidized the economy is likely to exhibit over-investment in physical capital. An additional impact of over-support is that excessive subsidization in the presence of limited government budgets is likely to crowd out government investment in other assets. This effect may exacerbate the relative over-investment in physical capital by reducing resources required for investment in human and natural capital.

Evaluating the degree of subsidization requires an estimation of optimal government support for the three assets. While there are theoretical arguments detailing the optimal level of government support, practical applications are extremely difficult to find. In order to avoid involvement in the debate on optimal government taxation and expenditure, this paper focuses on estimating the size, and analyzing the positive, negative, or neutral impact of physical capital subsidies. If such subsidies are a large component of government spending, and have little impact on firm productivity, or

profitability there may be reason to suspect that physical capital is being excessively, or needlessly subsidized.

The paper discusses the impact of physical capital subsidies in Chile. Studying the Chilean case is interesting for a number of reasons. First, historically Chile's development strategy has been based on natural resources; mainly copper extraction but increasingly wood products, fishing, fruits, and wines. Hence, it is legitimate to discuss whether this concentration is consistent with a balanced growth path. Second, after reforms in the mid 1970s, Chile dismantled most of its distorting taxes and subsidies, with notable exceptions precisely in natural resources. Especially, the government decided not to levy royalties on the extraction of copper and fish and subsidizing plantations of commercial forests. Again, this raises the issue of whether this has affected the allocation of resources. Third, Chile's tax structure differs markedly with those of developed economies, as it relies mostly on commerce taxes to finance government expenditures, as opposed to income taxes. This tax structure may have had some impact on the structure of investment and, hence, on capital stocks.

Section 2 of the paper discusses the effects on capital accumulation of the current tax structure in Chile, including tax burden, evasion, as well as the efficiency of the tax agency to collect revenue. The Chilean system displays substantial degrees of neutrality and efficiency, inducing minimal distortions in the composition of capital. I also compare the Chilean situation with more developed economies both in terms of tax rates and collection levels and conclude that the emphasis on value added taxes in Chile –as opposed to income taxes in developed economies– leaves less space to the tax system to alter the profitability of the different forms of capital.

Section 3 of the paper provides an assessment of potential tax revenue. Based on information for several countries, I estimate a simple econometric model of tax evasion which allows for the estimation of potential revenue from the different taxes. The main result is that, in the medium run, only marginal increases in tax collection can be achieved, mostly in the area of income taxes. Hence, it should not be expected substantial additional resources from tax reforms.

Section 4 of the paper focuses on foregone taxes and their likely effect on the accumulation of capital in different sectors of the economy. To my knowledge this is the first estimation for the Chilean economy. Foregone taxes arise mainly from three sources. First, from the government decision not to tax copper extraction (fisheries also enjoyed this benefit but the existence of capture

quotas reduces the potential subsidy). The estimated foregone tax in this case amounts to around US$ 300 million annually in the 1990s. Second, foregone taxes appear as a result of tax rebates to specific activities, in particular, forestry and labor training programs. Transfers to foresters are estimated at US$ 10 million, while tax foregone by labor training programs reached US$ 140 million in 2001.

Another form of distortions on capital accumulation arises when the government levies specific sector taxes and allows the private sector to collect part of it. In the Chilean case, the clearest case of is that of agricultural price bands. As shown in Section 5, price bands that have operated in practice as price-sustain mechanisms. While these subsidies are paid directly by consumers, the net effect is a transfer to producers that amounts to around US$ 75 million per year. In fact, while some poor farmers benefit from these transfers, the lion's share of it goes to the more wealthy farmers at the expense of low income urban families.

Section 6 of the paper deals with subsidies and, more generally, government expenditures. I classified expenditures in three categories: non-discretionary expenditures (comprising mostly those allocated to the general government), discretionary expenditures (those the government actually use to affect the profitability of the different types of capital, physical, natural, and human), and subsidies and foregone taxes (as discussed). The results suggest that roughly one half of total expenditures comprise discretionary expenditures, around 11% of GDP, but subsidies and foregone taxes are comparatively a smaller proportion of these. Non-discretionary expenditures, on the other hand, amount to 12% of GDP.

2. The Chilean Tax System.

This section describes the main features of the Chilean tax system, with emphasis on comparing tax rates, collection, and evasion at the international level and their likely impact on the accumulation of different forms of capital (human, natural, and physical). I consider five aspects of the tax system –tax burden, tax structure, tax evasion, tax efficiency, and tax collection costs– and conclude that the Chilean tax system does not induce substantial distortions in total capital accumulation, nor among the different components of the capital stock. While the neutrality of the tax structure and the efficiency of tax collection are high, some sectors benefit from special tax treatments and deserve further scrutiny, as presented below.

2.1 Tax burden

The tax burden measures total tax revenues as a percentage of the GDP, i.e., it measures the amount of resources transferred to the government each year. It can be seen in Table 1 that total net tax revenue in Chile reached 18.5% of the GNP in the 1990-2002 period, lower than those of the developed and East Asian countries but higher than in all Latin American countries

2.2 Tax Structure

Naturally, the tax burden affects differently the three forms of capital in the economy depending, among other things, on the tax structure and its incidence. Physical capital is usually taxed directly via business income and profit taxes. Human capital is also taxed –albeit more indirectly– in personal income taxes. Natural capital is taxed usually in indirect ways, although some countries imposed specific taxes to avoid over-exploitation of non-renewable resources or when negative externalities are substantial.

Table 1
General Government Tax Revenue (as percentage of GDP)

Developed Economies		Developing Economies	
Sweden (1995)	35.9	Israel (1995)	33.4
New Zealand (1995)	32.8	South Africa (1994)	26.3
Canada (1994)	32.6	Malaysia (1994)	23.5
United Kingdom (1995)	28.5	The Philippines (1994)	16.5
Italy (1994)	28.3	Indonesia (1994)	16.4
France (1995)	24.6	**Chile (1990-2002 avg.)**	**18.5**
Portugal (1994)	24.4	Colombia (1994)	14.7
Germany (1995)	23.3	Argentina (1992)	14.6
Spain (1993)	20.9	Ecuador (1994)	13.9
USA (1997)	20.7	Panama (1994)	13.0
Singapore (1995)	16.3	Mexico (1994)	12.8

Source: Barra and Jorrat (1998), based on IMF Government Finance Statistics Yearbooks.

Table 2 presents the structure of tax revenues in Chile. Total tax collection amounted to US$12.264 millions in 2000, which corresponds to 17.5% of GDP. Of this, almost 20% corresponds to the various forms of business income tax. Personal income taxes represent 11% of the total revenue. Value added taxes represent almost 50% of the total taxes, while specific taxes levied on the consumption of tobacco and fuels yield another 12% of total revenue. Given the low level of tariffs, custom duties amount to only 9% of tax revenues. However, specific taxes levied on agricultural products are an important source of distortions as discussed below. Other taxes, including mining and fishing permits, add a mere 0.2% of GDP.

Table 2
Tax Structure in Chile in 2000

	US$ Millions	% of Total	% of GDP
Total Tax Revenue	12,264	100.0	17.5
Business Income Tax	2,401	19.6	3.4
Personal Income Tax	1,337	10.9	1.9
Value Added Tax	6,124	49.9	8.7
Consumer Specific Taxes[1]	1,513	12.3	2.2
Custom Duties	1,125	9.2	1.6
Taxes on Legal Documents	446	3.6	0.6
Various Taxes[2]	124	-6.7	0.2
Other Revenues[3]	-823	-6.7	-1.2

Source: Servicio de Impuestos Internos (2001).
Notes: (1) Includes taxes levied to consumption of tobacco and fuels, (2) real state taxes, professional licenses, vehicles registration and transfer taxes, (3) includes inheritance and gift taxes and gambling taxes, (3) includes tax readjustments, fines and interests, and tax credits.

It can be seen in Table 2 that income taxes are a small fraction of tax revenue in Chile –5.3% of the GDP in 2000– and that government financing largely depends upon commerce taxes, both internal (VAT and specific taxes) and external (tariffs), reaching almost 13% of GDP. In more developed economies income taxes amount on average to 12% of GDP.[1] However, commerce taxes in those countries are markedly smaller, reaching on average only to 9% of GDP. Chile's tax structure also differs markedly from the average of Latin American economies which collect only 3.6% of GDP in income taxes and less than 7% in commerce taxes.[2] The VAT represents almost 80% of domestic taxes on consumption. The importance of this tax is due both to the very high rate levied on sales

[1] Figures are taken from (Barra and Jorrat, 1998) for 12 developed and emerging economies, including Sweden, New Zealand, Canada, Israel, United Kingdom, Japan, USA, Spain, Portugal, France, Singapore, and South Korea.

[2] Countries considered are Ecuador, Colombia, Mexico, Panama, Brazil, Uruguay, Peru, Argentina, Paraguay, Guatemala, and Bolivia (Barra and Jorrat,1998).

(18%) and to its large base, the latter as a result of the absence of exemptions and the rather low levels of evasion, as discussed in section 2.4.

With regards to income taxes, all legal residents in Chile are subject to income taxes, independently of the location in which income was generated. Income taxes are structured in four categories. The *primera categoría tax* is a 15% general tax that affects mainly medium-to-large size firms.[3] The *segunda categoria* tax is a progressive schedule personal-income tax as described in Appendix Table 1. The *global complementario* tax is similar in structure to the *segunda categoría* and taxes individual non-labor income but it is consolidated with it, so that taxpayers are not double taxed. Likewise, the *impuesto adicional* is a 35% tax levied upon distributed dividends or profits repatriated overseas (it applied only to non-residents), for which payments of the *primera categoría* can be used as tax credit, avoiding double taxation.

For some activities, income taxes are levied upon a presumed basis, in particular for small size firms in agriculture and transport for which accounting systems are too expensive. A special treatment is in place for foreign investors under the Foreign Investment Statute and the Foreign Exchange Regulations Compendium of the Central Bank of Chile. I provide a detailed description of this special tax treatment when discussing foregone taxes in section 3.

From a comparative viewpoint, income taxes in Chile differ markedly from those in other economies. The flat rate of 15% levied on business incomes is much lower than that of developed economies –where taxes hover around 35%– or in other Latin American economies (around 30% in Mexico, Argentina, and Uruguay), but it is similar to that in East Asian economies (Taiwan, Korea). On the other hand, maximum marginal income rates for individuals at 45% are extremely high for international standards: only in few developed countries have such rates (France or Spain), while the majority of countries the maximum is much lower than in Chile, around 30% on average.

It is difficult to assess whether the reliance on commerce taxes as a means of financing government policies may have a differential impact on the accumulation of the distinct types of capital. On one hand, one could argue that a low income tax rate for businesses provide incentives

[3] Micro businesses and very small farms can choose not to pay *primera categoría* and be treated as individuals for tax purposes (paying *segunda categoría*). Firms can deduce expenditures on labor training up to 1% of the total payroll and 50% of donations to universities and the arts.

to accumulate physical capital beyond the optimal, balanced path level. However, low income effective tax rates for individuals also provide a similar incentive. This would appear to leave the accumulation of capital in natural resources relatively unprotected. However, whenever natural resources are privately owned (as is the case in Chile with the only exceptions of mining and fishing), owners have the incentives to align their return to that of physical capital. On the other hand, the assessment of tax burden omits an important source of fluctuations in the return to investment –tax evasion– which I discuss in the next section.

2.3 Tax evasion

Tax burden is a partial indicator of the working of the tax system because it only considers taxes actually collected and skips the problem of evasion. Although the tax burden is higher in Chile than in other countries, the existence of evasion implies that one cannot conclude that the tax rate is also higher than in those countries. It fact, Barra and Jorrat (1999) provide evidence that tax rates in Chile are equal to or even lower than in other Latin American economies, but compliance is more strictly enforced and thus tax revenue is higher. Compliance in Chile is even higher than in some developed economies (e.g., Spain).

According to Jorrat (2000), the total rate of evasion in Chile hovers around 24% (see Table 3), a lower level when compared to the rest of the Latin America countries, but higher than in more developed economies. This estimate includes the legal avoidance of taxes, so that actual figures on evasion may be somewhat lower.

