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Chile Earthquake 2/27/2010: Stories & Lessons

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Chile Earthquake 2/27/2010: Stories & Lessons

Abstract

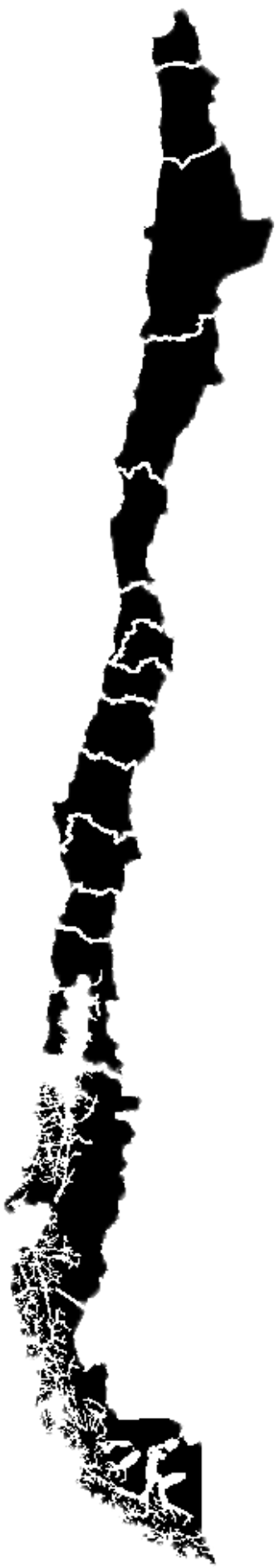
An 8.8 mega-earthquake hit the coast of Chile on February 27th, 2010 and is recorded as one of the largest earthquakes to date. Despite the magnitude of the earthquake, Chile suffered relatively little casualty rates and property damages. To analyze the impact of the earthquake even further, stock trends, bond market fluctuation, government credit ratings and personal anecdotes were factored and compared against other similar mega-earthquake incidents, notably one in Japan on March 11th, 2011 and another in New Zealand on February 22nd, 2011. While Japan and New Zealand both slipped in their government ratings and stock markets following the earthquakes, Chile's market – both the stock market and the government ratings – have actually increased following the mega-earthquake. Reconstruction spending, low fatality rate, and notably, the country's deep understanding of earthquake response procedures attributed to the nation's financial resiliency and quick recovery. Several interviews with government officials, NGO leaders and government officials were conducted to reveal unique leadership characteristics and management techniques applied during the mega-earthquake in order to provide insight beyond numbers.

Keywords

Chile, earthquake, social impact

Disciplines

Business



CHILE EARTHQUAKE \ 2.27.2010

STORIES & LESSONS

Richard Jungwoo Hong
University of Pennsylvania | Social Impact Research Experience | Jan 2014

+ ABSTRACT

An 8.8 mega-earthquake hit the coast of Chile on February 27th, 2010 and is recorded as one of the largest earthquakes to date. Despite the magnitude of the earthquake, Chile suffered relatively little casualty rates and property damages. To analyze the impact of the earthquake even further, stock trends, bond market fluctuation, government credit ratings and personal anecdotes were factored and compared against other similar mega-earthquake incidents, notably one in Japan on March 11th, 2011 and another in New Zealand on February 22nd, 2011. While Japan and New Zealand both slipped in their government ratings and stock markets following the earthquakes, Chile's market – both the stock market and the government ratings – have actually increased following the mega-earthquake. Reconstruction spending, low fatality rate, and notably, the country's deep understanding of earthquake response procedures attributed to the nation's financial resiliency and quick recovery. Several interviews with government officials, NGO leaders and government officials were conducted to reveal unique leadership characteristics and management techniques applied during the mega-earthquake in order to provide insight beyond numbers.

+ INTRODUCTION \ purpose

The purpose of this research proposal is to characterize the decisions that the Chilean organizations – both the government and the NGOs - took in response to the massive Maule earthquake that occurred on February 27th, 2010. An international research team – comprising of 3 investigators from the Wharton School of the University of Pennsylvania, four investigators from Catholic University and Vertical S.A., and a senior staff member of the World Economic Forum – have created a book/report in an attempt to understand Chile's leadership during the 2010 super-earthquake, correct procedures, and lessons other countries can learn from their successful strategies.

+ INTRODUCTION \ methodology

There are several methodologies to analyze what happened in Chile:

- Analyze the building codes and whether those codes are enforced for regulation purposes.
- Calculate how insured is Chile – both on corporate and consumer level – for natural disasters like the earthquake.
- Do citizens know about earthquake and tsunami risks? Do they understand the procedure if such disaster strikes?
- Analyze amount of financial damage that could be averted if disaster preventions were done correctly.
- Interview government officials, current administration's cabinet, and other leaders who were responsible for Chile's swift recovery. President Piñera's cabinet is listed in Appendix 5.

