

Analysing the impact of natural disasters on the
New Zealand economy: lessons from the
international literature

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Attestations of Authorship

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

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Abstract

In recent decades, natural disasters appear to be occurring more frequently and be more intensive, exacerbated by growing population and urbanisation. Apart from the loss of life, natural disasters are likely to have chronic adverse impacts on the economy. Public interest in the study of natural disasters has been growing globally. However, progress on mitigation programmes has been slow. Disaster mitigation is usually placed outside of economic development planning; the study of disaster mitigation strategies and the impact of disaster on economic systems are not well resourced (Ibarrarán et al., 2009). Evaluations of disaster impact focusing on small economies, like New Zealand are particularly limited.

Recent events such as the Canterbury earthquakes have highlighted the fragility of New Zealand's economy to natural disasters. This study investigates the impact of natural disasters, focusing on the Canterbury earthquakes on New Zealand's macroeconomic performance and how it influences the country's overall economic position. It addresses what lessons New Zealand can learn from the relevant international literature in terms of disaster mitigation strategies, macroeconomic policy implications as well as an evaluation of its institutional arrangements in the face of a disaster such as the role of the private and public insurance along with an examination of the Earthquake Commission (EQC). The international disaster experiences emphasised that pre-disaster strategic plans, in terms of preparedness and response, are particularly valuable and effective in minimising losses, in spite of the large cost in human and economic terms. New Zealand has generally responded to the earthquakes relatively well. However, a number of concerns have been raised, including a reduction in insurance and re-insurance availability, deterioration in the fiscal and debt capacity, increase in bank funding costs, problems in building standard, and deficiencies in the EQC system.

CHAPTER 1

Introduction

A study on the economy impact of natural disasters and disaster mitigation strategies can be developed to minimise human and economic loss due to natural disasters.

Natural hazards and disasters appear to be occurring more frequently with greater intensity, due to changes in the global environment in terms of climatic and economic structures in modern times. It would consequently affect residents seriously through natural, human and capital losses. Nevertheless, disaster and pre-disaster mitigation strategies are generally not included in the economic development plans (Ibarrarán et al., 2009). Recent global natural disasters, such as the 2004 Indian Ocean Tsunami, the 2008 Sichuan earthquake in China, the 2010 Haiti earthquake, the 2010 Canterbury earthquakes, as well as, the 2011 Tohoku earthquake demonstrated an increasing tendency in both frequency and intensity of natural disasters.

Moreover, there is an increasing trend of potential economic losses caused by natural disasters due to growing population and urbanisation (Howell, 2006). However, most countries are likely to report their disaster losses emphasising on the direct damages, such as the replacement value of the assets, not on the greater systematic impacts, such as impact on the monetary system, as well as potential risks on the economy, (Pelling, zerdem, & Barakat, 2002).

Furthermore, it is almost impossible to compare the effects of natural disasters across countries due to variations in population, level of income and the degree of risk exposure (Ibarrarán et al., 2009). However, to a great extent, lessons can be learnt on how to mitigate the adverse economic impacts on the affected nation by studying the

strategies and responses that have been implemented and used in others countries in response of disasters in the past. Toya and Skidmore (2007) argue that educational attainment, economy openness, size of the government, financial systems and income are relevant measures for the economic growth. Efficient direct disaster mitigation efforts, such as rescue and response operation by the Civil Defence, emergency aid relief, disaster preparedness training, etc., are capable of limiting the overall negative impact on the economy. Therefore, an impact assessment appears to be critical to better understand the economic impact of the Canterbury earthquakes and prepare, mitigate, respond and manage appropriately for future disasters.

The objective of this study is to address the macroeconomic impact of a natural disaster on the New Zealand economy and what lessons New Zealand can learn from the relevant international literature in terms of strategies for mitigating the economic impact of natural disasters, focusing on fiscal and monetary policy implications through a critical review of the international literature and case studies. The development and adoption of enhanced disaster prevention and preparedness measures are the keys to effectively reduce the risks in terms of human and economic loss caused by a natural disaster.

According to an investigation by Ibarrarán, Ruth, Ahmad, and London (2009), of natural hazards such as floods, droughts, windstorms, landslides, heat waves and others, earthquakes record the highest average deaths and damages. Therefore, the research focuses on the impact of the Canterbury earthquakes in New Zealand, international cases were drawn to establish the context and relative scale of it.

This study includes a detailed examination of existing New Zealand policy so as recommendations can be made within relevant context.