Table 3
Estimates of Tax Evasion in Chile in 1997

Type of tax	Income Taxes	Value Added Tax	Specific Taxes	Other Taxes	Total
as % of GDP	2.84	1.87	0.02	0.25	4.96
Evasion Rate (%)	39.2	19.7	1.4	5.6	23.9

Source: Jorrat (2000).

Evasion of the value added tax in Chile is higher than in most developed economies, but it is the lowest in Latin America, confirming the prior that enforcement of tax provisions and compliance in Chile is quite high. Although countries such as New Zealand, Israel, and Sweden have one-digit evasion rates of VAT, in the vast majority of developed and developing countries evasion is in the 30% to 40% range (Barra and Jorrat, 1999). In Chile, evasion was already around 25% in the early 1990s but declined steadily to around 18% by 1999, as shown in Table 4.

On the other hand, evasion of income taxes in Chile (including legal avoidance) was estimated by Jorrat (2000) at around 39% in 1997. In terms of its components, evasion of the profit tax by business firms hovers around 40% in the 1990s as shown in Table 5. This figure is highly correlated with the evasion of the VAT, as presented in Table 5. Whenever business under report sales, they reduce value added tax collection; under reporting income and reduce the tax base used to estimate the degree of evasion of income taxes. It can be seen that in the 1991-1997 period, over 70% of the evasion of first category profit tax was due to the evasion in value added taxes.

Table 4
Evasion of Value Added Taxes

	% of GDP	US$ millions	Evasion Rate (%)
1991	5.1%	1,236.0	26.8
1992	3.9%	1,185.0	22.9
1993	2.7%	1,000.0	18.3
1994	2.5%	1,121.0	19.6
1995	2.3%	1,256.0	20.3
1996	2.2%	1,307.0	20.0
1997	2.1%	1,363.0	19.7
1998	2.3%	1,564.0	22.0
1999	1.8%	1,243.0	18.3

Source: Servicio de Impuestos Internos (2001).

Table 5
Evasion of Business Profit Taxes[1]

	Tax Collection			Tax Evasion	Due to VAT evasion
	Theoretical (% of GDP)	**Effective** (% of GDP)	**Difference** (% of GDP)		
1991	4.62%	2.31%	2.31%	50.1%	77.3%
1992	4.64%	2.39%	2.25%	48.6%	69.0%
1993	4.02%	2.24%	1.77%	44.2%	69.7%
1994	4.23%	2.49%	1.74%	41.2%	73.5%
1995	4.27%	2.60%	1.67%	39.1%	76.5%
1996	4.12%	2.42%	1.69%	41.1%	76.2%
1997	4.17%	2.43%	1.74%	39.1%	73.8%

Source: Jorrat (2000)
Note: (1) refers to the *Primera Categoría* tax (15% over profits).

Although figures on profit-tax evasion in Chile may seem high, they do not differ markedly from those in advanced economies. In Table 6, I summarize the evidence of Jarass and Obermeier (1999) for eight developed countries using a similar methodology: it can be seen that the median evasion rate is in the 48% to 54% range, slightly above Chile's level. One should consider, however, that higher nominal tax rates induce more incentives to evade, so that observing similar evasion rates would signal lower compliance in Chile than more developed economies. Moreover, international comparisons on evasion should be taken only as indicative, as imprecise computations are expected from the complexity of tax systems and the differences in calculating tax bases.

Table 6
Nominal profit tax rate on corporations and effective income tax rate in 1995 (%)

	DK	ESP	GER	NL	UK	CH	JAP	USA
Nominal rate	34.0	37.0	58.7	35.0	33.0	38.1	58.6	49.2
Effective rate	22.7	10.1	13.8	18.2	21.6	23.2	25.3	22.6
Evasion rate	33.0	73.0	76.0	48.0	35.0	39.0	57.0	54.0

Source: Jarass and Obermeier (1999)

2.4 Efficiency of the Tax Structure

An important criterion when evaluating the impact of tax systems on capital accumulation is simplicity. Although simplicity is difficult to define in quantitative terms, the standard presumption is that tax systems tend to be more complex whenever they rely on differential tax types, different taxes rates, and include significant exemption mechanisms. In Chile, commerce taxes tend to be relatively simple and exemptions are very limited. For example, the VAT has a unique rate (18%) and exemptions are minimal when compared to other countries (only five activities are exempted: medical services and education, real estate transfers, financial services, and entertainment). This is especially relevant because VAT generate 50% of revenue. Hence, capital accumulation between sectors remains largely undistorted by the main source of fiscal revenue. Note that VAT, on the other hand, exemptions affect positively the profitability of the human capital accumulation as health and education are exempted.

Income taxes, on the other hand, do not display simplicity as the Chilean legislation is the result of reforms and modifications that are constantly underway. The majority of these modifications have been implemented trying to resolve particular problems of the law which have lost relevance over time and hampered simplicity. Complexity reflects in various ways. First, taxes on profits are cumbersome: there are 12 tax schedules for firms depending on the origin of capital, the sectors of the economy, the size of the firm, etc. Second, tax rates vary depending on the type of asset that generates the rent, the type of taxpayer that is entitled to the profit, etc. In principle, these asymmetries distort the allocation of resources in the economy. For example, the substantial

difference in tax rates between businesses and individuals lead to independent workers to operate as business firms to avoid paying a marginal tax rate of 45%. In 1999, only 4,500 taxpayers fell in that income bracket (see Appendix Table 1). The impact on capital accumulation is difficult to grasp due to the absence of public data and the lack of official studies

A second evaluation criterion is neutrality. One principle of neutrality is that taxation should not discriminate in terms of the sector of origin of the income. In general, income taxes in Chile do not discriminate among businesses or economic sectors, which suggests that distortions in the allocation of capital among sectors should be unimportant. There are, however, a few exceptions of interest to this paper. The forestry sector is taxed according to Law 701, which contemplates a series of tax rebates for those who make investments in commercial forests including a 50% income tax deduction and exemption from the real estate taxes. Most investments in mining operate under the Foreign Investment Statute which allows a special tax on interest payments and depreciation. The decision of the government of not taxing the extraction of publicly owned natural resources can also be considered an issue vis a vis tax neutrality, as it gives incentive to investment in certain areas of the economy (e.g., mining and fishing). I discuss and evaluate these distortions below.

On the other hand the Chilean tax system is neutral in terms of preventing double taxation. The VAT prevents double taxation, because it deducts credits paid from debited payments. The consolidation of taxes on business and patrimony under the *global complementario* and the use of *primera categoria* tax as credit for the *additional* tax also prevent double taxation. Recently legal changes authorize credits on taxes paid in other countries when profits have been repatriated, providing further neutrality for the domestic investment overseas.

In summary, the Chilean tax system is characterized by a substantial degree of neutrality and simplicity, with few exceptions discussed below. The latter are worth studying as they affect capital accumulation and may change the relative profitability of the different types of capital. Nevertheless, one should expect relatively small impacts on capital accumulation as most of the economy operates under the same tax schedule.

2.5 The efficiency of the administration of the tax system

For the standards of developing economies, the Chilean tax system is considered to be professional, non-corruptible, and quite efficient. Since 1994, the tax administration (S.I.I.) operates on the basis of annual performance targets and, since 1998, qualified employees have been receiving bonuses based on achievement, in particular on tax collection. The benchmark is set equal to revenue collected during the previous year, increased by the rate of growth of GDP times 1.1 (the estimated elasticity of tax revenue with respect of GDP).

Assessing the efficiency of tax administration is not easy, as it depends largely on the nature of the tax structure and the myriad of exemptions that usually characterize these systems. A standard indicator is the amount of resources devoted to tax agencies as percentage of GDP. As of 1999, the expenditures of the S.I.I. amounted to 0.07% of GDP. This figures compares favorably to that of the developed economies with similar evasion rates, such as the US (0.10%), France (0.15%), or Canada (0.29%), as shown in Table 7. It also compares very favorably to the rest of Latin American economies where costs are and tax evasion are much higher: in Argentina, the costs of tax agencies reached 0.22% of GDP and in Peru it reaches around 0.15% of GDP.

An alternative indicator is the average amount of resources spent to collect taxes. In Chile this level is US$ 0.4 to collect US$ 100. Mexico spends close to the same amount (US$ 0.3). In the US it reaches US$ 0.5. All the rest of the countries spend more. Due to lack of information this statistic excludes the administrative cost to the private sector in complying with their tax obligations.

A third indicator is based on the personnel of the tax administrator, normalized by the country population. Barra and Jorrat (1998) estimate that in Chile there are around 5,200 habitants for every official in the S.I.I. The average for the countries shown in Table 7 is lower. Chile compares also favorably to the developed countries, where it is presumed that the administrative systems operate in a more efficient manner.

In sum, these three indicators suggest that the tax system in Chile is above international standards. This aspect has special relevance because though Chile is efficient in evasion control in the Latin American context, it has evasion levels substantially higher than in the developed countries, where, at the same time, the collection budget is proportionally much higher than in Chile. Therefore,

additional resources into tax administration could allow Chile to come closer to the compliance levels of developed countries.

Table 7
Indicators of Efficiency in Tax Collection (1994)

Country	Tax Office Budget (% of GDP)	Cost of collecting US$100 (in US$)	Population / Personnel of Tax Office
Canada	0.29	0.9	1,284
Argentina	0.22	1.2	2,567
Colombia	0.23	1.3	9,636
Spain	0.16	0.7	1,965
France	0.15	0.7	1,324
Peru	0.14	1.3	9,899
USA	0.10	0.5	2,767
Brazil	0.10	1.2	n.a.
Venezuela	0.08	0.7	5,461
Chile	**0.07**	**0.4**	**5,183**
Uruguay	0.07	1.2	2,558
Bolivia	0.06	1.0	14,852
Mexico	0.04	0.3	3,036
Average	**0.13**	**0.9**	**4,656**

Source Barra and Jorrat (1998).

3. Potential Revenue

As discussed in section 2, the Chilean tax system is considered reasonably efficient in tax collection. Nevertheless, there are loopholes in the regulation as well as evasion. These, in turn, suggests the existence of transfers to private firms that might induce abnormally high rates of return for certain forms of capital. Estimating the magnitude of the potential revenue allow us to dimension the amount of transfers to different forms of capital.

To estimate potential revenue, I use the information employed to build the evidence in Tables 3 to 5. Given the focus of the paper on capital accumulation, I concentrate on the two most important taxes in terms of revenue: VAT and profit taxes.[4] For the other taxes –personal income, trade taxes, and specific taxes– I use actual figures adjusted to reflect changes in the efficiency of the tax agency, the S.I.I.

With regards to VAT, I construct an estimate of the tax base in the following manner. Since the VAT is charged to final sales, the theoretical base for the tax is based on the final consumption of goods and services from national accounts. I subtracted from total household consumption, those goods and services that are exempted from VAT (e.g., education, health, entertainment, financial services) and added the intermediate consumption of these sectors (given that VAT payments cannot be used as tax credit in this case). As shown in Table 8, the tax base for the VAT as fluctuated around 54% of GDP in the last five years.

Regarding business income taxes, the estimation of the base for the *primera categoría* tax is relatively straightforward, while that for the *adicional* tax is quite cumbersome and I was forced to drop it. Again, I used the "exploitation surplus" in the national accounts, appropriately adjusted to eliminate those activities not affected to this tax (e.g., exempted), those that use the imputed rent system, and an estimate –based on historical information– of current and past losses (cumulated). Finally, credits to the tax ought to be deduced. In Table 8 it can be seen that the tax base in this case is around 30% of GDP. The *adicional* tax requires more data than is available even at the S.I.I, as it requires to determine what are the dividend and profit repatriation policies of the firms.

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[4] I use Jorrat's (2000) methodology –based on the "theoretical" approach– to estimate each tax base.

Table 8
Tax Bases and Potential Revenue.

