



## Impacts of foreign investment on sustainable development in a Chilean mining region

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### Abstract

*The desert mining region of Antofagasta, Chile, enjoyed spectacular economic growth in the 1990s as a result of foreign direct investment (FDI), mainly in the exploitation of the region's rich copper deposits. In a country considered by international financial institutions to be a good example of economic performance, Antofagasta has been termed a model region, and Chile's economic and social development in the 1990s has been considered a suitable model for other Latin American countries. However, development indices based on statistical data must be examined with caution, as human welfare does not necessarily keep pace with economic growth. This article analyses the Antofagasta Region in terms of problems that may occur in conjunction with accelerated economic growth, and how these can affect the environment, as well as the regional labour market. The article also examines a regional economic strategy for Antofagasta recently proposed by the local government, and suggests new alternatives for the sustainable economic development of the region.*

*Keywords:* Mining and sustainable development; Water and mining; Foreign direct investment; Human development index; Subcontracting; Local and regional strategies of development; Export sector; Antofagasta; Chile; Mining cluster

### 1. Introduction

Throughout Chile's economic history, natural resources, especially mineral resources, have played an extraordinarily important role. During the Spanish conquest and the colonial period, gold and silver were Chile's principal products, around which the country's economy grew. Later on, wheat and nitrates (saltpeter) became the dominant exports to industrialized centres. Finally, after the great depression in the 1930s, copper became the leading export product, to which was added forestry and agricultural products, fruit and fish during the last 10 or 15 years.

Chile became the focus of attention in the international press in 1973, when a violent military coup unseated the leftist government of President Salvador Allende, who had been elected in 1970. This event brought an end to 50 years of civilian rule, and aborted the first attempt at a lawful and peaceful transition to socialism. The military regime that came to power in 1973, ruled the country until 1990.

Between 1988 and 1998, Chile experienced a remarkable economic growth, based on exports. The economic growth

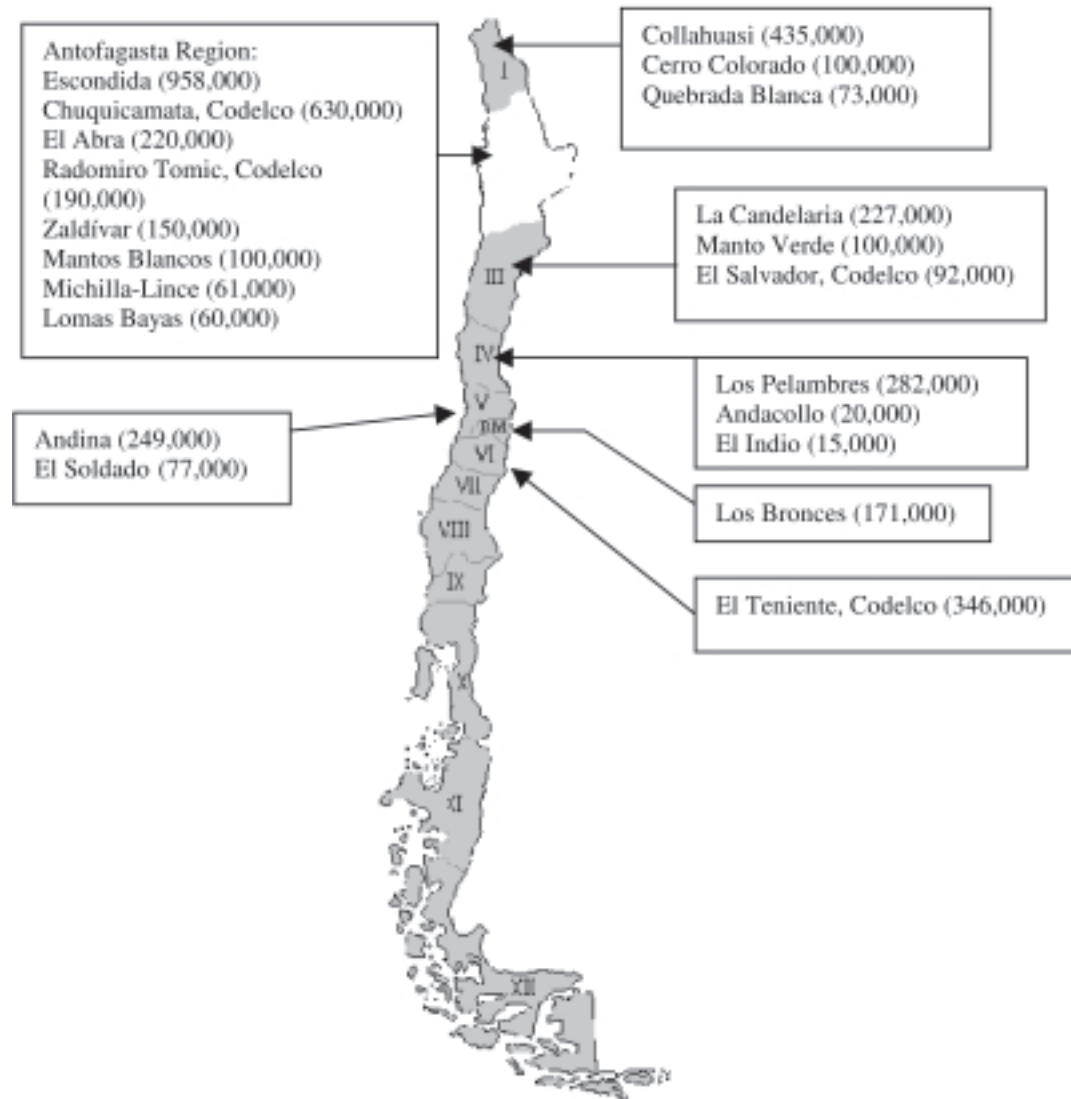
achieved during this period has been considered an example for other Latin American countries to follow, attributed to Chile's free-market oriented economic policy, initiated during the period of military dictatorship.

This article analyzes the economic, social and environmental impacts on the Antofagasta Region region of the economic boom in the 1990s, set off by foreign investments. First, it briefly describes the economic history of the region. It then discusses Antofagasta's social performance and the assessment of the region in human development indices. Certain human development indicators show very low values, not consistent with the economic growth in the region — the reasons for this asymmetry are explored. Finally, the article takes a critical look at the new economic strategy proposed for the Antofagasta Region by its new government, appointed in 1999, and suggests alternative policies for the region's development.

### 2. Copper mining in the Antofagasta Region

This article seeks to identify certain significant changes that have occurred in the Antofagasta Region, a region that has been considered a model of macroeconomic performance.

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Map 1. Copper production in the regions of Chile (in tonnes/year)

The regional economy of Antofagasta underwent a fundamental change as a consequence of the spectacular growth in foreign direct investment in the mining sector and the following rapid expansion of exports.

Antofagasta is the second of Chile's 13 administrative regions, numbered from north to south (see map 1). It has a population of about 450,000, out of a total national population of 15 million. With only 3% of the country's total population, the Antofagasta Region nevertheless contributes significantly to Chile's economy, with 30% of the country's exports originating from the world-class copper deposits in this desert area.

### 2.1. Brief history of mining in the Antofagasta Region

Antofagasta's current economy has its roots in the dual economic system of the pre-capitalist Chile of the 1800s. This was an enclave economy, identified by development

economists as the engine of capitalism in peripheral regions. Here, two distinct economic systems coexisted within the same country: one being the capitalist economy, created by foreign investors and based on export of raw materials; the other a pre-capitalist type of economy, producing for the domestic market.

In the 1800s, the Antofagasta Region was largely uninhabited, except for small groups of indigenous people living in the foothills of the Andes, scraping out a marginal living by way of subsistence agriculture. After Bolivia and Peru lost the Pacific War (1879–1883), the Antofagasta Region, previously part of Bolivia, came under Chilean sovereignty. The expansion of mining for nitrate and copper gradually induced migration to the Atacama desert.

The subsequent history of northern Chile in the 20<sup>th</sup> century evolved in a manner similar to that of other parts of southern Latin America: foreign capital investment became the nucleus of an economic enclave, fairly isolated from





the national economy. Inputs required for mineral extraction were imported from abroad, and only a very small portion of the profits from mining were invested in new ventures within the country.

Before World War II, nitrate fertilizer was the principal economic resource of the northern region. However, from the end of World War I onwards, Chilean nitrates were gradually replaced on the world market by synthetic nitrates produced in Germany. The final demise of the Chilean nitrate industry came with the great depression of 1929, when exports fell almost to their 1880 level. Chile fell into a deep economic slump that lasted from 1929 to 1938. By 1932, the per capita GDP had fallen to 60% of its 1928–29 levels (Meller, 1990). Today, the once lively camps that, in the heyday of nitrate mining, sheltered thousands of miners and their families, are abandoned, visited only by tourists.

In the years following the depression, the Chilean Government pushed for the industrialization of the country to reduce its dependence on exports of raw materials. This second industrialization period favoured a policy of import substitution by goods manufactured domestically.

In spite of the government's efforts, industrialization was slow, and Chile did not succeed in solving its problems of poverty and social inequality. Popular discontent grew. In 1970, a leftist government was brought to power by popular election, led by Dr Salvador Allende. The Chilean Parliament voted unanimously to nationalize the major mining industry, including copper, iron and nitrate mines. Allende's government had set out on a new path of socialism within a democratic system, but in 1973, the President died in the president's house and his government was unseated in a military coup. From 1973 to 1990, Chile was governed by a military junta. The political economy of the country was left in the hands of pro-market economists of the "Chicago School", known for having implemented the first neo-liberal reforms in Latin America.

### 2.2. *Change to democracy and liberalization of the economy*

The 1990s saw a new political and economic era, with civilians elected to government positions by popular vote. The coalition government, which has led Chile until the present, was formed by an alliance of the factions that had been opposed to the earlier military government. The new government continued the basic economic strategy of the previous period, complemented by major social spending.

Economic development prior to 1990, during the military dictatorship, was unremarkable: growth was slow, with some 40% of the population living in poverty. The political change in 1990 brought with it guarantees of long-term economic stability, and also a liberal policy towards private capital with additional legal advantages granted to foreign investors (Fazio, 1997; Cademartori, 1998). In the Antofagasta Region, a manifestation of the new economic strategy was the start-up of the Escondida Mine in 1990, a mega-project

copper mine, currently owned by the Australian transnational corporation BHP. The major mining industry in the region had until then been owned by the Chilean State, since the nationalization in 1971 of CODELCO's mine at Chuquicamata, the largest open face mine in the world. CODELCO was the only enterprise of significant size that did not revert to the private sector, due to its contribution to the military budget (by law 10% of its sales).

