

DIVERSIFICATION AND DEVELOPMENT IN LOCAL ECONOMIES BASED ON MINING SECTOR: The Case of the Chilean II Region.

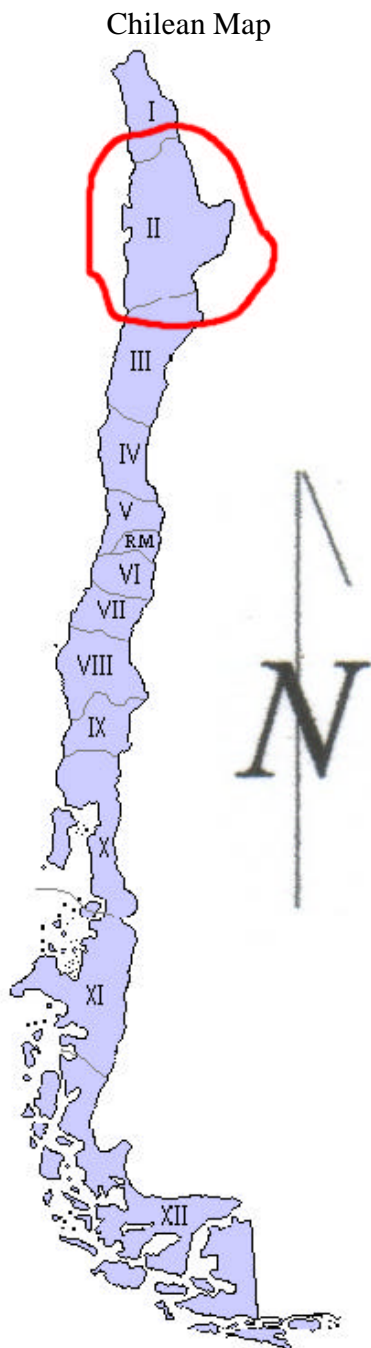
Abstract

The main objective of this paper is to measure the impact of the mining sector on the Chilean II Region and evaluate the conditions that affect the magnitude of this impact. Using an Input Output matrix for the II Region, we calculate the impact on output, income and employment. Later, we compare the impact on the labor market between private and stated owned firms, showing that there is a huge difference in the management system of each firm that results in different costs and benefits for regional development.

In addition, we show that the mining sector is not important in terms of the backward and forward linkages within the region, but that it is very important in terms of the operation level and that it has resulted in a productive cluster in the north of the country which is far beyond the rest of the country in terms of the Gross Regional Product per capita. Finally, we survey other impacts on the quality of life of the regional population, describing the actions that have been taken by private and state owned firms, as well as the role of the Government in promoting development in the II Region.

INTRODUCTION

The political geographic Chilean map has 13 regions. The II Region, located in the north area of the country, in the desert of Atacama, is rich in minerals, and its economic development is owed fundamentally to the mining exploitation. (see Chilean Map).



Between 1950 and 1880, Chile was the biggest copper exporter of the world. Later, the production of copper was down and from 1870 until 1930, the exploitation of nitrate was the main activity of the mining sector of the country. However, from 1928 copper was again the main mining activity of the country and the II Region.

Since 1928, we have been exploiting copper mines. We also exploit other minerals, but these are smaller in size.

Large-scale copper mining includes the technologically more advanced mines, which are able to raise financial resources in international markets, and export their production by themselves. By law, to be considered in this category the mine should produce more than 75,000 metric tons. (Fischer 1999).

In the II Region we find seven of the biggest mines of the country. Two of them: Chuquicamata and Radomiro Tomic are state owned; four of them: Minera Escondida Ltda., Michilla, Zaldivar and Mantos Blancos are private, and there is a joint venture between the Chilean State (49%) and Cyprus Amax (51%) which is named El Abra.

In Table 1, one can see that more than half of the total copper production of the country takes place in the II Region and how the companies contribute to the copper regional production.

Another interesting point of the copper exploitation in the II Region, as it is shown in Table 1, is that the companies are owned by the state and also by the private sector, and there is a new experience where there is a joint venture between them. This process of privatization of the mining exploitation has been growing in the last decade and since 1995, private copper output is larger than the one produced by the state owned companies.

Table 1
Production of Copper by Large Scale Companies of the Chilean II Region
(Metric tons of fine copper content)

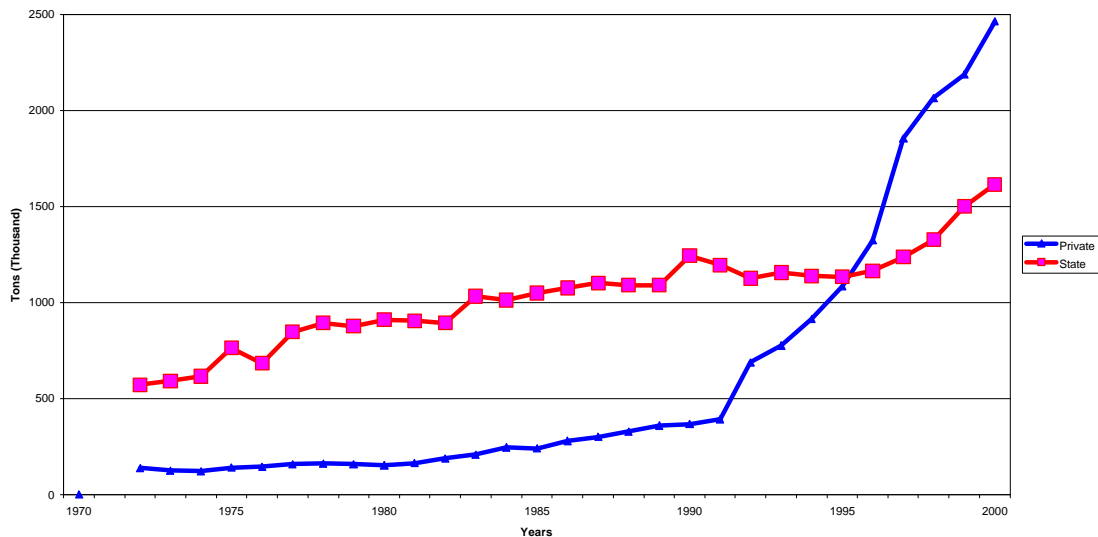
	1999	1998	1997	1996	1995	1994
Total (State owned - Codelco)	928027	909766	749425	648018	610150	606211
Chuquicamata	630067	650154	650210	632282	610150	606211
Radomiro Tomic	190104	161896	4049	0	0	0
El Abra (49% Codelco)	107856	97716	95166	15736	0	0
Total (Private companies)	1325118	1292860	1249054	1079098	620926	588079
Escondida (*)	896210	919000	906000	841361	466914	483631
El Abra (51% Cyprus Amax)	112258	101704	99050	16378	0	0
Michilla	60563	62066	62683	62969	56000	27000
Zaldivar	162000	120000	96000	77000	22000	0
Mantos Blancos	94087	90090	85321	81390	76012	77448
Total Regional Production (**)	2253145	2202626	1998479	1727116	1231076	1194290
Total National Production	4382600	3686900	3392202	3115800	2488598	2150300
% II Región Production	51,4%	59,7%	58,9%	55,4%	49,5%	55,5%