Given the fact that New Zealand is an earthquake-prone country, natural disaster mitigation actions are seen to be valuable in limiting the risk of economic losses during and after a natural disaster, in terms of both measurable benefits such as infrastructure damage, and immeasurable benefits such as stress on individuals. Therefore, an effective natural disaster mitigation strategy is an essential factor to take into account when undertaking future project planning and design decisions (Howell, 2006). In addition, an investigation of the institutional elements such as the role of public and private insurances was carried out. In addition, the Earthquake Commission (EQC) is a key element in New Zealand's mitigation strategy and its role was investigated as part of this study.

The remainder of the paper is as follows. Chapter 2 describes the methodology and data. Five sub-sections are organised in Chapter 3. Five sub-sections are organised in Chapter 3. Section 3.1 presents and discusses the estimated total macroeconomic impact of the Canterbury earthquakes on New Zealand's economy. Section 3.2 analyse implications for fiscal policy with lessons learnt from international literature and experiences. Section 3.3 analyses implications for monetary policy with lessons learnt from international literature and experiences. Section 3.4 is devoted to investigating the impacts on insurance and re-insurance industry and will examine the role and the effectiveness of the EQC, a unique government-owned insurance institution. Section 3.5 discusses any recommendations for the disaster strategic plans. Chapter 4 concludes this research by summarising the findings of the study and giving recommendations to policymakers as well as highlighting the limitations of the study and direction for future research.

CHAPTER 2

Methodology and data

This research relies on a critical review of international literature and working papers. The focus of the study is to identify the economic impact of a natural disaster, and evaluate the potential policy implications and responses, based on the New Zealand context.

Yin (2009) claims that when researchers have little control over events and the focus of the study is on a modern phenomenon, case studies are the favoured method. In this study, extreme cases, for example, high magnitude earthquakes in urban areas have been selected out of all types of natural disasters by using purposeful sampling strategy. In evaluation, unusual conditions or extreme outcomes from deviant cases can possibly explain both the unusual and the typical. Consequently, more typical programmes can be improved (Patton, 2002).

This project is based on an investigation of a contemporary phenomenon, supported by relevant quantitative data, in order to achieve and interpret relevant policy implications for New Zealand in the aftermath of the Canterbury earthquakes. According to Aronson (1994, p. 1), trends and patterns of living and/or behaviour can be analysed through quantitative data such as household spending and saving behaviour. Specific mitigation strategies, for example, in the effort to maintain macroeconomic stability are identified from the international literature and taken into New Zealand context. Any policy recommendations were made through critical process.

This study is based primarily on secondary data. Information and data on global natural disasters were referred from the international

literature and working papers and accessed via AUT database. Quantitative data and graphs of the macroeconomic variables for New Zealand such as GDP and unemployment rate are publicly available at the Government's official websites and drawn on to establish the context and relative scale of the Canterbury earthquakes. Quarterly data were selected and collected from the Statistics New Zealand website. Specific data of economic and fiscal indicators and analysis were collected from the website of government agencies, including the website of the Reserve Bank of New Zealand (RBNZ), the New Zealand Treasury, the EQC as well as the Department of Labour. Regional data are also available at the Local Council websites.

CHAPTER 3

3.1 An estimated impacts assessment of the recent Canterbury earthquakes on the New Zealand economy

Two major earthquakes in Canterbury were devastating and have had a profound human and economic impact in terms of both intermediate and secondary effects on New Zealand's economy and is likely to continue to be felt for many years. It is surprisingly difficult to quantify the final cost of the damage stemming from the earthquakes with the risk of ongoing damage from aftershocks. The economic effects are still emerging in the presence of the continuing aftershocks and fragile global economic outlook (Bollard & Hannah, 2012, p. 7). Some industries such as the Manufacture, and the Professional, Scientific and Technical sectors in the region have been badly affected in terms of production, employment and revenue. However, several major macroeconomic indicators suggest resilience (Department of Labour, 2011). This section outlines the intermediate effects of the earthquakes along with an evaluation on the macroeconomic performance measures such as GDP, balance of payments, employment status, industry sector performance, household consumption as well as migration patterns.

On 4 September 2010, a 7.1 magnitude¹ earthquake struck the Canterbury region of New Zealand at 4:35 am. The epicentre was just 40 kilometres away from the city of Christchurch, where is the largest urban area with a population of 386,000 in the South Island of New Zealand (GeoNet, 2010). Large scales of casualties were escaped, due to the time of the quake occurred when most people were in bed and the majority of constructions being reinforced in the area. Power outages and extensive direct damages were resulted by the quake.

¹ The Richter Magnitude Scale is a base-10 logarithmic scale and is used to measure the seismic energy released by an earthquake.

