Trade Liberalization, Development and Government Policy in Chile

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Abstract

This article evaluates the current stance of Chile's trade policy, and the threats to continued growth in trade. Topics covered are protectionism (tariff and non-tariff) in Chile and its export markets and the evolution of exports. The paper criticizes arguments that claim that Chile is facing limits to its export orientation based on natural resources. The main argument of this paper is that exports of natural resources have changed to include more technology and value added: salmon exports are a means of exporting fishmeal (a traditional exportable) with more processing; wine exports are a means of combining fruit with capital and technology. The paper includes three case studies of successful emerging firms in new sectors which are linked to natural resources, but involve novel ways of using technology in the sectors.

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1 Introduction

Some analysts have questioned whether a country can grow and develop on the basis of natural resources. The question is important, since a positive answer implies that the path of development followed by Chile in the last twenty-five years is mistaken. If this view is correct, it seems to call for industrial policy, in which a developing country decides that certain sectors need to be supported at the expense of other sectors. Unfortunately, the Chilean experience with state intervention in the economy and with protectionism in general (a natural outcome of industrial policy) has been negative, so the answer does not seem to lie in that direction. This is a dilemma for policymakers, since on the one hand, industrial policy does not work in Chile and, on the other hand, it is claimed that a hands-off approach to policy does not lead to development.

One of the points I would like to make in this note is that the dilemma is false: there is no reason to believe that a country that is rich in natural resources is condemned to remain poor. Sachs and Warner (1995) have written about the *curse of natural resources*, and provided evidence for low growth in countries cursed with natural resources. I believe Lane and Tornell (1995) are correct in pointing out that natural resources have a negative effect on growth rates but that this is due to an intervening effect: abundance of natural resources gives rise (though the political process) to policies that are inconsistent with growth.[1] Liberal policies with little state intervention, simple and limited regulation and an open trade stance have not been shown to slow development in countries with natural resources.

One of the arguments of this paper is that the malaise and discontent of Chilean policymakers was due in part to the slowdown in exports of the last four years. Policymakers started to believe that perhaps the country had reached the limits of growth based on natural resource-based exports. However, the slowdown in exports seems to have been related to the appreciation of the exchange rate rather than any limits to growth and this year, after two years of exchange rate depreciation, exports are surging ahead. In an effort to show that the pessimism is overdone, I provide examples of new export sectors that combine technology and natural resources in imaginative ways and that show that there is space for new developments even if newly mature industries such as salmon reach their limits to export growth.

This paper is thus fairly optimistic about the growth prospects of Chile so long as the government does not intervene more actively in the economy and so long as regulations do not stifle innovation.

The first section of this paper reviews the history of Chilean trade policy in the last thirty years, and then goes on to analyze the current trade policy. It then considers the critique of development

[1] One of them being a tendency in those countries to industrial policy and protectionism. Cited in Sachs and Warner (1995).

based on natural resources and argues that it does not provide many options for development. The next section provides short case studies of recent mature and developing exports sectors. The last section concludes.

2 A brief history of the Chilean liberalization process [2]

In order to understand Chilean trade policy in the last quarter century and specially the current dilemmas, it is necessary to go back to the period of import substitution which culminated in the coup d'Etat that overthrew the Allende government. In 1973 the Chilean economy was in chaos, due in large measure to serious political problems combined with inappropriate economic policies. The seeds of the economic crisis were sown in the middle-30's, when Chile abandoned its outwards-oriented model of development and changed to an import substitution regime, which was quite successful in its early stages but had become arthritic by the 1960's, when growth grew progressively slower and became dependent on the performance of the copper market. The social pressures due to slow growth made the country extremely unstable. These problems were compounded by the economic policies of the Allende government, which stifled private investment. After the coup of September 1973, the country embarked on an economic liberalization program, which returned economic policy to an export orientation.

Table 1: Evolution of the effective protection rate

Tradables	1961	1967	1975	1979
Average	133	168	90	13
Standard deviation	117	282	33	2
Range	488	1127	137	7

Source: Behrman, 1967 and Aedo and Lagos 1984, cited in Hachette (2000).

As can be seen from table 1, prior to 1979 the economy was very distorted by high and widely varying effective protection rates. Moreover, during the 1970-73 period, imports on 56% of tariff lines required previous deposits of 10,000% of the CIF value[3] and the remaining tariff lines required arbitrary procedures in order to obtain import licenses. After the coup, the economy entered into a liberalization phase which eliminated most non-tariff barriers, a process that had basically run its course by 1975. Moreover, tariff rates were lowered and their dispersion decreased. The modal and top tariff rates are given in Table 2. There was a large decrease in tariff rates and dispersion in 1975, a year of strong recession in Chile (GDP fell more than 15% that year), when there were

[2] The data in this section comes in large measure from Hachette (2000).

[3] Paying zero interest at a time that inflation was much higher than a hundred percent

Table 2: Tariff rates (percent)

Date	Top rate	modal rate
September 73	750	105
December 73	220	90
January 75	120	55
August 75	90	40
August 77	35	20
June 79	10	10
March 83	20	20
September 84	35	35
June 85	20	20
January 91	11	11

Source: Hachette (2000).

many bankruptcies of companies that specialized in import substitution.[4] After 1975 the economy continued in a path of fast but unstable growth until 1982, when another collapse due to exchange rate misalignment almost led to the overthrow of the military dictatorship.

After 1975, exports and trade in general increased substantially. In the five years from 1976 to 1980, the growth rate of exports was 12.0%, which can be compared to the rates of 0.5% for 1966-1970 and the 4.8% of 1970-1975. The composition of exports also changed substantially, with copper, which represented almost 76% of all exports in 1970 (and even more by 1973) representing only 46.1% of all exports by 1980. The remainder consisted of seafoods, (6%), agricultural products (6%), forestry products (12.7%). There was an increase in the variety of exports and in the regional distribution of import markets.

This fast growth in exports was checked by the increase in the real exchange rate, so in 1981 exports fell by more than 20% to US$5,247MM, while imports surged to US$6,364MM. The trade deficit, which represented 11% of GDP was sustained by large inflows of foreign funds.[5] When foreign banks stopped lending money the economy collapsed, with GDP falling by 14.1%, unemployment rising to more than 25% in 1983 and widespread bank and firm failures. Even by 1985, the economy had not recovered, and the growth rate of GDP for the years 1981-1985 is -0.4%, which meant that per capita income fell substantially more. After 1982, a new but economically old-fashioned cabinet raised tariff rates (see Table 2) and introduced antidumping (AD) measures.

By 1985, a technocratic cabinet was back in power, and it reduced tariff rates once again.[6]

[4]This was not the only cause of bankruptcies, which were also linked to macroeconomic factors such as a strong fiscal adjustment, exchange rate shocks, and monetary policy mistakes.

[5]Meller (1996), p. 200.

[6]In order to placate political pressures, the technocrats instituted the "*bandas*", a supposedly neutral price band on

This, coupled to a depreciated real exchange rate meant that exports resumed their growth path, growing at rates of more than 10.5 percent for the period 1986-1998. The importance of copper in Chilean exports decreased to 38% in 1999, even though several important copper mining projects were developed in this period, which boosted copper exports.[7]

The high rate of growth in exports was helped by the *reintegro simplificado*, a disguised export subsidy to new export lines. In principle a *reintegro* is WTO-acceptable as it consists of returning the value of the tariffs on inputs and VAT on sales abroad. What made the *simplificado* (simplified) version a subsidy is that it did not require accounting: on new and unimportant export lines, exporters would get back the uniform tariff rate on the FOB value of exports.[8] Total exports grew from US$10.7B in 1990 to US$15.6B in 1999 (1999 US$), but exports have stagnated from 1995 onwards, another period of rising real exchange rates.[9] The composition of exports is balanced. In 1998, Latin America received almost 20 percent of exports, NAFTA countries received 22 percent, the EU received 28 percent while Asia received 26 percent (with Japan receiving more than 13 percent of all exports).[10]

In recent years Chile has displayed a nuanced attitude to commercial policy: on the one hand it has reduced its tariff rates, aiming for a uniform 6% tariff rate. On the other hand it began to use safeguards and other forms of contingent protection, price bands on agricultural products became more protectionist and it appears the country started using technical barriers to trade and standards as barriers. Somewhat on the dubious side regarding protectionism, during the 90's Chile began a policy of establishing free trade agreements, about which more anon.