### 2.3. *Accelerated growth in copper production based on FDI*

The copper mining and extraction industry in the Antofagasta Region had been financed mainly by foreign direct investment, stimulated by:

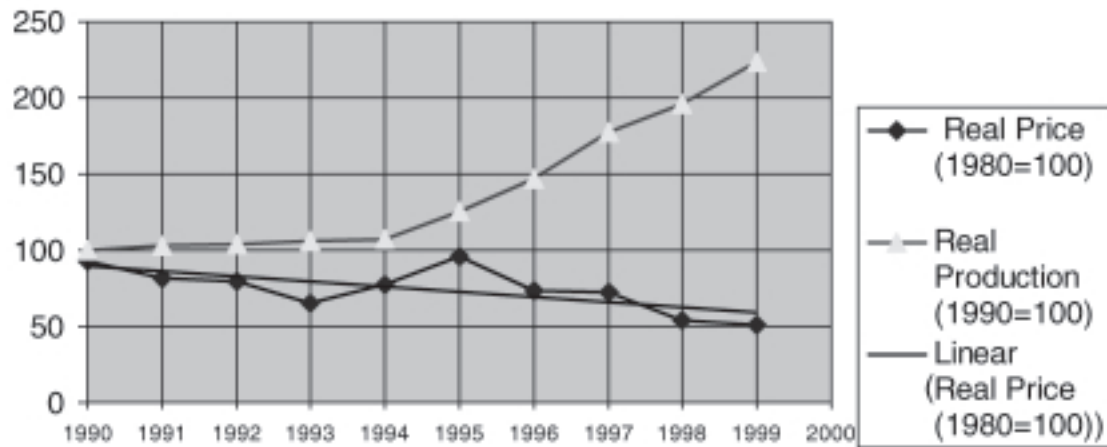
- A favourable legal environment with minimum regulation for capital investment;
- The greater economic and political stability in the country during the 1990s, after the demise of the military regime; and
- A massive influx of foreign capital into Latin America between 1990–1995.

After 1990, private transnational mining companies made considerable investment in the region, and from 1995 on, foreign mining companies started to produce a larger volume of copper ore than those owned by the Chilean State<sup>1</sup>. The expansion of Chile's copper production and copper price are/is shown in Fig. 1.

The significant increase in copper production in the Antofagasta Region from 1986–1996 is shown in Table 1. By 1999, in a little over one decade, copper production in the region had almost tripled its share in worldwide production compared to 1986.

The average yearly inflow of FDI into the region for the period 1991–1996 reached a peak US\$2,937 million — the highest level for any region in the country. The average annual growth rate in FDI was 43.7%, with 95.5% going to the mining sector (COCHILCO, 1999). Projections for the period 2000–2004 estimate that FDI in mining in the Antofagasta Region will amount to \$US 3,197 million out of a total FDI in Chile of \$US 3,817 million (El Mercurio de Antofagasta, 2000b). Mining accounts for about 60% of Antofagasta's gross regional product (GRP). As a result of the high level of investment in mining, the Antofagasta GRP grew at an average annual rate of 9.2% between 1991–1996, while the national average was 8.5% during this period (SERPLAC II Región, 1998). It should be noted

<sup>1</sup> CODELCO is the holding company for all the state-owned copper mines in Chile. The largest mine is Chuquicamata. Two new mines are located in its immediate vicinity: El Abra (51% private, 49% CODELCO) opened in 1996 and Radomiro Tomic (100% owned by CODELCO) opened in 1997. The company also has older mines outside the Antofagasta Region (such as El Teniente, Andina, El Salvador) which were nationalized in 1972 under President Allende.



**Figure 1.** Chilean copper production and real prices  
 Source: Developed by author from statistics from Chile's Banco Central.

**Table 1.** Share in worldwide copper production of the Antofagasta Region and of Chile (in thousands of metric tonnes of refined copper)

Company/region	1986	World share 1986	1996	World share 1996	1999	World share 1999
1. Codelco in Antofagasta (state owned)	515	6.1%	648	6.0%	928	7.5%
2. Minera Escondida Ltda. (private)	0	0.0%	841	7.7%	896	7.2%
3. Remainder of private mining in Antofagasta	57	0.7%	238	2.2%	429	3.5%
<b>Total for Antofagasta (1+2+3)</b>	<b>573</b>	<b>6.8%</b>	<b>1727</b>	<b>15.9%</b>	<b>2253</b>	<b>18.2%</b>
<b>Total for Chile</b>	1401	16.7%	3116	28.6%	4383	35.3%
<b>World total</b>	8393	100.0%	10878	100.0%	12400	100%

Source: For 1986–1996: Agacino *et al.* (1998); for 1999: Cochilco (2001).

here that between 1991–1996, employment grew by an average of 4% annually, but employment directly connected with the mining industry grew only by 1.4%. Mining thus decreased its share of total employment from 15 to 13%.<sup>2</sup> As further discussed below, this relates to labour practices, especially subcontracting.

According to estimates published in 1996 by the economist Orlando Caputo (Caputo, 1996; see also Caputo, 2000; Caputo *et al.*, 2001a and 2001b), overproduction in Chile caused the fall in the price of copper after the mid-1990s, which resulted in a loss of income to Chilean copper mines equivalent to US\$16 billion between 1996 and 2000. Between 1995 and 1999, Chile increased its production of refined copper to 1.9 million tonnes while total world imports remained just under 1.3 million tonnes. During the same period, 1995–1999, total world consumption of copper grew by 13%, while Chilean production increased by 76%. Caputo *et al.* (2001) show that, in 1989 the Chilean State

received US\$ 0.65 for each lb of copper, while in 1998 it only received US\$0.06. This loss was caused by overproduction of copper by the private sector, and the subsequent fall in world copper prices. Caputo and others have criticized the fact that Chile, while producing almost 45% of total world exports, followed a mineral policy based on the erroneous belief that its production would not influence world copper prices.

According to Alcayaga (1999), Chile increased its copper production by 611,000 tonnes<sup>3</sup> between 1990 and 1994, whereas copper production in the rest of the world declined by 62,000 tonnes. Between 1989 and 1998, worldwide production increased by 3,286,200 tonnes, whereas the worldwide consumption increased only by 2,345,900 tonnes.

An important share of the above increase in Chilean copper production came from the Antofagasta Region. The following section will discuss the region's social and economic development as assessed by recent studies.

<sup>2</sup> Although mining represents some 60% of regional production, it offers relatively low levels of employment.

<sup>3</sup> This total breaks down to an increase of 720,000 tonnes on the part of foreign privately owned companies, partially offset by a decrease in CODELCO's production by 109,000 tonnes.



### 3. Economic and social performance of the Antofagasta Region

Based on statistical data, many recent studies have placed the Antofagasta mining region in a leading position in terms of economic development, compared with other regions in Chile. This assessment may lead to the conclusion that a development strategy based on export of raw materials is an advantageous one.

There are a number of indices that focus on the economic and social development of the regions of Chile. For example, there is the Regional Competitiveness Report, compiled annually by the Chilean Government. In the 1997 edition of this work, Antofagasta ranks second nationally, surpassed only by the Metropolitan Region (of Santiago) (SUBDERE, 1998). The same index also evaluates the relative competitiveness of Chile's regions on the basis of various indicators, such as economic growth, physical infrastructure, quality of government, investment in science and technology, level of formal education, industrial productivity, and availability of natural resources (without addressing the issue of depletion). The same report concludes that regions V and VIII, tied to the old pattern of import substitution<sup>4</sup>, showed less favourable results in comparison to Santiago, while regions rich in natural resources, located in the far North and far South of the country, showed high (Regions II, III and XII) or medium (Regions I and XI) scores. However, this article argues that such an optimistic evaluation of Antofagasta needs to be examined carefully.

The best known study of this type is the Human Development Index, prepared by the United Nations Development Programme (UNDP). The value given for each country is an combined average based on three basic parameters: per capita income; health; and education<sup>5</sup>. The fact that there may be a discrepancy between a country's economic growth and its human development is demonstrated by the fact that the global ranking according to per capita income of a particular country may be very different from the same country's place in the human development index.

In the Human Development Report for the year 1996 (UNDP, 1996), the Antofagasta and Metropolitan regions are given the highest rank, both in the human development index and in terms of per capita income. Nevertheless, the report advises that the high economic growth rate registered for those two regions between 1990 and 1996, was not paralleled by an equally high growth rate in their human development indices. Thus, between 1990 and 1998,

the human development index for the Antofagasta Region rose by 7.1% (UNDP 1999: 12), which was in tenth place among Chile's thirteen regions.

In addition to producing the traditional Human Development Index, UNDP has added depth to its assessment of Chile by compiling new indices over quality of life. The 1998 United Nations Human Development Report for Chile ranked the Antofagasta Region second nationally in the so-called "objective human security index" (OHSI), but only in sixth place in the "subjective human security index" (SHSI) (UNDP, 1998). The variables included<sup>6</sup> in the SHSI and OHSI are shown in Table 2. The principal characteristic of SHSI is that it was compiled from local people's own perception of their quality of life based on an ad hoc inquiry. The OHSI, on the contrary, was developed from standard government statistics.

In contrast to the favourable results shown by economic indicators, the national results from the OHSI and SHSI led UNDP to conclude that human security, both objective and subjective, is unevenly distributed among social groups and among the country's regions (UNDP, 1998:19). Moreover, the assessment of the subjective indicators (SHSI) was more conservative than that of the objective indicators (OHSI) both nationwide and for the Antofagasta Region. Moreover, UNDP concluded in its 1998 Report, that Chile's booming economy concealed an underlying malaise on the part of the majority of the population. Despite remarkable economic growth in recent years, Chileans felt insecure, distrustful of others; they doubted the capacity of the social systems to assist them and were worried about the security of their jobs. The subsequent economic crisis, 1998–2001, proved them right in many of their apprehensions.

According to UNDP, the negative perceptions reflected in the OHSI and SHSI surveys stemmed partly from the prevailing inequality of income and opportunity in Chile. Cademartori (1998) recalls that a World Bank study of 65 countries listed Chile among the seven with the greatest income inequality.