(*) Fiscal Year (June 1st until May 31st)

Source: Built by the authors based on Annuals Finance State of Mining Companies, Cochilco (2000e) and Ocaranza et al (2000)

The following graph shows the evolution of the copper production by private and state owned companies from 1971 to 1999. It is clear that in the last decade there has been a huge increase in the private mining sector, which is a result mainly of foreign investment and explains that the current annual production is double the production of six years ago. The impact of this extraordinary growth is the object of this study.

Graph 1
EVOLUTION OF CHILEAN COPPER PRODUCTION: PRIVATE AND STATE OWNED FIRM
(Thousands of metric tons of fine copper content)



ECONOMIC IMPACTS OF THE MINING SECTOR ON THE II REGION

In order to measure the economic impacts of the Chilean Mining Sector on the II Region, we build up an input–output matrix (Aroca, 1999). The matrix includes twelve productive sectors, a final demand sector, and the payments to the factors: labor (wages) and capital (profits) (see Appendix 1).

We measure the impacts of a change in final demand (i.e. change in Consumption, Investment, Government Expenditure or Export) through the multipliers. In addition, to overcome the criticism that an input–output model “tends to underestimate economic impacts because it omits the interaction between households’ spendable income (particularly wages and salaries) that results directly or indirectly from economic activity and the consequent household spending on consumer goods” (Isard et al, 1998), we estimate two kind of multipliers. The first one (Open system) assumes that the additional income (wages) that is paid for a change in the final demand is not spent in the region. The second type of multipliers (Closed system) assumes that all the additional labor income associated to a change of the demand is spent on the region. Therefore, the real impact should be some point between these two multipliers.

Output Multipliers

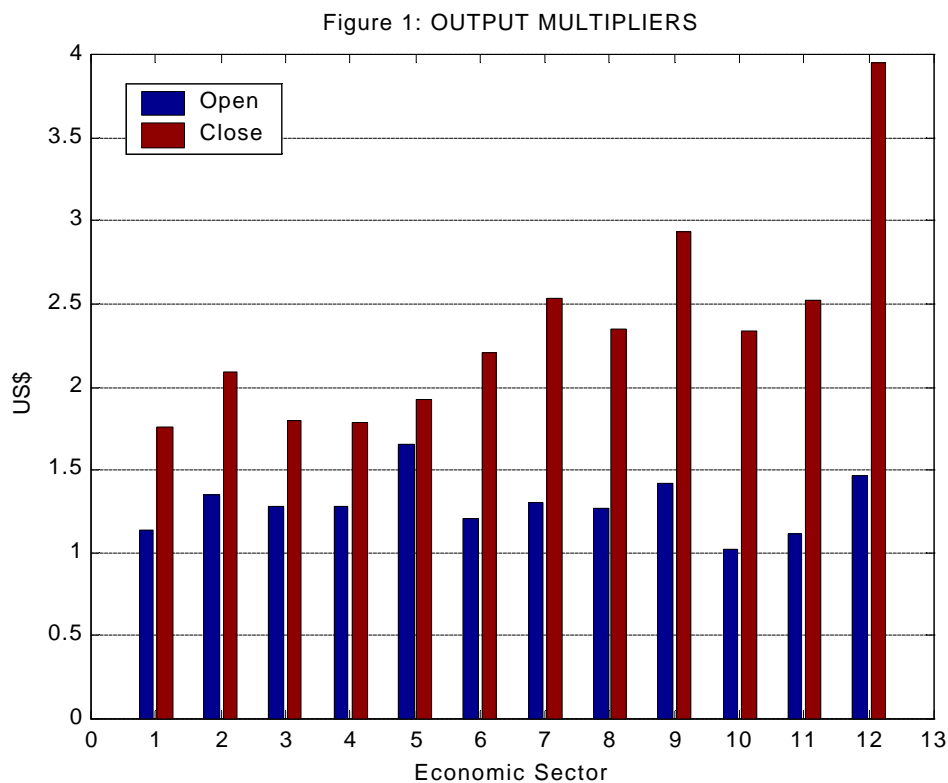
We distinguish the investment from the operation of the mining sector. The investment has a totally different expenditure structure, and so impact, from the operation. While the first is very intensive in terms of the increase in demand directed to the Construction sector, the operation almost does not need any input from this sector.

Thus, we first explore the impact of the mining sector operation. The output multipliers are calculated from the II Region Input Output Matrix, and the results are showed in Figure 1. The numbers of the sectors are the following:

1	Agriculture
2	Fishing
3	Mining
4	Manufacture
5	Utilities
6	Construction
7	Retails
8	Transportation and Communication
9	Business Services
10	Real State Services
11	Other Services
12	Public Administration

The mining sector is composed mainly by copper production. Copper production represents 84 per cent of the total production of the mining sector, and the mining sector represents more than 60 per cent of the Regional Product.

The open system multipliers do not take account of the possibility that when there is an exogenous increasing in the final demand, the workers will receive more money that they can spend in the region. On the other side, closed system multipliers assume that the entire additional wage is spent in the region. (See Appendix 2 for the formulae).



The open system multipliers vary between 1.01 and 1.65, which means that for one additional dollar that is spent on the final demand, the total output of the region increases by US\$ 1.65 if it is spent in the Construction sector (5)¹ or by 1.01 if the dollar is spent in the Real State Services sector (10). If the dollar is spent in the Mining sector it will imply an output increase of US\$ 1.3.