3 Recent trade policy

With a few exceptions that I will describe in this chapter, Chilean trade policy during the period 1986-1991 was a textbook example of an open policy, with low and falling uniform tariff rates and almost no non-tariff barriers to trade. Trade constituted more than 50 percent of GDP in 1990 (WDR 1993). In the early 90's the new civilian government decided to tinker with the model by embracing the notion of trade blocks, stimulated by the admission of Mexico into NAFTA. There does not seem to have been a thorough analysis of the implications of this change in policy.[11]

four agricultural products which quickly became protectionist, as I will show later.

[7] Recent data from the thesis of Andrés Pardo.

[8] This was a well designed subsidy, since it explicitly ran out after the accumulated value of exports on that tariff line surpassed US$10MM, thus not causing enough pain to receiving countries that they would actually act on it.

[9] In a break in the recent trend to stagnation of exports, in this year to September, exports are up by 19 percent. This seems to be a consequence of the recent depreciation in the real exchange rate, which stimulated exports. Data from Banco Central de Chile.

[10] Hachette (2000).

[11] See The World Bank (2000)) for a recent analysis of the benefits and disadvantages of trade blocks. *In addition, and specially among LA countries, FTA negotiations often follow a foreign policy rather than an economic route, thus increasing their*

According to Hachette (2000), there were several reasons for the change in approach: a) the fear of being left out of trade blocks, b) the "political" need to reinsert a country which had been an international pariah during the Pinochet government, c) the political need to change some of the policies of the military dictatorship, d) the belief that the benefits that could be obtained from unilateral liberalization were exhausted and that the only way of proceeding onto the next stage of exports (more industrial or higher value added exports) was to be a part of trade blocks, e) the possibility of political support from lobbies that ask for exception from the general clauses of the agreement.

In the early nineties Chile tried to be part of NAFTA but was rejected by the US, which decided to concentrate its efforts in the far more significant agreement with Mexico. In response, Chile established agreements with Mexico (1992, renewed and expanded in 1998) and with Canada (1997). But in the process, Chile also decided to establish FTA's with Bolivia, Venezuela, Costa Rica, Salvador, Panama, Colombia, Ecuador, Peru, Cuba, ALCA and more importantly, with Mercosur. Many of these agreements seem to have little purpose, some of them (Costa Rica, Salvador, Panama) because the amounts of bilateral trade are non-significant and some others (Bolivia, Peru, Venezuela, the first Mexico FTA and others) because the number of exceptions to the agreements is such a large fraction of the total numbers of items traded.[12]

Perhaps the most important bloc for Chile is Mercosur. Chile has associated itself to Mercosur in a loose FTA even though the member countries desire full Chilean participation. The reasons for not becoming a member of such an agreement are various, most importantly, the lack of an institutional setting that will constrain the behavior of the major partners: Argentina and Brazil. Both these countries have a history of failing to keep up with commitments, as is often seen by the imposition of illegal barriers to trade vis-à-vis other members of Mercosur.[13] Moreover, as The World Bank (2000) and others have observed, one of the benefits of a customs union is the ability to negotiate more effectively with other trade blocks. Unfortunately, this requires a shared objective, so that the advantages of negotiation in a large block are not lost in intra-block negotiation. Given the difference in the composition of exports of the countries in Mercosur, this is not the case, specially for a country like Chile, whose trade pattern only coincides with Brazil's on a small fraction of the latter's exports. Furthermore, the advantages of negotiation through a customs

economic disadvantages.

[12]Pablo Serra (personal communication) has argued that in the typical FTA all items for which the agreement would lead to gains from trade and thus increase welfare are those covered by exceptions. The reason is that the beneficial effects of trade are largest when factors of production is reallocated in response to changing prices, that is when some industries shrink or disappear. But it is these effects that the exceptions are meant to counteract, so liberalization usually covers goods which one of the country does not produce and therefore would, before the agreement, obtain in the world market. Thus, according to this argument, FTA's usually lead to trade diversion. The World Bank (2000), page 27, makes a similar point.

[13]These include Argentinas's "statistical assessments", Brasil's initiation of FTA negotiations with the Pacto Andino, administrative measures in Brazil and recent measures in Argentina that raise tariffs on all imports except capital goods.

union can be realized by countries that share a common stance without being linked otherwise, as can be seen by the case of the Cairns Group of agricultural exporters (which includes Argentina, Brazil, Chile, New Zealand and Australia).

3.1 Distortions in Chilean trade

In the early nineties, as we have mentioned, Chile was a shining application of trade theory at its best, with low and uniform tariffs, few exceptions and few NTB's. The picture nowadays looks rather different. Tariffs remain low (and in fact are lower in average than they were then), but this hides the variations in the effective rates depending on the origin of the product and on the product itself. This tariff structure is the result of a decade of FTA's. Fortunately, the low tariffs imply that trade diversion is unlikely to be very important.

Unfortunately, Chile has started experimenting with NTB's, of which various types are coming into common use: safeguards, antidumping actions, phytosanitary restrictions and administrative measures at the border.

3.2 Price bands

Chile introduced agricultural price bands in order to lower political pressures in the politically sensitive mid-south region. The bands covered wheat, sugar and vegetable oils.[14] The argument was that the variations in the international prices of these goods imposed too large a cost on farmers and that a neutral band (in terms of protection) in which the government would tack tariffs when international prices were low and would reduce tariffs below the uniform rate when they were high would not be protectionist and would reduce price variability, thus raising farmer's welfare. Unfortunately this mechanism has not worked correctly: farmers' lobbies have prevented the operation of the band when international prices are high and they have manipulated the administrative machinery that computes the price bands. Moreover, the bands were never going to be symmetric in any case, as the lowest tariff that could be applied was zero, whereas the highest possible tariff was the tariff bindings signed by Chile.[15] Recently safeguards were imposed in order to allow the tariff bindings to be pierced and the sugar industry has been pressuring government to apply to raise the tariff bindings in the sugar industry. The bands have become a permanent feature of the agricultural landscape, raising (on average) factor costs for exporters and the price of food to consumers. While it is true that the world agriculture markets are distorted by developed

[14]The bands were later enlarged to cover wheat flour, as millers were hurt by flour imports from Argentina with which they could not compete given the higher domestic price of wheat due to the band.

[15]When, at the beginnings of the nineties, the uniform tariff rate stood at 11 percent and the tariff bindings on the protected products was 31.5 percent, it meant that assuming normal probability price draws, the expected protection rate in the sector was higher than 11 percent, i.e. the bands are protectionist rather than neutral.

countries and this is unfair to developing country producers, this seems to be a permanent feature of the landscape, which means that protection is the wrong policy choice. More recently, there have been pressures for a price band on rice, as a response to the fall in international prices.

Given that price bands are in practice asymmetric, there is a burden on consumers and this burden is regressive, as we show below. Using information from the recent 1997 Survey of Household Expenditures, which was used in the preparation of the Consumer Price Index weights, we can build table 3, which shows expenditure on products directly affected by price bands, according to income quintiles. It is clear from the table that price bands are an extreme case of a regressive tax.[16] As an example, the table includes the effects of bands with an effect of 25% on the final goods price, well within the tariff bindings. Lower income families contribute almost 20% more more than high income families in absolute (and not only relative) terms in support of traditional agriculture.[17]

The benefits of price bands are also distributed regressively. The benefits of bands accrue mainly to fairly wealthy farmers, as is seen in table 4, which shows the percentage of total production of the agricultural products covered by bands produced by farmers with holdings larger than 100 hectares.[18] Since the effect of protection is to raise prices, these percentages correspond to the fraction of the tax paid by consumers and actually received by farmers that went to wealthy farmers.[19] Galetovic (2001) has shown that farms with less than five hectares, representing 63% of beet farmers, represent less than four percent of beet production and receive less than one percent of the transfers from consumers due to the price band in sugar, which amounted to US$258 million during the period 1998-2000.[20] The treasury also benefits, as it receives tariff revenue due to the protectionist bias of the bands. It is particularly interesting that in the case of the band on oil, almost 90% of consumption is imported (implying that the treasury benefits most).