In the 'subjective human security index' (SHSI), the Antofagasta Region was only in sixth place nationally, while it was in second place in the objective human security index (OHSI), and the Metropolitan Region fell to ninth place in the subjective index, although it had held a leading position in the objective index (UNDP, 1998).

Figure 2a shows the discrepancy between subjective human security (SHSI) and economic growth in the period 1990 to 1997 by way of two differentials:

- differential between SHSI and per capita GDP; and
- the differential between SHSI and per capita FDI.

<sup>4</sup> 'Import substitution' was an economic strategy used in the 1930s, after the great depression, by certain Latin American countries and recommended by ECLAC. It consisted in replacing foreign imports from developed countries with domestically manufactured goods in an effort to build up the domestic economy. High import tariffs and taxes applied to industrial imports were part of this economic strategy.

<sup>5</sup> See [www.undp.org](http://www.undp.org) and [www.UNDP.cl](http://www.UNDP.cl)

<sup>6</sup> In this index, each dimension has equal weight, and each variable within each dimension also has equal weight (simple averages).

**Table 2. Objective and subjective human security indicators**

Field	Objective human security indicators (OHSI)	Subjective human security indicators (SHSI)
Health	Survival rate <sup>a</sup>	<i>Catastrophic disease:</i> <ul style="list-style-type: none"> <li>● Access to timely care</li> <li>● Ability to afford the cost of care</li> <li>● Access to quality health assistance</li> </ul>
	Health insurance	<i>Minor illness:</i> <ul style="list-style-type: none"> <li>● Access to timely care</li> <li>● Ability to afford the cost of care</li> <li>● Access to quality health assistance</li> </ul>
	Proximity to surgery	
Education	Level of education	
Culture		To be informed of latest news
Labour	Labour training	Possibility of finding work in case of job loss/unemployment
	Employment	Confidence in not losing current job
	Stable employment contract	Possibility for non-employed to enter work force <sup>b</sup>
Pension	Pension fund	Sufficient/satisfactory income in old age
Housing	Quality of housing	
	Home ownership	
Crime	Proximity to police station	<i>Possibility of becoming victim of:</i> <ul style="list-style-type: none"> <li>● Robbery in public area</li> <li>● Robbery within the home</li> <li>● Sexual attack</li> <li>● Violence</li> <li>● Confidence that criminals will be condemned</li> </ul>
Sociability	Unionization	● Probability of receiving assistance from others
		● Probability of organizing neighbours to solve a common problem
		● Probability of receiving assistance from others in case of aggression in a public area

Source: Based on UNDP (1998), tables 9 and 13.

Notes: <sup>a</sup> Survival rate: this is the inverse of mortality — not the same as life expectancy at birth.

<sup>b</sup> These are the people that are not part of the work force, not the people that lose their jobs.

All indicators and variables used were standardized<sup>7</sup>. A negative differential indicates that subjective human security lags behind economic growth in that region. Figure 2a shows that Region 2 (Antofagasta) had the greatest negative differential, and that the other mining regions in the North of Chile (regions 1, 3 and 4) also showed negative values. The results are similar for both economic variables (GDP and FDI).

Figure 2b shows the difference between subjective security (SHSI) and objective security (OHSI) for each region, after standardizing both indices. It can be observed that the northern regions show a negative differential here also as in Figure 2a. The negative differential is also very high for Region 13 (the Metropolitan Region), site of the nation's capital, Santiago, and home to some 40% of the population. The Antofagasta Region also shows a negative differential between the subjective and objective human security indices. These findings suggest that in the ranking of the regions in Chile, there is a gap between economic

performance and perceived human security (subjective) (Figure 2a); and between objectively measured and perceived (subjective) quality of life (Figure 2b).

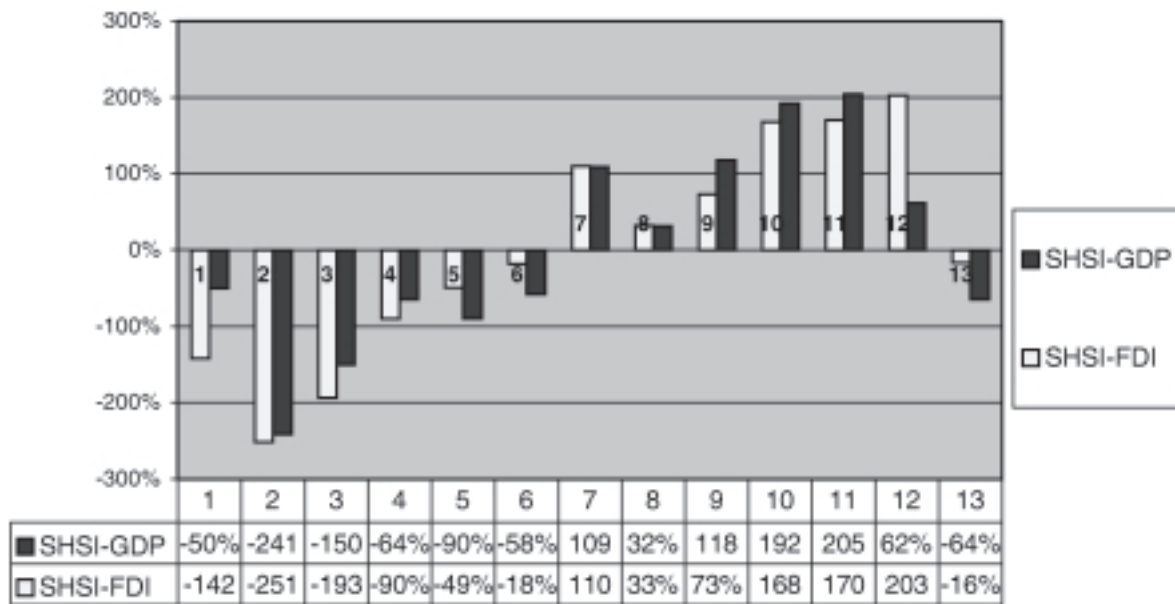
It is suggested in this article that the objective human development indicators used by UNDP do not include all relevant inputs. This is probably partly due to the difficulty in obtaining the requisite information. Chile's economic growth has resulted in an improvement in certain basic social indicators, especially in urban areas<sup>8</sup>. However, urban areas also register higher levels of stress, and social, labour and environmental problems (such as air pollution, congestion, difficult working conditions, crime and social marginalization, etc.).

As emphasized by Nobel laureate Amartya Sen (1989, 1998), it must be borne in mind that:

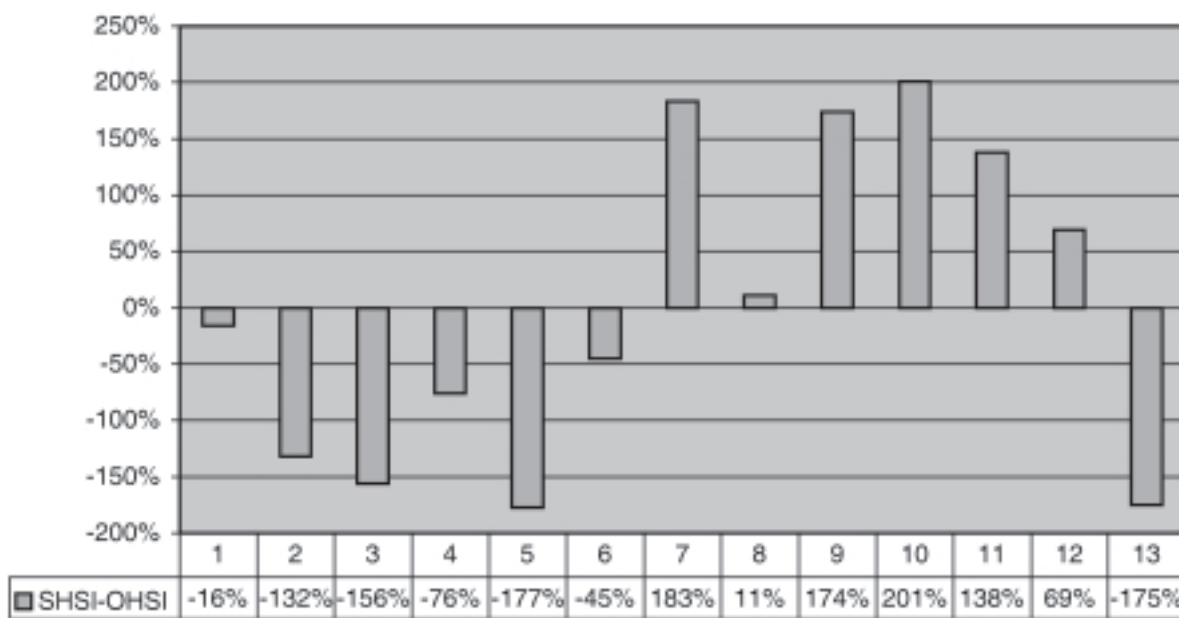
- Material prosperity is only one of many means to enrich people's lives; and
- Average material prosperity does not guarantee satisfaction.

<sup>7</sup> This standardization involved subtracting the average value from the original variable, and then dividing the result by the standard deviation.

<sup>8</sup> Thus, while in 1990, urban average income levels had been 36% higher than rural incomes, in 1998 they were surpassing them by 110% (UNDP, 1998).



**Figure 2a.** Subjective human security compared to economic growth  
 Note: Numbers from 1-13 indicate administrative region.  
 Source: Author's elaboration based on UNDP (1998).



**Figure 2b.** Subjective human security compared to objective human security  
 Note: Numbers from 1-13 indicate administrative region.  
 Source: Author's elaboration based on UNDP (1998).

First of all, objective indicators do not take into account the human cost of the extra efforts required to maintain the high rates of production increase that occurred in Antofagasta in the 1990s (see section 2 above). The next section of this article will show that while the considerable increase in foreign direct investment in the mineral sector in the Antofagasta Region in recent years has undoubtedly resulted in economic growth, it has also been

accompanied by not only a quantitative, but a qualitative change in labour practices. The use of subcontracted labour has expanded, both in the mines and the mining industry at large, involving considerably extended work schedules.

Secondly, indicators currently in use, although they may recognize the necessity for development to be environmentally sustainable, do not actually measure its sustainability. Therefore, these indicators do not highlight possible negative

impacts of a high and sustained rate of economic growth on fragile ecological equilibria.

