

A stylized map of Chile is shown in a light teal color. Overlaid on the map are several concentric, semi-circular lines representing seismic waves emanating from the central-southern part of the country. The map is partially obscured by a horizontal teal band that contains the title text.

# The Chilean earthquake of 27 February 2010: an overview



UNITED NATIONS

ECLAC

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The boundaries and names shown on this map do not imply official endorsement or acceptance by the United Nations.

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# 1. Introduction

This report highlights some of the key macroeconomic implications of the massive earthquake of magnitude 8.8 Mw that hit the Chilean Coast on 27 February 2010 and attempts to provide some prospective lines and reconstruction scenarios based on currently available official information.

The usual caveats apply and the information provided here should be used with caution as the scenarios presented in this report were simulated by means of comparative static techniques and lack the dynamics and sectoral inter-linkages of more sophisticated and complex modelling tools. However, they serve the purpose of presenting different reconstruction scenarios and financial gaps which are built upon different assumptions and levels of government expenditure and public debt. The report does not aim at providing a full-fledged assessment of the total damage and losses of the catastrophe since the primary information is not yet available and the emergency, rescue and search activities are still under way.

For the past thirty five years, ECLAC has cooperated with governments in Latin America and around the world in assessing —with the methodology developed by ECLAC itself— the socio-economic incidence of climate and other extreme events that result in catastrophes. One of the main findings and characteristics common to all natural events is that damage estimates calculated shortly after the disaster tend to be significantly overestimated as opposed to calculations which follow a thorough methodology based on consistency-stock-flow analysis techniques and a sectoral inductive bottom-up-approach.

In principle, one can identify several sources of loss from natural events. For the purposes of this report and on the basis of the evaluation criteria established by ECLAC, we distinguish between direct damage, defined as damage to assets that are impaired, immobilized or destroyed and to stocks, including final goods, goods in process, raw materials, inputs and spare parts; and losses (sometimes referred to as indirect damage) defined as a disruption of economic activity which may lead to loss of income or production, a curtailment of the flow of goods and services that cease to be produced or provided from the moment a disaster occurs and potentially until the rehabilitation and reconstruction process has been completed.

A number of empirical studies and evaluations conducted by ECLAC as well as other research and academic institutions on the impact of natural disasters distinguish between short-term and medium-term impacts. The most common finding of these studies is an immediate contraction in output and a worsening of external and fiscal balances as well as an increase in poverty and short-term spikes in price levels. The final impacts are ultimately country-specific and depend on the economy's structural conditions and more decisively on the economic policy mix undertaken to tackle the short-term effects of the disaster and the medium-term challenges of the rehabilitation and reconstruction process.

This report is divided into five sections. The introduction is followed by Section 2, presents the general description of the earthquake. Section 3 summarizes the potential macroeconomic impacts of the disaster along with alternative reconstruction scenarios. Section 4 presents a geographical and regional view and the final section summarizes the closing remarks. There are two annexes, with information of other disasters in Chile and their cost, and maps with information on social variables in the disaster areas.

## **2. Description of the natural event**

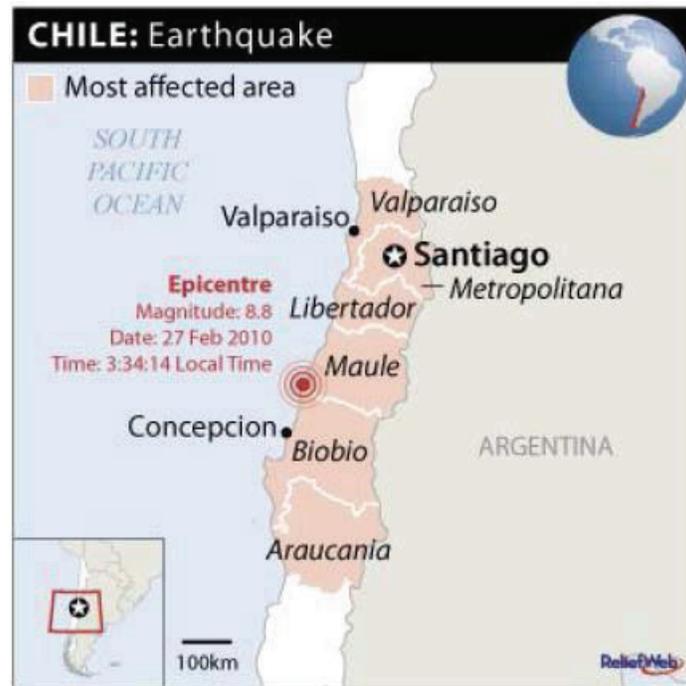
The Chilean earthquake of 27 February 2010 occurred at 03:34:17 local time (UTC-3), with a magnitude of 8.3 Mw according to the Seismological Service of Chile and 8.8 Mw according to the United States Geological Survey. This earthquake occurred on the boundary of the Nazca and South American tectonic plates which are converging at a rate of 70 mm per year. The earthquake occurred as thrust-faulting on the interface between the two plates, with the Nazca plate moving down and landward below the South American plate.

The epicentre was located on the coast approximately 8 km west of the town of Curanipe and 115 km north-northeast of Chile's second-largest city, Concepción. The quake lasted about 2 minutes 45 seconds and was felt in much of the Southern Cone, from as far north as Ica in Peru to Buenos Aires and São Paulo in the east.

A strong tsunami generated by the earthquake struck the Chilean coast, destroying several villages already devastated by the impact of the quake. The Juan Fernandez archipelago was hit by the tsunami, which devastated its only town, San Juan Bautista. A tsunami warning was issued for 53 countries throughout the Pacific basin, including Peru, Ecuador, Colombia, Panama, Costa Rica, Nicaragua, Antarctica, New Zealand, French Polynesia and Hawaii.

The quake is the second-strongest in the nation's history (surpassed only by the 1960 Valdivia earthquake, the most intense recorded by seismometers) and one of the five strongest ever recorded. It was 31 times stronger, and released about 178 times more energy, than the Haiti earthquake which occurred in January.

Map 1  
**EARTHQUAKE IN CHILE**



Source: ReliefWeb.

**(a) Situation overview: highlights**

The regions most severely affected by the earthquake were O'Higgins, Maule and Bío Bío. Valparaíso, the Metropolitan area of Santiago, and Araucanía, which are home to more than 13 million people, or 80% of the Chilean population, were also hit. In the regions of Maule and Bío Bío the earthquake was felt with an intensity of IX on the Mercalli scale and devastated much of the cities of Constitución, Concepción, Cobquecura and the port of Talcahuano.