	Gross Domestic Product $ mn	Tax Base		Tax Base (% GDP)		Potential Revenue (% of GDP)	
		Value Added $ mn	Business Incomes $ mn	Value Added	Business Incomes	Value Added	Business Incomes
1991	12,644,155	7,842,389	4,147,487	62.0%	32.8%	11.2%	4.9%
1992	16,103,553	9,843,905	5,278,237	61.1%	32.8%	11.0%	4.9%
1993	19,283,469	11,526,542	5,548,130	59.8%	28.8%	10.8%	4.3%
1994	23,213,803	13,587,002	7,027,936	58.5%	30.3%	10.5%	4.5%
1995	28,244,443	16,050,849	8,604,631	56.8%	30.5%	10.2%	4.6%
1996	31,237,289	17,237,732	9,229,258	55.2%	29.5%	9.9%	4.4%
1997	34,722,636	18,945,682	10,391,368	54.6%	29.9%	9.8%	4.5%
1998	36,534,873	20,010,733	10,960,462	54.8%	30.0%	9.9%	4.5%
1999	37,138,542	19,792,927	11,141,563	53.3%	30.0%	9.6%	4.5%
2000	40,393,464	22,216,405	12,118,039	54.0%	30.0%	9.5%	4.5%
2001	43,343,584	23,838,971	13,003,075	53.0%	30.0%	9.5%	4.5%

Source: Own elaboration based on National Accounts and data from Jorrat (2000).

Potential revenues can be calculated using the data on tax bases in Table 8 and recalling that the *primera categoría* tax is 15% and the VAT is 18% (taxes are to be raised to 16% and 19% respectively by the end of 2003). The potential revenue for the VAT at a theoretical level is 9.5% of GDP (0.54*0.18); current revenue is around 8.5% so that evasion is around 1% of GDP. Given the efficiency and resources of the S.I.I. it seems implausible that evasion rates would decline significantly in the near future. Nevertheless, Ican get an indirect measure of what collection would be if the S.I.I. is better endowed in terms of human and physical resources as proposed in the Plan Against Evasion currently in operation. This plan would increase staff by around 500 tax inspectors and expenditures from 0.12% of GDP to 0.15%. I use the international data to estimate a regression of evasion (as % of GDP) on the ratio of population to staff, collection costs, and the tax office budget (% of GDP).

I also added the VAT rate because it is usually suggested that higher rates tend to increase evasion. Arguably, this is a naive approach but helps framing a reasonable increase in efficiency. The econometric results are in Table 9. The projected evasion rate for VAT predicted by the model is 17.5%, that is about 2% below current levels. In such case, potential revenue would increase by 0.2% of GDP, rendering total potential revenue at 8.7%.

Table 9
Estimated regression for VAT evasion

	Intercept	IRS budget (% of GDP)	Cost of collecting	Population Personnel	Nominal VAT rate
Parameter	41.42	-213.10	51.13	0.0041	-0.43
Standard Deviation	15.34	98.62	14.62	0.0096	0.83
t-test	2.70	-2.16	3.50	4.14	-0.51
Adjusted R2	0.92				

Source: Own calculations.

In the case of the business profit tax I follow a similar strategy: the theoretical potential revenue is calculated using the tax base as estimated in Table 8 –around 30% of GDP– and assuming that the tax is 15%. The latter corresponds to the actual tax of 16% less 1% in credits to the tax; the last figure is the average for the 1995-2001 period. Hence, the potential revenue without the adjustment for the ability of the S.I.I. to collect the tax is 4.5% of GDP. Actual revenue is, as mentioned, around 2.5% of GDP. Contrary to the case of the VAT, the S.I.I. is not very efficient collecting income taxes when compared to developed economies. Unfortunately, there is no data available for evasion in this case, so I assume that the efficiency in VAT taxes translates also to business income taxes so that I choose evasion to be 35%. In such case, the Plan Against Evasion would yield an additional 1% of GDP more in collection (given that 70% of evasion in *primera categoria* tax is due to VAT evasion). Hence I estimate the potential revenue at around 3.9% of GDP. A similar calculation for personal income taxes yields a potential revenue of 2.4% of GDP

Finally, with regards to collection of other taxes, evasion rates are already very low so that it is safe to assume that no significant changes can occur. In the case of specific consumption goods, evasion is 1.4% so that I consider potential revenue levels at the 3.8% of GDP. Current levels of evasion are also quite low with regards to various taxes such as those on legal documents, fines, etc, so that I also keep the potential revenue at 0.8% of GDP.

Table 10
Potential Tax Revenue (% of GDP)

Total Tax Revenue	18.5
Business Income Tax	3.9
Personal Income Tax	2.4
Value Added Tax	8.7
Consumer Specific Taxes	2.2
Custom Duties	1.6
Taxes on Legal Documents	0.6
Various Taxes	0.2
Other Revenues	-1.2

Source: Own elaboration.

The total potential revenue computed in Table 10 is 18.5% of GDP. When comparing Tables 2 and 10, it should acknowledged that the difference between actual and potential revenues are modest. Moreover, this difference in both business income taxes and personal income taxes is of the same magnitude, 0.5% of GDP. This is a result largely of the efficiency of the S.I.I. in collecting taxes, as well as the "arbitrage" in which taxpayers engage so as to reduce tax payments. In the Chilean case, the excessively high marginal rates of the personal income tax led taxpayers to operate as small business (e.g., consulting firms) and pay business taxes. Hence, the effective average personal income tax is around 7.8% of income (computed at the mean income bracket).

4. Foregone Taxes in Chile

In the precedent section I have presented the main features of the Chilean tax system, in particular with regards to tax burden and evasion, and concluded that the aggregate evidence does not support the notion that tax rates or evasion induce important distortions in capital accumulation. The tax structure, however, can also affect the profitability of different forms of capital by exempting business from taxes. In such case, there is transfer and a fiscal cost in the form of foregone taxes.

The previous evaluation of the tax system suggests that foregone taxes in Chile concentrate in two areas: foregone taxes due to not taxing the extraction of natural resources (which applies basically to mining and fishing) and foregone taxes due to tax exemptions, resulting from policy decisions of supporting specific activities (e.g., forestry).

By nature, measuring foregone taxes involve a number of assumptions, as it must be based on determining a counterfactual scenario (i.e., what would have been the situation had the government taxed activities in a different way). Calculations, such as those in this chapter, suffer from neglecting the response of the private sector to different tax incentives. Typically, this is an important consideration for investment. Hence, results ought to be taken only as indicative of the fiscal cost of these policies.

4.1 Foregone taxes in mining

Certainly, foregone taxes in mining could be substantial when one considers the amount of investments and exports of the sector. Between 1990 and 2002, investment in copper mining reached US$ 12 billions (on average, 1.5% of GDP per year) and the volume of annual exports increased from 2 million tons to over 4.5 million tons. As of 2002, Chilean copper mines exported around US$ 7 billion, equivalent to 38% of total exports, and contributed to around 10% of total GDP.

Given the low level of employment in mining (around 30 thousand workers or around 0.3% of the labor force), one should expect that foregone taxes only distort the accumulation of physical capital and natural resources.

Institutional Framework

The mining sector is governed by the 1980 Mining Code and the 1984 Foreign Investment Statute (DFL 600). The latter is the main mechanism used by foreign investors in mining for the introduction of associated capital and credits. According to this statute, any person or legal entities, Chilean or foreigner with residence abroad can transfer foreign capital to Chile in the form of foreign full convertibility currency, tangible property, technology –when susceptible to capitalization-- credits associated to a foreign investment, capitalization of foreign credits and debts, and capitalization of profits entitled to be transferred abroad.

Foreign investment authorizations are agreed by means of a contract by public deed, subscribed by the investor and the Chilean State. Because the rights and guarantees granted to the investor are recorded in a contract, they cannot be unilaterally modified throughout the duration of the contract. The DFL 600 guarantees to the investor that the system applicable to the repatriation of capitals and after-tax-profits cannot be more unfavorable than the one ruling the coverage of the overall imports, and the applicable rate of exchange will be the most favorable obtainable one from the foreign exchange market.

The introduced capital cannot be transferred abroad before a year from the date it was introduced into the country. The profits, however, can be transferred abroad at any time, with no restriction whatsoever to its amount, once the corresponding taxes have been duly paid. Foreign investors can choose to pay a total tax rate of 42% over income for a 10-year period from the date of the beginning of operations of their respective companies. The firm can renounce this right and stay within the common tax system. In the case of investments over US$50 million, this period can be extended for up to a maximum of 20 years.

From the dictation of the Foreign Investment Statute, 36% of the investment materialized through this mechanism corresponds to projects in the mining sector. The first law guarantees to mining companies that no taxes will be imposed on the extraction of mineral ore and that only general taxes are to be applied. Consequently, mining investors did not have to pay any fee to the Chilean

government to start operations, beyond the legal property registration fee which is negligible.[5] Accordingly, the only taxes applicable are those to profits, which themselves depend on the nature of the firms (corporations, domestic vs foreign ownership, etc). As mentioned, business firms are subject to the *Primera Categoría* tax of 15% on profits.

Another mechanism used for introducing capitals and credits is the one established in Chapter 14 of the Foreign Exchange Regulations Compendium of the Central Bank of Chile. These regulations rule the procedures applicable to all the ways of introducing capitals and credits into the country. Chapter 14 establishes the general regulations relative to investments, capital or credit contributions from abroad and it constitutes an alternative path to the DL 600 to invest in Chile. The foreign currency introduced under this mechanism must be duly registered in Chile's Central Bank and stay within the valid legal and administrative provisions at the time of registration (currency reserve applied to foreign credits, time limits to repatriate capitals and profits, etc.).

At present there are no restrictions to repatriate profits, while capitals can be repatriated after a year from the date of their introduction into the country. Credits that are introduced into the country must be authorised and registered in Chile's Central Bank before being contracted abroad, which must be made through a banking institution or money exchange office from the formal exchange market.

The main difference between the mining code and the foreign investment statute is that the former is a legal contract between the Chilean government and private firms which restricts the ability of the government to change taxes, while under the mining code tax rates are those applying to all economic activities in Chile being, thus, subject to changes by the government. Under Chapter 14 the introduction of capitals only requires the authorization of the Central Bank of Chile.

When calculating profit repatriation taxes, regular business taxes included in the First Category Tax can be used as credits, so that effective nominal tax rates for shareholders are 27% and 20% respectively.

In addition, firms other than corporations *(sociedades anónimas)* in Chile can decide whether to use standard linear depreciation rates or accelerated (see Appendix Table 3 for details on

[5] In 2002, total taxes paid for mine registration was US$ 0.5 million per company (Consejo Minero, 2003).

depreciation rates in mining operations). Corporations can only use linear depreciation methods. Accelerated rates allow firms to reduce their tax base initially more than standard rates, but at the cost of paying higher taxes once capital goods are completely depreciated. In the computations I use linear depreciation rates for corporations and accelerated rates for others.

The main advantage given to mining operations –and also the main distortion in terms of capital subsidies– refers to the asymmetric treatment between credit services and profit repatriations. Although profit repatriations are taxed at 35%, interest payments on loans are taxed at only 4%. This gives incentives to mining firms to contract loans instead of using own capital to finance investment.

An evaluation of foregone taxes in private mining

Determining the amount of foregone taxes in mining is quite difficult because the information on private mines is not available.[6] Hence, a methodology based on a number of assumptions has to be developed. I first estimate what firms ought to have paid in taxes, according to the actual tax system and estimates of each mine earnings and operating costs. I then compare my estimates with what firms would have paid had the government imposed different levels of royalties or eliminated preferential tax treatments.

The first step of the methodology is to determine sales of copper by the different mines. Table 11 presents the information for copper production by company in the 1985-2002 period. It can be seen the remarkable expansion in production between 1994 and 2002, when production tripled. It can also be seen that a three firms (La Escondida, Los Pelambres, and Collahuasi) concentrate 60% of total production by private mines.

In order to estimate earnings from sales, I multiplied physical production by world prices, proxied by the average annual price in the London Stock Market Exchange (LSME). This is an approximation to the effective sale price since most transactions are made forward in futures contracts. In addition, this assumes that stocks of final products do not change significantly on time; this assumption is consistent with the information on the stocks held by LSME. The aggregate figure

[6] Private mines also do not issue financial statements, with the exception of La Escondida (the single largest producer) which I used to calibrate my simulation.

I obtain, nevertheless, do not differ significantly from that of total copper exports in national accounts. My methodology abstracts also from earnings derived from sales of secondary minerals that are obtained from copper extraction (e.g., molybdenum, silver), which are nevertheless minor both in terms of size and value.