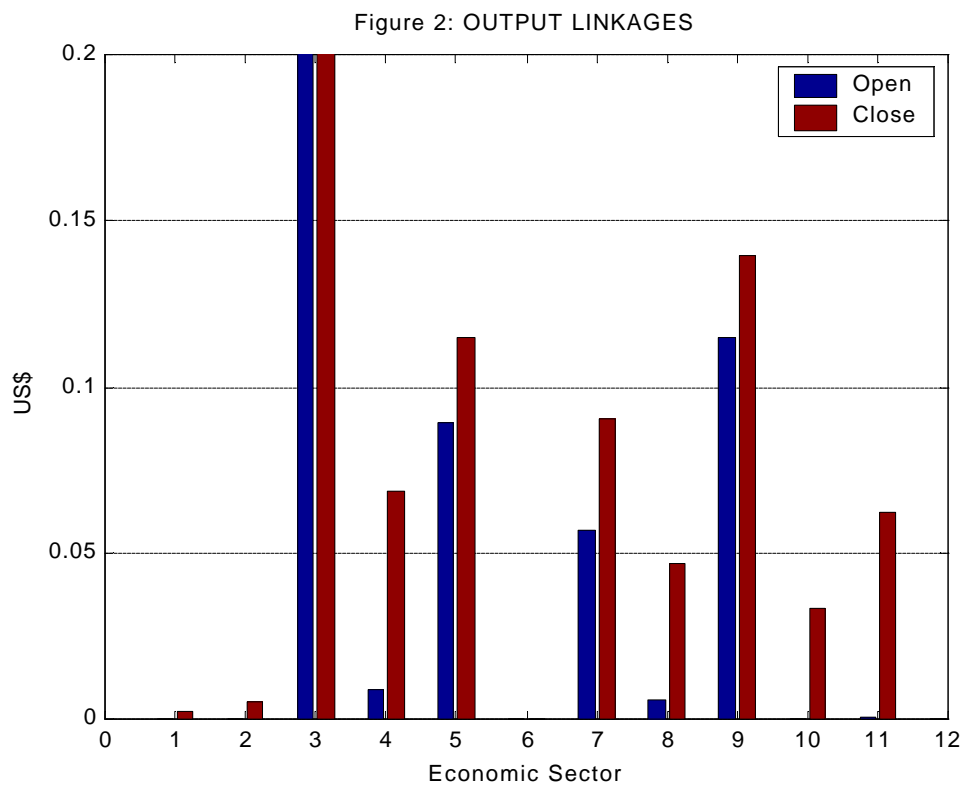
On the other side, if we assume that the new income that is generated by the additional dollar is spent in the region, we find significant difference among the economic impact of the sectors. It is clear from Figure 1 that the impact on total output is greater when the dollar goes to sectors associated with services, which are more labor intensive. The case of the Mining sector (3) shows an output multiplier of 1.8. It means that for each

¹ The number of the sectors will be written in parentheses to facilitate understanding of the graphics.

additional dollar that is spent in the Mining sector, 1.8 dollars are generated in the whole region. Therefore, given the situation of the Mining sector, where part of the mining labor force commutes from other regions, we can conclude that the real impact on total output of each additional dollar spent in the sector will be between 1.3 and 1.8 dollars.

Output Linkages

In addition to measuring the impact of a dollar spent in the mining sector, it is also interesting to know the sectors through which the impact is distributed. The linkages between sectors are measured by the coefficient of the Leontief Inverse Matrix. Figure 2 shows the linkage between the mining sector and the other sectors of the regional economy.

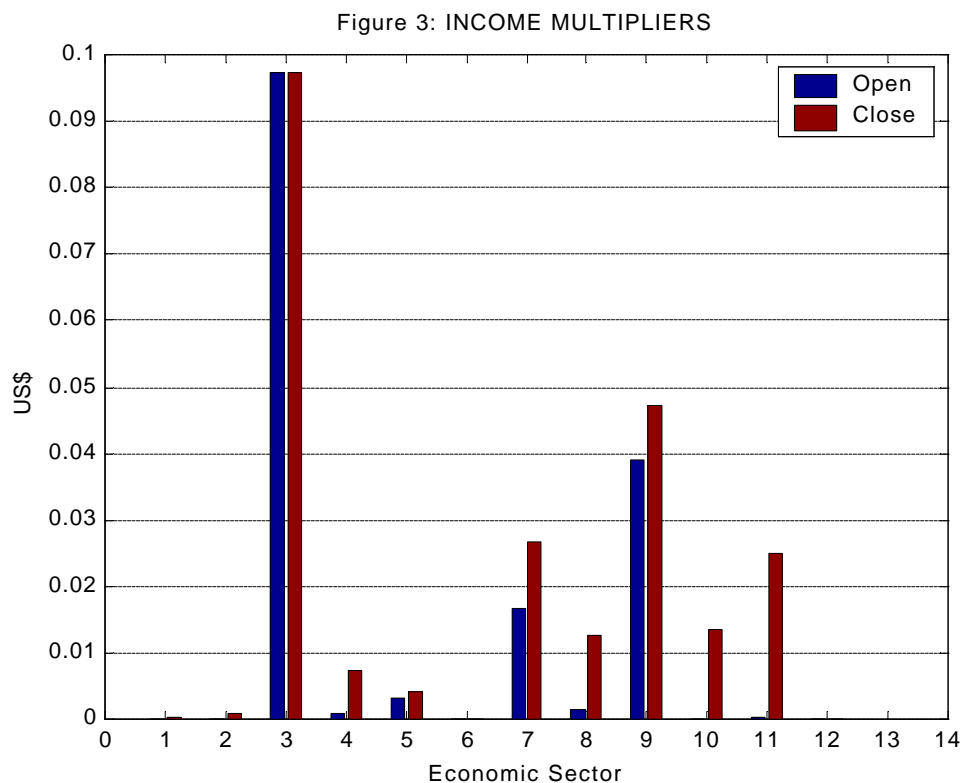


The Mining Sector (3) is connected with the Business Services sector (9), Utilities sector (5) (Energy sector) and the Retails sector (7). In addition, if the extra income that comes from the Mining sector is spent in the II Region, the linkages are stronger and four other sectors also appear to be connected with the Mining sector. These are: Manufacturing sector (4), Other Services sector (11), Transport and Communication sector (8), and Real State sector (10).

It is worth to call attention to the size of the closed system linkages. The cases of the Manufacturing (4) and Other Services sector (11) are really amazing, because they are greater than the Retail sector (7) open system linkage. It means that the impact of the expenditure of the workers within the Region is really significant and that the firm should try to motivate migration of the people more than provide incentives to commute between the region where they live and the II Region. This issue is not irrelevant. For example, El Abra (a joint venture between the Chilean State (49%) and Cyprus Amax (51%)), which produces about 220 thousand tons of copper per year, has 50 percent of the labor population who commute from other regions.