According to Situation Report No. 6 dated 10 March 2010, issued by the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) and based upon information from the Ministry of the Interior, the death toll stands at 507. According to Government reports, some 441,000 houses have been severely damaged or completely destroyed; assessments are still ongoing. Authorities are still establishing a comprehensive overview of the situation, providing medical services, shelter, food and water, and restoring transport, communications and basic services. Santiago airport is operating with restrictions and not at the level prior to the catastrophe.

In the regions of Araucanía and O'Higgins and in the Metropolitan Region, the quake was recorded as grade 8 and caused major damage in the capital, Santiago, Rancagua and rural locations. As a result, the Administration declared a state of disaster in the regions of O'Higgins, Maule and Bío Bío and imposed the relevant exceptional measures.

Map 2



Source: United Nations Office for the Coordination of Humanitarian Affairs.

It is still too early to assess the scale of the damage caused by the earthquake and tsunami to major infrastructure networks and to determine the extent of the destruction in coastal villages. The assessment below will focus on the three most severely affected regions, where the greatest social damage and loss of infrastructure and equipment have been observed.

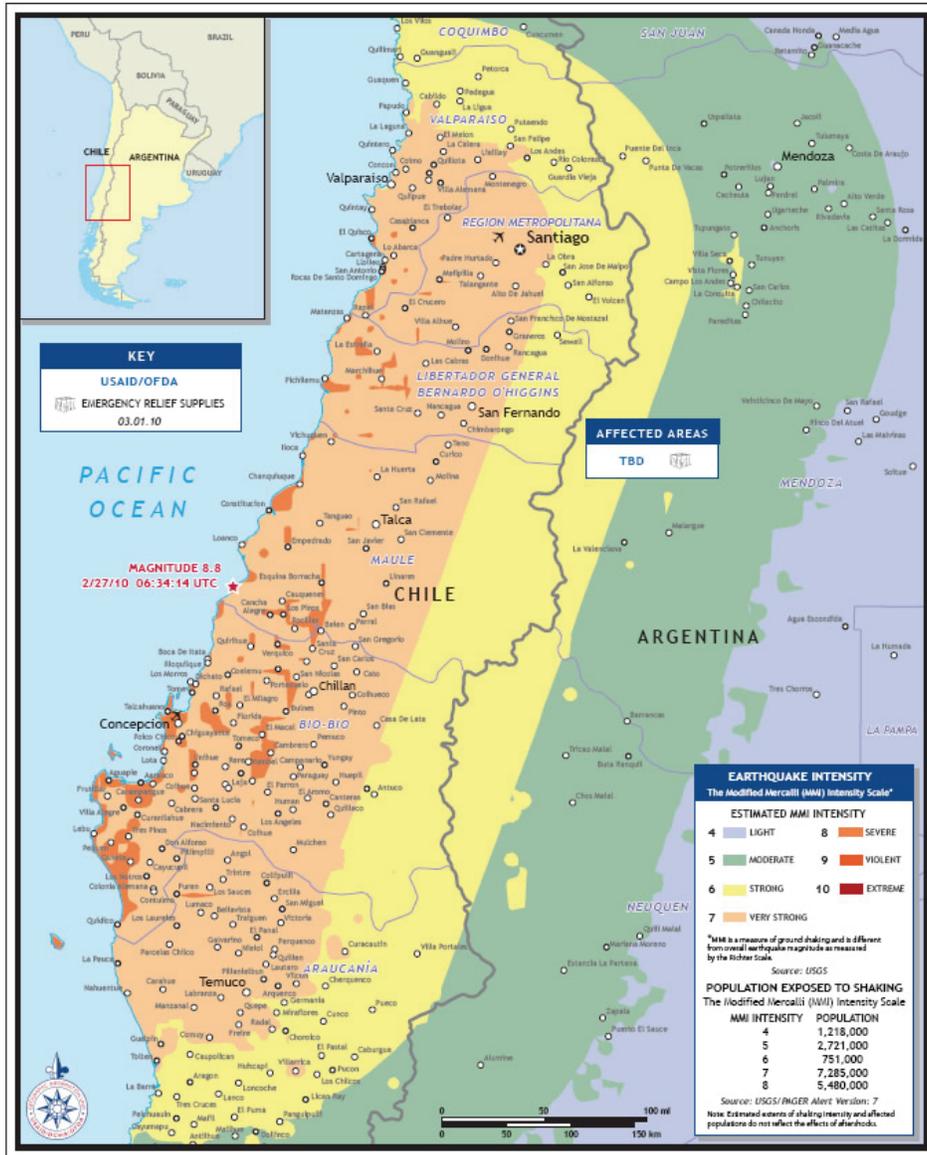
The territorial impact and cost scenarios (loss and damage) correlate with the characteristics of the event (earthquake, tsunami or both) and their impact in different territorial areas. In each of the regions, three areas may be identified:

- A coastal strip
- Agricultural valleys and medium-sized cities
- Metropolitan areas

### Map 3



### EARTHQUAKE-AFFECTED AREAS IN CHILE AND ARGENTINA



Source: United States Agency for International Development (USAID).

### **3. Macroeconomic impact of the Chilean earthquake**

#### **(a) The situation prior to the natural event<sup>1</sup>**

In 2009, Chile had to deal with the adverse effects of the international financial crisis which had started in the United States. Thanks to the capacities put in place in previous years, the Chilean authorities were able to apply countercyclical policies and, thus, curb the impact of the external turmoil and gradually create the conditions for resuming growth in 2010.

Towards the end of 2008 and in the first quarter of 2009, exports slumped, reflecting lower volumes as well as falling prices. Lower expectations of growth, employment and income strongly deterred both private investment and spending on consumer durables. A sharp slowdown in GDP growth during the second half of 2008 was reflected, in 2009, in a decline in production, a drawdown on inventories and a rise in unemployment, and GDP growth was 1.7% lower than in 2008.

Countercyclical policies were adopted to address this negative situation. They included a fiscal expenditure plan which contemplated various subsidies, employment and public investment programmes and credit support for small and medium-sized enterprises (SMEs) of approximately US\$ 4 billion or 2.8% of GDP. Sovereign funds built up during the previous years were used to finance these programmes.

The cost of these countercyclical measures, combined with a drop in tax revenues attributable to the slowdown in economic activity and the fall in copper prices, pushed up public spending and the actual deficit rose to 4.5% of GDP.

Monetary policy continued to be geared towards an average inflation target of 3% per year over the medium term. From January 2009, following the abrupt halt in the inflationary trend in the previous year and in response to the liquidity requirements resulting from the crisis, the central bank worked intensively to reduce interest rates. Thus, from July 2009, the annual rate stood at 0.5%, which represents a 775 basis-point reduction compared with the peak of 8.25% set in September 2008.

Credit picked up during the second half of the year, although total lending still remains below the level recorded in 2008.