Another aspect, discussed further in section 5 below, is the impact of the explosive growth of the mining sector on other economic sectors, and associated social and cultural repercussions. Current economic theory looks upon geographic relocation of work as an efficient method to reduce poverty related to local unemployment. In a wider perspective, however, as suggested by Amartya Sen, it is also true that such relocation may affect people's sense of identification with their natural surroundings, and curtail people's freedom to choose where and with whom they live, and their cultural and social environment. These issues are discussed in section 5.

#### 4. Labour practices

As discussed above, from 1880 to 1971, northern Chile was characterized by a dual economic system. In this economy, the domestic sector provided low-cost workers to the mineral extracting and exporting industry. The availability of cheap labour thus enabled the mining industry to exploit Chile's abundant natural resources.

Similarly, today, a 'satellite sector' provides goods and services to the mining industry at cheap prices, based on unregulated labour, extended working schedules and low wages. As has been noted in the literature, the unregulated labour market allows longer working days at lower pay (ECLAC, 2000). In periods of recession, labour contracts can be renewed at lower prices, which in turn forces the intermediary enterprises to cut their profit margins and lower the levels of wages paid. This is possible largely because subcontracted labour is outside the control of trade unions, and thus the negotiating power of workers (under short-term contracts, and in small enterprises) over salaries is reduced; dismissal and recruitment costs are lowered; and certain costs pertaining to accidents in the work place and professional illness are transferred from the contractor to the worker.

A study conducted by the Chilean Ministry of Labour (Echeverría, 1997) concluded that:

- Subcontracting of labour in Chile was practised in almost all economic sectors, and in certain sectors, subcontracted labour constituted half or more of the total labour force;
- The level of salaries of subcontracted workers was lower than of permanent workers in most cases; and
- In general, subcontracted labourers are supervised by the enterprise that uses their services — not the one that pays them — which leads to considerable ambiguity as to social responsibility towards the workers;

The significant increase in productivity (see Table 3) in the major copper industry during the 1990s was due mainly to the following factors:

- The subcontracting of tasks to small firms; and
- Technological innovation in production processes.

**Table 3. Labour productivity in the major copper mining industry**

Year	Productivity (tonnes refined copper/labour)
1991	42.69
1992	45.06
1993	49.80
1994	55.02
1995	62.45

Source: Agacino *et al.* (1998).

The productive apparatus of the major mining industry was split into two asymmetric components: the export sector on the one hand, and its chain of ancillary enterprises and services on the other. These latter enterprises engaged not only in providing traditional types of goods and services (such as building industrial plants, managing restaurants, sanitation and transport) but more and more they also undertook work directly tied to the mining industry proper (related to explosives, cleaning of equipment, computer/information systems, etc). The providers of these services are essentially intermediary enterprises, organised as small private companies, often family owned firms, that lease cheap labour.

The economic reasons why the salaries paid by subcontracting enterprises are necessarily lower than those paid to permanent workers for equivalent work are obvious:

- The amount paid to a subcontractor must be less than the cost to a firm of maintaining salaried staff to perform the same work — otherwise the use of the subcontractor's services would not be justified;
- The money received by the subcontractor necessarily does not equal the total of salaries paid its labourers, as it must also cover the expenses of the subcontracting business, often a chain of small subcontractors (subcontractors and subcontractors of subcontractors) and their workers; and
- Even in cases where the work is highly specialized and therefore warrants higher prices, the increased revenue remains in the hands of the subcontractor management, and the workers have little leverage to negotiate for higher pay.

Unfortunately, no statistics are available of current salaries in the Antofagasta mining sector that allow a comparison between permanent employees and subcontracted labour. However, there are indirect indications confirming that the hourly wages of subcontracted labourers are lower:

- As a result of a long struggle by the mine workers unions, and in view of the high profit levels in the major mining industry combined with harsh working conditions

**Table 4. Subcontracted labour in the Antofagasta mining sector**

Years	Subcontracted labour (1) Average number of persons	Permanent labour (2) Average number of persons	Subcontracted total (3) = (1) / ((1) + (2)) %
1987–1988	2308	19010	10.8%
1990–1991	3584	22003	14.0%
1993–1994	9310	19091	32.8%
1996–1997	19384	17930	51.9%

Source: SERNAGEOMIN: *Anuario de la Minería* (1987–1997).

for labour, mine workers in permanent employ are now receiving important social benefits, which the subcontracted workers do not receive. These benefits include: assistance for buying a home<sup>9</sup>; study grants for workers' children; collective medical insurance; voluntary pension contributions, etc. In addition, permanent workers enjoy better access to credit due to their stable job situation, compared to temporary wage earners; and

- Throughout the country and across the entire spectrum of economic sectors, the salaries of workers in small enterprises are lower than those of workers in larger companies; workers in small enterprises generally do not receive any benefits beyond their salary.

In the 1987–1988 biennium, only 12% of the labour force in the Antofagasta mining industry was working under subcontract. Table 4 shows the significant increase, within only a decade, in the level of subcontracted labour in the Antofagasta mining industry. These figures appear to rise at a faster pace in the Antofagasta Region than nationally, even within the copper mining sector.

Agacino *et al.* (1998), based on their studies of labour modalities in the Chilean mining sector during the 1990s, conclude that the rate of accidents is higher among subcontracted labourers than among permanent workers; that subcontracted labourers work longer hours than permanently employed workers; that subcontractors' systems of work schedules do not adhere to the standards laid down in the country's labour laws; and that the working environment of subcontracted labour is generally worse than that of permanent employees.

Agacino *et al.* (1998) have also calculated the frequency of accidents per hour worked in the Chilean copper mining industry. Comparing the periods 1987–1990 and 1991–1995, they show that while the accident rate in general has gone

<sup>9</sup> "Before initiating its production in 1990, the Minera Escondida company launched a major housing programme in the city of Antofagasta to assist its area employees in purchasing their own company-built house or apartment. By the end of fiscal year 1998, Escondida had built 642 housing units. This represents an annual investment of almost \$US 3 million. Construction has already begun on another 178 housing units in Antofagasta" (Minera Escondida Ltda., 1998).

down, the frequency of accidents in both periods is greater among subcontracted labour. The greatest difference in frequency of accidents between subcontracted and permanent labour occurs in the major copper mining industry: from 1991 to 1995, an average frequency rate of 8.6 accidents per million hours worked was recorded for permanent workers, compared to 21.5 for subcontracted labour.

The use of subcontracted labour has allowed mining companies to lengthen working days, as suggested by Table 5.

These findings are confirmed at the national level by Agacino *et al.* (1998) for the entire copper mining industry, including large scale, medium sized and small companies. Thus, a subcontracted labourer employed in the major copper mining industry in 1995 worked an average of 10.6 hours daily per year, whereas a permanently employed labourer worked 8.3 hours.

**Table 5. Total man-hours worked in Antofagasta mining companies (annual averages 1996–1997)**

Type of company	Man hours	Number of workers	Annual hours worked per person	Weekly hours worked per person (50 weeks per year)
Contractor	40,762,915	17,930	2,273.4	46.3
Contracted	48,098,815	19,384	2,481.4	50.6

Source: Author's elaboration based on SERNAGEOMIN (1987–1997).

Another way for the mining industry to render labour more flexible was the establishment of special working days or working schedules. Under normal circumstances, a worker is available to the employer 48 hours per week<sup>10</sup> from Monday to Friday or from Monday to Saturday. However, special work schedules may consist of four days work followed by four days off (4+4), seven days followed by seven days off (7+7); (8+8); (10+8); (20+10); (21+7) and other combinations. In working special schedules, labourers can often obtain a higher income than in other lines of work, and may also be able to save on personal expenditures, as well as enjoy a longer rest period at the end of the sequence. However, negative effects may include loss of contact with the family, particularly at holiday times, as workers may stay overnight at the company work camps for long periods. Family responsibilities, such as bringing up children, then falls to only one spouse. This type of working conditions may lead to a deterioration of spousal relations.

The special working schedules discussed above do not adhere to current labour laws, which stipulate that a worker should not work more than 48 hours per week. At the outset, special work schedules (*jornadas especiales*) were accepted in exceptional cases, and by law required special authorization from the government or an agreement between

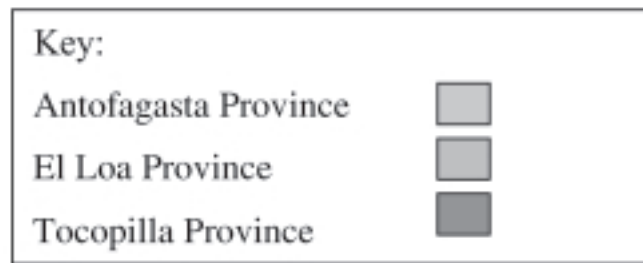
<sup>10</sup> The 48-hour workweek is the norm in Chile.



worker and manager. Today, the *jornadas especiales* have become a regular feature of the Chilean mining industry, especially for subcontracted labour. As the practice in reality has become routine and is no longer exceptional, the spirit of the law is not being respected.

Moreover, special work schedules in mining often involve working more than 12 hours a day, and often at altitudes over 3000 m above sea level. In some cases, working days are effectively 16 hours, if one includes travel time from the camp to the site of the deposit, time spent receiving instructions and writing required work reports — not recognized as part of the working day by many mining companies. In view of these conditions, luxuries such as swimming pools and exercise facilities made available by some mining companies seem ironic, as the workers are generally too exhausted at the end of their working day to be able to enjoy them (Delaire, 1999).

The increased use of subcontracted labour is not limited to privately-owned transnational corporations. The same practice seems to have been a factor in enabling the giant state-owned enterprise CODELCO to maintain its competitive edge during the 1990s when the company was facing a gradual decline in the metal content in its old deposits, and the steady decline in the price of copper (Caputo, 1998). Between 1992 and 1999, CODELCO's production increased from 1156 million tonnes to 1494 million tonnes per annum while the permanent labour force declined from 26,387 to 17,868 employees, including both office workers and labourers.



Map 2. Provinces and cities of the Antofagasta Region

### 5. Uneven economic development and environmental degradation

#### 5.1. Uneven economic development

A strategic objective of development is to achieve geographically balanced growth, as this sustains local participation. Local participation, in turn, involves individuals and civil society in development, and ensures that the voices of communities are heard and their identity preserved. However, contrary to this objective, economic development in the Antofagasta Region has been uneven, heavily skewed towards one of its three provinces (see Map 2). According to a recent study (Candia and Molina, 1998), the rate of economic growth has been rising in Antofagasta Province, stable in El Loa, and declining in Tocopilla. Figure 3 compares the respective shares of the three provinces in the region's labour force in 1972, 1982, 1992 and 1998.