Income and Employment Multipliers

Isard *et al* (1998) argue that many analysts feel that output multipliers are not very useful since they add up outputs over all sectors in the economy; it means output multipliers give the same value to all sectors. They state that a more interesting measure of economic importance should reflect the employment effects associated with output in the various sectors; income multipliers provide one way to do that. Figure 3 shows the Income Multipliers for the Mining sector.



Each dollar that is spent in the Mining sector (3) implies an increment in the income of the worker of different size. Almost 10 cents is received by the worker in the Mining

sector, close to 4 cents received by the workers in Business Services (9) sector and 1.7 cents receive the workers from the Retails sector (7). If the additional income of the workers in spent in the II Region, some additional cents are received by workers in Other Services sector (2,5 cents), Real State sector (1,3 cents) and Transport and Communication (1,2 cents).

The total amount that the workers in different sectors receive will be between 16 and 24 cents. The exact amount depends on how much of the additional income the workers spend in the II Region. It means that something between 16 to 24 percent of the mining output goes to the workers of the region of any sector. Alternatively, we can say that 9.7 percent of the mining sector output goes to the mining sector workers and between 6.3 and 14.3 percent of the mining sector output goes to workers in the other sectors of the regional economy.

On the other hand, the DL 600 had the objective to promote foreign investment on the country in a time when the unemployment rate was higher than 30 percent (year 1982) and the political environment was not tranquil. Thus, employment creation was one of the main objectives of this law.

The employment multiplier is the tool that can give us a measure of the impact of the mining operation on employment. We calculate the Type I and II Employment Multipliers because they give a better picture of the impact of mining sector on employment. These multipliers measure the impact using as a base the number of hired workers for the firm or sector. It means that the employment multiplier tells us how many hired workers there will be in the whole market, assuming that the firm or sector hires an additional worker.

Table 2: Employment Multipliers (Type I and II)

Sectors	Open System	Closed System
Agriculture	1.06	1.13
Fishing	1.22	1.25
Rest of Mining Sector	2.04	2.76
Private Firm	4.1	6.71
Manufacture	1.39	1.57
Utilities	4.54	6.29
Construction	1.2	1.57
Retails	1.1	1.27
Transportation and Communication	1.12	1.22
Business Services	1.45	2.34
Real State Services	1.01	1.34
Other Services	1.04	1.21
Public Administration	1.03	1.09

Source: Aroca (1999b)

To analyze the employment multipliers we use Table 2, which was built to evaluate the impact of a private firm on the II Region. In order to do this, the Mining sector of the input output matrix was split in two rows and columns. One of these columns was used to characterize the Private firm and the other was for the rest of the Mining sector. The rest of the Mining sector is older and more traditional, while the Private firm has a few years on the market and a very aggressive management.

First of all, a hired worker in the private firm means that 3.1 (Type I) or 5.7 (Type II) additional workers will be hired in the whole regional economy. This number is very impressive, since in the rest of the mining sector the equivalent numbers are much lower. They go from 1 to 1.7.

Initially, people argue that the new private firm hired a lower number of workers per ton of produced copper. But, when we analyze the level of labor force in different firms we find something interesting. The private firm had around 2 thousand workers on its payroll, while a state firm (Division Chuquicamata, Codelco, Chile) that has a similar level of production has around 7 thousand hired workers.

When we multiply these levels of labor force in each firm by the multipliers we find that there is a very similar quantity of workers associated with each firm, directly and indirectly. Thus, what the huge difference in the multipliers is reflecting is not the difference in intensities of labor but the difference in the management of the firms.

While the state firm hires all the workers that it needs to develop its operation, the private firm outsources a great part of its activities, therefore the workers do not show up in the payroll, but indirectly they are working for the private firm.

What are the effects of this difference in the management of the business on the Region?

We can count positive and negative effects in both situations. The state firm has a more egalitarian wages distribution because the firm hires all the people who work in the mine. In addition, the quantity of workers implies that the firm has scale economies to build facilities for the well being of the labor force.

On the other hand, the private firm only hires a portion of the total workers who work in the mine. Many people who work in the mine are not on the payroll of the firm but on the payroll of some other firm. Normally, the salaries paid by the supplying firm are lower than the salaries paid by the private firm, which may create a not so good labor environment.

At the same time, there are several new small or medium firms that sell services to the private firm. This is a very positive fact in favor of creating a new productive base and a new class of entrepreneurs that start by selling their services to the mining private firm, and later expand their operation to other sectors of the regional economy. This is the case of securities firms, computing firms, food firms, etc.

The state firm is starting to do something similar and several small firms have been created by workers who quit their job in the state firm and sell the service that they provided to state firm as a workers, but now as a small or medium size firm. Thus, these workers not only continue doing the job that they did before, but also they are now the owners of the firm. This process has also been very efficient for the state firm because these workers are much more productive now than before, since the incentives are better.

Backward and Forward Linkages

The backward linkage is a measure that is expressed in terms of a sector's use of inputs from other sectors in the economy. It can be calculated for the *direct* demand of inputs or for the *total* demand of input, which includes direct, indirect and induced demand of inputs. The larger this value for a sector the greater the sector dependence on others in the economy for its inputs, and therefore the more the economy might be expected to be stimulated by an increase in the sector output.

On the other hand, the forward linkage indicates the proportion of sector output that serves as inputs to all sectors in the regional economy. The larger a sector forward linkage, the more its output is used as an input to production in the regional economy. Thus, it can be argued that the larger a sector's forward linkage, the more an increase in its production would stimulate the economy.

Isard *et al* (1998), also suggest a way to present the results for both backward and forward linkage normalized by dividing by the average of the sectors linkages. Following this methodology, we get Table 3.

	High (TFL* >1)	Low (TFL* ≤1)
High (TBL* >1)	Fishing Utilities Retail Business Services	Public Administration
Low (TBL* ≤1)	Manufacturing	Agriculture Mining Construction Transportation and Communication Real State Services Other Services

TBL*: Total Backward Linkages normalize by dividing by the mean.

TFL*: Total Forward Linkages normalize by dividing by the mean.