Since the beginning of 2009, as international financial markets gradually returned to normal and risk perceptions diminished, the currency once again started to appreciate. The monetary authorities responded by making oral statements but did not rule out taking concrete measures in the future.

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<sup>1</sup> See ECLAC, *Preliminary Overview of the Economies of Latin America and the Caribbean, 2009* (LC/G.2424-P), Santiago, Chile, 2009.

Public spending was the main domestic growth driver, expanding by between 6% and 8%. Exports, which at first contracted significantly, picked up towards the end of the year. In annual terms, however, they contracted by between 4% and 6%. Imports shrank by 20%, in a context of flagging domestic demand.

The unemployment rate increased steadily, peaking at 10.8% between June and August 2009. Then, following a slight recovery in job creation and a slowdown in the increase in the labour supply, it dipped to 9.7% between August and October.

With demand weaker and external prices for some commodities declining, 12-month inflation to December stood at -1.4%. Nominal wages showed the effects of indexation mechanisms and the consequences of the crisis on the labour market. Thus, the general hourly wage index was lowered by an annual rate of 9% in 2008 to 6% in 2009. Following the reduction in inflation, real wages, which had declined slightly in 2008, increased on average by more than 4%.

In 2009, the balance-of-payments current account showed a surplus equivalent to 1.9% of GDP, compared with a deficit in 2008. This was due to the reduction in imports in value terms at the same time as volumes were down, owing to weaker domestic demand for consumer durables and capital goods, as well as to lower fuel prices compared with 2008. Exports were also down in value terms, due to the reduction in copper prices, but in this case the volumes did not diminish as much. International reserves were up for the second consecutive year. This increase was due in part to the special drawing rights recently assigned to Chile. In terms of the capital and financial account, foreign direct investment continued to flow in, corporate bond issues abroad resumed, external loans to banks in Chile recovered and the country continued to enjoy a low country risk rating with the access that this implies to resources on international financial markets.

## **(b) Projections for 2010 prior to the earthquake**

While 2009 was a year of negative growth, the policies adopted and the gradual improvement in the external environment set the stage for a significant improvement during 2010, supported by the recovery in domestic demand (thanks to better credit conditions and higher expectations) and the sustained dynamism of external demand for Chile's main exports.

Thus, ECLAC had projected a growth rate of 4.5% for 2010. As a result, unemployment rates, which have been on the decline since mid-2009, will continue their downward trend.

Once the emergency has passed, the emphasis of fiscal policy will once again be on restoring structural balance. Indeed, the approved budget for 2010 had projected an increase in government expenditure (total consolidated central government) of 4.3% over the 2009 figure, which represents a slowdown of close to three percentage points. The actual deficit should be below 1% of GDP.

The recovery in domestic demand points to a return to moderate levels of inflation within the target range for monetary policy. Thus, by mid-year, monetary policy rates should rise above the historic low of 0.5% recorded in July 2009.

Thanks to sustained demand for the country's major exports and to a slower recovery in imports (particularly capital goods), the external account will continue to show a small surplus, which will afford Chile continued access to external financial resources.

### **(c) Possible macroeconomic impacts of the earthquake**

It would be premature to attempt to estimate with any degree of accuracy the macroeconomic effects of the earthquake that struck Chile. It is possible, however, to sketch the sign and direction of the main economic variables and probable changes ahead.

#### **(i) Share of national GDP of the most severely affected regions**

The effects of the earthquake were concentrated in the sixth, seventh and eighth regions. In terms of GDP, Bío Bío (region VIII) is the second most important region. According to the latest figures released by the Central Bank of Chile (for the year 2006), the share of Bío Bío in Chile's total GDP is 10.4% (surpassed only by the metropolitan area, which accounts for 47 %). Maule (seventh region) represents about 4% of total GDP in Chile and the O'Higgins region (sixth region) 4.1%.

However, in terms of economic sectors, these regions play a vital role. The following table shows the share of each region in various sectors of economic activity. As shown, the three regions together represent about half of the activity of the agriculture-forestry sector (forestry, orchards, vineyards, livestock) and about a quarter of the activity of the manufacturing industry (mainly food, including fish meal, beverages, steel, pulp and paper, shipbuilding, and refinery ENAP). At the same time, these regions represent a third of the country's electricity generation.

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Table 1  
**SHARE OF THE WORST AFFECTED REGIONS IN TOTAL GDP**  
*(Percentages)*

Sector/Region	Bernardo O'Higgins	Maule	Bío Bío	Total
Agriculture/forestry	20.9	16.0	15.6	52.5
Fishing	0.0	0.1	22.5	22.7
Mining	5.1	0.3	0.5	5.9
Manufacturing	2.8	4.6	20.4	27.8
Electricity, gas and water	4.6	13.8	20.0	38.4
Construction	5.6	4.2	10.3	20.1
Commerce, restaurants and hotels	4.8	2.0	4.5	11.3
Transport and communications	3.2	3.9	8.1	15.3
Financial and business services	1.6	1.5	4.5	7.6
Housing	3.0	3.6	8.4	15.0
Personal services (2)	2.7	4.2	11.0	17.9
Public administration	3.2	3.9	10.2	17.2
Less: bank charges	1.4	1.4	3.5	6.3
<b>Gross domestic product</b>	<b>4.1</b>	<b>4.0</b>	<b>10.4</b>	<b>18.6</b>

Source: Central Bank of Chile.

### **(ii) Share in national employment of the most seriously affected regions**

The regions referred to above account for approximately 20% of national employment, 40% of national employment in agriculture, a quarter of employment in electricity, gas and water, and 18% of the sectors of manufacturing, trade, hotels and restaurants, transport and communications, and community, social and personal services.

In these regions, the main sectors in terms of employment are agriculture/forestry (21.8%); trade, hotels and restaurants (18.1%); and community, social and personal services (24.8%).

Table 2  
**SHARE OF THE WORST AFFECTED REGIONS IN TOTAL NATIONAL  
 EMPLOYMENT BY SECTOR, 2009**  
*(Percentages)*

<b>Sector/Region</b>	<b>Bernardo O'Higgins</b>	<b>Maule</b>	<b>Bío Bío</b>	<b>Total</b>
Agriculture, hunting and fishing	12.5	14.8	13.3	40.7
Mining and quarrying	9.4	1.6	3.3	14.3
Manufacturing	4.0	4.0	10.8	18.8
Electricity, gas and water	4.7	5.1	12.6	22.4
Construction	4.3	5.0	12.4	21.7
Commerce	3.7	4.8	10.2	18.8
Transport and communications	4.1	4.4	9.8	18.3
Financial services	2.1	2.5	8.2	12.9
Community, social and personal services	4.0	4.5	10.1	18.6
<b>Total</b>	<b>4.8</b>	<b>5.5</b>	<b>10.5</b>	<b>20.8</b>

Source: National Institute of Statistics of Chile.