##### 5.1.1. El Loa Province

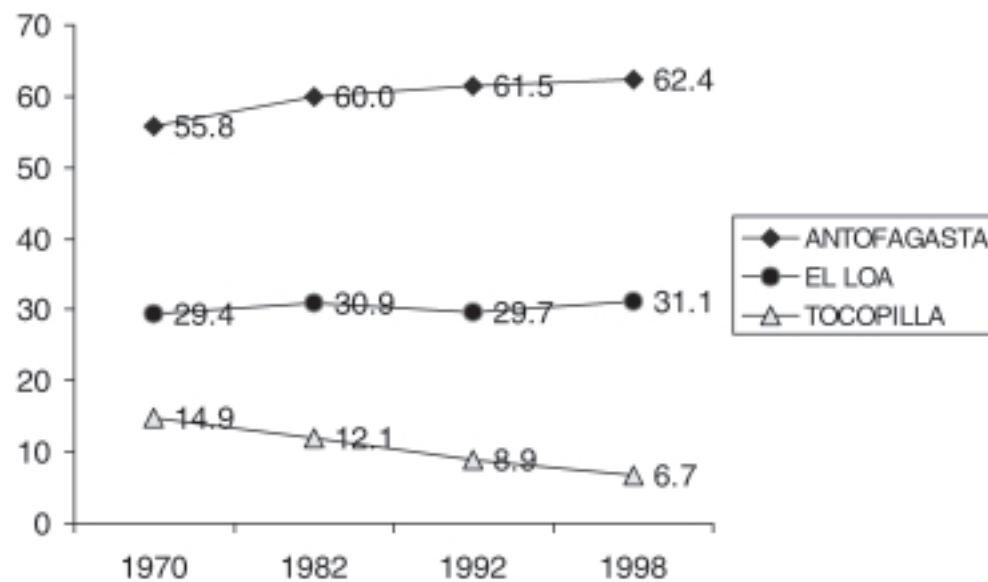
El Loa Province has maintained a stable labour force, mainly due to the copper mines of CODELCO located here. However, rural populations in the foothills of the Andes are suffering from water scarcity and rising water prices due to the growing demand from the mining industry in the

province, and from urban areas, including the Antofagasta metropolitan area. The increasing water scarcity has accelerated the decline of the region's subsistence agriculture. Loss of income from crops deepens the dependence of subsistence farmers on the meager public assistance benefits available. Migration patterns between regions seem to indicate that a concentration, similar to that around Santiago, is occurring around the city of Antofagasta, and to some extent around Calama (the provincial capital), which has been called a "dormitory city".

##### 5.1.2. Tocopilla Province

In the province of Tocopilla, with an economy based on small and medium scale mining, fisheries, harbour activities and energy production, the labour force has shrunk. Complaints from communities about high levels of unemployment and lack of clear economic prospects for the future, especially from the town of Tocopilla, have been reported in the media. The negative effects of declining copper prices on small mines were especially apparent in this province, but the phenomenon was nationwide. It is estimated that out of the 4000 small-scale mines that





**Figure 3.** Share of each province (%) in total regional labour force  
 Sources: For 1970–92: Candia and Molina (1998); for 1998: MIDEPLAN (2001).

existed in Chile in 1990, only 500 were still in operation by 1999, and out of the 30 medium-sized mining enterprises, only six were still working (El Mercurio de Antofagasta, 2000a). In Tocopilla Province, small mines were severely impacted by the fall in copper prices, and unemployment rates soared. An acute social crisis followed, of which the repercussions are still being felt today. Civil disturbances included a near boycott of the October 2000 municipal elections. In addition, Tocopilla City suffers from marine pollution, primarily caused by effluents from mining activities in the region, which have flowed unabated into the ocean for more than 20 years. Another form of environmental degradation in the area is air pollution from the recently initiated production of cheap energy from pet-coke (see Annex).

### 5.1.3. Antofagasta Province

The province of Antofagasta, seat of the regional capital and the centre of the large-scale private mining industry, shows a steady increase in the labour force from 1970 to 1992. According to statistical data, economic growth further accelerated after 1992, especially after the start-up of the Escondida Mine. The statistical data are supported by proxy indicators, such as the rise in car ownership in the city of Antofagasta, which had doubled between 1985 and 1995 (Arroyo and Ponce, 1998). From 1998 onwards, the recession set in. Repercussions of the Asian economic crisis accelerated the fall in the price of copper brought on by Chilean overproduction. The world economic situation had very serious consequences for the city of Antofagasta, where the ensuing economic slowdown soon resulted in widespread unemployment.

However, economic growth has also been uneven within the province of Antofagasta. Some 300 km south of

Antofagasta City, lies the small port of Taltal, which has had a depressed economy for many years. The situation has provoked repeated public protests and civil demonstrations from the inhabitants. On the other hand, economic hardship has had the positive effect of knitting the different social groups closer together. According to estimates by local authorities, unemployment reached almost 40% in 1999, mainly as a result of the copper crisis, which severely affected small mines, as discussed above. The unemployment figure would have been much higher had it not been for the emergency work programmes financed by the public sector, and the emigration of a good portion of the population.

### 5.2. Environmental stress

El Loa Province is home to the largest open face copper mine in the world, CODELCO's Chuquicamata mine (state owned), not far from the provincial capital of Calama. The operation includes a labour camp and processing plants. These are currently undergoing technological modernization in view of the serious pollution affecting nearby Calama.<sup>11</sup> In recent years, CODELCO, in joint venture with private capital, has begun exploitation of several new copper deposits in the vicinity, which has allowed the region to maintain its economic momentum. In a long-term strategy to compensate for the eventual depletion of its currently active mines, CODELCO is currently seeking associates in neighbouring countries, looking to become a mining

<sup>11</sup> As the mining camp at Chuquicamata does not comply with standards laid down in Chile's environmental law, CODELCO has decided to close it. The 20,000 people currently living at the camp, being workers and their families, will be transferred to Calama by 2002.

**Table 6. Area under cultivation and livestock holdings in San Pedro de Atacama (El Loa Province) in 1961, 1987 and 1993**

Crop/livestock	Crops (ha) and livestock in 1961	Crops (ha): 1987 Livestock: 1993
Alfalfa	801	354
Corn	147	98
Wheat	175	83
Vegetables	–	7
Fruit	32	7
Pulses	53	–
Not under cultivation	547	603
Number of animals	11,396	3410

Source: Chechere and Soufi (1994).

transnational for the development of mineral deposits in the Latin American region.

Alongside the mining industry, a small agricultural sector still survives in El Loa, both at the subsistence and small-scale commercial levels. Since this is a desert region, contamination and shortage of freshwater are serious problems. Agriculture depends on irrigation from local rivers or streams from ice melt. However, river flows have almost dried up, evidence of the hydrological collapse of the area, to which unsustainable extractions by the mining industry and the Antofagasta drinking water company are major contributing causes. The exacerbated water scarcity has also hastened soil erosion (Rosales and Herrera, 1998). Table 6 shows the gradual decrease in cultivation and livestock holdings between 1961 and 1993.

Environmental legislation in Chile was initiated in 1994 and approved one year later with the enactment of the basic law for the environment<sup>12</sup>. The absence, until this recent law, of regulatory guidelines, together with the perception of the area as an uninhabited desert, has fostered a mentality in the Antofagasta mining region that frequently does not look upon environmental degradation as a constraint, but as an economic opportunity. The tremendous increase in mining and mineral production has exacerbated existing environmental problems, such as water scarcity, as impacts accumulated over decades have gradually risen to a new level. The Annex lists some of the environmental problems in the Antofagasta Region. In recent years, these have not only alarmed the local population, but also prompted the Deputy's Commission on the Environment to declare the region an environmental risk zone.

### 5.5. Fisheries

Another symptom of Antofagasta's environmental ills and of its unbalanced economic development is the precarious state of its fisheries, mainly from over-exploitation.

<sup>12</sup> Law 19.300, enacted on 9 March 1995.

Throughout the country, the Chilean economic model, based almost exclusively on the export of natural resources, has engendered problems of environmental sustainability, not only in the mining sector, but in other export sectors, such as forestry (in the south of Chile) and fisheries (Claude, 1997).

Marine fisheries played an important role in the rapid growth of Chile's exports, but this growth has had a negative impact on the stocks of the principal species. Thus, the Spanish sardine is now considered to be endangered; its biomass, that was estimated at approximately 8 million tonnes at the beginning of 1985, had fallen to 1 million tonnes by 1991, and to a mere 310 000 tonnes by 1993 (Claude, 2001). Another example of fisheries decline is the jurel industry. In its prime, this activity represented 55% of Chile's fisheries, with landings in the order of 4.4 million tonnes in 1995. From 1996 onwards, landings gradually declined and stood at 1.2 million tonnes in 1999 (Gauer and Andrade, 2000).

In the 11-year period between 1987 and 1998, (see Figure 4) there has been a serious decline in fish landings in the Antofagasta Region. Fisheries was an important part of the local economy in communities such as Tocopilla, Mejillones and Taltal, and the crisis during the 1990s contributed strongly to the elevated levels of unemployment and poverty in these communities, as this economic activity was not replaced by new industries. Thus, the decline in fisheries has exacerbated the economic disequilibrium and the state of social malaise in the area, and also forced large numbers of local residents to emigrate.

The overexploitation of Chile's marine resources led to a confrontation between the local fishermen and the fish exporting industry. The government, in consultation with large industries, designed new temporary laws concerning fishing rights during the "emergency period". These laws authorised the exporting industry to fish in zones in northern Chile that had been previously reserved only for local fishermen. The conflict peaked with violent protests and road blockades during the second part of 2000.

Figure 5 presents a graphic illustration of statistical data regarding people's fear of negative health impacts from environmental contamination. Levels of fear are higher for northern Chile.

## 6. Proposed interregional mineral-industrial cluster

The regional government of Antofagasta, recently appointed by President Ricardo Lagos<sup>13</sup>, has proposed a new economic strategy for the region. This strategy involves the forming of a mineral-industrial cluster: a network of enterprises that

<sup>13</sup> President Lagos (Socialist Party) was recently elected for the period 2000–2006 by the political coalition that had governed Chile since 1990. The strategy was formulated by the region; however, regional governments in Chile are appointed by the President of the Republic.