3.2.1 Safeguards

Until recently, Chile did not have legislation on safeguards, and it was passed against the opposition of most serious Chilean economists. Their fears were soon realized, as lobbies took over this powerful instrument for protection. Last year, for instance, safeguards were imposed on the goods

[16] The table measures only direct effects, so it omits the indirect effects as products with price bands are wend their way as inputs into other products.

[17] This calculation uses family incomes ordered according to per person income, as is reasonable for the case of rice, bread, oil and sugar at the lower income levels. In any case, making the ordering depend on total family incomes reduces the effect marginally.

[18] While it is true that the quality of farmland matters in valuing wealth, the median holding of more than 100 hectares corresponds to substantially more wealth than that of the median citizen.

[19] In the case of sugar an unknown fraction of the higher price is received by the monopoly sugar refiner.

[20] For the monopoly sugar refiner, buying from these farmers ought to be more expensive than buying from larger, more efficient farmers, one possible explanation for this pattern of provision is that it represents an inexpensive mechanism to buy votes against eliminating the sugar band.

Table 3: Effects of price bands among quintiles of income[a]

Product	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
Rice					
Expenditure[b]	1,899	1,967	2,153	2,163	2,175
Average income[c]	129,457	219,567	321,080	488,654	1,332,303
E/Y[d]	1.47%	0.90%	0.67%	0.44%	0.16%
Bread					
Expenditure	12,568	12,122	11,731	10,321	8,145
Average income	124,655	213,160	307,991	475,749	1,281,321
E/Y	10.08%	5.69%	3.81%	2.17%	0.64%
Cooking oil					
Expenditure	2,403	2,779	2,927	3,238	3,588
Average income	128,589	220,804	318,720	496,091	1,385,245
E/Y	1.87%	1.26%	0.92%	0.65%	0.26%
Sugar					
Expenditure	2,278	2,385	2,500	2,465	2,089
Average income	129,628	217,813	318,825	489,447	1,361,295
E/Y	1.76%	1.09%	0.78%	0.50%	0.15%
Total expenditure	19,147	19,253	19,310	18,187	15,996
Effect of 25% surcharge	4,786	4,813	4,827	4,546	3,999

[a]Source V survey of family expenditures, INE.
[b]CH$ of January 1997.
[c]Differences in the quintile incomes are due to differences in the number of respondents who claimed to have consumed the good.
[d]Ratio of household expenditure in the good to household income.

Table 4: Percentage of production in landholdings larger than 100 hectares[a]

Product	% produced by farms > 100ha.
Rape seed	90
Beets	37
Wheat	61
Rice	51

[a]Source: VI agricultural census, INE 1996-1997.

protected by price bands in order that protection could rise above the 31.5% bindings agreed to by Chile in the Uruguay Round.[21] In the end, the protection rates on sugar rose to more than a hundred percent! Of course, the government is now renegotiating an extension of these safeguards in order to have the time to renegotiate tariff bindings. Again, most serious economists signed a petition against these measures, to no avail, since a solid lobby usually wins the political game against a logical argument. It is interesting to note that sugar refining is a monopoly in Chile so gains are concentrated, and that the monopoly has threatened the government with calling in its credit lines to small farmers and thus "becoming the largest landlord in Chile" if protection is lifted. In the case of vegetable oils, only 10 percent of consumption is produced domestically, but consumers would have paid sixty five percent more than the world price of oil last year had the *banda* worked as planned.[22] One of the reasons for the lack of any government reaction seems to be that the Finance Ministry (which considers the large fraction of customs revenues generated by the *bandas* as part of the budget) feels that any change in policy would involve subsidies to politically influential farmers.

The influence of small organized lobbies has increased in the last decade, as politicians have lacked foresight and tried to solve problems in the easiest way for the short term, thus losing reputation for good micro policymaking and gaining the reputation of being soft on lobbies.[23]

An extreme case of the influence of lobbies is exemplified by the failed attempts at establishing an FTA with New Zealand, which has twice been torpedoed by pressures from Chilean milk producers, even though they are both members of the Cairns Group of agricultural exporters and there are various similarities in their trade stance.

3.2.2 Antidumping regulations

Chile is a member of the WTO and therefore its AD procedures conform to the AD code. Nevertheless, as it is common in other countries, in the last few years changes have been introduced to make it easier to charge antidumping duties. The most effective change has been the inclusion of a representative of the Agriculture Department in the anti-distortions committee that investigates and decides cases of alleged dumping (and also decides the application of safeguards). Interestingly, given the size of farm and land-based exports in Chile (US$ 1.38billion in fruit exports, around US$2B in forestry products, more than US$600 MM in wine exports, etc, all of which have

[21] There was no evidence of a large surge in imports or damage to the local industry. The safeguards were decided at a political level, and the open hearings that take place before a decision is made are just a formality.

[22] Fortunately, this *banda* was punctured by a loophole. In the FTA negotiations with Bolivia, Chile ensured that vegetable oil was excepted from the agreement, but the negotiators forgot to except oil mixes. Currently, domestic producers are threatening unemployment in the sector, unless this situation is reversed.

[23] In the few occasions in which the government has attempted to resist the protectionist lobby, it has not been supported by the opposition, which can be populist, in contradiction to some of its cherished ideas of the subsidiary role of the state in the economy.

face the possibility of NTB trade restrictions when Chile protects import competing agriculture), the Agriculture Department follows the indications of the import substitution lobby, which is, in economic terms, far less significant. Since the Agriculture representative is the only one member of the anti-distortions committee that has a clear agenda, her preferences dominate the decisions and there is a growing tendency to approve contingent protection measures.

3.2.3 Phytosanitary restrictions

From their beginnings in 1947, the initial GATT agreements established that standards and norms should not be used with a protectionist intent.[24] The original GATT agreements proved unable to prevent the use of protectionist standards, since they lacked effective mechanisms to ascertain whether a country was breaking the rules. Furthermore, it was argued that the setting of standards was the prerogative of each country, and that to restrict their use infringed national sovereignty. Because of their ineffectiveness, the WTO sets stricter rules for the use of standards, and it is fairly easy to appeal to their unfair use.

Chile has also used phytosanitary restrictions to exclude agricultural exports coming from neighboring countries and even from the US. Even pass-through exports, which are not consumed in Chile but are reexported (lemons from Argentina, for instance) have faced problems, since Chilean farmers claim that they might introduce plagues that do not exist locally or that have been eradicated. Perhaps the best example is the case of meat imports which we describe below.

Argentine meat and hoof-and-mouth disease[25] Over the last two decades Chile has managed to eradicate a series of agricultural plagues, such as hoof-and-mouth disease and the fruit fly, and this has enabled Chilean agricultural products to be exported to countries which impose strict sanitary standards. In most cases, the elimination of plagues has been beneficial for the country, but there are some cases where the attempt to exterminate a plague may be interpreted as a protectionist measure. Consider the eradication of hoof-and-mouth disease, to which Chile has devoted significant resources, mainly due to the fact that foot-and-mouth disease was endemic in Argentina.[26] The declared aim of the policy was to eliminate hoof-and-mouth disease to allow Chile to export beef. However, during the long period in which this policy has been in force, Chile has exported only small amounts of meat. This is understandable, for Chile is a

[24] Notwithstanding this restriction, the initial round of GATT in 1947 established that norms and regulations could be used to "order" a market, a loophole which allowed the infamous marketing orders which prevent, for example, the entry of Chilean grapes during harvest periods in the United States.

[25] From Fischer (In press).

[26] Argentina shares several thousand kilometers of thinly populated frontier with Chile. Periodically smuggled cattle infect Chilean herds. When this happens all cattle in a large neighborhood must be destroyed in order to contain the disease.

country which has no comparative advantages in beef production. However, the policy managed to reduce meat imports from Argentina, as it prevented imports of cattle on the hoof due to phytosanitary restrictions. Only in recent years has it been possible to import vacuum-wrapped off-the-bone beef from Argentina, and this has given rise to numerous complaints from Chilean beef producers. Thus, the effort to eliminate hoof-and-mouth disease can also be seen as a mechanism for suppressing imports of Argentine beef. Moreover, Argentina and other neighboring countries have eradicated the disease, so exports of increased once again. In response, Chile introduced a non-standard method for grading meat, causing Argentinian (and US) beef producers to complain that it represents a technical barrier to trade.[27] In fact, in a personal communication, a technical adviser to the Agricultural lobby confessed that that was the object of the restriction and that it had been unsuccessful in stemming the flow of imports. Hence there was much satisfaction in farm lobbies when the disease was again found in Argentina.