Table 3  
**EMPLOYMENT STRUCTURE BY SECTOR OF ECONOMIC ACTIVITY,  
 MOST SERIOUSLY AFFECTED REGIONS, 2009**  
*(Percentages)*

<b>Sector/Region</b>	<b>Bernardo O'Higgins</b>	<b>Maule</b>	<b>Bío Bío</b>	<b>Total</b>
Agriculture, hunting and fishing	28.9	30.2	14.2	21.8
Mining and quarrying	2.9	0.4	0.5	1.0
Manufacturing	10.7	9.4	13.2	11.6
Electricity gas and water	0.5	0.5	0.6	0.5
Construction	7.4	7.6	9.9	8.7
Commerce	15.4	17.7	19.6	18.1
Transport and communications	7.0	6.7	7.8	7.3
Financial services	4.2	4.4	7.5	5.9
Community, social and personal services	23.0	22.5	26.8	24.8
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

Source: National Institute of Statistics of Chile.

**(iii) Share of the most severely affected regions in national exports of goods**

On the basis of 2008 figures, these three regions account for about 19% of total exports. Bío Bío represents about 9% of national exports, Maule 2.2% and Bernardo O'Higgins 8%.

Table 4  
**EXPORTS BY REGION AND SECTOR AS A PERCENTAGE OF NATIONAL TOTAL, 2008**  
(Percentages)

Sector/Region	O'Higgins	Maule	Bío Bío	Total
Agriculture, cattle-rearing and fishing	26.9	14.0	3.2	44.1
Mining	8.1	0.0	0.0	8.2
Food, beverages and tobacco	11.6	7.3	11.2	30.1
Textiles, made-up articles, leather and footwear	0.6	2.2	21.0	23.8
Forest industry, furniture and paper	0.2	7.9	77.7	85.8
Other manufactures	1.3	0.2	7.5	9.0
<b>Total</b>	<b>7.8</b>	<b>2.2</b>	<b>8.8</b>	<b>18.8</b>

**Source:** Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of data from the Regional Planning Division, Ministry of Planning and Cooperation.

In Bío Bío, 10 companies are responsible for 61.8% of exports from the region. Of these, 7 are in the timber and forestry sectors (60% of total), 1 is in the fuel refining sector (ENAP Refineries SA, 4.63%), and 2 in the fisheries sector (corresponding to 5.28% of total).

In O'Higgins most of the exports come from the mining sector (Codelco, with 60% of the region). Exports of wine, grain and fruits are also substantial.

In Maule, 10 companies in the wine sector, food, and pulp and paper account for 51% of exports.

Table 5  
**EXPORT STRUCTURE BY REGION, 2008**  
(Percentages)

Sector/Region	O'Higgins	Maule	Bío Bío
Agriculture, cattle-rearing and fishing	16.1	29.4	1.7
Mining	62.9	0.8	0.1
Food, beverages and tobacco	18.3	40.2	15.5
Textiles, made-up articles, leather and footwear	0.0	0.3	0.8
Forest industry, furniture and paper	0.2	27.8	69.4
Other manufactures	2.4	1.5	12.5
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

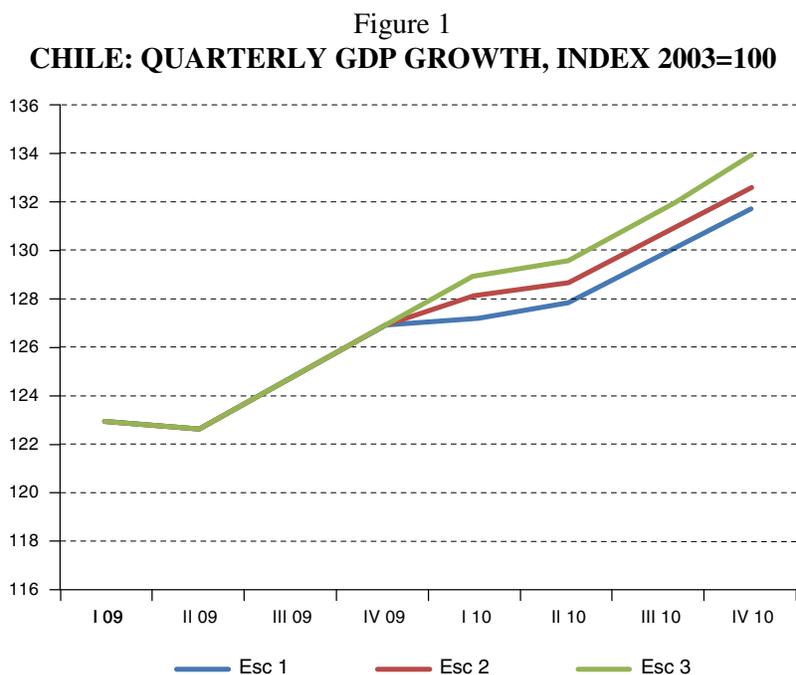
**Source:** Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of data from the Regional Planning Division, Ministry of Planning and Cooperation.

## (d) Potential impact of the earthquake on GDP growth in 2010

The projected rate of GDP growth in Chile for 2010 of 4.5% may be modified due to the impacts of the earthquake on the various sectors of the most affected regions. The worst hit sectors are agriculture/forestry, fishing, manufacturing, trade, hotels and restaurants, transport and communications. Output may contract in the first half-year, but in the second half, it could start to recover mainly owing to the reconstruction effort.

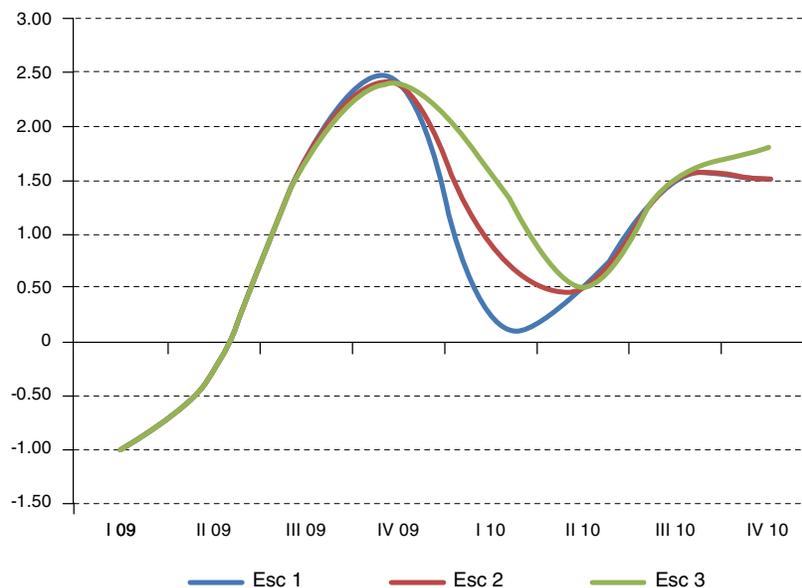
Three scenarios were considered for the GDP forecasts. They are:

- Scenario 1 - the impact of the quake on economic activity is so intense in March that the recovery in these regions and even in the metropolitan region will be gradual. Based on this assumption, GDP growth for 2010 would be of the order of 4.2%.
- Scenario 2 - the impact of the quake on economic activity is strong in March, the recovery of economic activity in the second quarter is gradual and growth assumptions are maintained for the second half of the year. In these circumstances, GDP growth for 2010 would be around 4.5%.
- Scenario 3 - despite the strong impact of the earthquake on economic activity in the first few days after the event, various industries resume their activities during the month of March, and in the second half-year an extensive programme of infrastructure rehabilitation is launched. Based on these assumptions, GDP growth would stand at around 5% in 2010.



Source: Economic Commission for Latin America and the Caribbean (ECLAC).

Figure 2  
**CHILE: PERCENTAGE VARIATION IN QUARTERLY GDP, COMPARED WITH  
 THE PREVIOUS QUARTER, SEASONALLY ADJUSTED**



Source: Economic Commission for Latin America and the Caribbean (ECLAC).

### (e) Potential variation in the macroeconomy

In terms of macroeconomic policy, the incoming administration will need to make amendments to the 2010 budget for two reasons:

- to compensate for welfare losses through direct subsidies (income transfers), rebuild infrastructure (direct public investment for reconstruction of roads, hospitals, schools, and for payment of guarantees to public works concession dealers, so that public investment will be equivalent to between 8.5% and 9% of GDP, compared with the initial figure of 8%); and continue social programmes.
- to boost investment through (i) tax incentives; and (ii) credit support through public institutions.

In sum, the 2010 budget will have to be adjusted to provide for these unforeseen public expenditures. The Government will need to draw on its foreign reserves, mainly from the Stabilization Fund for Economic and Social (FEES) and could also apply for foreign credit. The 2010 Budget Act will have to be amended in order to draw on this Fund, which stood at US\$ 11.257 billion in January 2010. The use of these resources should not have any repercussions on the country's financial situation, since Chile enjoys the best risk rating in the region, while external public debt is very low, (6.8% of GDP in 2009, projected to rise to 8.7%

of GDP in 2010). Expenditure on reconstruction following the earthquake will push this debt up, but without undermining the sustainability of public finances in Chile.

In short, it is expected that production and jobs will suffer in the worst affected regions. These losses should be offset during the course of the year by the new impetus coming from the reconstruction programmes. New jobs are expected to be generated primarily in the construction sector and not in the sectors that traditionally generate employment in the affected areas: agriculture and forestry, trade, hotels and restaurants and community, social and personal services. Recovery of the wage income of the affected population in 2010 will depend largely on their ability to adjust to the demands of work in construction. Hence, policies on income transfers to households will be vital for offsetting losses and maintaining standards of living.

As usual with this type of disaster, an initial spike in inflation should be expected in 2010, but should eventually subside, and ought not to jeopardize the inflation target of the Central Bank of Chile: a range of between 2% and 4%. Before the earthquake, the Central Bank had predicted that the projected increase in domestic demand and rising international commodity prices would fuel inflation in 2010.

Meanwhile, despite its autonomy, the Central Bank is likely to support the recovery, and therefore may decide not to react to the temporary spike in inflation, and to maintain the monetary policy rate. This will shore up domestic demand, particularly for durable goods, reconstruction and real estate purchases. Thus, the Central Bank is expected to maintain its rate until late into the third quarter.

Regarding the external balance, no drastic changes are expected. On the one hand exports from the regions most affected may diminish temporarily. Exports from other regions, however, will continue to grow compared with the previous year. At the same time, the external situation suggests that the country's major exports will attract higher prices relative to 2009. Thus, in terms of value, exports will continue to grow, although initially at a slower rate than originally projected. Fuelled by more buoyant domestic demand after the 2009 crisis, imports were already expected to rise and will now expand further owing to the reconstruction effort. A deficit in the balance of payments, could push up the exchange rate. However, the funds for reconstruction will come from the liquidation of foreign assets in Swiss francs and/or from external credit, which should counteract any possible pressure on the foreign exchange market and avert a deterioration of the current account.

In the event that the above developments cause a considerable fall in the exchange rate, the monetary authority will probably intervene more actively in the foreign exchange market, as it has over the last two years.

## **4. Local impacts: Damage and losses in housing, infrastructure and services (HIS)**

### **(a) The O'Higgins Region**

#### **(i) Description**

The main activities in this region are primary sector activities such as agriculture and mining. A high percentage of the population of the Libertador Bernardo O'Higgins Region is rural.

#### **(ii) Impact:**

##### *Regional level*

According to the National Office for Emergencies of Chile (ONEMI), a total of 71,209 houses have been damaged. The entire region was declared a disaster area to enable the central government to release extra resources for rescue and reconstruction. O'Higgins Region was severely damaged, especially in rural areas. Several rural communities were cut off and communication with them took considerably longer than for urban areas. Many of the homes in the area, built of adobe, were completely destroyed or unusable. In the commune of Peralillo, 90% of dwellings fell, including many that were owner-occupied. Meanwhile, in Chépica, 60% of their homes are uninhabitable and the Church of San Antonio de Padua collapsed completely, leaving only its bell-tower standing. The destruction of homes was not the only problem of the rural towns: Placilla Cemetery was seriously damaged and many bodies were left exposed, creating a source of infection in the area.

The earthquake also caused damage to road infrastructure, cutting off Route 5 south and the Carretera de la Fruta (or Fruit Highway). Despite initial warnings, the Convento Viejo Reservoir withstood the earthquake and showed no sign of collapsing. Meanwhile, Monticello Grand Casino, the largest casino in South America, suffered significant damage.

The earthquake is reported to have caused serious damage to the wine industry in the Colchagua Valley, destroying warehouses and millions of gallons of wine, while lack of irrigation in the absence of water and electricity seriously threatens the harvest, one of the Merlot strains being the most at risk.

##### *Specific areas*

- Coastal areas

The region's coastal areas suffered the double impact of the earthquake and tsunami. Localities such as Navidad, Matanzas and Pichilemu were severely damaged. The worst ravages were seen in Bucalemu. Tourism and artisanal fishing are the mainstays of these small communities. The immediate coastline was totally devastated with losses and damage to housing, infrastructure and services (HIS).