The second step involves determining production costs for each mining operation. This is very difficult since there are several factors that affect costs both between firms and in time. First and foremost, private firms do not provide information on cost structures. Second, production methods and technologies differ among firms, ranging from open-pit extraction to tunneling. Third, the type of copper process used by companies can be very different, including electrowinning, solvent extraction, and concentration. Fourth, copper content in the ore changes in time as firms typically exploit higher grade mineral at the beginning of operations. Fifth, technological changes may have significant impact on productivity levels.

Using a variety of sources[7] I develop a methodology to determine cash costs for the main 16 firms of the private sector operating in Chile in the 1990-2002 period. Appendix Table 6 summarizes the estimated values. I added a fixed indirect cost of US¢ 12 per pound. For La Escondida –the largest operating mine selling around 25% of exports– I found that the difference of my results and their own estimates of cash costs were minimal; for the 1991-2002 period correlation is 91%.

I use these estimates of earnings and cash costs to determine net income. In the third step, I estimate the investment profile of firms in order to determinate financial costs and the depreciation imputed for each firm in every year. Investment levels were obtained from official sources (e.g., Cochilco) and I assumed that whenever numbers comprised more than one year, investment was made proportionally[8]. Moreover, based on available information and when needed I split total investment into five components (costs of mine opening, machinery and equipment, buildings, installations, startup costs, indirect expenditures) according to a fixed structure. This allows to use different depreciation rates for each type of capital good and compute more precisely the depreciation used by firms to determine their tax base.

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[7] Costs are based on estimates by Soto (1996) and fragmentary information in different copper industry reports.

[8] For example, if a firm reported investments for US$ 100. for the 1999-2000 period. I assumed US$ 50 each year.

Table 11
Imputed Operating Results of Private Mining Companies in Chile.
in US$ millions of each year and percentage of GDP.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Sales	515	1,132	1,228	1,236	1,925	3,089	3,642	4,263	3,367	4,167	5,207	5,141	4820
Operating Costs	351	671	661	773	1,040	1,478	1,887	2,235	2,279	2,741	2,907	2,896	2,856
Depreciation	83	113	232	761	1,277	867	911	1,290	1,093	848	566	698	597
Financial Costs	30	29	28	29	61	86	97	86	181	235	309	305	579
Taxes due	17	65	123	96	173	234	308	306	99	134	167	117	86
Taxes due as % of GDP	0.05	0.19	0.29	0.22	0.34	0.36	0.41	0.37	0.12	0.18	0.22	0.17	0.13

Source: Own elaboration.

Once depreciation is computed, I estimate financial costs derived from investment profiles. I assume that all investment in each firm was financed with credit, contracted at the US prime interest rate and that loans are extended for a 20-year maturity period. As mentioned, the Chilean regulation levies a 35% tax on interest payments made to overseas financial institutions; nevertheless, if the financial intermediary is legally located in Chile –a status awarded by the Central Bank–, interest payments are only taxed at 4%. Evidence suggests that loans contracted by copper mines are effectively taxed at 4%. Financial costs, in the form of interest payments, are then included in the computation of before-taxes profits.[9]

Table 11 summarizes my estimation of before taxes profits of mining companies operating in Chile in the 1990-2002 period. The first interesting result in Table 11 is that, according to my calculations and conditional upon the current tax structure, private firms should have paid annual taxes of around US$ 140 million in the 1990-2002 period or 2% of GDP in 2002.[10] Of course, it is possible that firms paid less than that amount since imputed profits and taxes depend largely on the schedule of depreciation of the investments.

A second interesting result of the simulation is that several firms that use accelerated depreciation schedules are approaching the stage in which assets are completely depreciated and profits –and consequently taxes– are expected to be positive and more significant.

It should be remembered, nevertheless, that private mining firms paid additional taxes in the form of import taxes, taxes on financial operations, local taxes, and the like. In the absence of detailed information, the only estimate is that provided by Consejo Minero (2003) of around US$ 27 million on average in the 1990-2002 period.

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[9] The 35% tax on profit repatriations in Chile is rather high for international standards. Among developed economies only France shares this level, while Canada, Spain, Singapore and the US have rates below 30% (Price Waterhouse, 2003).

[10] My estimate is very similar to that of Lagos and Torrens (2001). Their methodology, although similar, could not be replicated and motivated the use of the above mentioned methodology. Likewise, the Mining Council released an aggregate figure of US$ 1,783 millions for taxes paid in the 1990-2002, i.e. slightly below my estimate of US$ 1,820. Their methodology, in particular the number of firms included in the estimate is not available (Mining Council Presentation to the Chilean Congress, 2003).

A third interesting result of my calculation is that they do not support the claim that private mines use distorted transfer prices in order to reduce tax payments and siphon profits out of the country.[11] In the simulations above I used LSME prices for production and US Prime interest rates for debt servicing to obtain a total of US$ 1,820 million in taxes due in the 1990-2002 period. According to Consejo Minero (2003) the total amount of taxes paid in the same period reached US$ 1,783 million. The difference is obviously very small, considering the simplicity of the methodology I used. Had private firms transferred production at lower-than-market prices, taxes paid should have been much smaller. Likewise, had debt service been above US prime interest rates, profits and taxes should have been smaller.

This conclusion should be taken with care because period several mines did not pay taxes in the 1990-2002, as they were having losses derived from the use of accelerated depreciation schedules. Had they used distorted transfer prices, this would not have shown in my calculation. Moreover, it has been claimed that this would allow firms to amass substantial "accumulated losses" so that in the future it would permit them to reduce tax payments (this is the argument in Fundación Terram, 2002b, the lead think tank against current mining policies in Chile). There are, nevertheless, some flaws in this argument. First, exports and transaction prices can be regularly investigated the Chilean authorities by the S.I.I. (tax administrator), Cochilco (the Chilean copper commission), the Central Bank, customs, etc. In fact, for tax purposes, the S.I.I. has the authority to change transfer prices if they do not conform to market values. Second, transactions are also overseen by tax authorities in the home country of foreign companies, so that tax frauds are difficult to hide. Third, in the calculations by Fundación Terram (2003) there is a confusion between flows and stocks of debts.[12]

Finally, changes in the income tax law were introduced in 2001 to increase transparency and public information and, in particular, to control abnormal terms in loans and credit given to firms by

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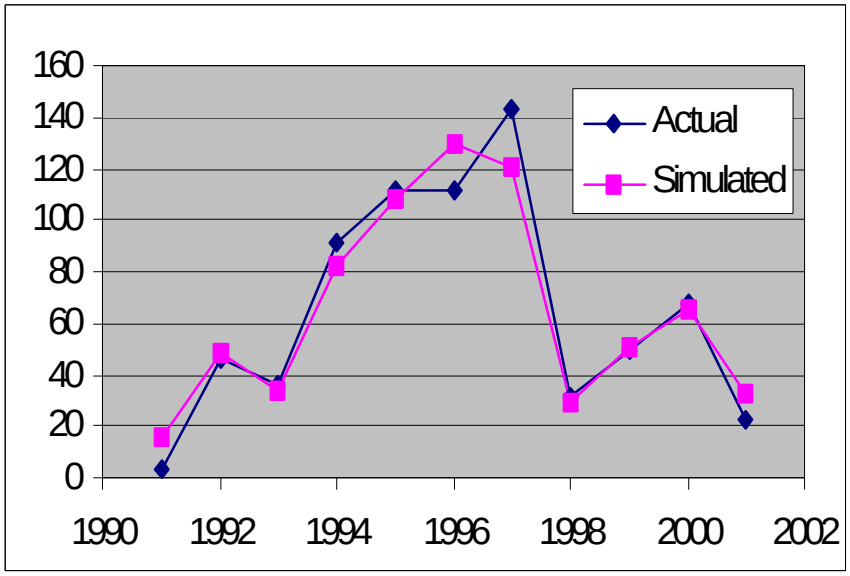
[11] This is a frequent claim, largely unsupported by hard data. For example, Fundación Terram (2002a) claims that La Escondida transferred copper at ¢55 per pound instead of market values of ¢90 per pound.

[12] For example, they claim that interest payments are excessively high because "in 24 years of operations and out of total investments of US$ 1,800 millions, interest payments have amounted to US$ 1,088 millions" (page 9). Evidently, if loans were contracted at, say, 30 years maturity, after 24 years cumulated debt service and *principal amortization* ought to be in the neighborhood of total investment.

financial institutions with joint ownership (connected loans). This makes the claim of substantial foregone taxes in the future less credible.

The robustness of the methodology I developed can be tested against the data from mine La Escondida (the largest producer in Chile), for which data on declared taxes is available. In figure 1, it can be seen that my simulated calculations tracks actual values quite closely, thus providing some confidence in the results. Likewise, annual average taxes calculated by Lagos and Torrens (2001) are quite similar to my values (US$ 120 million vs US$ 109 million) for the 1985-1998 period.

Figure 1
Actual and Simulated Taxes for Mine Escondida



An evaluation of actual taxes in public mining

Table 12 shows the calculation of taxes paid by Codelco (the holding of public mines), obtained from annual reports. It can be seen that Codelco mines paid around US$ 550 million a year, from the combination of profit taxes for public firms (40%) and the "Army Law" (by law 10% of sales go directly to finance defense). In addition, public mines paid dividends to the tune of US$ 230

million per year in the same period. In total, contributions made to the government were 1.5% of GDP.

From the comparison of Tables 11 and 12, it is quite obvious that taxes paid by the private sector are a small fraction of the contribution of Codelco to fiscal revenue. One has to be cautious, nevertheless, in jumping too quickly to the conclusion that tax rates for private firms are too low, because private sector firms benefit from being newcomers to the sector and, hence, of having tax credits upon installation costs and the depreciation of investment. Of the 12 firms that I consider in my analysis, only three have been in operations for 10 years or more, the period in which they would have benefit the most from the Foreign Investment Statute.

Nevertheless, there is also the presumption that the government could have been more proactive when raising tax revenues from this sector. The initial consideration that Chile required to grant generous conditions and a self-limiting tax framework to induce foreign investment is likely to be non-binding nowadays. After two decades of stability and rule of law, the Chilean economy and its authorities enjoy substantial credibility, so that foreign investors probably do need to be excessively rewarded to be interested in ventures in the mining sector.

An estimation of foregone taxes

There are two exercises that can be undertaken to measure the amount of foregone taxes in mining. First, I can calculate the value of foregone taxes due to the asymmetry in the tax treatment between credit service and the amortization and repatriation of profits. A simple calculation was made requiring private firms to pay 35% tax on interest payments instead of the current 4% tax rate. This is an extreme exercise as it amounts to repel (at zero cost) the contracts made between the investors and the Chilean government. This tax rate would correspond also to the median effective tax rate for the 33 main mining operations in the US, according to Price Waterhouse (2003a).

Table 12
Operating Results of Codelco
in US$ millions of each year and percentage of GDP.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Sales	3,339	2,774	2,986	2,528	2,809	3,985	3,129	3,510	2,817	2,867	3,568	3,244	3,490
Operating Costs	1,397	1,449	1,742	1,812	2,072	1,977	1,908	2,276	2,214	2,230	2,467	2,583	2,787
Depreciation imputed	295	287	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	390
Financial Costs	161	111	56	42	38	44	57	71	79	92	97	96	100
Taxes paid	915	595	547	303	572	945	867	719	349	238	488	362	326
Dividends	590	275	299	124	206	630	77	410	43	31	237	102	0
Taxes and dividends (% GDP)	5.0	2.5	2.0	1.0	1.5	2.4	1.2	1.4	0.5	0.4	1.0	0.7	0.5

Source: Own elaboration based on Codelco's financial reports.