3.3 Other countries

Chile is not the only country exercising NTB's in lieu of tariffs for protection. Table 5 provides examples of restrictions in other LA countries.[28]

Moreover, Chile has faced significant non-tariff protection in other countries, as is exemplified in the following examples[29]:

1. A law governing the recycling of packaging materials (the Töpfer Law in Germany) making it prohibitive to export fresh fruit packed in wooden boxes. The consequence was a significant increase in the costs of fruit exports and the bankruptcy of firms involved in box manufacture.

2. An unilateral ban on Chilean fruit exports to the United States, because of the discovery of two grapes supposedly contaminated with cyanide.

3. Allegations of dumping and phytosanitary problems in fishmeal exports to Mexico, a country with which Chile had recently signed a free trade agreement.

4. A dumping allegation affecting salmon exports to the United States; salmon being one of the biggest growth industries of recent years. Dumping was found but the duties applied were so small that exports were not dented after the final decision, but were very affected in the

[27] Despite the protectionist consequences, the elimination of hoof-and-mouth disease has probably generated positive externalities for Chile. Importing countries are more willing to relax their phytosanitary requirements given that Chile has managed to eliminate an endemic disease of a neighboring country, thereby increasing their confidence in phytosanitary mechanisms in Chile.

[28] From Fischer and Meller (In press).

[29] The first four examples are from Fischer (In press).

Table 5: Non-tariff protection in Latin America

Measure	Countries
Import procedures	Salvador, Paraguay, Argentina,
• Import and custom encumbrances	Brazil, Uruguay
• Import licenses	
• Other taxes and charges	
• Advance payment of VAT and other taxes	
Unexpected tariff increases	Mercosur, esp. Brazil
AD and countervailing measures	Mexico, Argentina
Safeguards	Brazil, Chile (recently)
Tariff escalation	Salvador, Mercosur, Mexico
Tariff quotas	Salvador, Mexico
Labelling requirements	Mexico, Chile
Sanitary and Phytosanitary restrictions	Chile, Mexico, Brazil
Special agricultural protection	All

Source: From Fischer and Meller (In press).

period previous to the decision, as bonds need to be posted against a possible high applied rate.

5. Difficulties in exporting wooden moldings to Canada because the standards of that country require them to be made of a single piece of wood; whereas in Chile moldings are assembled out of shorter pieces.

6. The inability to export scallops under their French name of *Coquilles Saint Jaques*, which meant a lower price in France.[30] The WTO eventually decided in favor of the exporting countries.

7. Venezuela accused Chilean wine exporters of dumping, a strange allegation in a country that does not produce wine. Recently, the accusation was rejected.

Developed countries have normally not played fair with developing countries. As I have mentioned before, their protectionist policies in agriculture, are one of the main arguments used by Chilean farmers that demand protection. Developed countries practice tariff escalation against value-added exports and in general use most of the *tricks of the trade* against developing countries. The following paragraphs describe the use of NTB's by developed countries against developing countries.[31]

[30] They were designated *pedoncles*, a far less attractive name.
[31] From Fischer (In press).

European Union Even though the European Union boasts fairly low tariff rates, these are much higher in the agricultural sector with extreme peaks for some products such as poultry, dairy products, meat, cereals, sugar and tobacco. The structure of tariffs shows some degree of escalation, as mentioned before. There exist tariff quotas for fruit and other agricultural products. The EU is a regular user of AD regulations, specially in the textile sector. The zero risk approach in safety and environmental directives may also be considered a trade barrier. Moreover, the new ISO 9000 and 14000 standards increase the difficulties of exporting to the EU market for small developing country firms, and share many of the characteristics of technical barriers to trade. Europe has also become involved in various trade disputes regarding products exported by Latin American countries. For example, the discrimination against bananas produced in Ecuador and Central America has led to a serious trade dispute between the US and the EU. Wine exports can also be vulnerable to trade disputes, since Europe requires that wine must be produced under wine making practices acceptable to the EU, violating basic principles of GATT.

The United States While in many respects the US is an open market, there are several indications that there remains a substantial level of protection. The indiscriminate use of AD and countervailing subsidy allegations against steel, soy beans and oranges from Brazil, salmon and flowers from Colombia and Chile, and other uses of contingent protection measures impose a degree of uncertainty on developing country exporters. This is compounded by the application of marketing orders for fruit that are biased against foreign exporters and the introduction of phytosanitary restrictions with what appears to be randomness.[32] There is concern with respect to the administrative features of the US contingent protection regulations, some of which do not seem to agree with the GATT codes.[33] Some Latin American countries (apart from Mexico) countries were possible candidates for an FTA agreement with the US, but the lack of "fast track" authority made the prospects unattractive. There is also some concern about the way in which the US certifies countries for anti-drug efforts and its influence on trade. Similarly, the US efforts to impose its own standards of intellectual property protection are viewed with concern in developing countries, specially because lack of compliance can lead to sanctions.

Japan Japan used to be a country which imposed myriad administrative measures that impeded agricultural imports. These barriers have decreased, even though phytosanitary procedures remain complex. There remain some high tariff peaks in specific products. Japan imposes stringent conditions on fresh fruits, vegetables and other horticultural products, many of them without

[32]Consider for example, the (subsequently lifted) restrictions on imports of Chilean lumber due to the possibility of pests, even though the wood had been previously treated.

[33]Even the US partners in NAFTA are not immune from non-tariff barriers, as in the current problem with trucks from Mexico and timber from Canada.

scientific evidence. Imported fruit and flowers are often subjected to fumigation which destroys their commercial potential. This increases the risks for exporters and acts as an efficient trade barrier. Certain derived food products such as snack foods, ice cream, fruit juices, confections and others are subject to tariff escalation. Sectors such as shoes enjoy the protection of tariff-quotas, while value-added wood products are protected by tariff escalation. Administrative procedures are cumbersome and slow, while charging high fees. Japan also uses standards that are unique and outdated but successful in reducing foreign competition. In conclusion, though the changes in Japans economic policies have reduced the extent of the new forms of protection, substantial barriers remain for developing country exporters.

3.3.1 To conclude this section

By the normal standards of most other countries (see previous section), Chile remains a liberal country. The problem, from my point of view, is that the tendency to piecemeal protectionism in current policymaking might be taking the country in the wrong direction. There seems to be no articulate lobby against protectionism, even in those cases (such as the pisco case) in which one of the major Chilean export success stories, the wine industry, might be at risk.[34] This is surprising, since the forest products industry, for instance, faces restrictions in FTA countries in response to Chile's stance on the *banda* products.

4 Development and Natural Resources

One of the topics of this paper is to examine the issue of natural resource based exports as a barrier to development. Many economists have argued that the development process has stages in which countries proceed from natural resource exports to exports of industrial goods and then service exports in a process that mirrors the development of their economies. This analysis led to the policies of import substitution advocated by the Economic Commission for Latin America and the Caribbean (ECLAC) during the fifties and sixties, policies that are associated with the Argentinian economist Raúl Prebisch. Unfortunately these policies, as we have mentioned before, brought stagnation during the sixties and were probably one of the root causes of the crisis of the 70s and 80s in Latin America.

Given that one of the things we have learnt from that experience is that opening the economy is more conducive to growth, especially in small economies such as Chile's, the question that rears its ugly head is what are the products that Chile is going to export in order to in order to climb the next rung in the development ladder. This is specially a problem since Chile is abundant in mineral

[34] For a study of the pisco case, which is still in the news, see Fischer (In press).

based natural resources (labor is relatively scarce by world standards, as is farmland and capital in all its forms) and therefore is "condemned" to continue basing its economy on natural resource exports. Some observers from a "Prebisch" viewpoint might conclude that Chile has no chance of becoming a developed country, because it is cursed with an abundance of natural resources!