Table 3 shows that the most important sectors in terms of the output backward and forward linkages are Fishing, Utilities (Energy), Retail, and Business Services sector. These three last sectors are the ones with which the mining sector have the higher linkage

according to Figure 1. Thus, even though the Mining sector is not one of the most important sectors in term of its linkage with other sectors, its main connections are with the three most important sectors of the region. When we combine this result with the fact that the Mining sector produces more than 60 percent of the total regional output, we see, indeed, that the Mining sector is by far the most important sector of the region.

The Mining Sector and the Spatial Context of the II Region

In addition to the economic impact of the Mining sector on the Chilean II Region we have another measure that is associated not only with the operation of the mining sector but also with its investment process, which has been one of the main reasons for a high and constant growth in the last decade.

In order to show the impact of the growth of the mining sector we follow Aroca and Bosch (2000), where they use a Moran Scatterplot to present one of the consequences of the Mining Sector activities.

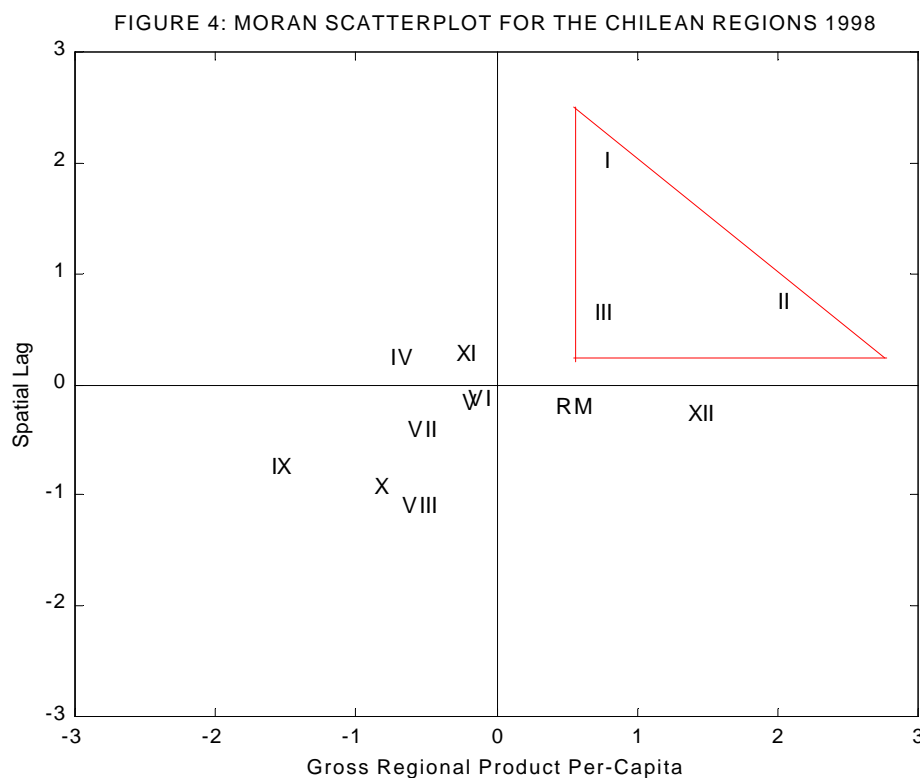


Figure 4 shows the relation between the Gross Regional Product Per-Capita (GRPpc) and its spatial lag, which is calculated as the average of GRPpc of the regions that are neighbors to the region under study. Regions which are in the first quadrant, are the ones that have a GRPpc greater than the country mean and their neighbors also have an average GRPpc greater than the country average; the regions that are located in this

quadrant are called hot spots. On the other hand, we have the third quadrant where are located the regions that have GRPpc lower than the average with neighbors with similar characteristics; this zone is a recessive one. The other two quadrants represent transition zones.

We calculate this relation from 1960 to 1998 and we find significant differences only in the last decade, where Figure 4 is the most representative. It said that there is a clear hot spot in the north of the country composed by Regions I, II and III. This is a cluster where the II Region is the leader and at the same time the one with biggest GRPpc. This cluster is characterized by the importance of the mining production and given the projects that are in the evaluation or investment process, this zone will continue growing faster than the country average.

Taxes and Patents.

In Chile, according to the tributary legislation, the state mining companies pay higher taxes than the private ones. The foreign private mining companies pay a tax of 15% on profits. In addition, they have to pay a tax (35% of profits) on remittances of profits to the exterior, but they can deduct the 15% paid before, so they pay 35 tax% at most. They are also exempted from the payment of added value tax (I.V.A.) on imports of capital goods. On the other hand, the state companies, besides the tax on profits, should pay an extra tax of 40%. It is not deductible; that is to say, their contribution translates to 55% of their profits. (Agancino *et al*, 1998).

An interesting point here is that since 1995 private copper production is greater than state copper production. However, the tax contribution of the private mining sector continues to be much lower than that of the state owned companies. For example, as is shown in Table 4, in the year 1995 the contribution of the private mining sector was 16.1% and in 1996 it reached 25.2% of the total taxes collected in the mining sector, while for those same years the private production of copper represented 53.2% and 60% respectively of the total production of the mining sector of the country.

It is important to point out that the money collected in taxes doesn't stay in the region, but rather it goes to the national fiscal budget to be administered by the central government, and thus the impact of tax payments by the mining companies is not tangible directly in the region.

On the other hand, private mining companies must pay annually an amount for concept of mining Patents, which varies according to the quantity of hectares used by the mine. The collection stays completely in the region, which is distributed between the municipalities and the F.N.D.R. (National Fund of Regional Development), which finances different projects that contribute with the development of the region. The payment of mining patents results in an important difference in the impact in the II Region between state and private mining, since only the private companies contribute this way to funds that are invested entirely in the region, improving the quality of their inhabitants' life.

Table 4
Tax Revenue from Mining Sector
(Million US\$)

	1990-1996	1996	1995	1994	1993	1992	1991	1990
Codelco	2937	629	731	345	77	328	287	539
ENAP	456	148	102	117	25	10	29	26
Stated Mining Sector	3393	777	833	462	102	338	315	565
Mantos Blancos	26.7	4.9	2.3	1.7	1.1	3.3	7.2	6.2
Michilla	16.1	5.4	9.5	1.2	0	0	0	0
Escondida	744.8	248.4	154.9	138.4	71.2	128.8	3	0.1
Soquimich	2.9	2.5	0.3	0	0	0	0.1	0
Private Mining Sector	791	261	167	141	72	132	10	6
Sector Minería (*)	4183	1038	1000	604	174	471	326	571
Otros Sectores	8666	1392	1516	1494	1704	1273	1079	209
Total Tax Revenue from Mining	12849	2430	2516	2097	1878	1743	1405	780

Source: Consultora Gemines; extract from Agacino et al (1998)

(*) The included firm represents 80% of the mining sector output.