- Agricultural valleys and medium-sized cities

The agricultural valleys and medium-sized towns sustained damage to their stock of capital assets (70%), services and infrastructure and housing, as well to their agricultural and economic infrastructure (including damage to 20% of their wine-related infrastructure). The regional capital suffered damage mainly in its historic centre and in some suburban locations. The major cities of Rengo, San Vicente, Santa Cruz and San Fernando, which account for 70% of the region's population, sustained significant losses. In total, so far nearly 5,000 houses were destroyed in the region and about 32,000 homes (representing shelter for some 15% of the population) have some type of damage.

## **(b) The Maule Region**

### **(i) Description**

This region specializes in forestry and agriculture, which provide about 32% of its gross domestic product. It exports wood from forest stands (wood processing, such as logs and metro ruma) and industrial products. In this area, Constitución's cellulose plant has meant a boost for timber production in the region. Its population stands at approximately 920.000 inhabitants.

### **(ii) Impact**

#### *Regional*

The Seventh Region was undoubtedly one of the hardest hit across the country. Much of the destruction was concentrated in the coastal sector and was due to the tsunami. Places like Constitución, Ilocos, and Pelluhue Curanipe were virtually wiped off the map.

In Constitución, half an hour after the earthquake struck, the first of three 8-metre waves surged up through the mouth of the Maule river and into the city's Plaza de Armas. Many of the deceased (a couple hundred people) were at the time camping on a small island in the area. .

The cities of Cauquenes, Talca, Linares and Parral Curico and many of the towns of the region suffered critical structural damage. The centuries-old adobe buildings of these cities, which had withstood the previous earthquakes of 1960 and 1985 with minimal damage, since in both cases they were relatively far from the respective epicentres, were severely damaged or completely destroyed this time . More than half the historical area of these cities was devastated, including various historical monuments and centuries-old buildings from colonial times. The Pan American Highway was severely damaged when the bridge over the river collapsed, while the access route to Parral, Cauquenes and Chanco was impassable, cutting off communications between the capital and the cities affected in the seventh and eighth regions.

### *Specific areas*

- Coastal Area

The area of Constitución was indeed one of the sites of the worst devastation. The three giant waves that swept through the town, wiped out 80% of its tourism infrastructure. This loss was compounded by the destruction of the cellulose plant. Localities such as Licantén, Gualano, Pelluhue, Chanco, Curepto and Vichuquén, Iloca and Duao lost virtually their entire housing stock, as well as their equipment and services. The hospital at Gualane collapsed. Connectivity infrastructure was also destroyed. The highest fatalities occurred in Constitución..

- Agricultural valleys and medium-sized cities

The cities of Curico, Linares, Cauquenes, Talca and Parral experienced extensive damage primarily to their residential infrastructure. This region totalled the highest number of fatalities. In terms of major infrastructure, the collapse of the bridge over the Rio Claro presents a horrifying picture. Damage to the infrastructure of hospitals in Talca, Curico, Parral and Linares was severe (80%).

## **(c) The Bío Bío Region**

### **(i) Description**

The Bío Bío Region is an area whose main economic activities are forestry and fishing, followed by agriculture, manufacturing and services. The conurbation of Greater Concepción (with more than 1 million inhabitants) is the largest urban centre of this region, and provides commercial, tourism, education and health services.

Talcahuano has an economy based on heavy industry, steel plants, shipyards and oil refineries (ENAP). It is also a military port and houses the Asmar shipyard and the Navy's submarine fleet. According to data from the 2002 census, Bío Bío has approximately 2.3 million inhabitants and is the second most densely populated region in the country.

### **(ii) Impact**

#### *Regional situation*

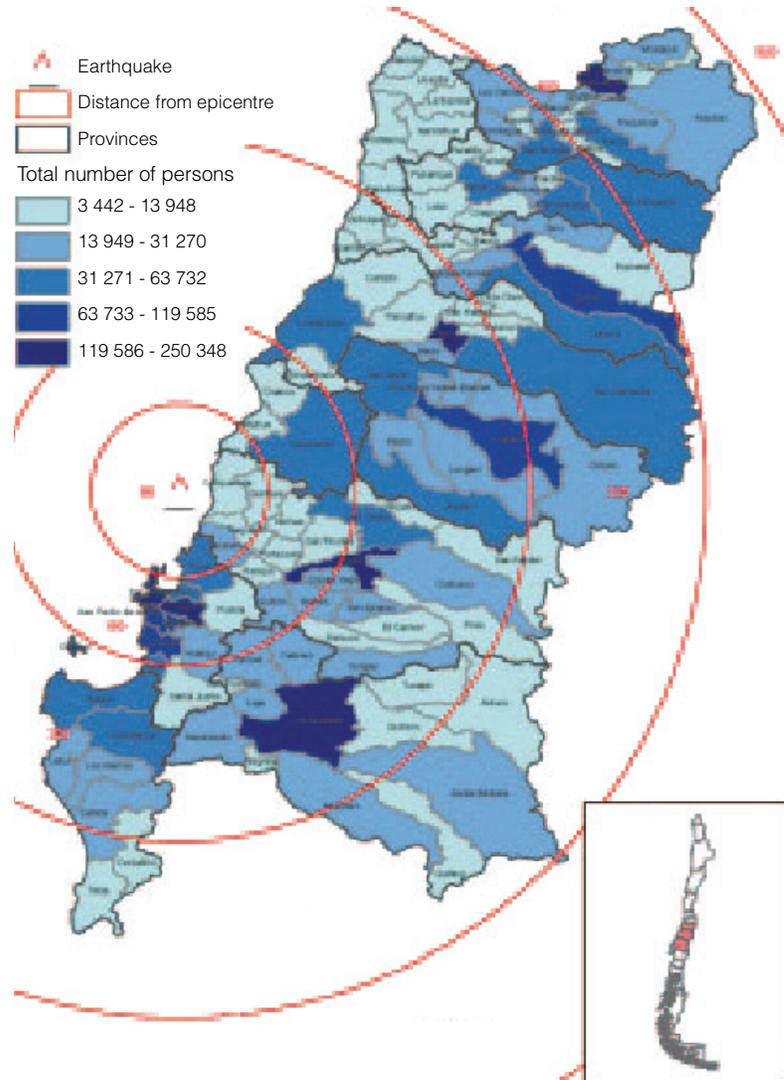
Greater Concepción in the Region of Bío Bío caused the most concern because of its size and large population. The city of Concepcion suffered severe damage to homes, buildings and infrastructure. Although much of the population was at home when the shaking started, at the time there were many people in the area of the station, the main entertainment centre in Concepción. The police had to use megaphones to control people fleeing restaurants.