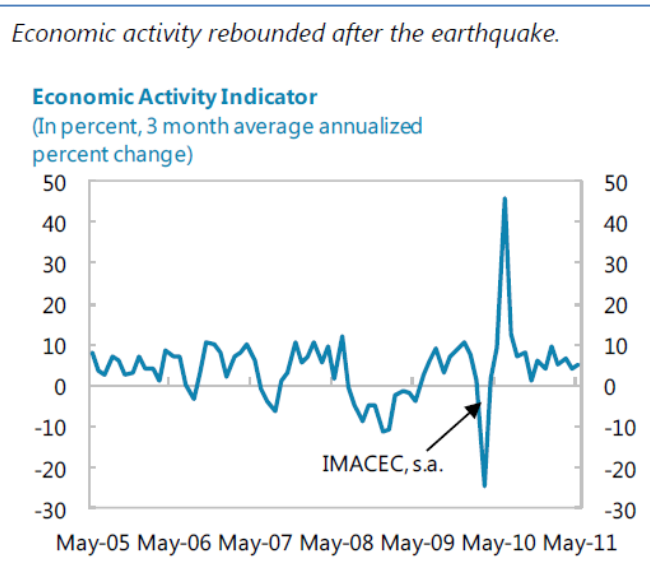
+ THE EARTHQUAKE \ detail

Shortly after the massive earthquake in Haiti on January 12th, 2010, a super-earthquake (8.8 on the magnitude scale versus 7.0 for Haiti) rocked the Chilean for approximately three minutes. The earthquake was powerful enough (roughly 500 times greater than the Haitian earthquake) to claim itself as the 6th greatest earthquake ever recorded – just behind Japan’s 9.0 earthquake that resulted in 15,000 deaths from tsunamis and debris. The damages done to Chile are shown in **Appendix 1**.

Although Chile underwent a staggering loss of 17% of the country’s GDP, information following the mega-earthquake only reported 525 deaths. To put the number in perspective, the chart shown in **Appendix 2** compares Chile’s low fatality rate compared to other countries that were hit by earthquakes.

However, the majority of Chile’s electrical grid was shut down within minutes of the earthquake, and more than 90 percent of the public were subject to faulty telephone lines, irresponsive cellular towers and lack of internet services. In addition to the absence of communication, “The earthquake and tsunami displaced 800,000 people from their homes, and two million experienced at least some residential breakage”¹

²However, Chile’s recovery was swift and sound. 3000 schools that were shut down initially in Chile were all reopened within a month of the earthquake. Financially, Chile’s annual GDP growth turned



negative initially during the earthquake, but by 2011, the country’s annual growth was back to 5+ percent rate.

Goldman Sachs economist **Alberto Ramos** said the following:

“In all, the earthquake will impact the economy during the first half 2010, but *significant policy flexibility, institutional credibility and the resilience* accumulated in recent years should assist Chile in overcoming this tragedy.”³

¹ Kunreuther, Michel-Kerjan, Useem. *First Order of Business*. 2014.

² Source: International Monetary Fund, *Chile, 2011 Article IV Consultation*, 2011, p. 17; IMACEC is a monthly GDP proxy for Chile.

³ Jude Webber, “Economic Tremors Unlikely to be Felt in the Long Term,” *Financial Times*, March 1, 2010

An assessment team from **International Monetary Fund** concluded similarly:

“Chile’s economy has recovered rapidly from the global financial crisis and the February 2010 earthquake. Its resilience was underpinned by solid policy frameworks (including a *fiscal rule, inflation targeting and exchange rate flexibility*), a sound banking system and a strong policy response, facilitated by the existence of large fiscal buffers.”

Data collected from the past several decades would heavily suggest that natural disasters are impossible to stop and unnatural disasters are impossible to predict. Human setbacks, however, are predictable, and their scale depends much upon the decisions of those who lead⁴. The mission is to analyze what Chile has done correctly – from both Bachelet and Piñera administrations in Chile – to help other countries avoid unforeseen disasters.

+ THE EARTHQUAKE \ government response

A major political change was being implemented to the Chilean government at the time of the earthquake. When the earthquake struck, the government was not only changing the presidency (from Michelle Bachelet to Sebastian Piñera) but also involved a change in the political stance (from Leftist government to Central-Right). This political change also happened at the Senate level, and many government officials in each region were changed days before the earthquake struck.

Given the recent political change, the government was relatively slow to act. Other than basic policing to control order, it took them almost 2 weeks to properly respond to the disaster relief with military presence and supplies⁵. In fact, Aldo Boitano at Vertical S.A. stated that Bachelet did not immediately call the National Guard to help with the disaster relief effort, a move later heavily criticized during her 2013 Presidential campaign. In addition, she even initially stated to other countries that Chile did not need any help, which she later corrected.

However, the majority of the heavy duty rescue plan fell on the shoulders of the president-elect, Sebastian Piñera. His first response to the earthquake was very simple and defining: “Clear leadership that *explained* to the people, short and easy, what happened to the country, not just what is happening to them but also what is happening to the other people. People want to know what happened to the

⁴ USGS and American Red Cross, p. 1

⁵ Appendix 7 – Interview with Aldo Boitano, Vertical S.A.

rest of the country.”⁶ However, the president-elect defined more plans for immediate recovery, mandating to restore absolute necessity such as civil order, water and electricity.

Unlike United States where the general population expects the government – both the state and federal – to be the sole response to a disaster, Chileans expect the NGOs to contribute to the relief efforts as well.

+ THE EARTHQUAKE \ role of NGOs

Based on the interviews conducted with Aldo Boitano at Vertical S.A. in Santiago (**Appendix 7**), the role of NGOs is significantly different in Chile than those in United States. The primary role of an NGO is to console the community when a disaster strikes. In most cases, the NGOs are made up of professionals from the community, appointed political officials and experts who are knowledgeable about disaster prevention techniques.

Especially because the population in Chile has a general distrust towards the central government, the NGOs are better suited for restoring order, consoling those struck by the disaster, and understanding precisely what the community needs in order to bounce back from the disaster. However, it is the combination of NGO’s ability to understand the community’s needs and government’s resources/order that truly defined Chile’s remarkable recovery.