This view has led certain policymakers to propose altering Chile's stance regarding foreign investment (equal treatment for all), by subsidizing hi-tech firms settling in Chile or to propose protection for certain sectors deemed vital for development.[35] This would, of course, bring us back to the policies of the fifties and sixties, which were so unsuccessful in promoting development. The problem, I believe, is that policymakers underestimate the ingenuity of entrepreneurs, as will be shown later. Since the macro-level data they use does not allow them to detect the direction of future exports, of innovation or of investment, they are led to believe that new export sectors do not exist and that innovations cannot be taking place. Thus they believe that any future exports will be of the same type as current exports (mainly natural resource based), and since they do not believe it is possible to expand these exports forever, they fear a stagnation of exports and the impossibility of achieving development without a major change in economic policies.

This viewpoint is exemplified by Larraín *et al.* (1999)[36] in which they argue first, that Chile has based its export growth in natural resource based exports, and that this pattern has not changed significantly in the last decades; and second, that the current pattern of exports can not be expanded sufficiently to sustain the exports of a developed economy. Hence, they argue that Chile must develop a policy of mild direct intervention in the economy. They argue, for instance, that Chile ought to have competed with Costa Rica by offering special privileges to Intel, in order that it install its proposed a plant in Latin America.[37] Though they hedge their recommendations with many qualifiers, there is no question that Larraín and Sachs propose that Chile abandon its traditional (for the last twenty-five years) policy of not choosing winners and favor some sectors at the expense of others.

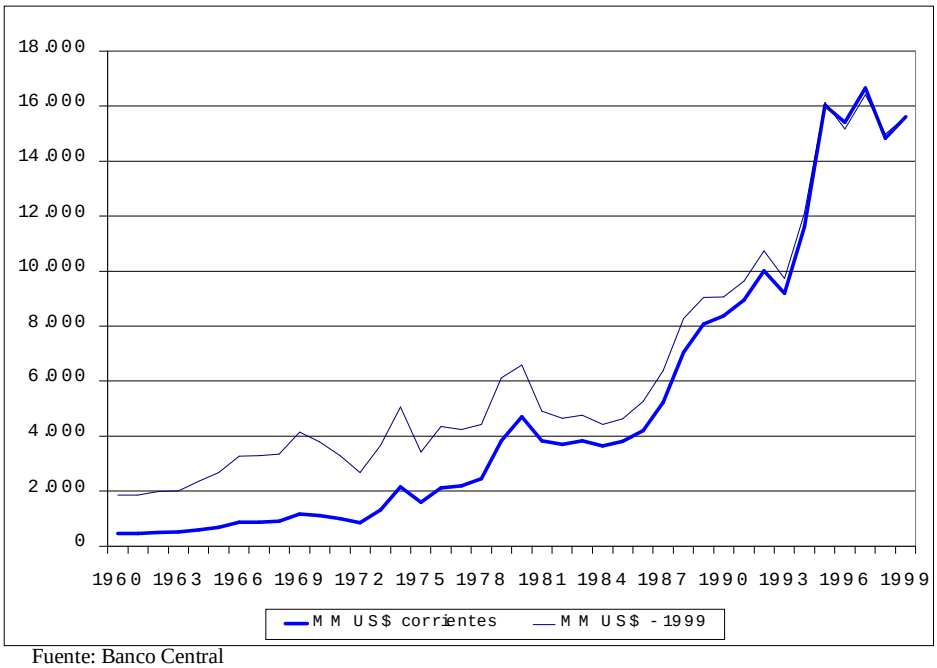
These arguments seem very convincing at first sight, but are mistaken, in my view. These and other analysts are influenced by the slowdown in the economy and in exports that became apparent in the late nineties, as can be seen in Figure 1; by the fact that there was a major increase in investment in copper mines during the early 90's and that the share of copper in exports did not

[35] Another proposal currently making the rounds is to increase funding for R&D from its present level of 0.8% of GDP to 1.5% or more. Note that in contrast to South Korea and other successful countries, Chilean firms perform very little research, with around 80% of current funding coming from the government. Hence the proposal might create a caste of cosseted scientists whose research holds no interest for productive firms.

[36] Based on the arguments proposed in Sachs and Warner (1995).

[37] Quoting from page 74: *We, thus, recommend that Chile's investment promotion agency gain expertise on a sector-by-sector basis, examining options and polling international firms, regarding the following issues:* (1) The role of tax policy, including the possible importance of tax concessions in the case of large projects in which Chile is in competition with alternative locations. (2) . . .

Figure 1: Total exports 1960-99 (current and 1999 US$MM)



Fuente: Banco Central

fall substantially in the period. Critics have argued that the slow growth in exports (and in GDP) is a permanent feature due to the limits of the present economic model. When you couple the slow growth of exports with the fact that copper and copper concentrates have represented around 40-45% of Chile's exports since the early 80's, we have a picture that leads to policy recommendations such as those of Sachs-Larraín.

In reply to these analysis, I would like to argue that there are many reasons to believe that the non-interventionist export oriented model used by Chile is working well and that aspects such as the preponderance of copper in Chile's exports do not necessarily mean that this feature will continue into the future. An alternative explanation of the slowdown in exports is provided by the appreciation of the exchange rate in the period 1991-1998. This view seems confirmed by the fact that exports grew at a rate of 19% (up to October 2000), following an important depreciation in the exchange rate (more than 20% to the US$ since December of 1999). If this view is correct, there is no reason to worry that export growth is constrained.[38] According to this interpretation, whenever exchange rate appreciation exceeds the differential increase in productivity of Chile vis-à-vis its trading partners, exports will suffer. As I have mentioned before, critics of this view will point out that the country cannot increase its exports of natural resources since there are

[38]Manuel Marfán has pointed out that figure 1 is misleading, since export volumes continued to rise during the period.

Table 6: Exportaciones principales 2000, a 4 dígitos

	Partida	Descripción	Valor (MUS$)	% Export
		Total General	18.425.000	100,0%
1	7403	Cobre refinado y aleaciones.	4.662.385	25,3%
2	2603	Minerales de cobre y concentrados.	2.383.813	12,9%
3	4703	Pasta química de madera	1.111.697	6,0%
4	0806	Uvas, frescas o pasas.	693.448	3,8%
5	0304	Filetes de pescado frescos, o congelados.	603.211	3,3%
6	2204	Vino	580.231	3,1%
7	0303	Pescado congelado	490.610	2,7%
8	4407	Madera aserrada	334.230	1,8%
9	2905	Alcoholes aciclicos	316.911	1,7%
10	7108	Oro	291.746	1,6%
11	0016	Rancho naves, aeronaves, vehiculos transporte	290.571	1,6%
12	7402	Cobre sin refinar	286.085	1,6%
13	0808	Manzanas, peras y membrillos.	256.269	1,4%
14	2301	Harina de pescado	235.345	1,3%
15	2710	Aceites de petróleo	174.070	0,9%
16	2613	Minerales y concentrados de molibdeno	170.367	0,9%
17	0809	Cerezas, melocotones y otras frutas frescas.	161.337	0,9%
18	2801	Fluór, cloro, bromo y yodo.	147.085	0,8%
19	2601	Minerales y concentrados de hierro.	141.879	0,8%
20	4401	Leña; madera en particulas; aserrín.	133.794	0,7%

Table 7: Exportaciones principales 1990, a 4 dígitos

	Partida	Descripción	Valor (MUS$)	% Export
		Total General	8.580.275	100,0%
1	7403	Cobre refinado y aleaciones.	2.813.737	32,8%
2	2603	Minerales y concentrados de cobre	504.632	5,9%
3	0806	Uvas, frescas o pasas.	405.201	4,7%
4	2301	Harina de pescado	379.821	4,4%
5	4703	Pasta quimica de madera	314.196	3,7%
6	7402	Cobre sin refinar	311.915	3,6%
7	7108	Oro	228.325	2,7%
8	0808	Manzanas, peras y membrillos	176.575	2,1%
9	0303	Pescado congelado	157.828	1,8%
10	4407	Madera aserrada	157.459	1,8%
11	2601	Minerales y concentrados de hierro	140.571	1,6%
12	0809	Cerezas, melocotones y otras frutas frescas.	105.761	1,2%
13	0016	Rancho naves, aeronaves y vehiculos transporte	103.723	1,2%
14	2613	Minerales y concentrados de molibdeno.	94.265	1,1%
15	4403	Madera en bruto.	93.783	1,1%
16	0304	Filetes de pescado.	91.605	1,1%
17	7106	Plata.	89.741	1,0%
18	2616	Minerales y concentrados de metales preciosos.	83.675	1,0%
19	2905	Alcoholes aciclicos y sus derivados.	78.942	0,9%
20	0302	Pescado fresco o refrigerado, excepto filetes.	77.562	0,9%