Sewers were damaged along with broken water lines. Several cases of gastroenteritis were reported as a result of water contamination in southwest of Christchurch, the town of Rolleston. All schools were ordered to be closed until 13 September. Several notable landmarks and buildings were badly affected (NZ Red Cross, 2011, p. 1).

Less than six months after the tragedy, another magnitude 6.3 earthquake that is classified to be aftershock of the September quake hit again in the Canterbury region on 22 February 2011 at lunchtime with the epicentre even more closer to the city of Christchurch (GeoNet, 2011). Since it came about at lunchtime on a weekday when most people were at school/work or on the street, the risks of being injured by collapsed structures were high. 181 people from more than 20 countries were killed and approximately 1,500 to 2,000 people were injured this time, creating the quake the second-deadliest natural disaster in New Zealand's recorded history.

Widespread damage developed across Christchurch on the basis of weakened buildings and infrastructure caused by the September 10 earthquake. Eighty percent of the Christchurch city had no electricity on the day of the earthquake. Road and bridge damage led to greater challenges and difficulties for rescue. Serious soil liquefaction² and surface flooding occurred, generating roughly 400,000 tons silt in the eastern suburbs which also hampered rescue efforts (NZ Red Cross, 2011, p. 1)

However, direct damage to human life and the physical assets is only part of the story; significant secondary effects also have been observed. According to the 2011 Budget, the New Zealand Treasury estimates the combined financial cost of the direct loss at around \$15 billion which represents about 8 percent of national GDP, caused by

² Liquefaction is a phenomenon in which the strength and stiffness of a saturated soil is reduced by an applied stress, usually earthquake shaking or other rapid loading, causing it to behave like a liquid.

the first two major quakes. Local economic activity fell dramatically due to large declines in business and consumer confidence both inside and outside the Canterbury region. The impact on the exports of goods has been limited while export of services, including tourism and education, has been severely compromised. Although the current high exchange rate poses further difficulties on the exports, it is currently being partially offset by improved terms of trade.

Early cost estimates seem to be unreliable as damage resulting from the earthquakes is not limited to buildings and infrastructure, but also to the land itself which presents exceptional problems for rebuilding (Bollard & Hannah, 2012, p. 7). Further damage assessments have become available over time. According to Treasury's October Fiscal and Economic update, the equivalent of 10 percent of GDP will be spent for the reconstruction assumed. Damage estimates have increased from \$15 billion to \$20 billion or up to \$30 billion if additional costs from inflation and adjustment of insurance arrangement or higher required building standard are involved. Of the estimated \$20 billion, \$13.5 billion is the total net cost to the Crown (NZ parliament, 2011a). This shock is seen to be exceptionally large to the New Zealand economy. As a comparison, the damage caused by the massive earthquake in Japan in March 2011 is estimated to be equivalent to around 3 percent of Japan's annual GDP.

The earthquakes also have considerable immeasurable impacts. After such traumatic events, local residents have been left, not just with physical, but also psychological injuries. A number of people have been suffering from the post-traumatic stress disorder (PTSD) and the symptom can be developed gradually. It can persist for years (HITLabNZ, n.d.) Moreover, the disasters have caused a higher rate of family violence. According to Canterbury Police, there was a provisional increase of 53% in reported family violence just days after the first quake in 2010 (Christchurch Women's Refuge, 2010, p. 2).

New Zealand was slowly recovering from the global financial crisis when the domestic earthquake crisis; clearly this has shocked its economy on an unprecedented scale. An analysis of the wider impacts based on each of the indicators is as follows.

Short-term economic activity was badly disturbed as consumer and business sentiment reduced sharply throughout the economy which resulted in declines in household and business spending, in addition to, lost production and exports, in the Canterbury region (Bollard & Hannah, 2012, p. 9).

Table 1 shows the percentage change of GDP in New Zealand from the second quarter of 2010 to the third quarter of 2011 which covers the period of the two major Canterbury earthquakes. It indicates that the real production GDP growth fell to negative 0.1 percent in the third quarter compared to 0.3 percent increase in the second quarter of 2010 when the September earthquake occurred and it also dropped visibly from 0.7 percent to 0.1 percent after the February 2011 earthquake. The nominal GDP on expenditure rose aggressively and continue to increase since the third quarter of 2010. An analysis of the impact of these quakes on each component of GDP has been produced by the Statistics New Zealand (2011) in the March 2011 quarter. It concludes that there are some disruptions to the manufacturing sector, electricity supply, retail and accommodation, transport services, real estate and business services, communications, ownership of owner-occupied dwellings as well as education activity and community services in the Canterbury region but not noticeable at the national level. Only residential and commercial building construction affected negatively both in the local region and nationally (Statistics NZ, 2011b).