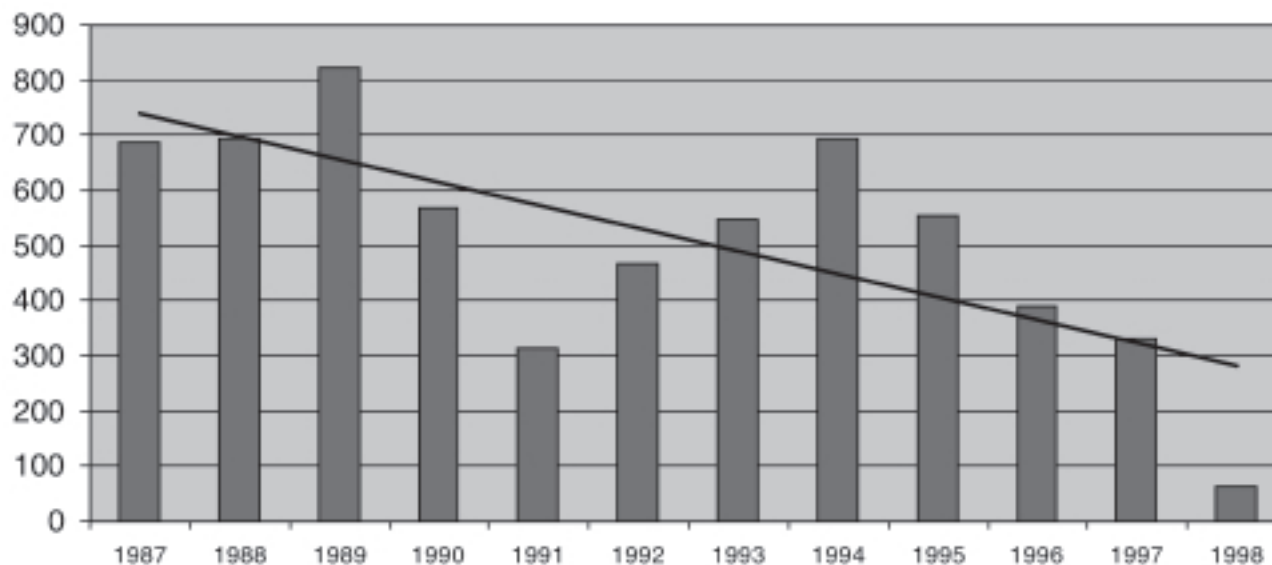


Figure 4. Fish landings in the Antofagasta Region 1987–1998 (in thousands of tonnes)  
Source: INE (2001).

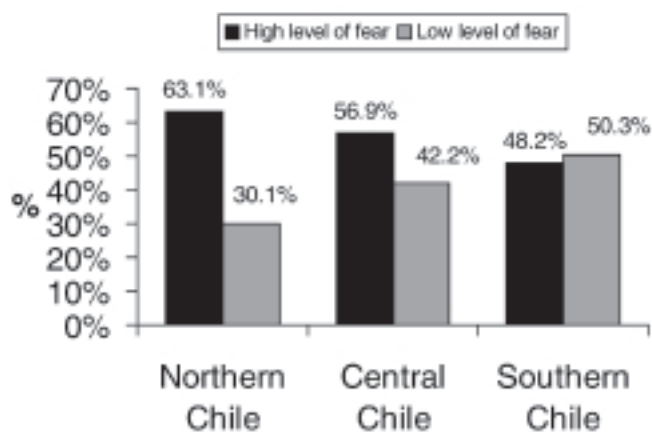


Figure 5. People's fear of negative health impacts from environmental contamination  
Source: UNDP (1998).

mutually strengthen one another through purchase/sales of related services. The cluster configuration allows participating enterprises to benefit from economies of scale and share technical innovations. The cluster concept is intended to strengthen the regional economy through:

- Promoting linkages between small enterprises that provide goods and services to the large mining companies; and
- Creating enterprises that manufacture products using copper extracted by the large mining companies.

#### 6.1. Promoting linkages between small enterprises

The main barrier to the first point above is that existing local enterprises have neither the requisite professional ability nor access to cutting-edge technology, being largely

small and medium enterprises (SMEs), often family-owned, and lacking a scientific staff. It is therefore natural that the proposal aims mainly to improve the capacity of SMEs through regional linkages to serve the existing wealth-creation process of the mining sector.

To raise the level of capacity of the SMEs would require both time and money. Some of them have managed to raise their professional level, improve their technologies, and modernize their equipment, wisely taking advantage of the boom during the 1990s (Saura, 2000). But it is most unlikely that the majority of these small enterprises will have access to increased resources, since they exist precisely because they charge very low prices, making just enough profit to recover their costs. These subcontractors in the mining sector are under very heavy competition from both within and outside the region. Demand for their services is irregular, which makes it difficult for them to become specialized. In addition, it is difficult for them to obtain financing from banks (Bustos and Franco, 1996). It is more likely that the proposal will lead to a continuation of the process of internal polarisation within the subcontract sector. Subcontractors tend to fall into two categories. A mere handful of enterprises manage to benefit, as they are able to increase their market share and earn a larger profit. A second group, the great majority, capture only a very small share of the market, make small profit margins, and when they do not serve the major mining industry, they work for large-scale subcontractors based outside the region.

The mining industry has not been able to create a new industrial sector. Based on an input/output matrix over the region, Aroca (2001) indicates that the Antofagasta mining sector has only limited backward and forward linkage with other sectors of the economy. The impact of the mining sector on incomes indicates that for each US dollar produced,

9% goes to the workers of the mining sector and between 7 and 15% to workers of other productive sectors in the region.

### 6.2. Creating a manufacturing industry using copper

Implementation of this policy would most likely increase revenues for the Antofagasta Region. However, it does not seem likely that such a strategy will be introduced at this time. There are two reasons why the Government of Chile is not creating enterprises (directly or indirectly) to refine copper ore, or new enterprises that could manufacture goods based on copper. First, Chile's current policy is to reduce direct state involvement in the productive economy. Second, policy instruments required for the establishment of a domestic copper refining industry, or the manufacture of copper-based goods, are not in place. Such a policy could include conventional economic measures for the industrial sector, such as selective or cheap loans for manufacturers of export products; selective income tax on FDI to enhance domestic manufacture of goods for export; and other incentives.

In fact, the value differential of refined copper compared to unprocessed ore has fallen since the mid-1980s: in the period 1986–1990, refined copper constituted 69.3% of Chile's copper exports, but this share fell to 60% in the subsequent seven-year period (1991–1998) and stood at 62.2% in 1998. Also, in 1998, the value of exports in US dollars of products manufactured in Chile made of copper was only 2.1% of total copper exports (Lagos, 1999).

Further, the proposed industrial cluster needs resources that do not exist today due to the fact that mining transnationals leave an insignificant portion of their earnings in Chile. Otto *et al.* (2000) estimate that tax rate for foreign mining companies operating in Chile is much lower than in other countries (see Table 7). In 1996, private mining

companies paid a total of 29% taxes on profit. Information about taxes in mining is not publicly available; however, such information was obtained from an investigation conducted by Senator J. Lavandero. The investigation found that the Company Minera Disputada Las Condes Ltda, until 1998 the second largest foreign copper mining enterprise in Chile, did not pay a single dollar in taxes to the Chilean State during 20 years of operation, as it declared as expenditure interest paid on a loan from its proprietor, Exxon Overseas Investment (Alcayaga, 1999).

It should be recognized here that among programmes undertaken by mining companies to benefit local communities in the Antofagasta Region, the most important are those of Minera Escondida, which include the creation of a foundation to finance projects in education, health and technology. Nevertheless, those programmes do not address the question of long-term economic sustainability for the region beyond the life of the copper deposits.

## 7. A new strategy for the development of the Antofagasta Region

As stated earlier, the explosive growth of investment in mining and subsequent steeply increased production has generated a nexus of problems, which could be summarized as:

- Deterioration in employment conditions;
- Geographically uneven development;
- Environmental degradation; and
- Low level of mining rent.

This regional situation occurs in a general context of income inequality in Chile, which increased after 1973 (Cademartori, 1998). Official statistics reveal (Encuesta CASEN) that in 1988, 56.9% of total national income was captured by families in high income brackets, after monetary subsidies, constituting 20% of the population, while 43.1% of national income was distributed among the remaining 80% (Martner, 1999).

These real losses in quality of life values do not show up in the first indices human development indexes currently being used (and even less so in conventional macroeconomic statistics), as the traditional model of wealth, and basic GDP statistics, implicitly associate the idea of development with growth, measured as a function of production of goods per capita.

To move towards a socio-economically more balanced and ecologically sustainable situation, the author proposes the following policies and measures for the Antofagasta Region.

### 7.1. Creating a sustainability fund

It is proposed that mining companies active in the Antofagasta Region pay an additional duty for the benefit

**Table 7. Average income tax rates for mining companies in different countries**

Country	Average tax rate <sup>a</sup>
Argentina	40.0
Bolivia	43.1
Burkina Faso	83.9
Canada <sup>b</sup>	63.8
Chile	36.6
China	41.7
Mexico	49.9
Peru	42.8
USA <sup>c</sup>	49.9
Uzbekistan	62.0
Zimbabwe	39.8

Source: Otto *et al.* (2000).

Notes: <sup>a</sup> The average tax rate has been calculated by dividing the sum of all government receipts by the sum of all cash flows before taxes, without taking into account the date of currency valuation. The model used was based on a copper project, assuming that production costs and sales were identical in all countries, and that reserves would be depleted after 19 years.

<sup>b</sup> State of Ontario; <sup>c</sup> Arizona

of the region's economic development, into what could be called a Regional Sustainability Fund. The justification for such a fund is that the sustainability of economic development in mining regions requires that part of the revenues of mineral exploitation is dedicated to the formation of capital in the region. This conversion of natural capital into other forms of capital should guarantee a permanent income at the regional level. A number of other authors have elaborated formulas to calculate the real value of the natural capital, or the part of the rent that should be invested into capital formation, possibly in the form of a sustainability fund. Thus, in the case of a non-renewable resource, Hartwick and Long Ngo (1999) have shown that investing the rents accruing from resource extraction in other types of capital is sufficient to maintain a constant consumption path. Moreover, an additional tax makes economic sense in view of the very low levels of taxation in Chile compared to mineral taxation in other countries (see Table 7). This duty would be levied on the net sale price of all goods and services purchased in the region (and other spillover items); this would correspond approximately to the portion of a company's earnings that is being exported. The author suggests that such a fund should be used to finance regional projects to build up a productive capacity to sustain the regional economy once the copper deposits are depleted. Such projects should consider:

- New manufacturing industries based on minerals;
- Inputs for the international mining industry; and
- New initiatives towards an export industry that does not depend on copper mining.