Table 13
Imputed Foregone Taxes from Private Mining
in US$ millions of each year and percentage of GDP.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1. Taxes due under current tax schedules													
US$ millions	17	65	123	96	173	234	308	306	99	134	167	117	86
% of GDP	0.05	0.19	0.29	0.22	0.34	0.36	0.41	0.37	0.12	0.18	0.22	0.17	0.13
2. Taxes due assuming 35% on credit services													
US$ millions	23	71	128	101	185	253	329	330	157	214	269	219	283
% of GDP	0.07	0.21	0.30	0.23	0.36	0.39	0.44	0.40	0.19	0.29	0.35	0.32	0.43
3. Taxes due assuming 5% royalty													
US$ millions	25	61	125	109	182	236	333	332	146	221	311	290	294
% of GDP	0.07	0.18	0.29	0.25	0.36	0.36	0.44	0.40	0.18	0.30	0.41	0.42	0.44
Imputed Foregone Taxes (% of GDP)													
(2) - (1)	0.02	0.02	0.01	0.01	0.02	0.03	0.03	0.03	0.07	0.11	0.13	0.15	0.30
(3) - (1)	0.02	-0.01	0.00	0.03	0.02	0.00	0.03	0.03	0.06	0.12	0.19	0.25	0.31

Source: Own elaboration.

Second, one can calculate how much taxes were foregone by the government in the 1992-2001 period by its decision of not taxing the extraction of mineral ore. Mining royalties in other countries are levied on different basis in other countries, depending on the type of mineral and production processes. In the case of non-gold minerals, royalties are sometimes based on area of concession (as in the Chilean case and already accounted for in table 11), sales (2.25% in Colorado, US) or smelter return (e.g., 3% in Argentina) as discussed in Price Waterhouse (2003b). I use a 5% royalty rate on profits, given the availability of data and to avoid the distorting effects that would otherwise arise between firms that refine copper and those that export only copper concentrate [13].

In table 13, I present the results of both exercises, assuming that investment remains unaffected by the change in taxes. Treating taxes on profits and debt service symmetrically increases taxes due in all years; on average in the 1991-2002 period, due taxes under the 35% tax would increase by around US$50 million each year or roughly 0.07% of GDP. On the other hand, levying a 5% royalty fee on profits would increase due taxes by around US$ 60 millions (or 0.07% of GDP), a result that includes both a higher direct tax collection on sales and a subsequent smaller collection of profit taxes.

Environmental concerns

There is little analysis of the nature and cost of environmental damages produced by different economic activities in Chile, despite the evidence of pollution in certain areas. The main problem is the lack of micro-data to do economic evaluations. With regards to mining, the issue has not been more pressing because mines concentrate either in the north of the country –a dessert largely unpopulated– and in the Andean mountains, usually far away from cities. In addition, mining itself tends to be a non-polluting activity; the main environmental concern with regards to pollution are copper smelters and refineries. Contrary to refineries, mines are usually environmentally safe for two reasons. First, being foreign-owned they operate under stricter environmental codes than the Chilean law (Figueroa et al., 1999). Second, their main pollution concern –water contamination– is also their

[13] Since the government is the legal owner of the land (mining concessions are only a right to exploit the ore), the tax corresponds to a royalty.

major production concern; copper mined do need water to operate and since water is scarce in the dessert, mining operations tend to re-use as much water as possible, and thus recycle.[14]

According to Baurregard and Dufuy (2002), mining operations in the Chile hold important water rights in important areas of the country. Water rights in Chile are assigned freely by the government upon request; whenever water rights on a waterbed are completely assigned, a private market for water rights operate. In most regions in the north of country where water is scarce, mines hold a substantial fraction of water rights (around 40% of the total), being the rest allocated to potable water and agriculture. Nevertheless, mines hold water rights in excess of those needed to fulfill their needs. In fact, in the only region where water is being possibly over extracted (II region), this is largely the result of agriculture activities, which use more water than allowed by legal rights.

With regards to air pollution, there are five large copper refining complexes, four of them owned by public holdings Codelco and Enami (Potrerillos, Ventanas, Caletones, and Paipote). These are located near populated areas, used to be highly pollutant, and have negative impacts on the population's health. During the 1990s, the government felt the pressure of the population to control emissions and set about to invest in abatement measures. As of 2003, all installations comply with regulations for PM2.5 and PM10, which are the riskiest to human life. The annual cost of environmental investment is in Table 14. These figures comprise both air-pollution abatement measures as well as the investment in water quality control (typically improvements in waste water dams). Perhaps a little ironically, the environmental assessment of these investments suggests that most of the benefit of abatement comes from improved yields in the surrounding agricultural areas and not from improved health in the population (Coria, 2002).

[14] Other mining operations by very small producers (e.g., gold) tend also to be highly polluting but the environmental cost is minimal due to their operation scale (Sanchez et al. 1999).

Table 14
Investment in Pollution Abatement by Public Mines
(US$ millions)

	Codelco	Enami
1989	39.9	48.1
1990	17.6	26.3
1991	23.6	3.3
1992	67.9	6.9
1993	55.9	1.6
1994	43	3.3
1995	106.7	18.5
1996	140	32.7
1997	148	53.2
1998	214.6	32.8

Source: Figueroa et al. (1999).

4.2 Foregone Taxes in the Fishing Sector

Contrary of the case of mining, information on the fishing industry is very limited and does not allow for an easy computation of foregone taxes. The industry comprises two very different sectors: commercial (pelagic) fisheries operating along the coast and at high seas, and aquiculture of salmon and rainbow trout (located in specific areas in the south of the country). A substantial fraction of commercial captures is exported either in the form of fish meal. On the contrary, most of aquiculture products are exported frozen. Table 15 presents a summary description of capture/production and exports by these two sub-sectors. It can be seen that differences in performance. Between 1993 and 2002, production in aquiculture quadrupled. Falling international prices, however, reduced the return and exports only tripled in value. On the contrary, commercial fishing captures have declined steadily since 1995. To some extent, the decline in export value is due to declining international prices for fish meal. Nevertheless, the lion's share of the falling performance

of the subsector is the collapse of the biomass of fish in the mid-1990s due to over harvesting and the natural disaster associated with *El Niño* in 1998-99.

Table 15
Commercial Fishing and Aquiculture in Chile

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Capture/production (tho. tons)	6.000	7.844	7.617	7.049	6.279	3.743	5.423	4.911	4.783	na
• Commercial	5.864	7.660	7.411	6.726	5.904	3.362	5.118	4.486	4.151	na
• Aquiculture	135	184	206	323	375	381	305	425	632	na
Exports (US$ millions)	1.172	1.366	1.782	1.772	1.873	1.674	1.784	1.875	1.861	1.959
• Commercial	844	970	1.230	1.170	1.143	904	892	825	819	901
• Aquiculture	328	396	552	602	730	770	892	1.050	1.042	1.058

Fuente: Subsecretaría de Pesca.

Institutional Framework

Commercial fishing in Chile has been plagued by poor regulation and over harvesting of the biomass. In the early 1990, over 90% of the main species were declared as exhausted leading to the imposition of quotas and capture restrictions. The 1991 Fishing Las allowed improved control. All species were subject to annual capture quotas, allocated among fisheries as a function of "effort", i.e., as a function of vessel size, operation areas and fishing techniques. The annual quota was allocated between commercial and artisan fisheries by the authority. This led to a perverse incentives in the working of the sector and to low efficiency harvesting: since there were not individual quotas, whoever capture the fish first ended up making profits. In turn, this induced poor practices in biomass management, overinvestment in effort, excess concentration in fish meal (70% of capture) as a way to quickly export captures, and labor instability.

The introduction of individual transfer quotas (ITQ) would have helped ameliorating this problems by reducing captures and increasing efficiency. However, according to Peña (2002)

lobbying pressures led to ad-hoc restrictions on the application of ITQs, with the result that only four fisheries were been restricted, none of which represent a significant share in value added generated by the Chilean fishing sector. The fisheries crisis of the late 1990s triggered a second legislative initiative attempting to expand the use of ITQs. A short-term priority was to allow for the use of ITQs in the horse mackerel fishery, which had been severely punished by the *El Niño* phenomenon of 1998-99. However, this initiative ended up being delayed by successful lobbying, led by private sector interests with the support of a heterogeneous group of artisan fishermen and small industrial fishing firms. A few species, however, are subject to ITQs which are auctioned at the beginning of each year. These quotas affect those species that are of relatively higher value added than fish meal (e.g., high sea cod). In the 1993-2002 period, the auction price of the quota vis a vis the international price has been very volatile, ranging between 1% and 45%, with a mean value of 10% (Sánchez and Peña, 2003).

Foregone Taxes

Estimating foregone taxes in this case is not easy for several reasons. First, there are no reliable studies on the change in biomass of different species due to commercial fishing. The *El Niño* phenomenon complicates matters even more. In fact, there are no economic evaluations of the biomass, being whatever is available mostly the result of simulation models of reproduction and capture, with no considerations for economic sustainability. Hence, the direct computation of the value for the private sector of the over-harvested species in the last decade is impossible. Second, there are no information on the capital stock of the commercial fishing sector (nor of taxes paid). This preclude us to estimate foregone taxes as the difference between the actual return on investment and a "normal" return.

Consequently, there are two options left to estimate indirectly the amount of resources that the government could have taxed away from the sector in payment for the harvested fish. One is to use international values for commercial fishing licenses. These are not readily available and in general present a myriad of differences even within confined geographic areas (e.g., Krkley, 1997 report over 75 different types of commercial fishing licenses only in the state of Virgina). More importantly, they

tend to reflect the local conditions of the industry and not necessarily those of Chile. An alternative method would be to use the above mentioned quota prices and calculate the implicit willingness of the private sector to pay for the right to fish. When auctions are properly designed and the market operates adequately, fishing ITQs should signal the value of the fish for the private sector. If the median value of the Chilean ITQs is used on exports (which is equivalent to total productions as only 3% is consumed domestically), the total amount of foregone taxes is around US$ 24 million per year.

Table 16
Foregone Taxes in Commercial Fishing
(US$ millions)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Exports	844	970	1.230	1.170	1.143	904	892	825	819	901
Foregone taxes	21	24	31	29	29	23	22	21	20	23

Source: Own elaboration

With regards to aquiculture, it is extremely difficult to estimate foregone taxes and I do not attempt to do it. The production process uses a natural resource which is not paid (water from the sea or the lakes), but all other factors are private property, including the food, the fish eggs, and the installation in which the fish are grown. Land in which these exploitations locate is usually concessioned by the government, as in several other areas (ski resorts, roads, etc.)

Environmental Concerns

Commercial fisheries are, undoubtedly, in a very precarious situation. Due to over harvesting and also as a result of natural disasters (e.g., *El Niño*), the biomass of certain species has declined to dangerous levels[15] and activity has declined steadily. This is evident in the collapse in capture experienced by some species, a fact that is not reflected in table 15 because producers switched to

[15] Basch et al. (2003) estimate a decline in total commercial biomass from 20 million tons in 1986-87 to around 7 million tons in 1999. Their methodology, however, is not available.

alternative species. For example, horse mackerel captures declined from 4.4 million tons in 1994 to less than 1.2 million tons in 2000 and 2001; likewise, anchovies declined from 2.7 million tons to less than 1 million tons in the same period. Vessels and processing capacity has also declined since 1995.

With regards to aquiculture, the production process uses a natural resource which is not paid (water from the sea or lakes) and dumps into the ocean some waste from feeding the fish. There are no serious measures of the potential cost of the latter, although some authors speculate that the level of nitrogen in the water could be higher than before aquiculture plants installed.

4.3 Foregone Taxes in the Forestry Sector

Institutional Framework

In 1974 the government changed the regulation of the forestry sector by introducing Law DL 701. The law guarantees in absolute terms the private property of forest plantations (non expropriation), allows for up to 75% subsidization of planting and managing forests, and grant tax deductions on local taxes and profits.[16]

The change in regulation was very successful in terms of sectoral growth and export promotion. Between 1974 and 2002, annual plantation expanded from 30 thousand hectares to over 130 thousands hectares. Exports rose from less than US$ 120 million in 1974 to almost US$ 2.5 billion in 2002. During the 1990s, annual investment was US$ 25 million on average and the contribution to GDP was 2.5%.

In terms of capital accumulation, subsidies given to forestry increases mainly the stock of natural resources. Investment in physical capital is comparatively small (mostly transportation and harvesting machinery). Likewise, human capital formation does not benefit indirectly because employment is minimal and comprises largely unskilled labor.