Table 8: Exportaciones principales 1980, a 4 dígitos

	Partida	Descripción	Valor (MUS$)	% Export
		Total General	4.818.142	100,0%
1	7403	Cobre refinado y aleaciones.	1.669.778	34,7%
2	7402	Cobre sin refinar	302.543	6,3%
3	2301	Harina de pescado.	233.527	4,8%
4	4703	Pasta quimica de madera	230.500	4,8%
5	8102	Molibdeno y manufacturas de molibdeno	228.992	4,8%
6	2603	Minerales y concetrados de cobre.	224.651	4,7%
7	4407	Madera aserrada	171.295	3,6%
8	2601	Minerales y concentrados de hierro.	157.552	3,3%
9	7106	Plata	114.754	2,4%
10	4403	Madera en bruto	104.989	2,2%
11	2613	Minerales y concentrados de molibdeno	102.798	2,1%
12	0808	Manzanas, peras y membrillos.	86.657	1,8%
13	2616	Minerales y concentrados de metales preciosos.	70.445	1,5%
14	2710	Aceites de petroleo.	62.673	1,3%
15	0806	Uvas, frescas o pasas.	56.520	1,2%
16	0713	Legumbres secas.	49.483	1,0%
17	7108	Oro	46.049	1,0%
18	3102	Abonos minerales nitrogenados.	40.214	0,8%
19	0302/3/4	Pescado fresco y filetes, fresco o congelado	40.205	0,8%
20	7407	Barras y perfiles de cobre.	38.848	0,8%

Nota: El item 0302/03/04 corresponde en la antigua definición a cuatro dígitos a la agregación de los ítemes 0302, 0303 y 0304.

environmental limits, and that in any case importers, under pressure from environmentalists will oppose increases. Thus they wonder how Chile, without specific support mechanisms, will be able to continue on its path of outwards oriented development.[39] To address these issues we must use a less disaggregated analysis of the data.

Consider, first the commodity composition of exports at the 4-digit level shown in table 6, 7 and 8. These tables show the participation in total exports of the twenty most important export groupings in 1980, 1990 and the year 2000. If we divide commodities into a first group composed of metals and minerals, which represent the most natural resource intensive exports (codes 7403, 2630, 7108, 7402, 2613, 2801, 7106, 2616, 2601, 8102 and 2601), a second group which has a certain degree of elaboration and capital, or require sophisticated systems for delivery (4703, 0806, 2905, 0808, 2301, 2710, 0809, 4401, 4403, 0713, 3102, 7407) and a third group of goods that are more sophisticated, because they represent a second stage in the exploitation of natural resources.[40] Then we see that the importance of exports in the first group in total exports fell from more than 60% in 1980 to about 50% in 1990 and to less than 45% in 2000. On the other hand exports in the third group have grown from slightly more than 4% in 1980 to almost 11% in 2000. Clearly, there has been a decrease in the relative importance of the highly natural resource-based exports.

Second, note that the relative importance copper exports has not fallen in the last ten years, after a decrease in the period 1980-1990, which appears supportive of Larraín *et al.* (1999). One explanation is the enormous increase in investment in copper mining by foreign companies during the period. This is a natural consequence of the fact that up to the early 90's, there had been no important foreign investment in the copper sector since the mid-60's.[41] In the early part of the period, there was a fear of expropriation, next, foreign investment in mining was not allowed and when eventually it was allowed, there was too much political risk. In the meanwhile the technology (both in exploration and extraction) improved substantially, which implied that marginal sites in the 60's became extremely attractive in the nineties and moreover, new mines were found or became easier to discover. There were rents in the sector and thus there was a rush of investment during the first half of the decade, which explains the fact that the importance of copper exports did not decrease during the decade. However, it is unlikely that the rate of investment in the sector will continue in the future, since the rates of return in the mines developed later (Collahuasi, for instance) are fairly similar to those in other sectors. Hence there are reasons to believe that the decline in the importance of copper in Chilean exports, which was notorious in the period 1970-1990, will continue after the hiatus of the 90's.

The third point I would like to make is exemplified by the cases described in the remainder

[39] Larraín *et al.* (1999).

[40] Note that wine (2204) can be described as grapes plus capital and labor, salmon exports (0304, 0303) are fish meal plus capital and labor, sawn pieces of timber (4407) represent a similar use of forest plantations.

[41] With the exception of Disputada, which was an already existing mine.

of the chapter. It consists in noticing that first, entrepreneurs will take advantage of conditions in a country, so that successful exports in one sector create knowledge that can be used to develop other export lines. Hence we will examine briefly two export oriented sectors that were developed and achieved maturity during the nineties and then we will examine industries that are in the process of development and that may become the new salmon and wine industries of this decade. There is always the possibility that the infant industries described at the end of the section may fail in the future, but there is no question that if Chile does not become encumbered with too many constraints and regulations, other new industries will take their place. An interesting point to note is the interaction (in terms of knowledge, and of resources) between the newly appearing industries and mature export-oriented industries is a case of linkages, a feature of 60's economic analysis.[42] Finally it is interesting to note that the technology required in these industries is quite sophisticated and in terms of value added, sending fresh fish (or fish fillets) from Chile to the US adds perhaps more value than a traditional industrial export.[43]

4.1 Salmon

Ten years ago salmon exports were just beginning and the industry was in its infancy. The technology had been explored by Fundación Chile, a private non-profit organization whose purpose is to develop new commercial technologies. The Fundación realized that Chile, with its long and unpolluted coastline (in the South) and lack of salmon diseases, boasted excellent conditions for salmon farming.[44] Fundación Chile developed the first modern centers and provided technical assistance to other firms, and helped organize technical seminars in the early years. As salmon farming took hold in Chile, Fundación Chile sold its plants (at a profit, which was later invested in less successful projects). New firms appeared and production skyrocketed. The latest projections indicate that this year salmon exports will reach US$1 Billion, 30% more than in 1999 and that the sector has become economically almost more important than natural fisheries.

Another important point to note is that development of such an important industry requires the development of long chains of upstream and downstream industries. It is necessary to train fish biologists and veterinarians, to develop a feed industry, to organize distribution systems for medicines and a whole sub-industry related to the rafts in which salmon are grown, and specialized equipment. There is some research in the diseases of salmon and its adaptation to the Chilean environment.[45] Nevertheless, most of the salmon eggs are still imported, with some experts fearing

[42]The difference, is that in the sixties policymakers tried to influence linkages through subsidies and other types of intervention, whereas the examples described here are a natural outgrowth of entrepreneurship left loose.

[43]Meller and Saéz (1995) have argued this point forcefully.

[44]To these advantages one must add the availability of fishmeal from natural fisheries that provides a major component of the food of cultivated salmon.