Current public expenditure in the Antofagasta Region does not exceed \$US 100 million per year, and is confined to local and regional infrastructure, education, health and capacity building. Compared to this, BHP recently invested \$US 1 billion for 2000–2001 in its Escondida Mine, to enable the mine to increase its annual production of copper concentrate from ore with less than 50% copper content from 800 to 1200 million tonnes per year.

According to the author's preliminary calculations (See Table 8), a tax rate on the order of 5%–10% of the exportable surplus would be sufficient to finance the sustainable management of the region's natural resources. This tax rate would translate to receipts into the sustainability fund of between \$US 117 million (5%) and 234 million (10%) per annum (see Table 8).

### 7.2. Organization of water rights

Chile possesses abundant water resources in its central and southern regions. Antofagasta, however, is a desert region with scarce water resources. An old national water law is currently in force throughout the country, under which water user rights, once granted for industrial purposes, may be used by the beneficiary free of charge. This has led to

**Table 8. Estimated income basis for regional sustainability fund**

	% 1995	Average 1995–98 (millions dollars)
Sales of mineral	100.0	4503
Purchases in the region	(19.0)	856
Wages	(10.0)	450
Indirect taxes	(3.0)	135
Direct taxes	(16.0)	720
Subtotal	(48.0)	2161
Surplus	52.0	2341
Sustainability fund tax (10%)	(5.2)	234
Sustainability fund tax (5%)	(2.6)	117

Source: Author's elaboration based on *Antofagasta Input/Output Matrix for 1995* (Aroca, 2000).

a situation where water rights can be leased at a speculative price, can remain unused for long periods of time, and can be resold. In Antofagasta, water rights are usually sold to the major mining companies. In these transactions, the government does not receive any income<sup>14</sup>.

Since water is a strategic economic resource and scarce in the region, the author is suggesting that it must generate a revenue flowing to the government. The revenue from sale and/or lease of water rights could be deposited into the regional sustainability fund and would thus enable the government to finance regional water management (conservation and treatment) programmes. The rates charged for water should be proportionate to the income of the industry that uses it and should reflect its net opportunity cost, after discounting exploration costs. Current holders of historical water rights could be exempt from such charges as long as they do not sell their rights.

### 7.3. Establishment of an industrial development bank

It is suggested that the regional sustainability fund could be invested in an industrial development bank, working together with regional government institutions which would be responsible for funnelling regional savings to investment projects with high impact in terms of added value, equitable distribution of income and concern for the environment. The Antofagasta Region does not currently have any bank specialized in industrial projects for the long-term development of the region. The author believes that in order to fulfil its social responsibility, such a bank must be owned jointly by both government and private interests, with 51% in the hands of the government and 49% held by representatives of small enterprises and social institutions.

<sup>14</sup> This situation discriminates against domestic users since the law requires water supply companies (in the process of being privatized) to include in the price to users the estimated economic value of the resource in its natural state (see Cademartori, 2001).



#### 7.4. *Revising the rules for foreign direct investment*

At the moment, no regulations exist that allow FDI to be used as a lever to create value added within the country. Therefore, the major portion of the incoming capital flow continues to be directed towards the exploitation of raw materials. It appears necessary to impose taxes, customs duties and tax refunds on value added and to distinguish between FDI flows directed towards extraction of raw materials, and FDI flows that are invested in the production of value-added goods and services. In parallel, the calculation of the foreign investor's tax base should recognize as expenditure only salaries for permanent and unionized labour — this provision would serve to protect workers' rights and guard against unsustainable labour practices. Tax laws should be coordinated with other commercial partners and perhaps neighbouring countries in Latin America to avoid "tax dumping".

#### 7.5. *Stamp of social approval*

Companies that regularly uphold workers' rights should be able to be certified in a way that improves their public image. Such certification could be awarded by public institutions that have responsibilities in labour related public affairs, such as union issues, matters related to labour law, etc. To obtain certification, multinational corporations and their subcontractors would have to prove that their practices are in compliance with international conventions and guidelines laid down by the International Labour Organisation (ILO). Unions could provide information and training to companies that wish to explore such standards. On their part, state enterprises and state financed programmes should incorporate the concept of a social seal of approval into the criteria for selecting companies to execute publicly funded projects.

#### 7.6. *Tax system for geographic decentralisation*

The current tax system in Chile is neutral with respect to the geographic location of businesses within the country. This has led to the agglomeration of industries in the metropolitan area of Santiago (Mattos, 1996), which in turn has led to increased environmental costs, e.g. from pollution. In order to promote a balanced geographic spread of economic development throughout the country, the author is suggesting that corporate income tax needs to be weighted on a geographic basis. The current uniform tax rate should be replaced by a system that imposes a surcharge on industries located in the Metropolitan Region, and a discount to those located in less congested areas.

#### 7.7. *A new role for state-owned copper mining companies*

A recently proposed new plan of "modernization" of CODELCO consists of establishing alliances with trans-

national companies to explore for new deposits and exploit new mines in Latin America. However, such a strategy promises to persist in the long standing error of overspecialization in the export of raw material. Instead, the author proposes that CODELCO's development plan should be oriented towards developing new businesses that incorporate long-term added value into the production chain. Another beneficial role that CODELCO could embrace would be to take the lead in reorganizing the World Association of Copper Producers to control annual world copper production, so that overproduction can be avoided, and stable prices maintained, pegged to the cycles of the world economy.

## 8. Conclusion

This article has analyzed the socio-economic and environmental consequences of the expanding activities of transnational mining corporations in the Antofagasta Region in the North of Chile. As a result of the expansion of the copper mining industry, this region experienced a higher than average economic growth from 1990 to 1998 compared to other regions in Chile, a country considered by international agencies, such as the World Bank and the International Monetary Fund, to be an exemplary open market economy. The region's spectacular economic growth occasioned certain economic and social statistics to show very positive results for Antofagasta.

However, the first UNDP human development index to directly measure people's own perception of their quality of life (SHSI), shows that the Antofagasta Region is not better off than other regions in Chile, and that a majority of people throughout the country experience a sense of malaise.

This article has sought to clarify the causes of this uneasiness in the region of Antofagasta. First, the competitiveness of the mining industry in the region has increased, partly as a result of increased use of subcontracted labour, which has lowered the quality of new employment opportunities created in the 1990s. Second, the accelerated rate of mineral production, with its intense use of natural resources, has caused damage to the environment, and was a major factor precipitating the fall in world copper prices. The overexploitation and exhaustion of environmental resources have caused a general economic crisis, affecting the populations of many small towns in the region.

These negative effects are not being compensated for by the income from the region's rich copper deposits, since taxes imposed on the major mining industry are low. Nor has much progress been made in terms of processing the ore or manufacturing goods from copper, as only weak linkages have been established between the mining companies and the enterprises providing inputs.

In 2000, Antofagasta's new government proposed a new strategy for the successful industrial development of the region, not dependent on a non-renewable natural resource, such as copper. However, it is argued here that this strategy





will not by itself bring about a fundamental change, since it lacks a financial basis.

This article has proposed a series of measures, including: the establishment of a regional sustainability fund to finance new local industries based on copper; changes in the rules governing foreign direct investment; regulations for use of local water resources; the establishment of a new industrial taxation system that encourages industries to locate in regions far from the capital; a special role for Chile's state-owned copper company; and greater control over the labour market.

This article has not addressed the political aspects of implementing the proposed policies. To bring about such changes will obviously require the active political engagement of the local population in the region. However, the people in Antofagasta are fairly well aware of the fragility of the existing economic structure; they still remember the demise of the nitrate industry in the 1930s and the ensuing economic crisis. Thus, in comparison to other regions in Chile, the political climate in Antofagasta is relatively more favourable towards change.

#### Annex

##### Recent environmental problems in the Antofagasta Region.

Source: El Mercurio de Antofagasta (See [www.elmercurioantofagasta.cl](http://www.elmercurioantofagasta.cl))

#### Environmental effects

##### Pollution of the Loa River (1997)

The Loa River crosses the Atacama Desert and flows into the Pacific. Chemical analyses revealed the presence of arsenic in the river; concentrations ranged from 20 to 31 milligrams/litre, considerably higher than the normal concentration from 1 to 1.5 milligrams/litre. Initially, the presence of copper in the water had been discovered. Also, the water had strongly reduced oxygen levels, which was believed by scientists to be the reason for the death of ecosystem species. High concentrations of arsenic, lead, copper and cadmium were registered, among other heavy minerals.

##### Lead pollution (1998–2000)

High levels of lead were detected in the blood of people working directly with this metal and in the neighbouring population in the port of Antofagasta City. Registered levels ranged from 10 to 44 milligrams of lead/ 100 milligrams of blood. The acceptable norm is up to 15 milligrams. Some children displayed organic changes with irreversible damage at the neurological level. Health damages from lead pollution include: low red bloodcell count; sterility; hormonal malfunctions; stunted growth; hyperactivity; memory loss; and aggressiveness. Lead adheres to bones and the brain.

##### The pet-coke affair (1999–2000)

Residents in Tocopilla have complained about breathing difficulties caused by a black substance accumulated in the forecourt of the Electroandina Company. This substance is burned to produce electricity for Tocopilla City, and currently one more company plans to set up a similar production in the town of Mejillones. The toxicity of the compound, called "pet-coke", a residue of petroleum and coal, has been evaluated, and is considered carcinogenic by the Antofagasta Health Services due to its high nickel and vanadium content. The low international price of pet-coke (\$US 1/tonne at a sulphur content of 6–8%) derives from the fact that it is prohibited in the countries that export it.