[16] The law stems from the need to reduce investment risks derived from lack of confidence in the public policies (itself the result of political turmoil in the early 1970s), the purpose of developing the wood products industry, and the lack of a secondary market for newly planted forests (Grass y Raga, 1991).

An evaluation of the cost of subsidies

The 1974 law, nevertheless, has also amounted to a significant subsidy to producers at the time of investment. As shown in Table 17, government subsidies were on average around 45% of the costs of planting and managing forests in the 1990s; however, after 2000 they have declined to around 33%. The measurement of these subsidies include those given to planting and those allocated to forest management and environment protection. On average, subsidies amount to US$ 11 millions of roughly 0.02% of GDP.

Table 17
Foregone Taxes in Forestry

	Investment (US$ tho.)	Area planted (hectares)	Area subsidized (hectares)	Total foregone tax (US$ tho.)	Total foregone tax (% GDP)
1991	17,553	117,442	37533	7,695	0.02%
1992	24,288	130,429	51,713	10,848	0.02%
1993	26,644	124,704	48,083	10,381	0.02%
1994	26.737	109,885	68,215	14,766	0.03%
1995	30,485	99,858	54,961	14,931	0.02%
1996	23,700	78,592	51,356	15,442	0.02%
1997	22,667	79,484	30,657	7,683	0.01%
1998	23522	86,579	23,699	7,841	0.01%
1999	30366	108,269	31,480	10,122	0.01%
2000	na	na	42,719	11,635	0.02%
2001	na	na	22,509	7956	0.01%

Source: ECLAC (2000) and own elaboration based on CONAF information.

Native Forests and Environmental Concerns

Information on native forests and their exploitation is scarce. There are some concerns on the possible substitution of planted for native forest, but measurements are imprecise. Nevertheless, the 1997 survey of forest areas found that native forests were around 13.5 million hectares, while planted forests amounted to 2.1 million hectares. In terms of exploitation, wood and its derivatives from native forests amounted in 1997 to only 13% of total production. In fact, the available information suggests that the exploitation of native forests is in decline (ECLAC, 2000).

The most controversial aspect of the forestry sector, as discussed by O'Ryan and Fierro (1999) relates to allegedly unsustainable forest-management practices, in particular as they may cause negative impacts on the ecological as well as the replacement of plantations for native forests. Ecological groups allege that since the passing of Law 701 extensive areas of native forests were replaced by plantations, to the tune of 200,000 hectares (Lara and others, 1996).[17]

According to O'Ryan and Fierro (1999), however, the situation seems to be quite different. Citing work done by the Forestry Institute at CORFO, a national entity with a long tradition of research and diffusion of forestry information, they concluded that in the 30 years prior to 1990 no more than 135,000 ha of native forests had been replaced by plantations, that the substitutions occurred in the period 1974-1983 and that since 1984 replacement has not been significant. The apparent explanation of the difference between the two reports is that the values used by Lara and others include land turned over for crop growing and livestock breeding which cannot be considered as replacement of native forest by plantations, nor can it be attributed to government policies.

Environmental groups also claim that plantations are negative for the environment, due to the acidification of soils, water-regime disruptions, and reduced biodiversity. These arguments have been refuted by Grass (1992) and Hartwig (1994) which show that the behavior of soil acidity after several decades of pine plantations is fully comparable with that of native species. The fact that plantations consume more water than native forests does not necessarily imply a disruption in water regimes because plantations tend to be installed precisely in areas of abundant winter rainfall. As regards to

[17] This estimate dwarves when compared to the stock of native of forests, as it amounts to only 1.5% of the total forest area.

biodiversity, O'Ryan and Fierro (1999) conclude that although when a plantation is established the environment is affected, the variety of flora and fauna actually depends on the shrub and litter layer, or *sotobosque* (vegetation that grows up between the trees of a forest), and this in turn depends on soil quality, climate and the amount of light the forest lets in. Thus in low-density pine plantations, the flora and fauna that develops is very similar to what appears under other types of forest in the same geographical area.

4.4 Foregone Taxes in Labor Training Programs.

A different form of foregone taxes arises from training programs which benefit legally established firms as they can deduct a fraction of the cost of training from taxes. Although the regulation is intended to be neutral, it does not benefit firms that pay income taxes on the basis of imputed rents (because they cannot deduce costs from expenditures) nor independent workers. Obviously, it does not include the informal sector.

Institutional Framework

SENCE is an agency of the government in charge of handling tax rebates for private sector firms that engage in labor training programs. Firms can either provide training by themselves or out source the services with specially authorized firms, called OTECs. Training programs are valued according to the number of hours imparted by each course and a unit cost determined by SENCE.

Labor training expenses can be deduced from the first category tax with a ceiling of 1% of the annual payroll, except for micro-enterprises which are allowed to deduce taxes up to US$6,000 a year and small business that have a ceiling of US$ 12,000. In addition, SENCE handles other tax-deduction schemes for specifically targeted groups (young apprentices), which are negligible in terms of resources and foregone taxes.

An evaluation of foregone taxes

Since 1991, SENCE has granted tax deductions in an increasing manner, as shown in Table 18. In the early 1990s, foregone taxes amounted to less than 0.1% of GDP. By the early 2000s, they have increased to 0.2% of GDP, equivalent to around US$ 150 millions a year. The measurement of foregone taxes includes all forms of transfers by Sence.

It is not trivial to determine to what extent this subsidy benefits human capital accumulation or company owners, and thus, physical capital accumulation. If labor training is of general nature (i.e., useful in any industry), the benefitted is the worker; on the contrary if it is firm-specific, the benefitted is the firm and, eventually, would lead to higher capital accumulation whenever there is complementarity between human and physical capital.

Table 18
Foregone Taxes in Labor Training Programs

	Number of workers trained	Total foregone tax (US$ tho.)	Total foregone tax (% of GDP)
1991	na	33,735	0.09%
1992	na	45,054	0.10%
1993	na	56,226	0.12%
1994	na	68,950	0.12%
1995	na	84,974	0.12%
1996	na	106,985	0.14%
1997	482,914	115,238	0.14%
1998	476,436	113,271	0.14%
1999	504,436	109,680	0.15%
2000	620,235	126,548	0.17%
2001	756,080	143,466	0.21%

Source: Sence Annual Reports.

5. Sector Specific Distorting Taxes: the Case of Agricultural Price Bands

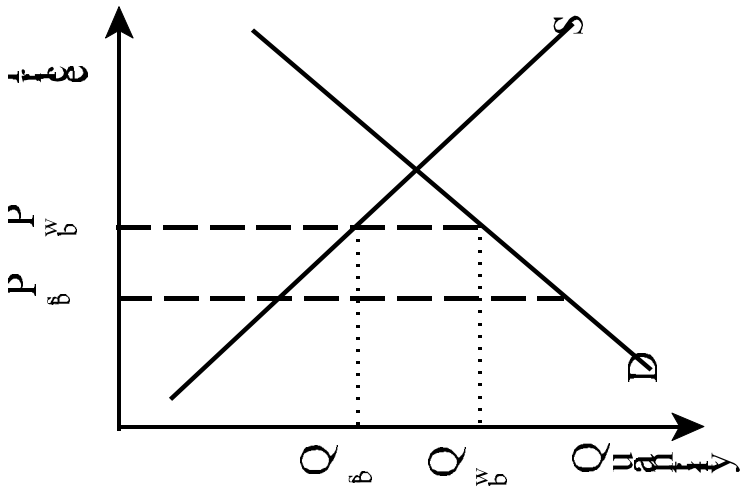
Price bands were implemented in Chile in the mid 1980s for three main crops: wheat, sugar, and oilseeds. In principle these bands should stabilize the domestic price of the crops, benefitting in the long run both domestic consumers and producers. Whenever international prices are above the ceiling of the band, tariffs are reduced so that imports are encouraged and domestic prices do not increase excessively. This benefits consumers at the cost of producers earnings. Likewise, whenever international prices fell below a pre-determined threshold, tariffs are increased so as to reduce imports and avoid domestic prices falling too much. This benefits producers at the cost of consumers incomes. If the mechanism is properly calibrated, in the long run domestic prices should correspond to the expected international price.

In the case of wheat, nevertheless, the mechanism is poorly designed. Since 1984, only three times the price has hit the ceiling, benefitting consumers. Most of the times (14 out of the 18 years), the mechanism has generated a domestic price well above international levels, inducing an important transfers from consumers to domestic producers and the government, the latter via tax revenues. Likewise, sugar price bands have also led to substantial protection to domestic producers. Only twice has the price been above the floor of the band in the 1990-2002 period, leading to important transfers from consumers to producers.

The calculation consists in evaluating the cost of support prices as described in figure 1[18]. The domestic supply is depicted a *S*, the domestic demand is labeled *D*, the international price of wheat is termed P_{sb} (adjusted for transport costs, financial costs, etc.), the domestic price including protection implicit in the band is P_{wb}. Demand at the domestic price is $Q_{wb,}$ which is supplied by the domestic producers Q_{sb} and by importers (Q_{wb} - Q_{sb}). Consequently, consumers pay a higher price for wheat, transferring (Q_{wb} - Q_{sb}) (P_{wb} - P_{sb}) to the government in the form of taxes and Q_{sb} (P_{wb} - P_{sb}) to domestic producers.

[18] I also include in the calculation those years in which the band acted as a ceiling or did not act at all (in the latter case, transfers are zero).

Figure 2



In table 11 I present a simple estimation of the amount of transfers and taxes paid by consumers in wheat and sugar. It can be seen that transfers from consumers to producers are substantial, reaching on average US$ 36 millions per year. The government benefitted also raising tax collection by about US$ 9 millions per year. In total, consumers had to pay transfers of US$ 45 million on average per year.[19]

I present a similar estimation for the case of sugar. The amount of transfers and taxes paid by consumers reached US$ 43 millions, corresponding to transfers to producers in the form of higher prices of around US$ 30 millions per year and higher taxes paid to the government of about US$ 14 millions per year.

[19] Roeschman (2002) observes that price bands also act as an insurance mechanisms against the risk of price fluctuations. Risk-averse producers benefit from risk reduction and, according to his estimation, expand output in almost 5%.

Table 19
Transfers from wheat and sugar price bands
(in US$ millions of 2001)

	Wheat				Sugar			
Year	Transfers to government	Transfers to producers	Total transfers from consumers	Net income effect on first quintile	Transfers to government	Transfers to producers	Total transfers from consumers	Net income effect on first quintile
1990	1.4	43.9	45.3	-0.6	0.0	0.0	0.0	0.0
1991	8.4	83.1	91.5	-1.4	1.4	2.4	3.8	-0.1
1992	4.9	13.4	18.2	-0.4	6.5	3.5	10.0	-0.4
1993	8.7	22.3	31.0	-0.7	1.1	27.8	28.8	0.7
1994	1.3	2.4	-3.7	-0.9	-2.7	-17.6	-20.2	-0.3
1995	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	-7.3	-12.2	-19.5	0.5	0.4	1.2	1.7	0.0
1997	6.1	31.2	37.3	-0.7	19.2	25.0	44.2	-0.9
1998	25.2	105.6	130.7	-2.5	31.5	74.2	105.8	-0.5
1999	41.4	78.6	120.0	-2.8	45.0	83.8	128.8	-1.4
2000	18.7	55.7	74.4	-1.5	33.0	70.3	103.3	-0.8
2001	5.5	39.9	45.4	-0.8	18.0	53.9	71.9	0.0
2002	0.0	0.0	0.0	0.0	21.4	64.5	86.0	0.0
Total	**114.3**	**463.7**	**578.0**	**-10.9**	**174.9**	**420.6**	**595.6**	**-3.6**

Source: own elaboration, based on information of the Ministry of Agriculture and INE.

Implicit income redistribution

A rationale to protect producers arises whenever those producers are also among the most vulnerable groups of the population. In the case of wheat, a number of producers are among the poor. Accordingly, protecting wheat would perhaps protect the poor if transfers received by poor producers come mostly from rich consumers. This, unfortunately, is not the case in Chile. Based on the information of ODEPA, I estimated the area devoted to wheat in 370 thousand hectares (this is around 50% of the total area devoted to annual crops in Chile in 2002). Small producers –i.e., those exploitations with total area below 10 hectares– account for less than 20 thousand hectares and 5.2% of total wheat production. That is, the benefit of wheat protection goes in its vast majority towards medium-to-large size producers, away from low-income producers.