According to Aldo, NGOs were the first ones to respond to the disaster. Their first task was to relieve the community, help individuals find their relatives, and start communicating with the government in Santiago. The NGOs, teamed with professionals and utility companies, planned for 1.5 months on how to re-insure the public, and methods to continually keep food, water and electricity running in areas without power.

However, not everything was smooth sailing. For example, some workers were only volunteering to fetch a job from the government-funded housing reconstruction projects. In addition, Aldo states that “help from Santiago contributed more to the problem than solving it”, referring to volunteers from Santiago more interested in taking photos of the aftermath rather than actually providing valuable resources for the earthquake-struck community.

⁶ Kunreuther, Michel-Kerjan, Useem. *First Order of Business*. 2014.

+ THE EARTHQUAKE \ leadership & management

The world was recovering from the 2008-2009 global financial crises and the Chilean economy was not exempt from the hindrances of the Great Recession. When the disaster struck, “The rate of growth was very low. The job creation capacity was very low. The unemployment rate was very high. The investment rate as a percent of GNP was falling down. Productivity was negative. Poverty was increasing.”⁷

To make the matter even worse, Chile received the lowest amount of donations/funding internationally in comparison to the other earthquake-hit countries.⁸

Earthquake Event	Haiti Jan. 12, 2010	Chile Feb. 27, 2010	Japan Mar. 11, 2011	New Zealand Feb. 22, 2011
Magnitude (Mw)	7.0	8.8	9.0	6.3
Estimated deaths	223,000	533	15,883	181
Economic damage in \$ billions	8.1	30	309	15
Economic damage as percent of GDP	117%	18%	5.6%	10.5%
Pace of incoming international aid during the first four days (\$/hour)	107,812	16,297	260,417	60,417
Pre-event				
Population (millions)	9.0	17.1	128.1	4.3
GDP per Capita (PPP)	\$1,338	\$14,340	\$35,500	\$28,400
Population Below Poverty Line (%)	80	18	16	15
Funding relief and reconstruction (\$ bil.)				
National government	950	9,000	198,000	8,500
Insurers	108	8,000	35,000	12,000
Foreign aid, including cash, in-kind, and pledges	4,052	125	17,100	2,668
Governments and multinational agencies	2,941	51	12,500	971
Private individuals and organizations	1,111	74	4,600	1,697

With the NGOs given a heavy work load of relieving the earthquake-struck community on the front-end, the government was defining the tone of the nation:

“First, Piñera insisted that his campaign goals of economic growth and job creation would not be compromised. Second, he required that his government think strategically and act deliberately so that the nation’s comeback would go well beyond its existing condition at the time of the event. Third, he

⁷ Kunreuther, Michel-Kerjan, Useem. *First Order of Business*. 2014.

⁸ Kunreuther, Michel-Kerjan, Useem. *First Order of Business*. 2014.

insisted that all of the reconstruction be guided and constrained by the nation's traditions and values. And fourth, he averred that the restoration would come as completely and quickly as possible, and that all of it was to be completed by his exit on March 11, 2014."

During the interview, Aldo stated that the biggest threat in the modern era is not shortage of water or food but rather a lack of communication. With irresponsive cell phone towers and a lack of electricity, regular cell phones could not be utilized. It is not necessarily the dearth of communication that strikes fear in us, but more the absence of something so fundamental that we have in our daily lives. Only a few who were equipped with specially motorized cellular devices by the military had access to communication. Aldo details that "when we arrived at the scene, the first thing people wanted was a working phone" in order to call and locate their loved ones.

The swift and extensive assurance of the public was a distinctive factor of the Chilean recovery. It is difficult for the federal government to be cognizant of all incidents, and a bridge between the local community – represented by the NGOs – and the government needs to be present. The NGOs alone could not have had the power to restore order while the government alone would not have understood the direct needs of the public.

+ THE EARTHQUAKE \ recovery

The key defining reasons behind Chile's swift recovery were "a history of earthquakes, a well-enforced building code, and a provision that holds builders liable for their building's durability for a decade", which all contributed to a surprising low casualty rate. However, their swift financial recovery, which is analyzed extensively in the following sections, can also be attributed to their indebtedness and lack of international borrowing prior to the earthquake.

Aldo states that most Chileans have property insurance and health insurance. The government was also able to gain swift influx of capital from private insurers backed by international reinsurers. In fact, "a third of the cost of Chile's recovery was borne entirely by private insurers"⁹. The importance of insurance should be depicted as a significant factor to countries in similar geography.

In addition, there were other key techniques that both the NGOs and the government took to expedite the recovery process:

⁹ Kunreuther, Michel-Kerjan, Useem. *First Order of Business*. 2014.

- 200,000 houses were funded by the government to be re-constructed or constructed.
- 3000 schools were to be repaired and all were re-opened within 6 months
- Government spending increased economic activity, raising national credit ratings
- National Emergency Center opened for 24/7 instead of 40 hours a week
- Building codes were re-checked in areas hit by disaster to avoid future building from collapsing
- To avoid heavy traffic in hospitals, some hospitals used “reverse triage” – sending “least-ill patients to their homes with medications, instructions and the promise of home-visits by hospital staff”.¹⁰
- The government purchased the entire stock of local supermarkets at prevailing prices to make sure that the local community received essentials and supermarkets were not taking advantage of the situation by setting the prices at an unfair level.

¹⁰ Kunreuther, Michel-Kerjan, Useem. *First Order of Business*. 2014.