IMPACTS ON THE COMMUNITY OF THE MINING SECTOR ON THE II REGION

In addition to the economic impacts described previously, the Large Scale Regional Mining firms affect the community of the II Region in the following ways:

Plans of benefits to the community: The mining companies of the region have undertaken plans of benefits to the community. They can be classified into Plans of Short or of Long Term. Those of short term have as a time horizon the period of exploitation of the mine; on the other hand, those of Long Term seek to produce an impact in the community that goes beyond the useful life of the mine (Sanchez *et al*, 2000).

Among the long term benefits, the most important are those undertaken for Mining Escondida, since it has created a foundation dedicated to finance projects in the education, health and technology areas. This foundation undertakes projects of high social impact on marginal groups of the community, such as indigenous populations, handicapped people, woman household heads with incomplete studies, women in jail, etc. Also, Fundación Escondida has supported cultural and sport programs (Minera Escondida Limited 1998 and 1999).

On the other hand, Codelco, the state national company with several divisions in different regions, doesn't concentrate its contributions to the II Region, but on the whole nation. Nevertheless, it is working with local authorities in a program denominated Plan Calama that has as its objective to make the city of Calama more attractive for the workers of Codelco, and close the city of Chuquicamata, which is located on the mine. It means that Codelco will invest in infrastructure of the urban city, and also will expand the possibilities of health, education and entertainment. (CODELCO, 2000).

Codelco and most of the private mining companies have a policy of benefits to the community of Short Term which most frequently consists of donations to diverse institutions such as schools, orphanages, old men's shelters, municipalities, sport clubs, etc. These donations are usually contributions in money or in goods that have been used by the companies, such as computers, furniture, etc.

Another benefit perceived by the community is the subsidy that some mining companies give to their workers for the purchase of housings through the implementation of residence plans. The Escondida program has built 820 residence units in different sectors of the city of Antofagasta (Minera Escondida Ltda., 1999) and it has subsidized their workers in the purchase of these. Zaldívar has also invested in these plans, but it has given the option to its employees to choose where they want to buy, which has resulted in a better integration of the workers in the community. On the other hand, Codelco historically has given its workers housing at very low cost and now it has a plan to transfer the population of Chuquicamata to the city of Calama, subsidizing workers' purchases of new residences.

Decrease in the Level of Poverty: The private mining firms have contributed to lowering the percentage of poor in the II Region, since although the mining itself does not demand non skilled labor, other productive sectors as Construction and Retail sector have hired a considerable part of them, and they are highly associated with the Mining sector (Cochilco, 1999).

Negative effects on the population's health: There has been an increase in respiratory illnesses, especially in the town of Chuquicamata. On the other hand, in the region, the biggest quantity in cases of AIDS of the country has been detected, which can be the consequence of an increase of prostitution rates and alcoholism in the region and these problems are typical of neighbor communities of the mine. Another warning indicator in the II Region is that it presents the highest rate of suicides and divorces in the country, which reflects the deterioration that can take place in the family, because the schedule of work that results in the head of the household being absent several days each week. (El Mercurio 2000a and 2000b).

A negative externality attributed to the mining companies is the emission of toxic gases to the environment, which is critical near the towns close to a mine, as for instance in the case of the city Chuquicamata, located next to a division of Codelco. At the moment Codelco is developing a decontamination plan and is moving the population to the city of Calama (Fischer 1999). In the case of the other companies located in the region the effect on the air is not so harmful since they are in areas far from the cities.

Some CODELCO smelters have violated the environmental norms of the air; among them is Chuquicamata that is located in the II Region. It has been forced to establish a decontamination plan. For this smelter plant, Codelco undertook a plan that involved global investment of US\$107 Millions (Codelco 1999).

Fortunately, the new mining projects installed in the II Region after 1980 implemented environmental policies in line with international standards, projecting that Chile would sooner or later legislate in this respect. Indeed, in 1992 the state passed the new environmental law and created the National Commission of the Environment (CONAMA), an institution in charge of enforcing the environmental norms (Ginocchio, 1998).

THE ROLE OF THE GOVERNMENT IN MINING SECTOR DEVELOPMENT

The main way that the Government has influenced the development of the mining sector has been through the laws. It has created the framework in which the companies will work. Over the last three decades, the mining legislation has evolved according to the country's vision of government. We survey this process as a sequence from the 70s until the current situation.

- Up to 1971 the Chilean Mining Legislation, according to the constitution of 1925, was based on the principle of Freedom of Mines; it implied that the property rights of the mines belonged to its discoverers.
- In July 1971, during the Allende's Government, the Law 17450 was dictated. Through this Law the nationalization of the mining locations was legalized, changing these from being private property to property in concession, which would be regulated by the new Mining Code. This law meant the expropriation of the large copper mines without compensation. But, the mining code didn't pass because Pinochet's government took office.
- 1974, the Pinochet Government promulgated DL 600 (known as Statute of Foreign Investment), which assured the foreign investor's equitable treatment in front of the national ones, it allows free access to all the sectors of the economy with a minimum intervention of the state in its activities.
- D.L. 1350, in 1976, created the National Corporation of Copper (Codelco - Chile), composed by 4 divisions, which produced 84 percent of Chilean copper (Moguillansky 1998).
- The Law 13156, also promulgated by the military government, established that 10 percent of the sales revenues of Codelco are dedicated to finance the armed forces.
- In 1980, the Pinochet Government passed a new Constitution. This new constitution that came to replace the one of 1925, maintained the spirit of the Law 17450, which means that the full domain of the state on minerals was declared.
- In January of 1982, during the Pinochet Government, the Constitutional Organic Law on Mining Concessions (LOCCM) was promulgated. This Organic Law modifies the spirit of the Constitution substantially and tries to stimulate private investment with guarantees unprecedented in other economic activities. In this law, the Full Domain of the State with regard to the mining wealth is defined as subsidiary, which means that it is valid in case there is no private firm that

discovers the mine and/or requests it in concession. The concession for exploitation has an indefinite duration, since its conservation is only subject to the payment of an annual patent which is also deductible from tax payments. (Agancino *et al*, 1998).