[45]Initially by Fundación Chile, but now performed by the Salmon and Trout Association, local universities and the

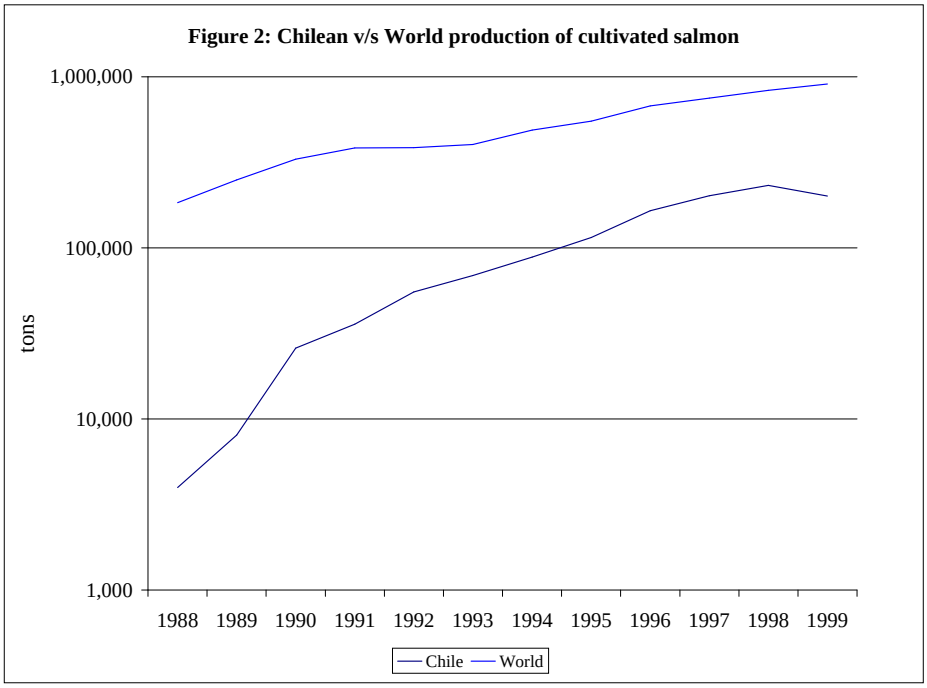


Table 9: Salmon production

Year	Chile	World
1988	3,970	183,870
1989	8,050	249,540
1990	26,000	329,400
1991	35,800	383,500
1992	55,300	385,900
1993	68,900	402,500
1994	88,400	488,500
1995	115,000	550,700
1996	165,200	676,100
1997	201,500	751,400
1998	232,000	833,700

Source: Tesis Andrés Pardo.

the transmission of foreign diseases. In the post-production side there is the development of a sub-industry of smoked salmon, refrigeration technology adapted to fresh fish, and a whole chain of transport that can send a fish from its farm in the South of Chile to New York in 24 hours. As we will see, many of these specialized inputs are used in some of the newer industries such as the turbot and abalone sectors.

4.2 Wine

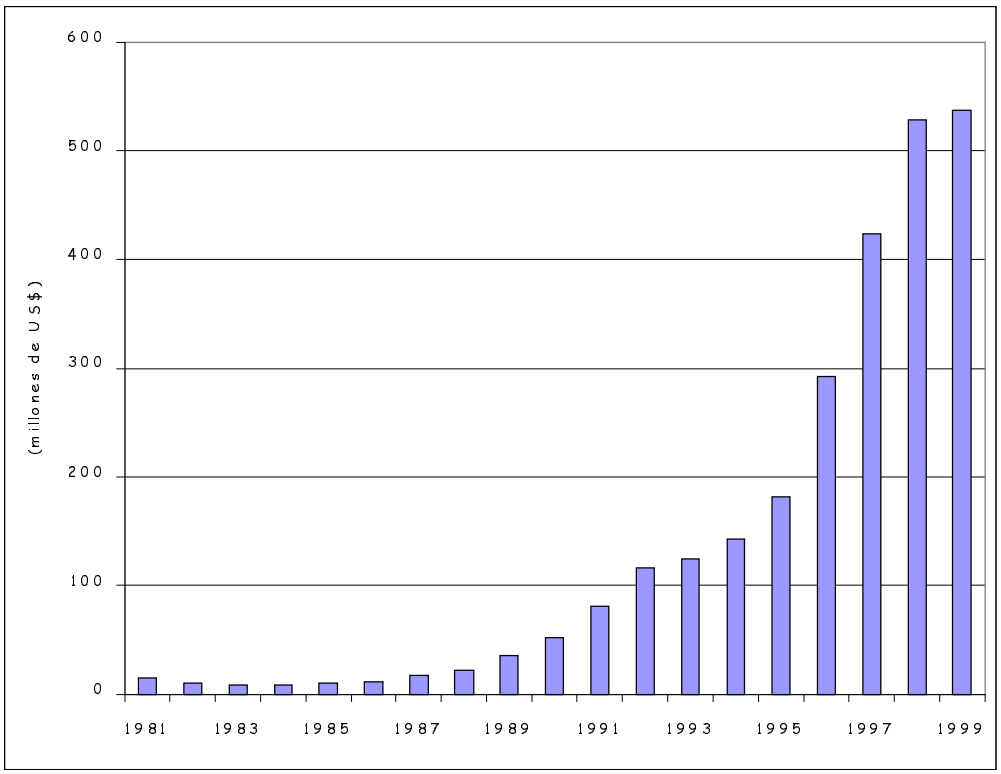
Wine has been grown in Chile since the XVI century, less than one hundred years after the arrival of the Conquistadores. For the next three hundred years, vast amounts of wine of standard quality were produced, using *país* grapes that were adapted to the Chilean climate. In the XIX century, large landowners under French cultural influence started importing French noble vines: cabernet sauvignon, pinot noir, merlot, carmènere among the reds and chardonnay, sauvignon blanc, petit verdot, among the whites. At the same time these landowners imported the latest technology in the guise of French oenologists. Chilean wine became well known due to the good results its wines obtained in wine tasting contests. However, that tradition was lost during the import substitution régime, after the imposition of alcohol taxes and a ban on new vineyards imposed in 1938. Chile continued to produce honest but uninspiring wine until the end of the 70s.

In the early 80's a few entrepreneurs noticed that Chile had conditions for the production of fine wines that are comparable to some of the best locations in California, Australia and South Africa: dry sunny summers, cold nights and moderate winters. Moreover, Chile's vineyards had never been affected by *phylloxera*, so the only remaining ungrafted vines in the world were Chilean. Investment and new technology started pouring into the country (from the US, France and Australia) and the prices of land suitable to wine production rose accordingly. Wine technology was rapidly upgraded, replacing the old casks by new steel fermentation casks.[46] There was a large increase in the number of oenology students and they were learning the latest techniques. Thus it is not surprising that Chilean wines rose in quality and started winning international contests once again. The rise in exports, to around US$600MM currently, was to be expected. At this stage Chilean exporters are successful, but they are striving to produce the so-called ultra-premium wines, which are the most expensive wines and the most well known. The idea is that a the reputation of ultra-premium wines extends to all the brands produced by the same vineyard, so having a well known ultra-premium is an efficient marketing device. They have been unable, so far, to break into this niche. It is also a sector facing intense worldwide competition, and the possibility of protection in its major markets. Nevertheless, it is an example of a newly developing high technology sector related to natural resources.

larger firms.

[46] Fine wines pass though an additional stage at which they are stored in small new french oak casks prior to bottling.

Figure 3: Wine exports 1981-1999, in US$MM



Fuente: Banco Central

4.3 Dump bodies

This is an example of industrial development due to the existence of an industry based on natural resources, i.e., an example of what used to be called backward linkages. In this case, the existence of a mining market and the experience gained from it allowed a small chilean company to acquire an important fraction of the world market for large scale (300 ton) mining dump bodies.

Chile has one of the larger mining sectors in the world, which implies that there is a large demand for specialized equipment. Dicsa (Distribuidores Cummins SA), a large (1000 employees)family firm, used to be a distributor of mining equipment with a strong maintenance division. In the mid 90's, Cristían Feuereisen, a Chilean engineer, was the manager of the new business development unit. The unit became the Chilean representative of Tricom, a US producer of high-grade steel.

Up to that point mining dump loaders were made of low-grade steel. The wear and tear of the mining industry made it imperative that the dump loader be protected by liners, which were made of low-grade steel, and would normally have to be changed every year or so. In looking for an outlet for the high grade steel, Feuereisen's noticed that a reduction in the weight of the dump bodies could reduce costs substantially, while at the same time extending the life of the liners.

This unit was quite successful and Feuereisen asked his employers for a one year leave and funding to develop the idea of a new, lightweight dump loader made of high grade steel, with no liner. The main advantage is that it leads to a substantial reduction in weight for the dump loader, which allows more mineral to be taken each trip. There can be substantial reductions in the costs of the mining process, so a successful model would be an extremely attractive proposition for the mining companies. Combining company funds and his own money, he had around US$300K to create a prototype.