+ AFTERMATH COMPARISON \ stocks

When earthquake strikes, most of the attention is initially focused towards fatality and direct financial damages. However, the stock index – often the best representation of a country's financial status – also takes a huge hit from the calamity. Let's look at 3 different mega-earthquakes in the past decade:

Indian Ocean Earthquake and Tsunami

December 26th, 2004



11

During the Indian Earthquake/Tsunami – December 26th, 2004 – the stock index NSEI (biggest index in India) took a slight hit (roughly from 2.1 K to 1.9K, nearly 10% drop). However, the drop isn't as significant as the Japanese earthquake which resulted in nearly 20% drop even though the fatality rate and the overall financial damages were far greater in the Indian Earthquake.

11

<http://in.finance.yahoo.com/echarts?s=%5ENSEI#symbol=%5Ensei;range=20040101,20051201;compare=;indicator=volume;charttype=area;crosshair=on;ohlcvvalues=0;logscale=off;source=undefined;>

Japanese Tohoku Earthquake and Tsunami

March 11th, 2011



12

During the Japanese Earthquake/Tsunami – March 11th, 2011 – the Nikkei 225 index incurred an enormous drop (roughly from 10.5 K to 8.6K, nearly 20%) within a matter of weeks. In addition, FTSE 100 index – the London exchange – “lost £47 billion of its value in London as it shed more than 180 points in early trading.” In addition, the oil prices dropped sharply as investors predicted that a renewed recession in Japan would take a toll on its demand.¹³

12

<http://finance.yahoo.com/echarts?s=%5EN225+Interactive#symbol=%5En225;range=20091230,20111230;compare=;indicator=volume;charttype=area;crosshair=on;ohlcvvalues=0;logscale=off;source=undefined>

¹³ <http://www.dailymail.co.uk/news/article-1366676/Japan-tsunami-Global-stock-markets-tumble-amid-fears-nuclear-disaster.html>

Chile Earthquake

February 27th, 2010



14

When the Chile earthquake struck – February 27th, 2010 – the IGPA (stock index that tracks most of stocks in the Santiago exchange – did not budge. Compared to the Japanese Earthquake (which resulted in a 20% drop) and the Indian Earthquake (which resulted in a 10% drop), the Chilean earthquake – partly due to extremely low fatality and swift recovery – did not pose any financial threat to the stock market.

¹⁴ <http://www.tradingeconomics.com/chile/stock-market>

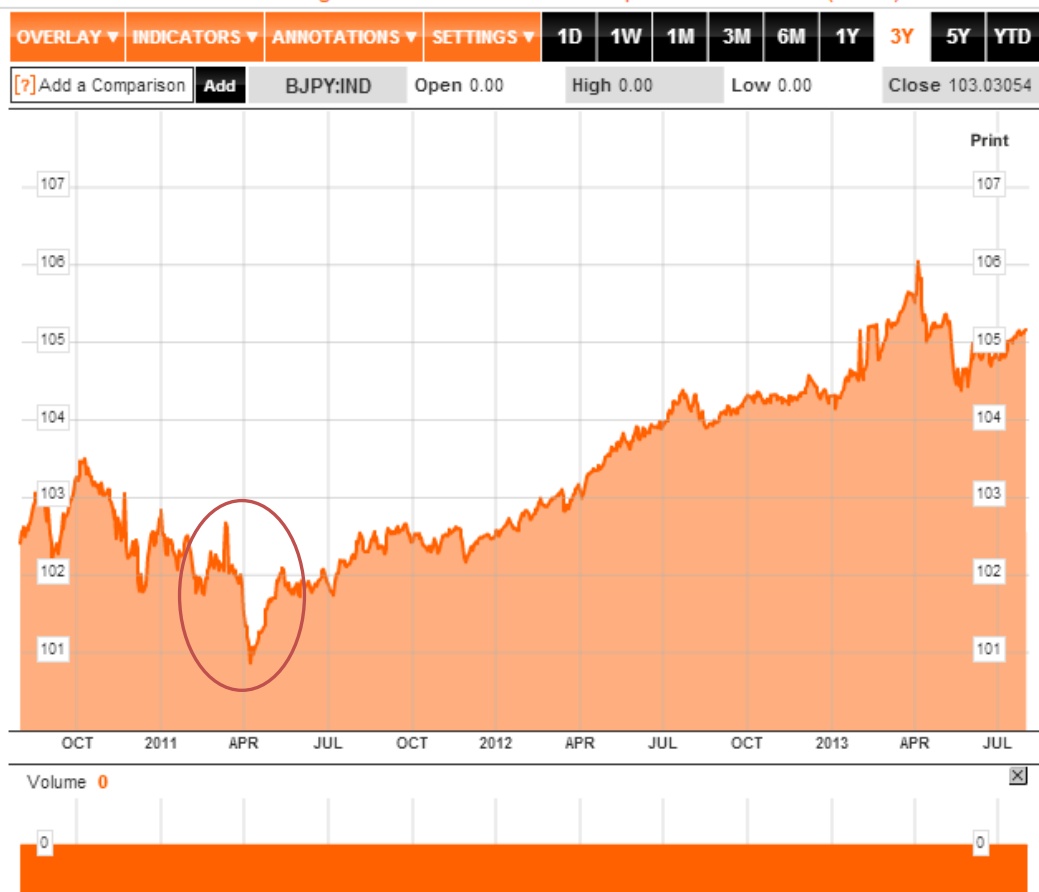
+ AFTERMATH COMPARISON \ bonds

Stock exchanges are an accurate measurement of the initial impact of the disaster. However, fixed income can be implemented to measure the overall healthiness of the nation's financial landscape post-earthquake. Especially because earthquakes can disrupt supply chain, daily operations, office buildings and general business models, some corporations might look to default on their next payment, driving the bond prices down. Here, we break down the bond indices of two countries: Japan and Chile.