- In 1992, the Aylwin Government promulgated law 19137. It allows Codelco-Chile to develop associations with private firms for the exploration and exploitation of new mines.
- Laws of Atmospheric Contamination. Two bodies of law have been passed: the D.S. 185 (Supreme Law, 1992) that establishes maximum levels of contamination in the air, and the Ordinance N° 165/98 (June 1999) that regulates emissions of arsenic to the air.
- Laws on Water Contamination: They are dispersed in several legal bodies because the resource is required for different uses. The most known are the Code of Waters and the Code of Mining.

This whole institutional framework has reestablished private and foreign investors' trust in the country, making Chile an attractive place to invest, particularly in the mining sector, which was strongly affected by the nationalization of the mines. Nevertheless, the legal stability has turned out to be a necessary, but not sufficient condition to stimulate the realization of mining projects, since business takes into account other long term factors such as geologic characteristics, incorporation of new technologies that reduce the production costs in the industry of the copper, price perspectives and the mineral and political and economic stability of the country. These conditions have been met, so at the end of the 1980s, the mining boom started up and in 1989 the investment in the country via DL 600 was US\$974 Millions (see Table 5).

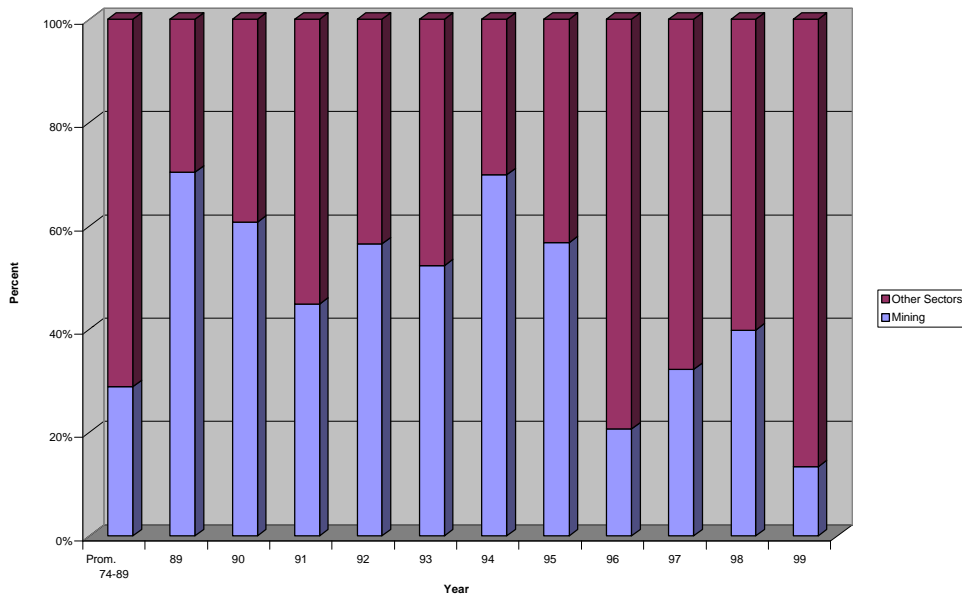
Table 5
Foreign Investment Based on DL 600
(US\$ Million)

SECTOR	Prom.	89	90	91	92	93	94	95	96	97	98	99
	74-89											
Total	311	974	1320	980	995	1724	2519	3020	4800	5041	5998	9086
Mining	90	686	803	440	563	902	1761	1716	995	1626	2394	1221
Other Sectors	221	288	517	540	432	822	758	1304	3805	3415	3604	7865
% Mining	28.94	70.43	60.83	44.90	56.58	52.32	69.91	56.82	20.73	32.26	39.90	13.40

Fuente: Moguillansky 1998 y Cochilco 2000h.

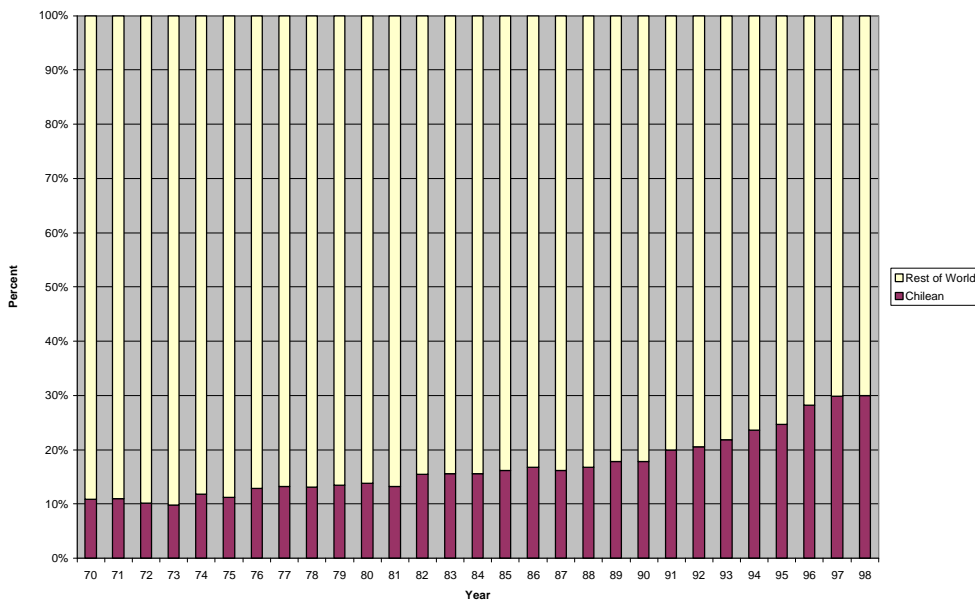
As shown in the Figure 5, foreign investments were concentrated in the mining sector until the year 1995, with projects of copper exploitation located in the II Region being predominant. Starting from 1996 the mining investment boom lost n relative importance, since of the US\$4800 Millions of foreign investment materialized in the country that year, only 20.7 percent went to the mining sector.

FIGURE 5: FOREIGN INVESTMENT BASED ON DL 600



The strong investment carried out in the mining sector brought the consequence that Chile recovered the world leadership in the copper production, passing from producing 11% of the world total in 1970 to 30% in 1998 (see Figure 6).