#### Antecedents

This is the third case of serious contamination of the Loa River. The first occurred in December 1996, when 13,000 litres of sulphuric acid and copper effluents were spilled by Codelco's El Abra Mine after one of the lixiviation batteries broke. The second happened in March 1997, when a dark spot was observed on the Loa River accompanied by foam and a bad smell; the death of a large number of fish followed the event. The third was due to the breakage of the Sloman floodgate (October 1997) that caused a sediment spill of heavy materials. In all three cases, authorities have denied any connection to mining, attributing the contamination to natural causes.

Since 1904, Chile has an agreement with Bolivia to transport Bolivian merchandise through Chilean territory to a port on the Pacific Ocean. Lead is transported by the Antofagasta-Bolivia Railroad, which is owned by the Luksic Group (one of the most powerful in Latin America.) The Railroad denies its legal responsibility. After two years of litigation, the sanitary authority of Antofagasta prohibited the transit and storing of lead shipments. The stock of lead is transferred out of the urban radius. The Medical Association of Chile announced that it would lodge a formal complaint. The outcome of the Court of Appeals prohibited the railway from handling the lead unless contained in bags or sealed containers. Nevertheless, no fines for the railroad company have been imposed.

Three large electrical companies have invested to create capacity to produce a power supply greater than current demand from the mining industry; this has resulted in a price war and competition to produce at low costs. The three companies are: Norgener Company, owned by the Spanish holding company ENDESA; the Edelnor Company, owned by American Mirant, with three power stations in the North of Chile; and a third enterprise that produces electricity from natural gas, from the new Argentinean-Chilean pipeline. This company has criticised its thermoelectric competitors for using pet-coke. The Antofagasta Health Services and the deputies of the Parliament's Environment Commission have condemned the import of pet-coke. The companies protested since pet-coke had already been authorised, and produced a study, which tries to show that pet-coke is not toxic at prevalent concentrations. In addition, the companies argued that the substance had been authorised in other parts of Chile. The new regional government authorises the use of pet-coke and criticises those who "do not recognise the regional autonomy."

#### References

Alcayaga, J., 1999. *El libro negro del metal rojo*. Aremi Ediciones, Santiago, Chile.

Aroca, P., 2000. Programa de simulación EVI para la Matriz Insumo Producto de la Región de Antofagasta. Mimeo. Instituto de Economía Aplicada Regional, Universidad Católica del Norte, Antofagasta, Chile.



- Aroca, P., 2001. Impacts and development in local economies based on mining: The case of the Chilean II Region. *Resources Policy* 27: 119–134.
- Arroyo, M., Ponce M., 1998. Proyección del crecimiento del parque vehicular de Antofagasta. Informe de Investigación. Departamento de Economía, Universidad Católica del Norte, Antofagasta, Chile.
- Agacino, R., González, C., Rojas, J., 1998. *Capital trasnacional y trabajo: el desarrollo minero en Chile*. LOM Ediciones (www.lom.cl), Santiago, Chile.
- Bustos, M.T., Franco, V., 1996. Caracterización de los encadenamientos productivos y bases de la competitividad de las empresas subcontratistas del área metalmeccánica en la ciudad de Antofagasta. Memoria de título de Ingeniería Comercial, Universidad Católica del Norte, Antofagasta, Chile.
- Cademartori Jan, Lufin, M., Alvarez, F., Vial, J., 1995. Valor del Recurso Hídrico Región de Antofagasta. Informe de Investigación, Departamento de Economía, Universidad Católica del Norte, Antofagasta, Chile.
- Cademartori, Jan, 2001. Consecuencias negativas de la concesión de la empresa de agua potable ESSAN S.A: a privados. *Revista O'Tempora*, 1, Septiembre. Universidad José Santos Ossa, Antofagasta, Chile.
- Cademartori, José, 1998. *Chile: el modelo neoliberal*. Ediciones Chile América-CESOC, Santiago, Chile.
- Candia, C., Molina, X., 1998. Distribución espacial de la actividad productiva y localización de la firma industrial en las firmas de la II Región. Seminario de Título Ingeniería Comercial, Universidad Católica del Norte, Antofagasta, Chile.
- Caputo, Orlando, 1996. La producción mundial de cobre creada por Chile y su impacto en la economía nacional. Mimeo. Universidad ARCIS-CETES, Santiago, Chile.
- Caputo, O., Lavandero, J., Riesco, M., 2000. Conclusiones del Seminario: Hacia una Política Nacional del Cobre en el Senado de Chile. Mayo 2000. Mimeo. Universidad Arcis. Santiago, Chile.
- Caputo, O., Radrigán, J., Galarce, G., 2001a. La sobreproducción mundial de cobre creada desde nuestro país y la crisis de la Economía Chilena: Agotamiento del Modelo. Centro de Estudios sobre Trasnalización, Economía y Sociedad (CETES), Santiago, Chile. July.
- Caputo, O., Radrigán, J., Galarce, G., 2001b. Manifiesto del Cobre. Centro de Estudios sobre Trasnalización, Economía y Sociedad (CETES), Santiago, Chile. July.
- Cheehere, E., Soufi, W., 1994. Diagnostic agraire de l'oasis de San Pedro de Atacama, Chili. Memoire pour l'obtencion du Diplome d'Ingenieur Agronome. Institute National Agronomique, Paris.
- Claude, Marcel, 1997. Una vez más la miseria ¿ Es Chile un país sustentable?. LOM Ediciones, Santiago, Chile.(www.lom.cl)
- Claude, Marcel, 2000. Carencias de la vía chilena al desarrollo. www.chile.sustentable.net
- COCHILCO, 1999. Impactos Sociales de la Minería Privada en Chile. Mimeo. Comisión Chilena del Cobre, Santiago, Chile.
- COCHILCO, 2001. www.cochilco.cl.
- De Mattos, Carlos, 1996. Avances de la globalización y la nueva dinámica metropolitana: 1975–1995. *Revista Eure* 65: 39–63. Instituto de Estudios Urbanos de la Universidad Católica de Chile, Santiago, Chile.
- De Laire, Fernando, 1999. La trama invisible o los claroscuros de la flexibilidad. Cuaderno de Investigación N° 8. Departamento de Estudios, Dirección del Trabajo. Santiago, Chile.
- Echeverría, Magdalena, 1997. Subcontratación de la producción y subcontratación del trabajo. *Revista Temas Laborales*, Año 3, N° 7, Septiembre. Dirección del Trabajo, Departamento de Estudios, Santiago, Chile.
- El Mercurio de Antofagasta, 2000a. *Revista Norte Minero*, pp. 9–11, January.
- El Mercurio de Antofagasta, 2000b. Corporación de Bienes de Capital. 15 December. (www.mercurioantofagasta.cl).
- Fazio, Hugo, 1997. Mapa de la extrema riqueza en Chile. Lom Ediciones, Santiago, Chile.
- Gauer, K., Andrade, C., 2000. Uso y abuso de nuestros recursos pesqueros. *Revista Ambiente y Desarrollo*, 4. Diciembre. CIPMA, Santiago, Chile.
- Hettne, B., 1990. *Development Theory and The Three Worlds*. Longman Scientific and Technical, Harlow, UK.
- Hartwick, J.M., Van Long Ngo, 1999. Constant Consumption and the Economic Depreciation of Natural Capital: The Non-autonomous Case. *International Economic Review*, 40(1), February.
- INE (2001): www.ine.cl.
- Lagos, Juan Francisco, 1999. Chile, exportador de cobre en bruto: una involución en la composición de las exportaciones de su principal riqueza minera. *Revista Economía y Trabajo*, 9: 27–57.
- Martner, Gonzalo Daniel, 1999. Gobernar al mercado, las nuevas fronteras del Estado en el Siglo XXI. LOM Ediciones (www.lom.cl), Santiago, Chile.
- Meller, Patricio, 1990. Una perspectiva de largo plazo del desarrollo económico chileno, 1880–1990. In Meller P., Blomstrom, M. (Eds), *Trayectorias Divergentes: Comparación de un siglo de desarrollo económico latinoamericano y escandinavo*. Editorial Universitaria, Santiago, Chile.
- Minera Escondida Ltda., 1998. Annual Report and Financial Statements Fiscal Year 1998.
- MIDEPLAN, 2001. www.mideplan.cl.
- Max Neef, M., Elizalde, A., Hopenhayn, M., 1993. *Desarrollo a Escala Humana*. Publicaciones Icaria, Barcelona.
- Otto, J., Batarseh, M.L., Cordes, J., 2000. Global Taxation Comparative Study. Second Edition. Institute for Global Resources Policy and Management, Colorado School of Mines, Golden, Colorado.
- Rosales, U., Herrera, P., 1998. Diagnóstico y recomendaciones estratégicas para el Sector Agrícola de Antofagasta. Memoria para el título de Ingeniero Comercial. Facultad de Economía. Universidad Católica del Norte, Antofagasta, Chile.
- Sen, Amartya, 1989. Development as capability of expansion. *Journal of Development Planning*, 19.
- Sen, Amartya, 1998. Capacidad y Bienestar. Editorial. In: Nussbaum M. C., Sen, A. (Eds), *La calidad de vida*. F.C.E., Ciudad de México.
- SERPLAC II Region, 1998. I Taller de Coyuntura Económica Regional. Documento de Trabajo para el Foro de Desarrollo Productivo Regional. Antofagasta, Chile. October.
- SERNAGEOMIN, 1987–1997. *Anuario de la Minería*. Servicio Nacional de Geología y Minas. Ministerio de Minería, Santiago, Chile.
- Seura, Sergio, 2000. El concepto de empresa en las metalmeccánicas y contratistas de la Gran Minería de la Segunda Región de Antofagasta. Seminario de Título Ingeniería Comercial. Universidad Católica del Norte, Antofagasta, Chile.
- SUBDERE, 1998. Informe sobre Competitividad Regional. Subsecretaría de Desarrollo Regional, Ministerio del Interior, Santiago, Chile.
- United Nations Development Programme (UNDP), 1996. *Human Development Report in Chile — Year 1996*. (In Spanish). UNDP, Santiago, Chile.
- United Nations Development Programme (UNDP), 1998. *Human Development Report in Chile — Year 1998. The Paradox of Modernization*. UNDP, Santiago, Chile. March.
- United Nations Development Programme (UNDP), 1999. Índice de Desarrollo Humano en Chile 1990–1998. Temas de desarrollo sustentable. Report N° 3. UNDP, Santiago, Chile.
- United Nations Economic Commission for Latin America and the Caribbean (ECLAC), 2000. Panorama Social de América Latina 1999–2000. United Nations/ECLAC, Santiago, Chile. August.