Japanese Earthquake

As we can observe from the graph below, the Japanese Investment Grade Corporate Bond Index (BJPY) dipped significant following the earthquake. In addition to the country's general credit rating downgraded, investors flocked away from the Japanese bond market.

Interactive Chart for Bloomberg JPY Investment Grade Corporate Bond Index (BJPY)



Chile Earthquake

As indicated from below, there was only a slight dip in the DJones LA Tixx Chile government Peso Bond Index following the earthquake. The slight drop indicates that the investors are more convinced of the nation's financial healthiness in comparison to Japan's steep decline.

Dow Jones LA Tixx Chile Government Peso Bond Index (INDEXDJX:DJLCGP)

Add to portfolio

1,856.21 -1.12 (-0.06%)

Jul 31 - Close
INDEXDJX real-time data - Disclaimer

Range 1,856.21 - 1,856.21
52 week 1,771.09 - 1,857.33
Open 1,856.21
Vol. 0.00

+1 { 0

Compare:



+ AFTERMATH COMPARISON \ government

Stocks and bonds are good measurement for financial resiliency of given country to disasters. However, another interesting metric is to observe the credit ratings of each government. We analyze three recent earthquakes: one in Japan, one in New Zealand, and of course, the one in Chile.

EFFECT ON RATINGS \ NEW ZEALAND \ 2.22.2011 \ 6.3 M_w \ \$40 Bil. Loss

Feb.2011

Earthquake of 6.3 magnitude has hit New Zealand.

Sep.2011

The outlook is stable after the long-term local-currency rating was reduced one level to AA+ and foreign-currency debt was cut to AA from AA+, S&P said in a statement. New Zealand's dollar extended its biggest quarterly drop since 2008 after Fitch announced similar moves yesterday. Both credit assessors cited concern that government and household debt is expanding.¹⁵

**STANDARD
& POOR'S**


Sep.2011

**Fitch
Ratings**

Standard & Poor's Ratings Services and Fitch Ratings both downgraded New Zealand's government debt Friday, citing its worsening external-debt position and the costs of earthquake recovery. The ratings companies, acting less than nine hours apart, cut their long-term foreign-currency ratings to AA from AA-plus and the local-currency ratings to AA-plus from AAA, with stable outlooks.¹⁶

¹⁵ <http://www.businessweek.com/news/2011-09-30/new-zealand-yields-surge-as-ratings-cut-by-s-p-fitch.html>

¹⁶ <http://online.wsj.com/article/SB10001424052970204226204576601601469975690.html>



EFFECT ON RATINGS \ JAPAN \ 3.11.2011 \ 9.0 Mw \ \$235 Bil. Loss

Mar.2011

Earthquake of 9.0 magnitude has hit Japan.

April.2011

**STANDARD
& POOR'S**

Standard and Poor's threatened to cut Japan's sovereign credit rating again, warning the huge cost of last month's devastating earthquake will hurt already weak public finances unless bickering politicians can agree to raise taxes. It affirmed its long-term sovereign credit rating on Japan at **AA minus** -- the lowest among the major agencies -- but downgraded the outlook to negative from stable. Public debt, already twice the size of the \$5 trillion economy, is set to swell as the country faces reconstruction costs following the March 11 earthquake and tsunami that could reach 50 trillion yen (\$613 billion), S&P said.¹⁷

May.2011

MOODY'S

Moody's warned on Tuesday that the devastation that struck Japan nearly three months ago is making it even harder for the country to recover from the financial crisis. It put Japan's **Aa2 rating** – the rating agency's third-highest grade – on review for a possible downgrade, adding that there was a "low chance" of a multi-notch downgrade.¹⁸

Aug.2011

MOODY'S

Moody's, the credit ratings agency, lowered Japan's credit rating by one notch on Wednesday, warning that frequent changes in administration, weak prospects for economic growth and its recent natural and nuclear disasters made it difficult for the government to pare down its huge debt.¹⁹

May.2012

**Fitch
Ratings**

Fitch said it was cutting the sovereign rating to **A-plus**, putting it on a par with Estonia and Malta, and below the local currency ratings for Asian rivals China and Korea. The firm's action lowers the double-A long-term foreign-currency rating and the double-A-minus local currency issuer default rating to the new A-plus level.²⁰

¹⁷ <http://www.reuters.com/article/2011/04/27/us-japan-economy-rating-idUSTRE73Q0J920110427>

¹⁸ <http://www.theguardian.com/business/2011/may/31/japan-unemployment-credit-rating-threat>

¹⁹ http://www.nytimes.com/2011/08/24/business/global/japans-credit-rating-cut-by-moodys.html?_r=0

²⁰ <http://online.wsj.com/article/SB10001424052702303610504577419700029425564.html>

EFFECT ON RATINGS \ CHILE \ 2.27.2010 \ 8.8 Mw \ \$15 to \$30 Bil. Loss

Feb.2010

Earthquake of 8.8 magnitudes has hit the central coast of Chile.