FIGURE 6: WORLD COPPER OUTPUT



It is important to highlight that when we are referring to private mining, we are speaking almost entirely of foreign investors, because Chilean companies (with the exception of the group Luksic, owner of the mine Michilla and Pelambres) did not participate in the boom, mainly because of capital constraints, since the necessary investment amount in the sector is very high. On the other hand, participation by institutions that manage big quantities of money to invest, such as the Pensions Fund Administrator (A.F.P), is limited because the mining sector exceeds the maximum risk allowed.

ACTIONS TO STIMULATE DEVELOPMENT IN THE II REGION

Several actions can be taken in order to stimulate regional development. Propositions in this respect include:

- In order to maintain or improve the quality of the environment it is necessary to comply with the environmental law. The enforcement is still poor and there is a lot of room for the state and companies to improve their environmental performance.
- In order to promote the growth of the productive base it is necessary to improve the financial system. The small and medium firms have serious problems getting credit from the banks; these problems are the collateral and the cost (interest rate). Some institutions have proposed a system of venture capital or special banks supported by the State. This is a very important problem to solve in order to expand the productive base of the II Region
- The forward linkages are really low in the copper industry in the II Region and there are few possibilities to increase it. Thus, it is important to make stronger the backward linkages by developing some of the following activities:
 - Developing a medium and small supplier program with the objective to improve the quality of the services and inputs that are bought or outsourced by the large-scale mining companies.
 - A practice that had had good experimental results is the support of the large-scale mining companies to a technical education institute. There is a low supply of skilled workers at technical level, and initiatives like this could strengthen the productive base.
- The large-scale mining companies should try to hire local labor or promote migration.
- The head offices of the companies are normally located in Santiago (Chilean capital city), because the main offices of the Government and the financial institutions are there. However, if they were located in the II Region, many of the firms whose main clients are the mining companies would move to the II Region, improving the productive base of the zone.

In addition, all the current programs with the objective of helping the community should be reinforced, making them as efficient as possible.

CONCLUSION

We can highlight the following results from the research:

- The mining sector impact on the gross regional output is important because of the level of mining sector and not because the linkages with the other sectors of the region.
- The mining sector impact on the income implies that for each American dollar that is produced nine cents go to the workers of the mining sector and between 7 and 15 cents go to the workers of the other productive regional sectors.
- There are some significant differences between the private and state owned companies with respect to the management of the labor force. While state owned companies hired almost all the workers that they need to operate the mine, the private firms outsourced an important part of its operation. This management strategy has an important positive impact in developing a productive base in the zone.
- The tax system is very different for state and private owned firms. Although the tax payments of both types of firms benefit mainly the central government, some of the payments of the private firms stays in the regions.
- The mining sector is still one of the main sectors attracting foreign investment, and during the last decade it has been the cause of the huge economic growth in the region and the country.
- There are positive and negative impacts on the community. Here, the commitment of the companies and the regional government authorities is necessary to deal with the growing problems such as prostitution, AIDS, high rate of divorces, high rate of suicide, etc., which are directly or indirectly related to the development of the mining sector.

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- b) *Inversión Extranjera Materializada en Minería según DL 600 por Regiones*
- c) *El Rol del Estado en la Minería Chilena*
- d) *EL Rol del Estado para el Desarrollo de la Minería*
- e) *Producción Chilena de Cobre Comerciable*
- f) *Normativa Relacionada con Minería*
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APPENDIX 1

INPUT OUTPUT MATRIX FOR THE CHILEAN II REGION

Sectors	1	2	3	4	5	6	7	8	9	10	11	12	Int. Sales	C	Other FD	FD	Total PP
1 Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	5,723	42	5,765	5,765
2 Fishing	0	5,134	0	8,906	0	0	0	0	0	0	58	0	14,099	8,796	7,953	16,749	30,848
3 Mining	0	1	1,876	1,582	64	4,849	305	37	947	0	44	31	9,738	366	4,084,462	4,084,828	4,094,566
4 Manufacture	334	1,982	4,433	58,780	9,013	95,400	17,786	9,042	12,296	190	5,911	44	215,211	120,356	140,347	260,702	475,914
5 Utilities	22	31	224,050	7,827	226,460	2,194	5,200	1,504	9,180	665	2,174	3,592	482,899	35,831	116,320	152,151	635,050
6 Construction	0	0	0	0	0	0	0	880	0	0	0	0	880	0	826,536	826,536	827,416
7 Retails	133	690	225,097	1,561	3,184	1,960	1,896	3,463	3,724	10	2,253	87	244,059	82,663	7,741	90,404	334,463
8 Transp/Comm.	113	29	17,290	1,877	6,274	152	2,554	7,594	438	0	1,147	1,743	39,211	101,345	10,816	112,161	151,372
9 Business Serv.	14	254	311,788	19,198	10,495	26,691	49,118	6,130	152,387	34	7,164	4,969	588,241	19,693	0	19,693	607,934
10 Real State Serv.	0	0	0	0	0	0	0	0	0	0	0	0	0	89,451	0	89,451	89,451
11 Other Services	7	2	178	11	2,676	287	845	1,777	90	109	1,232	73	7,287	161,870	68,629	250,499	237,786
12 Public Adm.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32,883	32,883	32,883
Inter. Buys	624	8,123	784,712	99,742	258,167	131,533	77,703	30,427	179,062	1,009	19,982	10,540	1,601,624	626,094	5,315,729	5,941,823	7,543,447
Wages	940	5,029	398,034	50,949	22,293	221,472	104,032	40,308	207,137	35,656	95,113	21,627	1,202,591	0	0	0	1,202,591
Depreciation	382	2,466	119,862	35,018	96,144	11,509	0	12,783	0	2,243	3,889	0	284,297	0	0	0	284,297
Profits	2,082	6,861	1,944,354	130,135	154,557	113,635	106,601	41,318	82,801	19,053	96,068	0	2,697,466	0	0	0	2,697,466
Ind. Taxes	126	218	110,953	2,524	0	2,641	2,779	911	13,075	642	1,294	0	135,164	0	0	0	135,164
Import	1,610	8,151	736,771	157,261	103,889	346,625	61,409	24,750	129,360	30,849	20,916	716	1,622,305	0	0	0	1,622,305
Total PP	5,765	30,848	4,094,685	475,629	635,050	827,416	352,525	150,498	611,434	89,451	237,263	32,883	7,543,447	626,094	5,315,729	5,941,823	13,485,270
Employment	532	6,462	21,452	15,454	865	20,385	23,103	14,314	9,433	3,167	18,364	11,729					

Source: Aroca (1999). In thousands of American Dollars