People in Concepción and Talcahuano rushed to higher ground to escape the tsunami that hit the shores. In the port of Talcahuano, the sea thrust boats into the city centre, flooding the streets and leaving in its wake mud and debris. The naval base and shipyard and the ASMAR Hall Building suffered major damage, as did the port, where large numbers of containers were flooded. The Huascar Monitor (a floating museum) was swept away by the tsunami, but did not suffer structural damage.

In the regional capital, several landslides were reported and fire swept through the Faculty of Chemistry at the University of Concepción. The conurbation was cut off following the collapse of major access roads and the bridges across the river Bío Bío. The Puente viejo was completely destroyed, while Llacolén Bridge and John Paul II Bridge suffered structural damage. The Alto Río apartment building toppled over, becoming a symbol of the catastrophe. Opened just a few months before the earthquake incident, this fifteen-story building collapsed horizontally, leaving dozens of people trapped inside.

- Coast. One of the areas devastated by the earthquake and tsunami was the village of Dichato. Located in the north of the region in the town of Tome, Dichato has a population of about 3,000 inhabitants (2000 census figure), whose main activities were artisanal fishing and small-scale tourism. Cobquecura was another affected area.
- Agricultural valleys. The domestic agricultural valleys and medium-sized cities, such as Chillán and Los Angeles, were badly damaged.
- Urban agglomerations. Given their size, the main urban areas on the coast are included in this section: Concepción, Talcahuano, Coronel and Lota.

**Map 4**  
**TOTAL POPULATION IN THE WORST AFFECTED AREAS AND DISTANCE FROM THE EPICENTRE**



## 5. Final remarks

The earthquake and tsunami that hit the coast of Chile on February 27<sup>th</sup> were devastating in terms of loss of human lives and destruction of infrastructure and housing. However, the full picture of economic and social impacts in terms of damage and losses remains unknown and will be unveiled as soon as a comprehensive sectoral evaluation takes place. Luckily, the production infrastructure associated with copper—the country’s main export commodity— remains unscathed and thus, the main driver of the economy is intact and will play a crucial role in supporting and reinforcing the reconstruction process.

Moreover, Chile is in an excellent fiscal position and well able to finance the cost of reconstruction using a mix of economic policies designed to reorient its current public expenditure towards the reconstruction process, assuming that the reallocation of 2% of the budget is pursued and adequate risk transfer mechanisms are applied together with the use of external financing to offset the imbalances in public and private finances triggered by disasters of this nature. It is our belief that Chile will recover as the Government will be financially equipped to conduct public works, provide the necessary emergency response and finance the rehabilitation and reconstruction for the post-disaster phases.

At the regional level, The Maule and Bío Bío regions account for 16% of employment and approximately 10% of total exports. Together with Bernardo O'Higgins, they represent approximately 18% of Chile's GDP, and 20% of employment. Output is expected to contract in the short term in these three regions and, as a result, the output for the whole economy will trend downwards over the next two to three years. In the medium term (third and fourth year), it will spike due to the reconstruction efforts. It must be noted that this is the typical pattern following natural disasters when capital stock are seriously damaged. There will however, be a negative short-term impact on external and fiscal balances and employment, not only because of direct damage in these regions but because of the wider effects to other regions, including Santiago, and the transportation problems that will hamper production in the south. This in turn may affect the chain of payments in some sectors, adding pressure to the financial system, particularly those banks that are most exposed. Some support will be needed from the Central Bank to ensure system-wide liquidity. Insurance companies will be hard hit too.

An initial supply shock is expected and will be followed by a demand shock fuelled by uncertainty and recovery expenditures that may induce an inflationary ramp. In terms of inflation, the dynamic would be the inverse of GDP. At the beginning inflation rises but in the medium term it would eventually subside. It is unlikely though that the Central Bank will harden its monetary policy: thus, interest rates will probably remain stable with a rather expansionary monetary policy and a low interest rate that will lower reconstruction and recovery costs. The final impacts are ultimately country-specific and depend on the economy's structural conditions and more decisively on the economic policy mix undertaken to tackle the short-term effects of the disaster and the medium-term challenges of the rehabilitation and reconstruction process.

## Annex

### Previous studies on Chile's vulnerability

Over the past 35 years, ECLAC has developed a disaster impact assessment tool, the Post Disaster Needs Assessment, an instrument which is regularly applied by the United Nations and the World Bank. It is being used for the current assessment of the January 12 earthquake in Haiti and ECLAC is providing the appropriate technical backstopping, as it did for El Salvador in late 2009 and for Mexico, where it studied the AH1N1 pandemic in the earlier part of that year.

The disasters assessed by ECLAC using analytical approaches developed over 60 years are not just situations that require prompt humanitarian assistance, but events that will impact the sustainability of the development process.

Thorough disaster impact assessments reveal the effect that disasters can inflict on economic activity, on the livelihoods and welfare of the population and on environmental sustainability. A country's vulnerability is linked to its size, level of development and technological intensity as well as to its dependence on natural-resource-based sectors, such as agriculture and tourism.

Assessments of past disasters provide an insight into the pattern and intensity of natural events, their costs and implications and relationship to climate change. This is a new area now being explored more systematically.

ECLAC is adding to its traditional activities<sup>2</sup> further studies on climate change adaptation and mitigation. Its work is thus linked to global initiatives such as the International Strategy for Disaster Risk Reduction and it promotes alliances and partnerships with agencies in the United Nations system—including the Pan American Health Organization (PAHO) and the United Nations Development Programme (UNDP).

According to a 2006 study on Chile's exposure to disasters and on risk management, Chile is arguably the world's most seismic country and holds the record for the seismic event of greatest energy release: the earthquake of May 1960. In the last 30 years, 8 important events have been recorded, the most recent ones in 1997 and 2005 in the north of the country. From the economic point of view, both seismic and climate events have had a major impact. While earthquakes have not generated a large number of deaths in the last decades, thanks to significant advances in construction techniques, standards and regulations, the 1939 and 1960 earthquakes accounted for more than 10,000 and 3,000 deaths, respectively. In Chile, there are several institutions dedicated to the generation of scientific information and technical support. They demonstrate the development achieved in reducing hazards and vulnerability, especially in areas like meteorology or seismology, for which significant data are available. Although natural

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<sup>2</sup> Technical assistance in assessment, training of government officials, interregional cooperation with the other regional commissions (with support of the World Bank), advances in the development of risk reduction and risk indicators (with other partners such as IDB), analysis of risk-inducing factors to develop policy proposals.

phenomena recur over time, the absence of valid historical records and consistent time series makes it difficult to obtain comprehensive information on their overall impact and economic consequences. Moreover, in most cases, technical reports generated ex-post, focus mainly on population and housing and lack the methodology to account for damage and loss.