Table 1: Gross Domestic Product (GDP)

		2010Q2	2010Q3	2010Q4	2011Q1	2011Q2	2011Q3
Real production GDP	qtr percent change	0.3	-0.1	0.3	0.7	0.1	0.8
	ann ave percent change	0.1	1	1.3	1.2	1.1	1.3
Nominal GDP - expenditure basis	ann ave percent change	2	3.2	5.2	6	6.1	6.2
Real GDP per capita	ann ave percent change	-1.1	-0.2	0.1	0.1	0.1	0.3

Sources: Statistics New Zealand, Reserve Bank of New Zealand, NZIER, ANZ National Bank, Datastream, Westpac McDermott Miller.

However, other factors such as the ongoing financial crises in Europe and sluggish expansion in the U.S. also clearly impact on New Zealand's GDP. Therefore, it is difficult to estimate the specific impact of the earthquakes precisely.

The impact on the regional economy is significant. Prior to the earthquakes, Canterbury followed a corresponding growth pattern to the rest of New Zealand. Note that there are no official statistics on regional GDP, evidence of the impact can be seen in Figure 1 that annual estimates of GDP in Canterbury by Infometrics, which is a Wellington based economic consultancy company producing estimates of regional GDP, reduced by 4.6 percent in the year ended September 2011 from the previous year. This was the result of accumulation of decline in production throughout 2011 subsequent to the earthquakes (CDC, 2012).

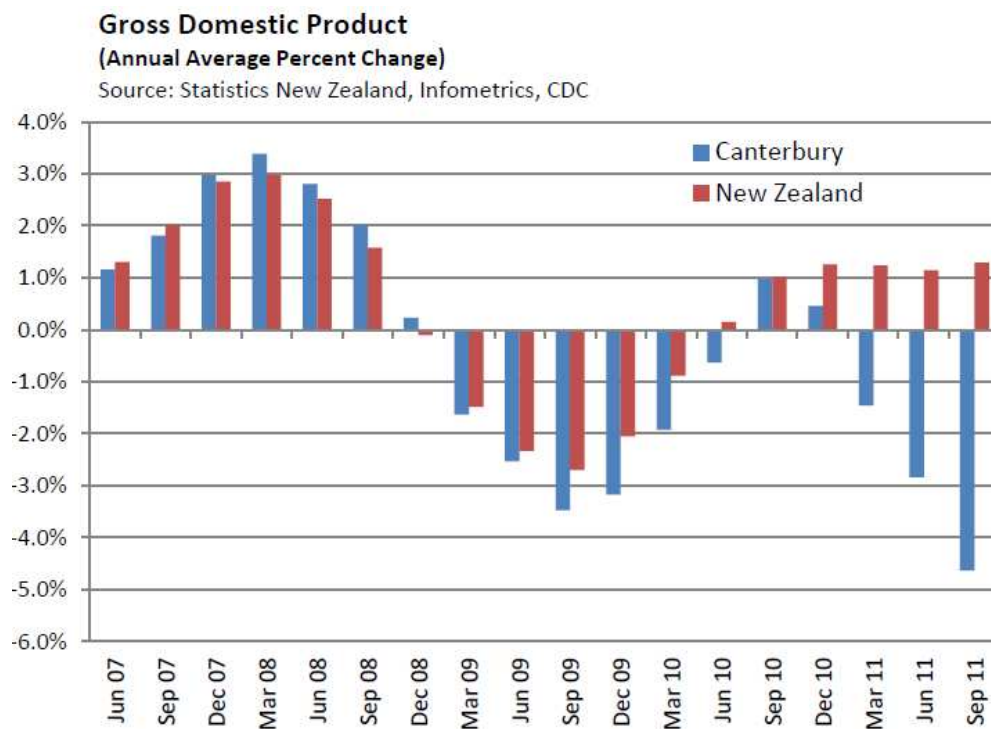


Figure 1: Infometrics' estimate of annual average percent change in GDP in Canterbury and the rest of New Zealand

Moreover, major industries in the Canterbury region were affected by the quakes. Table 2 shows the net impact of the earthquakes on workplaces by eight industry groups in the Canterbury region. There was a negative net impact on workplace staff levels across all industry sectors, with the exception of the Construction and the Primary, Transport and Utilities sectors. Since the earthquakes, national building activity picked up as construction in the affected area began to emerge. Due to the earthquakes, there was a 24.7 percent increase in staff levels in the Construction industry.