Jun.2010

MOODY'S

In June 2010, Moody's upgraded Chile's credit rating to **Aa3** from **A1** with positive outlook because "The upgrade reflected the country's demonstrated economic and financial resilience even in the face of major adverse shocks, including February's historic earthquake"²¹

Jul.2010

Chile's government recently launched a \$1.5 billion bond issuance, in both local and foreign currency, in the international capital markets. The government's plan to issue this debt was made public months ago, and is fully incorporated in Chile's ratings. Chile's foreign and local currency government bond ratings were upgraded to **Aa3** on June 16 2010. The upgrade reflected the country's demonstrated economic and financial resilience even in the face of major adverse shocks, including February's historic earthquake. The government's strong fiscal position and favorable debt profile, including the expected upcoming debt issuance, also supported the upgrade.²²

Dec.2010

STANDARD
& POOR'S

In December 2010, Standard & Poor's revised the outlook to positive because "Chile's strong financial profile, growing economic stability, and good growth prospects support the positive outlook". Previously, in December 2007, Standard & Poor's upgraded Chile's credit rating to **A+** from **A** with stable outlook, lauding the strength of its economy and saying its economy was "more resilient than ever".²³

Feb.2011

Fitch
Ratings

In February 2011, Fitch upgraded Chile's credit rating to **A+** from **A** with stable outlook because features of Chilean economy "have allowed Chile to remain very resilient despite the two severe shocks emanating from the global credit crisis and the 2010 devastating earthquake."²⁴

Dec.2012

MOODY'S

In December 2012, Moody's upgraded Chile's credit rating to **Aa3** from **A1** with stable outlook, to reflect the resilience of the economy to external shocks, including the 2012 earthquake. In addition, it considered the solid fiscal position and the favorable debt profile.²⁵

²¹ <http://www.hacienda.cl/english/investor-relations-office/why-chile.html>

²² http://www.moodys.com/research/Moodys-says-Chiles-ratings-remain-stable-after-15b-bond-issuance?docid=PR_203197

²³ <http://www.hacienda.cl/english/investor-relations-office/why-chile.html>

²⁴ <http://www.hacienda.cl/english/investor-relations-office/why-chile.html>

²⁵ <http://www.hacienda.cl/english/investor-relations-office/why-chile.html>

EFFECT ON RATINGS \ COMPARISON TIMELINE

	<u>STANDARD</u> <u>& POOR'S</u>	MOODY'S	Fitch Ratings
CHILE	A+	A1	A+
JAPAN	AA-	Aa2	A+
NEW ZEALAND	AA	N/A	AA

Red \ Downgraded
Green \ Upgraded

+ ADDITIONAL INFORMATION \ appendix

APPENDIX \ 1

Impact	Number
Airports damaged	8
Ports and fishing coves destroyed	30
Hospitals damaged or destroyed	40
Bridges severely damaged or destroyed	210
Km. of coastline devastated	630
Km. of roadways severely damaged	1,554
Schools damaged	4,538
Public housing units damaged	8,000
Homes destroyed	81,400
Homes severely damaged	109,000
Homeless residents	800,000
School students displaced	1.2 million
Municipalities impacted	69 percent
Health organizations impacted	75 percent
Population impacted	81 percent
Estimated cost (17 percent of GDP)	\$30 billion

Source: Ministry of Housing and Urban Development, Reconstruction Program, 2012; Hernán de Solminihaç, 2012.

Note: Figures are estimates.

APPENDIX \ 2

Location	Date	Moment Magnitude	Estimated Fatalities
Valdivia, Chile	May 22, 1960	9.5	5,700
Prince William Sound, Alaska	March 28, 1964	9.2	125
Andreanof Islands, Aleutian Islands, Alaska	March 9, 1957	9.1	0
Off the coast of Tōhoku, Japan	March 11, 2011	9.0	15,870
Kamchatka, Russia	Nov. 4, 1952	9.0	Unknown
Off the western coast of Sumatra, Indonesia	Dec. 26, 2004	9.0	230,000+
Off the coast of Ecuador	Jan. 31, 1906	8.8	1,000
Off the Maule region, Chile	Feb. 27, 2010	8.8	523
Rat Islands, Aleutian Islands, Alaska	Feb. 4, 1965	8.7	Unknown
Northern Sumatra, Indonesia	March 28, 2005	8.7	1,303

Source: <http://www.infoplease.com/ipa/A0763403.html#ixzz2A93tHXQQ>

APPENDIX \ 3

Rank	Country	Risk %
1	Vanuatu	64
2	Tonga	55
3	Philippines	53
4	Japan	46
5	Costa Rica	43
6	Brunei Darussalam	41
7	Mauritius	37
8	Guatemala	36
9	El Salvador	33
10	Bangladesh	32
11	Chile	31
12	Netherlands	31
13	Solomon Islands	30
14	Fiji	28
15	Cambodia	28

Source: United Nations University Institute for Environment and Human Security and The Nature Conservancy, with Alliance Development Works, *World Risk Report, 2012*. Risk exposure percentage is defined by the fraction of the population that is exposed to natural hazards, including earthquakes, cyclones, flooding, drought, or rising sea-levels.