After building the prototype it was installed in a truck in Candelaria, a large Chilean mine owned by Phelps Dodge, in order to test the concept. After a few months, the dump loader cracked, but happily via a fracture that did not signal that the basic concept was in error.[47] After repairs, the dump loader worked for more than a year before failure. By then, Phelps Dodge was interested in the project and a second improved version of the dump loader worked well.

In the meanwhile, Komatsu, entered the area of mining equipment (Komatsu Mining Systems), dominated by Caterpillar, in 96-97. It also bought Dicsa, with the exception of the dump loader unit, which was split from the company and became Hiload, owned by Feuereisen and the original owners of Dicsa.

During 96-97, Phelps Dodge was convinced and it ordered the new light dump loader for ten Komatsu trucks. There were still some technical snags but the advantages were sufficient

[47] Apart from the use of high grade steel and no liner, the new dump loader uses I-bars for support rather than the box-bars used in older models.

that a further 15 Komatsu trucks including a new version of the light dump loader were sold to Collahuasi in 1998. Pelambres bought another 20 dump loaders.

In 1999 a test was carried out in which light dump loader designs by Komatsu and Caterpillar were made to compete against the Hiload model in Chino, an important US mine belonging to Phelps Dodge. The Chilean design failed quickly was easily repaired by remote control from Chile, while the other designs failed catastrophically after some time.

1999 was a bad year for the mining sector, with very little investment, so Hiload closed down, entering a state of hibernation, from which it emerged in 2000, when it sold 96 units of a new model light dump loader, with firm projections of 181 units during 2001. The units have a price of around US$140K, and the technology has been patented internationally. The world market of dump loaders is around 500-600 units a year, so Hiload has become one of the major players in the market. In fact, the demand for high grade steel of Hiload is equivalent to 10% of the high grade steel production of a large steel producer such as Thyssen.

The benefits for users are so substantial that the light dump loader pays for itself in approximately 6 months of operations. Even though Hiload has a small investment in plant of around US$2MM, but the technology is very advanced including automatized machinery for most of the processes. Hiload is an extremely profitable operation, with only 60 employees.

It is interesting to note that this new product is closely associated to the existence of a large market for the product due to the existence of natural resources. A manufacturer in Japan or Germany would not be able to test a new model of dump loader in the extreme conditions required in the mining sector unless it were to ship them to sites. Finally, note that Hiload is making great efforts to improve its technology in order to stay ahead of the competition using the advantage of a large installed base in order to gain experience of ways of improving the technology.

4.4 Turbot

Turbot is a flatfish that is in high demand by in European type cuisine. Natural fisheries are depleted so fish farming has begun in France, Spain and Scotland, in order to supply 50% of the market. Some years ago, Fundación Chile, an institution that tries to introduce new products and technologies into Chile (in association with private firms), bought a European technology to farm turbot. The results were disheartening, and the effort was a failure. Some of the private firms (together with Fundación Chile) involved decided to try a new approach and a national technology was developed, by which means Chile now produces 250 tons of fresh turbot, or 5% of total world sales.

The development of the technology involved the whole life cycle of the turbot, from the production of eggs and juveniles (of 14 grams) to the final product, a mature turbot weighing more

that 1.5–4 kilos. It is a complex technology, with the fish growing in shaded tanks to simulate the darkness at the bottom of the sea and changing lighting and heat conditions to simulate the seasons. The company produces its own food for the juveniles but buys modified salmon pellets (widely available in Chile) for the feed of mature fish.

As an ancillary business, Seafoods Chile is selling juveniles to China, having sent 100K this year and 500K projected for next year. The production of turbot with the present levels of plant equiopment is estimated at 300 tons, most of it for export, which has a FOB price of US$7.50/kilo. The scheme is profitable though not wildly so, especially because it is hampered in its Europe, which is the main market, by 15% tariffs and transportation costs. Moreover, prices have been dropping as the European producers have increased production. In an effort to develop alternatives, the company is carrying out market studies of demand in the US, using a collaborative approach involving a Chilean University and Wharton, with half the costs paid by CORFO, Chile's MITI.

In this case it was the expertise and confidence created by the success of the salmon fisheries that has helped develop this technology. moreover, it is easy to find people wit the expertise required to develop the technology: marine biologists, fish farming specialists, veterinarians specialized in fish diseases.

4.5 Abalone

Abalone is a vegetarian mollusk whose demand has led to overexploitation in the wild. While 28.000 tons were gathered in 1968, by 1996, production in the wild had fallen to 10.000 tons. This led to attempts at farming, which now accounts for about 5.000 tons of worldwide production. There are many species of abalone, the most desirable being *ezo awabi* which is native to Japan. Demand is concentrated in Asia, especially Japan.

In Chile farming begun under Fundación Chile, which made the first attempts at cultivating the red abalone from California.[48] Production begins with the collection of "seed", i.e. fertilized eggs, which become larvae and then juveniles. The process continues until the mollusk reaches a marketable length of 10 cm, or 120 grams (currently), after 40 months. The process of feeding the larvae is complex and has required formulation of special feed mixes and the hiring of scientists such as researchers in mollusk diseases.

The first sales took place in 1999, selling 15 tons of fresh abalone at a FOB price of around US$30/kilo. There were some initial difficulties in finding distributors in Japan, but that seems to have been solved. This year production will top 50 tons, and they will be exported frozen using modern cryogenic technology. By 2003, the object is to export 150 tons of abalone, with a high per

[48]Chile has its own wild version of the abalone *conchalepas conchalepas*, which is carnivorous (thus difficult to farm) and under threat due to overexploitation.

unit profit.[49] Recently, the Seafood Chile approved an US$ 8MM expansion project that should lead to additional sales of 250 tons by 2004, i.e. approximately US$12MM in exports by 2004.

5 Conclusions

Chile is a small, open country which is rich in natural resources. It faces at least two trade related problems in its path to development.

First, it faces trade restrictions in its export markets as well as distortions in international agricultural markets, which in turn trigger local protection lobbies. A related issue is that any policy analysis of potential trade restrictions must recognize that even though Chile is a small economy, it is an important world player in many of its export markets, which means that it might be considered a threat to foreign import competing industries. For instance, Chile is the second largest wine exporter to the US, the second largest world producer of cultivated salmon, the largest exporter of copper and a very important player in fruit markets such as grapes (first esporter to the US), apples (first exporter to the EU), kiwis and others. Thus it is probable that Chile will face increasing restrictions to its exports, and fortunately the government is proposing the creation of a specialized unit in the Foreign Office that will try to that will work in defusing potential restrictions to trade.

Second, there is the idea that a natural resource-based route to development does not exist. I have argued that whereas it is possible that there is a correlation between natural resource abundance and underdevelopment, the causality goes through the political system, which in natural-resource abundant countries tends towards protectionism and against development based on natural resource exports.[50] The paper also presents natural resource-based industries that might be the exemplars of new sources of exports when current industries reach the limits of their export growth. While policymakers might not be able to observe these developments in the macro data they use in their analysis, it appears that the examples presented here are just a small sample of the many projects that use Chile's natural resource abundance and combine it with new technology in order to create thriving new industries.

It is probable that there is scope for a broad based public policy of increasing subsidies for research and development, if they are linked even weakly, to the requirements of Chilean firms. Such programs, such as FONDEF, already exist, and it might be worthwhile to evaluate their performance and to see if they are of any help for newly developing sectors. Another possibility is

[49] There is at least one additional project which has been fairly successful in producing abalone in Chile, but it is somewhat less advanced.

[50] Following the argument of Lane and Tornell (1995). Meller (personal communication) has pointed out that Chile is an outlier in the Sachs and Warner (1995) regressions since it has grown fairly steadily for the last 15 years despite an abundance of natural resources.

to have a semi-public foundation, such as the *Fundación Chile*, which promotes the creation of firms using new technologies and which has been successful in the case of salmon (but less successful in other cases). What is not a good idea, mainly because of the political economy implications, is the notion of picking winners and attracting foreign investors in specific sectors because of the putative benefits of their investments.

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