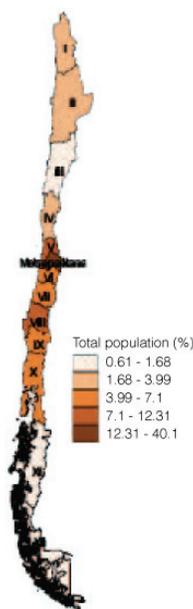
The 2006 study considered potential extreme disaster scenarios in order to look into their potential impacts. One of the two considered was an extreme seismic event with a 500-year recurrence period, consisting of a  $M_w = 8,5^3$  in the subduction zone opposite the VI and VII regions, similar to the zone where the current event struck.

This so called “simulated South scenario” determined the potential number of houses which, according to an earlier study (Kárník, 1984) would be severely damaged, partially destroyed or would collapse altogether. The study showed that as many as 34% of all households (or 40% of the population) in the regions concerned would have serious damage to their houses, especially those made of ,adobe, the most common building material in several communities.

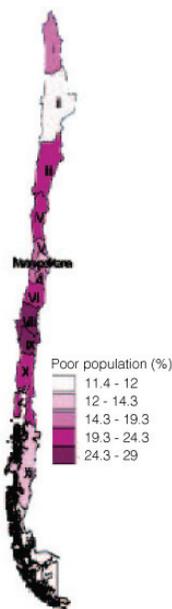
It should be noted that the fifth and eighth regions have the highest population density as well as the highest poverty rates, and, at the same time, are among those that contribute most to GDP (see maps).

Map A-1

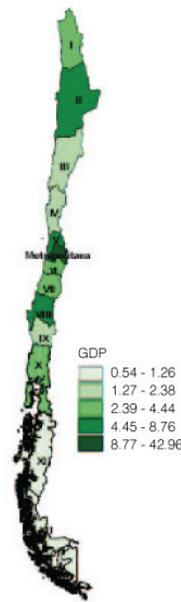
Chile: Population distribution by region, 2002  
(Percentages)



Chile: Population living in poverty (2002)



Chile: Regional distribution of GDP (Percentages)



**Source:** Economic Commission for Latin America and the Caribbean (ECLAC) on the basis of information from the National Statistical Institute, the Ministry of Planning and Cooperation (MIDEPLAN) and the Central Bank of Chile.

<sup>3</sup> Modified Mercalli scale.

The table below sets out data illustrating the economic impact of past disasters.

Table A-1  
**DIRECT DAMAGE (INFRASTRUCTURAL IMPACT) OF EARTHQUAKES IN CHILE**  
*(Millions of current dollars)*

Years	Millions of dollars
1939	2 716.4
1942	0.75
1943	25.3
1946	1.69
1949	3.04
1949	0.22
1953	12.8
1953	2.25
1958	0.2
1960	961.7
1965	152.4
1966	0.99
1967	1.99
1971	446.6
1975	38.9
1975	5.68
1976	1.82
1985	1 639
Total (47 years)	6 011.63
Average	127.91

**Source:** Arze, “Costo sísmico y economía”, 1996.

The extraordinarily strong earthquake in Chile represents an occasion for ECLAC to work closely with the host country in surmounting the impact in one of the countries best prepared for such events. Chile has developed resilience to disasters over the years. According to international databases, notably that of the Centre for Research on the Epidemiology of Disasters (CRED), Chile has suffered 30 earthquakes, 83 major flood episodes and at least 6 volcanic eruptions since 1900: in total more than 228 major disasters, 76 of them since 1960. The total number of victims exceeds 8,2 millions since 1960 (see tables below).

Table A-2

Disaster Type	Occurrence 1960-2009	Occurrence 1900-2009
	Chile	Total
Drought	2	10
Earthquake (seismic activity)	14	30
Epidemic	1	8
Extreme temperature	5	5
Flood	26	83
Mass movement wet/landslide	4	6
Storm	13	71
Volcano	5	6
Wildfire	6	9
<b>Grand Total</b>	<b>76</b>	<b>228</b>

Disaster Type	Victims 1960-2009	Victims 1900-2009
	Chile	Total
Drought	120 000	2 665 217
Earthquake (seismic activity)	5 979 993	6 092 297
Epidemic	41	7 590
Extreme temperature	35 008	35 008
Flood	1 439 931	3 543 116
Mass movement wet/landslide	83 070	84 392
Storm	503 808	8 053 047
Volcano	75 560	75 660
Wildfire	1 595	1 595
<b>Grand total victims = deaths + total affected</b>	<b>8 239 006</b>	<b>20 557 922</b>

Source: “EM-DAT: The OFDA/CRED International Disaster Database” [online] [www.emdat.be](http://www.emdat.be).

According to this source, the ten most devastating events for the period 1900 to 2010, ranked by number of fatalities are:

Table A-3

Disaster	Date	No. of fatalities
Earthquake (seismic activity)	24/01/1939	30 000
Earthquake (seismic activity)	16/08/1906	20 000
Earthquake (seismic activity)	21/05/1960	6 000
Earthquake (seismic activity)	4/5/05	1 000
Flood	7/1/65	600
Earthquake (seismic activity)	5/13/05	570
Earthquake (seismic activity)	28/03/1965	400
Earthquake (seismic activity)	3/1/63	280
Earthquake (seismic activity)	4/11/05	220
Earthquake (seismic activity)	3/3/85	180
<b>Total</b>		<b>59 250</b>

In terms of economic impact, the ten most devastating are:

Table A-4

<b>Disaster</b>	<b>Date</b>	<b>Damage (millions of dollars)</b>
Earthquake (seismic activity)	3/3/1985	1 500 000
Earthquake (seismic activity)	24/01/1939	920 000
Earthquake (seismic activity)	22/05/1960	550 000
Earthquake (seismic activity)	6/5/1953	500 000
Wildfire	2/1/1999	280 000
Earthquake (seismic activity)	8/7/1971	236 400
Earthquake (seismic activity)	March 1963	235 000
Drought	January 1991	200 000
Flood	24/05/2002	200 000
Flood	10/6/1997	182 400
<b>Total (current dollars, at year of occurrence)</b>		<b>4 803 800</b>

The impact of this record-breaking disaster in terms of intensity will become evident over the next few weeks and it may not be desirable to rush into an assessment of monetary losses at a time when critical humanitarian needs are still to be met. The international community and the United Nations System stand ready to assist in this phase, and later, at the appropriate time and in full cooperation with the Government of Chile, to undertake the necessary socioeconomic and development studies. It is the conviction of ECLAC that this event will further enhance Chile's resilience.

Map A-2  
**CHILE: PERCENTAGE OF RURAL HOUSING WITH ADOBE WALLS IN O'HIGGINS, MAULE, AND BÍO BÍO, 2002 CENSUS**