APPENDIX \ 4

Rank	Country	Expert Sample	Risk Management Question score	Margin of error
1	Singapore	171	6.08	0.11
2	Qatar	113	6.01	0.18
3	Oman	75	5.55	0.26
4	United Arab Emirates	163	5.47	0.17
5	Canada	101	5.41	0.20
6	Sweden	76	5.41	0.28
7	Saudi Arabia	94	5.41	0.29
8	New Zealand	52	5.40	0.24
9	Finland	36	5.32	0.43
10	Chile	78	5.20	0.29
17	Germany	127	4.90	0.25
18	Turkey	84	4.83	0.28
19	Switzerland	77	4.82	0.32
20	United Kingdom	102	4.81	0.28

29	United States	390	4.53	0.14
30	China	369	4.51	0.13
31	France	128	4.51	0.27
32	Australia	67	4.49	0.41
38	India	119	4.31	0.27
39	Italy	86	4.24	0.32
45	Brazil	141	4.16	0.23
67	Japan	111	3.67	0.28
138	Argentina	96	2.08	0.25
139	Venezuela	38	1.68	0.28

Source: World Economic Forum Executive Opinion Survey (question x.xx), “How would you assess your national government's overall risk management effectiveness of monitoring, preparing for, responding to and mitigating against major global risks (e.g., financial crisis, natural disasters, climate change, pandemics, etc.)? Scale: 1 = not effective in managing major global risks; 7 = effective in managing major global risks.” World Economic Forum, *National Competitiveness*, Geneva, Switzerland, World Economic Forum, 2013.

APPENDIX \ 5

Office	Name
Interior	Rodrigo Hinzpeter
Foreign Affairs	Alfredo Moreno
Defense	Jaime Ravinet
	Andrés Allamand
Finance	Felipe Larraín
Secy. Gen. of Presidency	Cristián Larroulet
Secy. Gen. of Government	Ena von Baer
	Andrés Chadwick
Economy	Juan Andrés Fontaine
	Pablo Longueira
Planning	Felipe Kast
	Joaquín Lavín
Education	Joaquín Lavín
	Felipe Bulnes
	Harald Beyer
Justice	Felipe Bulnes
	Teodoro Ribera
Labor	Camila Merino
	Evelyn Matthei
Public Works	Hernán de Solminihac
	Laurence Golborne
Health	Jaime Mañalich
Housing & Urbanism	Magdalena Matte
	Rodrigo Pérez

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Mining	Laurence Golborne
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Energy	Ricardo Raineri
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	Fernando Echeverría
	Rodrigo Álvarez
	Jorge Bunster
Women	Carolina Schmidt
Culture & the Arts	Luciano Cruz-Coke
Environment	María Ignacia Benítez

APPENDIX \ 6

Moody's		S&P		Fitch		
Long Term	Short Term	Long Term	Short Term	Long Term	Short Term	
Aaa	P-1	AAA	A-1+	AAA	A1+	Prime
Aa1		AA+		AA+		High grade
Aa2		AA		AA		
Aa3		AA-	AA-			
A1		A+	A-1	A+	A1	Upper Medium grade
A2	P-2	A	A-2	A	A2	Lower Medium grade
A3		A-		A-		
Baa1	P-3	BBB+	A-3	BBB+	A3	Lower Medium grade
Baa2		BBB		BBB		
Baa3		BBB-		BBB-		
Ba1	Not Prime	BB+	B	BB+	B	Non Investmentgrade speculative
Ba2		BB		BB		
Ba3		BB-		BB-		
B1		B+	B+	Highly Speculative		
B2		B	B			
B3		B-	B-			
Caa	Not Prime	CCC+	C	CCC	C	Substantial risks
Ca		CCC				Extremely speculative
C		CCC-				In default with little prospect for discovery
/	Not Prime	D	/	DDD	/	In default
/				DD		
/				D		

APPENDIX \ 7

Ricky: What was disaster prevention process like?

Aldo: There was such a lack of leadership that President Bachelet appointed presidential delegates in each region as the “intendente”, most important political figure in the region. Bachelet appointed the people only for 4 days since she was leaving the office. Apparently, the man in charge of the largest police station in the area [Region 7] was crying because he was overwhelmed by the situation. People were starting to rob supermarkets, fighting in the streets and they didn’t know what to do. Due to that, NGOs organized electric companies, water companies, important political figure, etc. for 1.5 months and they all used pen and paper because there were no phones at the time.

Ricky: What was the general feeling towards the government?

Aldo: There were a lot of resentment towards the central government and political figures because they more or less abandoned them.

Ricky: Do you think if the earthquake were to happen right now where there are no transitions between the two presidents [Bachelet & Piñera], the situation would have been different?

Aldo: In a way, yes. But in another way, how the government acts would have been the same. Maybe the police force would not have been as detached. Again, there would have been similar resentments towards the senators and congressmen since most of the political figures reside in Santiago, the capital, and they are very detached from the situation which was happening in a more distant area.

Ricky: What exactly is the role of NGO in Chile? For example, in United States, when a disaster strikes, people look at the central government first, and then organizations like the Red Cross.

Aldo: The primary role of the NGOs and the local community authority is to give consolation to the community. “Un Techo” which is a government-funded project to the NGO was to provide temporary housing to those suffering from disasters. However, there were controversies about the project since some were trying to show off to continue getting funded from the government.

Ricky: So, where would the people go for help if the disaster struck again? NGOs or Government?

Aldo: Still NGO.

Ricky: What was the NGO’s first response to the earthquake?

Aldo: First thing was to take care of the families. Because it was such a big earthquake, people were scattered all over the place, and locating them was the first priority. The two interviewees who were here explained that they had to hop on a military van and the senator’s car to go around the neighborhood. Remember that gas and electricity were down, so transportation was terribly difficult.

Ricky: Could you specify what you mean by “taking care” of the families?