On the other hand, transfers do not necessarily come from the rich: on average Chilean consumers spend around 4.7% of their income on products that use wheat as a component (e.g., pastas, bread, cereals), but this figure hides the important differences among income groups. According to Roeschman (2002), in the first quintile consumers spend around 10% of their income in wheat-based products, while in the fifth quintile this figures reduce to 2.5%. This, in turn, implies that a substantial part of the burden of the tax falls on low income groups.

Based on these figures I estimated that the net transfer to poor groups is largely negative, i.e., the stabilization of wheat prices benefits primarily higher income segments of the population. When considering the first quintile, I estimated that poor groups have transferred around US$ 1 million a year to the richest groups on average. A similar exercise performed for the case of sugar yield a much lower estimate of net income losses of US$ 0.3 millions.

6. Government Expenditures and the Allocation of Subsidies

Since the market liberalization reforms of the 1970s and 1980s, the Chilean economy has tended to replace transfers to target groups and segments of the economy for supply-side subsidies, across the board transfers, and sector specific benefits. This policy orientation arises from the conviction that public resources ought to be delivered as efficiently as possible and that non-targeted subsidies are inefficient. In turn, it has streamlined procedures and led authorities to concentrate efforts in a few ministries and autonomous agencies.

In order to review the impact of subsidies in Chile, it is convenient to discuss briefly fiscal expenditures. Table 20 presents the consolidated expenditures of the general government (i.e., including municipalities and excluding state-owned enterprises). It can be seen that total expenditures amounted to around 19% of GDP on average in the 1992-2001 period, with a slight upward trend since 1997. In addition, the share of each ministry tends to be quite stable reflecting both the relative inability of politicians to use funds on a discretional basis and the tendency of the central government to allocate funds based on past budgets.

As expected, expenditures in health and education are the most significant, as well as those in defense and social security payments. The latter include the transfers of pensions funds made to private pension funds managers in the form of "recognition" bonds and, to a less extent, the payment of minimum pensions. On average, public expenditures in education were 3.1% of GDP in the decade. This may not seem too high a figure when compared to other developing economies, but it should be kept in mind that in Chile the private sector finances a substantial fraction of secondary and tertiary education costs. Likewise, though to a lesser degree, the private sector also finances health expenditures, complementing government resources (2.4% of GDP on average).

The government provides a classification for subsidies that, for the purposes of this paper, is inadequate. Subsidies, which in the period amount to 0.55% of GDP, are those programs that transfer resources to targeted groups and are not assigned to a particular ministry or were originally created by law and paid out of the general budget. In fact, of the five items considered, two cannot be considered properly subsidies (railroad worker's compensations, and unemployment insurance payments).

Table 20
Government Expenditures, functional classification
(% of GDP)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Government	0.8%	0.8%	0.8%	0.7%	0.7%	0.7%	0.8%	0.8%	0.9%	0.8%	0.8%
Defense	2.1%	1.8%	1.8%	1.7%	1.5%	1.6%	1.6%	1.7%	1.8%	1.8%	1.7%
Justice	1.0%	1.0%	1.0%	1.0%	1.0%	1.1%	1.1%	1.2%	1.3%	1.3%	1.3%
Health	2.2%	2.1%	2.2%	2.3%	2.2%	2.3%	2.3%	2.5%	2.6%	2.7%	2.8%
Housing	1.1%	1.0%	1.0%	1.0%	1.0%	1.0%	0.9%	1.0%	1.0%	0.9%	0.9%
Social Security	6.1%	5.4%	5.6%	5.4%	5.1%	5.4%	5.4%	5.7%	6.4%	6.4%	6.5%
Education	2.6%	2.5%	2.6%	2.7%	2.7%	3.0%	3.1%	3.5%	3.8%	3.9%	4.1%
Subsidies*	1.1%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.6%	0.6%	0.6%	0.6%
Mkt. Regulation	1.3%	0.8%	0.6%	0.6%	0.5%	0.5%	0.6%	0.6%	0.7%	0.5%	0.4%
Infrastructure	1.1%	0.9%	1.0%	1.1%	1.2%	1.3%	1.4%	1.4%	1.3%	1.3%	1.3%
Others n.i.e.	0.1%	1.3%	1.2%	0.9%	0.7%	0.5%	0.4%	0.6%	0.3%	0.5%	0.5%
Total	19.5%	18.1%	18.2%	17.8%	16.8%	17.9%	18.1%	19.6%	20.7%	20.6%	21.0%

Source: Dipres, Ministry of Finance.
Note: Subsidies correspond to asignación familiar (family allowances), maternity leave, railroad worker's compensations, unemployment insurance, and potable water subsidies.

Most subsidies are included in the budgets of each ministry (e.g., farmers support transfers are included in the Ministry of Agriculture) and need to be identified one by one. In Table 21, I have reclassified these expenditures to identify those items within ministries that contain subsidy components affecting either human or physical capital formation. A note of caution is due: the government tends to classify transfers as subsidies, which is sometimes not adequate. For example, emergency employment programs are classified as "production subsidies" when they are transferred via public works, even if these emergency programs consist in collecting garbage and cleaning green areas. Hence, care should be used when comparing these figures to those provided by the authorities.

I have classified as "non-discretionary expenditures" those employed in the general working of the government (including the Presidency, the Congress, and other political ministries, the ministry of Finance, Planning, and Foreign Affairs), defense, justice, social security, regulatory agencies (including all *superintendencias* and the portion of the Ministry of the Economy that deals with regulation), infrastructure (excluding transfers to irrigation). On average, these non-discretionary expenditures reached 11.4% of GDP in the 1990-2001 period, slightly above one half of total government expenditures. The largest share of these expenditures corresponds to social security[20] (50%), with defense, justice and infrastructure explaining most of the remaining expenses.

Discretionary expenditures, on the other hand, include those of the ministries of health, education, and housing. In addition, I included public expenses on the environmental agencies (including administrative costs), promotion agencies, direct subsidies (i.e., those not assigned to a particular ministry), Corfo's expenditures on research and development, transfers made in support of subsistence miners, and foregone taxes identified and estimated in the previous section (labor training, forestry and mining). Subsidies and foregone taxes account for only 11% of total discretionary expenditures, mostly in the form of direct subsidies (5%). I included funds allocated to INDAP (Agricultural Development Fund), CONAF (Forestry Commission), CORFO-SERCOTEC (Technical Transfer Agency), SENCE (Labor Training Services), and ENAMI (this is a copper refining company that acts as a price-supporter agency for small and micro mining operations). These institutions, in general, provides two types of services to firms. First, they transfer funds to firms.

[20] I considered social security contributions as non-discretionary because in the individual capitalization system of Chile, employers –in this case the State– do not have access to the funds that are entirely workers' saving.

Second, they allow firms to waive the payment of taxes under certain circumstances (tax exemptions or deductions). Expenditures by INDAP (a farmer and peasants support entity) and CONAF (the forestry support entity) include both actual subsidies and the administrative costs involved in their operations. Subsidies given to improving firm management and technology by two divisions of CORFO (Sercotec and Fontec) are also included as subsidies, as well as ENAMI provides subsidies to the mining sector, in the form of support prices for purchases of copper ore and subsidized refining for very small mining operations. These subsidies have declined substantially in the 1990s.

The lion's share of discretionary expenditures, as expected, is in health, housing, and education, which takes almost two thirds of the total, i.e., 8% of GDP. Subsidies allocated directly by the government beyond the budget of the ministries amounts to an additional 1.1%. Discretionary expenditures on the environment I minimal with only 0.3% of GDP. Promotion of private sector activities –either through Corfo or directly– amounts to 1.3% of GDP and, finally, foregone taxes is 0.6% of GDP.

Table 21
Government Expenditures and Foregone Taxes (% of GDP)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Non discretionary expenditures												
Government[a]	0.7%	0.8%	0.8%	0.8%	0.7%	0.7%	0.7%	0.7%	0.8%	0.9%	0.8%	0.8%
Defense	2.1%	2.0%	1.9%	1.8%	1.7%	1.6%	1.6%	1.6%	1.7%	1.8%	1.8%	1.8%
Justice	0.9%	0.9%	1.0%	1.0%	1.0%	1.0%	1.0%	1.1%	1.2%	1.3%	1.3%	1.4%
Social Security [b]	6.1%	5.8%	5.6%	5.7%	5.5%	5.2%	5.4%	5.4%	5.7%	6.4%	6.4%	6.7%
Regulatory Agencies [c]	0.4%	0.5%	0.8%	0.6%	0.6%	0.4%	0.5%	0.5%	0.5%	0.6%	0.4%	0.3%
Infrastructure [d]	1.0%	1.1%	1.0%	1.1%	1.2%	1.3%	1.5%	1.5%	1.6%	1.5%	1.4%	1.5%
Total non discretionary	11.1%	11.2%	11.1%	11.0%	10.7%	10.1%	10.7%	10.9%	11.5%	12.5%	12.1%	12.5%
Discretionary expenditures												
Health[e]	1.9%	2.1%	2.2%	2.3%	2.3%	2.2%	2.3%	2.3%	2.5%	2.6%	2.7%	2.9%
Housing	1.0%	1.1%	1.0%	1.1%	1.0%	1.0%	1.0%	0.9%	1.0%	1.0%	0.9%	0.9%
Education	2.4%	2.5%	2.6%	2.7%	2.7%	2.7%	3.0%	3.1%	3.5%	3.8%	3.9%	4.2%
Environment Agencies [a]	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%
Promotion[a]	0.7%	0.7%	1.0%	1.1%	1.0%	0.9%	0.9%	0.9%	0.8%	0.8%	0.7%	0.7%
Other Social[h]	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%	0.4%	0.4%	0.4%	0.6%	0.6%	0.5%
Direct Subsidies[i]	0.6%	0.6%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.6%	0.6%	0.6%	0.6%
Corfo [j]	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	0.2%
Mining Transfers [j]			0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Foregone taxes in Labor Training (Sence)	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	0.2%
Foregone taxes in Forestry (Conaf)	0.1%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Foregone taxes in Mining [k]	0.0%	0.0%	0.01%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.2%	0.3%
Foregone taxes in Fishing												
Total Discretionary, Subsidies &Forgone Taxes	7.3%	7.6%	8.1%	8.5%	8.4%	8.0%	8.5%	8.8%	9.4%	10.1%	10.2%	11.0%

Notes: (a) excludes R&D expenditures from CORFO from Ministerio de Hacienda and CONAMA from Secretaría General de la Presidencia, (b) excludes Superindentency of Social Security and of AFP, (c) includes all superintendencies (AFP, Seg. Soc, Bancos, Electricidad y Combustible, Valores y Seguros, Servicios Sanitarios, ISAPRES), (c) excludes irrigation subsidies from Ministerio de Obras Públicas, (e) exclude Superintendency of Isapres, (f) includes Indap, Conama, Sernapesca, and Conaf, (g) excludes Corfo, Conaf and Superintendency of Electricity and Fuels, (h) includes Fosis, Digeder, Sename, Conace, Ministry of Labor, and other institutions of social work and excludes Sence, Conaf, and Indap, (i) includes maternity leave, unemployment, family allowances, and water and sanitation, (i) includes CORFO R&D expenditures (Sercotec and Fontec), (k) comprises ENAMI subsidies to small mining operations, (l) considers foregone taxes in profit repatriations.

7. Conclusions

The Chilean economy has been praised for high and sustained economic growth and for the reliance of the authorities in non-distorting policies as means to allocate resources and finance public policies. Likewise, since market liberalization reforms in the 1980s, the government has eliminated most supply-side subsidies, across the board transfers, and sector specific benefits, replacing them for transfers to different target groups and segments of the economy. This policy orientation stems from the conviction that public resources ought to be delivered as efficiently as possible and that non-targeted subsidies are inefficient. In turn, it has streamlined procedures and led authorities to concentrate efforts in a few ministries and autonomous agencies.