Aldo: Checking families, checking general well-being of the people, making sure there is order. The 7th Region office was destroyed while the 8th Region office was operating. Basically, Rodrigo [CEO of Vertical] and Leonardo [Vice President of Vertical] were starting from the bottom of the country and going up north. NGOs were the first response team, and due to the trust gained from the people, NGOs were easier to navigate throughout the disaster than per say the government. The central government was criticized heavily, especially Bachelet, for not calling the national military troops to support the earthquake relief effort.

Ricky: I understand that NGOs' first goal was to comfort people, but as far as lack of gasoline or electricity, how did they deal with that?

Aldo: NGOs and various utility companies worked with the military to constantly supply resources from nearby sources.

Ricky: Did you receive any help from Santiago or was it too far?

Aldo: There were some help from Santiago, but it was without us asking. To be quite honest, many volunteers from Santiago actually added more to the problem than solving it. They were taking pictures of the disaster, trying to take career opportunities from reconstruction projects, etc.

Ricky: When did the government actually kick in?

Aldo: About 2 weeks after the disaster. We only had help from the military and the police to keep control of the population, and companies who were trying to rebuild infrastructure. It was similar to how Bush reacted to Hurricane Katrina... political figures are rarely the first ones at the scene, but almost always make bigger deal out of things to look good on tv.

Ricky: What was the hardest thing that the NGO faced?

Aldo: Communication. Having no cell phones provided extreme difficulty not only between the NGOs and those who were volunteering, but to the people. Everybody wanted to talk to their relatives and confirm that their families were okay. Because electricity was out and also the cell phone towers got knocked out, regular cell phones were obsolete. We had special phones that used special motor provided by the military but it would only work for a few hours. Every time we try to go help someone, they were always requesting cell phones, so they can call their loved ones in other places.

Ricky: So if the cell phones issue was solved, would everything have been significantly better?

Aldo: Not necessarily. We were also worried about the people on the coastline since we haven't had any big tsunamis since 1960. Also, it was around the 60s when the new building codes were put in place and regulated. Many of the structures around the country were built before that time, so we were worried that those buildings might get easily destroyed.

Ricky: I used to live in Japan which is a country constantly experiencing earthquakes and tsunamis. The building codes there are heavily regulated, and the population understands the risk of such disasters. However, they suffered 15000 casualties while Chile only suffered 525. Why is that the case?

Aldo: The main difference is the tsunami. Their tsunami was one of a kind in 1000 years. Both of the countries experienced similar earthquakes. In fact, Chile has a major earthquake almost every 10 years, hitting different parts of the country since the country is so vertically long. We do extensive research on earthquakes, and every children and adults understand the earthquake drill. However, tsunamis are relatively new. I have done extensive research on earthquakes and tsunamis in Japan and Chile, and it seems that there is a big tsunami every 1000 years to a particular country. There recent one that hit Japan was their share, and our last one was around the 1500s. Because it's not as apparent and we don't necessarily see it during our lifetime, we under-prepare for it. We were lucky that there were no big tsunamis following the earthquake in 2010, especially given the fact that the national emergency agency was closed during the time.

Ricky: How do you prepared for a tsunami?

Aldo: You just go up in elevation. 85 % of Chile is mountain, which ranks us as the most mountainous region in the world, rivaling Switzerland. Therefore, we do not have any flat beaches. I guess educating the people around the coast to react immediately to large earthquakes would be the key to survival.

Ricky: From the 525 people who died, what percentage was from tsunamis?

Aldo: 300 were from tsunamis and the rest were from falling debris. Most of them were not in Santiago.

Ricky: Were other countries affected at all?

Aldo: not at all. Chile is really the only one affected by earthquakes in South America. Argentina has their one problem, which is volcano.

Ricky: What were the effects of the Earthquake? Since fatality rate was low and the stock exchange barely dipped.

Aldo: 3000 schools were broken down, and 200,000 houses were broken down as well. However, most schools were re-opened by April, and even before then, they found creative ways for everyone to continue their education. There were other various difficulties. The government mandated to build houses for those who lost their homes. However, many of them wanted to stay in their hometown, especially since many of the houses were passed down from generations to generations. Some of them didn't have paper work nor did they sign the deed to the house when the ownership changed. So, we had to send lawyers and psychologists to figure the situation out. Generally, those who were affected the most were middle to lower class.

Ricky: What was the one single biggest key to earthquake prevention?

Aldo: Education. Educating the people about what to do during earthquakes. The older generation remembers the big earthquake in 1960 which was 9.5 on the Richter scale, killing 125,000 people. So, constantly reminding the new generations of what to do is important, and we have had programs to do that.

Ricky: It's interesting that Japanese stock index and the Indian stock exchange both dipped heavily following respective tsunamis. However, Chile's went up?

Aldo: Our economy went up actually because the earthquake and reconstruction created a lot of jobs, and the aftermath of the earthquake – both financial aftermath and fatality rate – was better than expected given the magnitude of the earthquake.

Ricky: Are most people insured?

Aldo: Yes, most have private property insurances. Also Health Insurances are common as well.

Ricky: What were some of the biggest hardships?

Aldo: The government was very detached from the situation, and could not relate to the people at all. They were giving us things that we didn't need, and not supplying commodities that we did need. Most of the senators used the situations as a political spin, and even Bachelet told the entire world that we did not need help, which in my opinion, was not the case at all. However, we did learn a lot from the situation. We imposed stricter building codes, continue educating people about response techniques, and created 24/7 national emergency response agency.

+ ADDITIONAL INFORMATION \ acknowledgments

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