Although the main macroeconomic policies remain neutral, distorting policies continue to exert some influence at the sectoral level and between different types of investors (e.g., preferential treatment for foreign investors). These asymmetries in tax treatments –along with some discretion in the allocation of public transfers– induce non-negligible differences in the returns to different forms of capital (physical, natural, and human).

This paper analyses the degree of subsidization of physical capital in Chile as supported by government policies and its likely effects on the accumulation of human capital and the conservation of natural resources. The main conclusion is that there is little evidence of widespread distortions in the allocation of investment between physical, human, and natural resource capital. The tax system displays substantial degrees of neutrality and efficiency, inducing minimal distortions in the composition of capital. Foregone taxes, arising mostly from the government decision not to tax the extraction of natural resources, induces some distortions in mining and fishing, but only in the latter this has probably led to excessively high extraction rates. Estimated foregone taxes amount to around US$ 320 million per year or 0.5% of GDP. Foregone taxes also appear as a result of tax rebates to specific activities, in particular forestry, but transfers are quite low (US$ 10 million).

On the other hand, government expenditures do not display evident signs of favoring specific sectors or distorting capital accumulation, despite the fact that discretionary expenditures are substantial (11% of GDP).

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Appendix

Appendix Table 1
Personal Income Brackets for Segunda Categoría Tax in 2000

Income tax brackets[1] (annual income in US$)	Marginal Tax Rate	Number of taxpayers[2]
Below 7,000	exempted	2,476,000
7,001 to 15,500	5%	575,833
15,501 to 25,900	10%	64,356
25,901 to 36,200	15%	19,375
36,201 to 46,570	25%	8,362
46,571 to 62,095	35%	5,049
above 62,095	45%	4,188

Note: (1) converted to US$ at the average exchange rate of 2000.
(2) figures for 1999.

Appendix Table 2
Tax categories in Chile

Tax type	Applicable to	Tax rate
Primera categoría	Corporations and large size firms	15%
Segunda Categoría	Individuals, independent workers, and small size firms.	Progressive, from 5% to annual income around US$ 7,000 to 45% for rents above US$ 60,000[1]
Global Complementario	Natural persons and patrimonies. Consolidated with primera and segunda categoria taxes	Progressive, from 5% to annual income around US$ 7,000 to 45% for rents above US$ 60,000[1]
Impuesto Adicional	Distributed profits, profits remitted overseas	35% with some exceptions.

Appendix Table 3
Depreciation Profiles
In years

	Costs of Mine Opening	Machinery	Buildings	Installations	Startup costs	Indirect costs
Standard	5	10	30	10	5	5
Accelerated	1	3	10	3	1	1

Source: Internal Revenue Service

Appendix Table 4
Estimated Investment Structure
(as percentage of total investment)

Costs of Mine Opening	Machinery	Buildings	Installations	Startup costs	Indirect costs
9%	34%	34%	11%	6%	6%

Source: Own estimations.

Appendix Table 5
Copper production by main private sector mines
thousands of metric tons

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Candelaria					31	150	137	156	215	227	204	221	221
Cerro Colorado					21	36	59	60	75	100	119	134	134
Collahuasi									48	435	436	453	453
Disputada	112	107	132	181	188	199	201	202	216	248	254	252	252
El Abra							51	194	199	220	197	218	218
Escondida	9	298	336	389	484	467	809	902	857	926	875	787	787
Lomas Bayas									19	45	51	56	56
Los pelambres										12	309	374	374
Mantos Blancos	73	79	69	75	78	76	122	133	138	152	155	157	157
Michilla					27	56	63	63	62	61	52	50	50
Quebrada Blanca					7	46	68	67	71	73	69	75	75
Zaldívar						22	78	96	135	150	148	140	140
Total	194	484	537	645	835	1053	1588	1873	2036	2649	2869	2915	2915

Source: Cochilco

Appendix Table 6
Estimated Cash Costs
in US cents per pound

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Candelaria					0.63	0.56	0.55	0.56	0.51	0.51	0.51	0.51	0.51
Cerro Colorado					0.61	0.55	0.50	0.48	0.45	0.44	0.44	0.43	0.43
Collahuasi									0.44	0.44	0.44	0.43	0.39
Disputada	0.63	0.63	0.60	0.60	0.60	0.58	0.60	0.59	0.55	0.52	0.48	0.47	0.47
El Abra							0.45	0.45	0.45	0.45	0.45	0.48	0.48
Escondida	0.43	0.43	0.42	0.42	0.41	0.41	0.41	0.45	0.45	0.39	0.39	0.38	0.38
Lomas Bayas									0.51	0.51	0.51	0.45	0.45
Los pelambres									0.60	0.42	0.39	0.35	0.35
Mantos Blancos	0.71	0.71	0.70	0.70	0.70	0.68	0.70	0.69	0.66	0.62	0.59	0.58	0.58
Michilla				0.45	0.44	0.43	0.43	0.42	0.41	0.40	0.39	0.39	0.39
Quebrada Blanca				0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Zaldívar						0.62	0.56	0.59	0.44	0.41	0.41	0.42	0.42

Source: Own elaboration.

Appendix Table 7
Estimated Annual Investment, 1991-2002
in US$ millions

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Candelaria		188	188	188		152	152					
Cerro Colorado			287		49			195				
Collahuasi							1,760	195				400
Disputada	15	133	133	133			32	195				
El Abra				1,696								
Escondida	279		100	100	520	280	470			500	700	
Lomas Bayas						250					175	175
Los Pelambres							1,360				225	225
Mantos Blancos				180			145				15	15
Michilla Lince	39			45								
Quebrada Blanca			400							8	8	
Zaldivar			800								34	

Source: Own calculations.

Appendix Table 8
Government Expenditures Reclassified (% of GDP)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Expenditures Supporting Human Capital Formation		6.09%	6.36%	6.43%	6.17%	6.72%	6.81%	7.40%	7.83%	7.98%	8.30%
Health		2.09%	2.23%	2.31%	2.15%	2.29%	2.32%	2.51%	2.63%	2.72%	2.84%
Education		2.53%	2.62%	2.67%	2.67%	2.96%	3.12%	3.47%	3.77%	3.91%	4.09%
Housing		0.99%	1.03%	1.01%	0.95%	1.04%	0.94%	0.97%	0.97%	0.88%	0.90%
Other subsidies[a]		0.48%	0.47%	0.44%	0.41%	0.42%	0.43%	0.45%	0.46%	0.47%	0.46%
Expenditures Supporting Physical Capital Formation		0.19%	0.21%	0.15%	0.13%	0.16%	0.15%	0.16%	0.16%	0.14%	0.21%
Agriculture[b]		0.04%	0.05%	0.06%	0.09%	0.11%	0.10%	0.09%	0.08%	0.07%	0.06%
Development[c]		0.02%	0.02%	0.01%	0.01%	0.01%	0.01%	0.01%	0.03%	0.03%	0.03%
Management[d]		0.03%	0.04%	0.03%	0.02%	0.03%	0.03%	0.04%	0.04%	0.03%	0.03%
Mining[e]		0.05%	0.04%	0.01%	0.01%	0.02%	0.02%	0.01%	0.01%	0.01%	0.01%
Expenditures Supporting Natural Capital Formation		0.25%	0.20%	0.26%	0.25%	0.25%	0.25%	0.25%	0.26%	0.25%	0.18%
Irrigation[f]		0.20%	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%	0.10%
Forestry[g]		0.05%	0.05%	0.06%	0.05%	0.05%	0.05%	0.05%	0.06%	0.05%	0.08%
Rest of govt. expenditures		12.54%	12.51%	12.05%	11.23%	11.79%	11.90%	12.67%	13.39%	13.02%	13.12%

Note: (a) includes including family allowances, maternity leave, unemployment benefits, and potable water subsidies and the FOSIS, (b) includes credit subsidies by INDAP, (c) includes Corfo Programs (Sercotec, Fontec, etc), (d) includes expenditures of Sence (excluding tax deductions), (e) includes subsidies made to PYME mining operations by ENAMI, (f) includes expenditures by INDAP and Ministry of Public Works, (g) includes subsidies given by CONAF.

Appendix Table 9
Government Expenditures Reclassified (in current US$ mn)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Expenditures Supporting Human Capital Formation	2818	3,124	3,617	4,448	5,093	5,641	5,870	5,713	5,974	5,668
Health	968	1,098	1,297	1,549	1,739	1,924	1,992	1,920	2,037	1,943
Education	1,171	1,286	1,503	1,924	2,246	2,581	2,753	2,753	2,929	2,796
Housing	458	508	569	682	787	777	767	705	659	618
Other subsidies[a]	221	232	247	293	321	358	357	335	349	312
Expenditures Supporting Physical Capital Formation	63	74	63	78	111	140	140	154	150	139
Agriculture[b]	17	23	35	52	72	94	87	96	99	92
Development[c]	8	10	6	6	6	6	11	23	22	21
Management[d]	15	21	17	15	22	25	31	26	23	18
Mining[e]	23	21	5	4	11	14	10	8	7	8
Expenditures Supporting Natural Capital Formation	100	118	134	150	169	202	203	181	155	150
Irrigation[f]	79	94	102	112	129	160	159	139	116	96
Forestry[g]	21	25	31	37	40	42	43	42	39	54
Rest of govt. expenditures	6,060	6,465	7,155	8,578	9,497	10,479	10,679	10,487	10,511	9654

Note: (a) includes including family allowances, maternity leave, unemployment benefits, and potable water subsidies and the FOSIS, (b) includes credit subsidies by INDAP, (c) includes Corfo Programs (Sercotec, Fontec, etc), (d) includes expenditures of Sence (excluding tax deductions), (e) includes subsidies made to PYME mining operations by ENAMI, (f) includes expenditures by INDAP and Ministry of Public Works, (g) includes subsidies given by CONAF.

Classification of Economic Activities

I have classified economic activities in Chile according to the suggested methodology based on the value added of each sector as described in 1996 input-output matrix elaborated by the Central Bank. It comprises the 74 sectors of the basic matrix; in Appendix Table 11 there is a detailed description of the classification. It can be seen in Appendix Table 10 that 72.6% of the economic activity in Chile can be classified as clean or no polluting, 8.2% can be considered polluting and only 19.2% is based on natural resources. Likewise, investment is roughly divided into the same figures.

Appendix Table 10

Classification of economic activities (%).

	Output	Investment
Clean	72.6	70.3
Polluting	8.2	6.7
Natural resources	19.2	19.3

Source: own elaboration.

Appendix Table 11
Re classification of activities in Chile

1	Agriculture	C
2	Fruits	C
3	Livestock	C
4	Forestry	C
5	Fishing	C
6	Coal mining	C
7	Oil mining	C
8	Iron mining	C
9	Copper mining	C
10	Other mining	C
11	Meat processing	C
12	Fish processing	C
13	Preserves	C
14	Natural oils processing	C
15	Milk industries	C
16	Milling	C
17	Animal foods	C
18	Bakeries	C
19	Sugar production	C
20	Other foods	C
21	Alcohols	A
22	Wineries	A
23	Breweries	A
24	Non alcoholic beverages	A
25	Tobacco	A
26	Textiles	A
27	Clothing	A
28	Leather goods	B
29	Shoes	B
30	Wood and derivatives	C
31	Paper	B
32	Printing	C
33	Fuel refineries	B
34	Basic chemicals industries	B
35	Other chemicals industries	B
36	Rubber factories	B
37	Plastic industries	B
38	Glass	B
39	Other non metal factories	B
40	Basic iron and coal industries	B
41	Basic industries of other minerals	B
42	Metals industries	B
43	Machinery (non electric)	A
44	Electric machinery	A
45	Transportation equipment	A
46	Furniture	A
47	Other manufacturing	A
48	Electricity	A
49	Gas	A
50	Water	A
51	Construction	A
52	Commerce	A
53	Hotels	A
54	Restaurants	A
55	Railway transportation	A
56	Passenger transportation	A
57	Road cargo	A
58	Maritime cargo	A
59	Air cargo	A
60	Other transport	A
61	Communications	A
62	Financial intermediation	A
63	Insurance companies	A
64	Real Estate	A
65	Management	A
66	Private housing	A
67	Government services	A
68	Public education	A
69	Private education	A
70	Public health	A
71	Private health	A
72	Leisure	A
73	Other services	A
74	Banking	A