Manufacturing, being an important sector in the region such as Food, beverage and tobacco manufacturing, which often bring in valuable export revenue, was reported to be the largest negative affected industry. Only the Construction and the Hospitality sectors experienced a positive net impact on revenue. The Other industry groups suffered the most in terms of revenue from the earthquakes. Overall, at least in the short term, the earthquakes effects on

revenue were much more than that on staff levels. Loss of customers, for example, was the general reason for the decline of revenue (Department of Labour, 2011, pp.2-3).The impact on employment compared to the national trend is discussed further below.

Table 2: The net impact on workplaces that have been affected by the earthquakes by industry sector

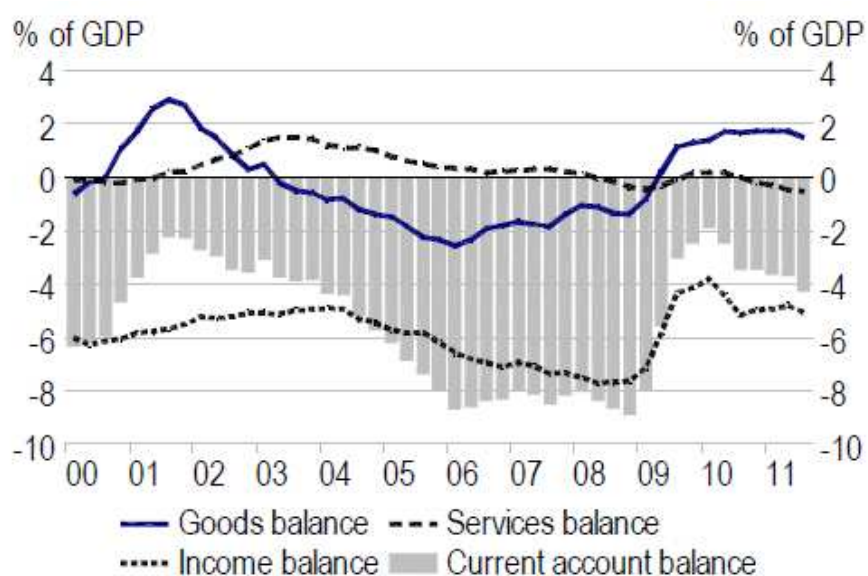
Industry	Staff levels	Revenue
Construction	24.7%	15.9%
Hospitality	-1.6%	13.0%
Primary, Transport, Utilities	3.0%	-5.1%
Retail, Wholesale	-11.8%	-19.7%
Public, Health, Education	-4.9%	-27.7%
Manufacture	-16.1%	-33.7%
Professional, Scientific and Technical	-15.7%	-37.0%
Other Industries	-12.8%	-37.7%
Total - All Firms	-5.4%	-18.5%

Source: Department of Labour

Meanwhile, there also have been some adverse consequences on international transactions following the earthquakes. Figure 2 shows the annual balance of payments including goods and services balance, income balance as well as current account balance from 2000 to the year ending September 2011. The year ended June and September 2010 current account deficit were 3.0 percent and 3.5 percent of GDP respectively. For the year ended December 2010, without the re-insurance claims related to the September earthquakes, the current account deficit was 4.1 percent of GDP. The current account deficit rose to 4.3 percent of GDP at the end of the third quarter of 2011, up from 3.7 percent at the end of the second quarter. It indicates that the current account deficit has become wider as a result of earthquakes. Note that the Canterbury-related re-insurance claims on non-residents have been reclassified as capital

transfers, instead of current transfers since June 2011. As a result, the large value of inflows from re-insurance claims overseas is excluded from the current account (Statistics NZ, 2011a).

Moreover, the quarterly service balances over the last year has turned negative because of the growing services imports, due to the increased premiums charged for the insurance services, combined with the reduced international student and visitor expenditures largely resulting from the Canterbury earthquakes (NZ Treasury, 2012, p. 5). No significant impact on the goods balance has yet been observed, despite that the reconstruction work in Canterbury is expected to increase imports of goods, particularly inputs into the conduction sector (Statistics NZ, 2011a).



Source: Statistics NZ

Figure 2: Annual Balance of Payments (in % of GDP), 2000-2011

Recovery is likely to be steady but slow. As observed above, for the quarter ended September 2011, there has been an 8 percent decline in total employment in the Canterbury region, despite the 18 percent increase in the construction industry. Higher demand for construction-related workers will emerge once the rebuilding is fully

on track later in 2012. The latest statistic report points out that the population in the Christchurch city has been reduced by 8,900 to June 2011 in view of the fact that people prefer to relocate from the earthquake-affected areas (NZ Parliament, 2011a).

The reduction in the number of people employed resulting from the earthquakes has further exacerbated the impact on Canterbury's GDP.

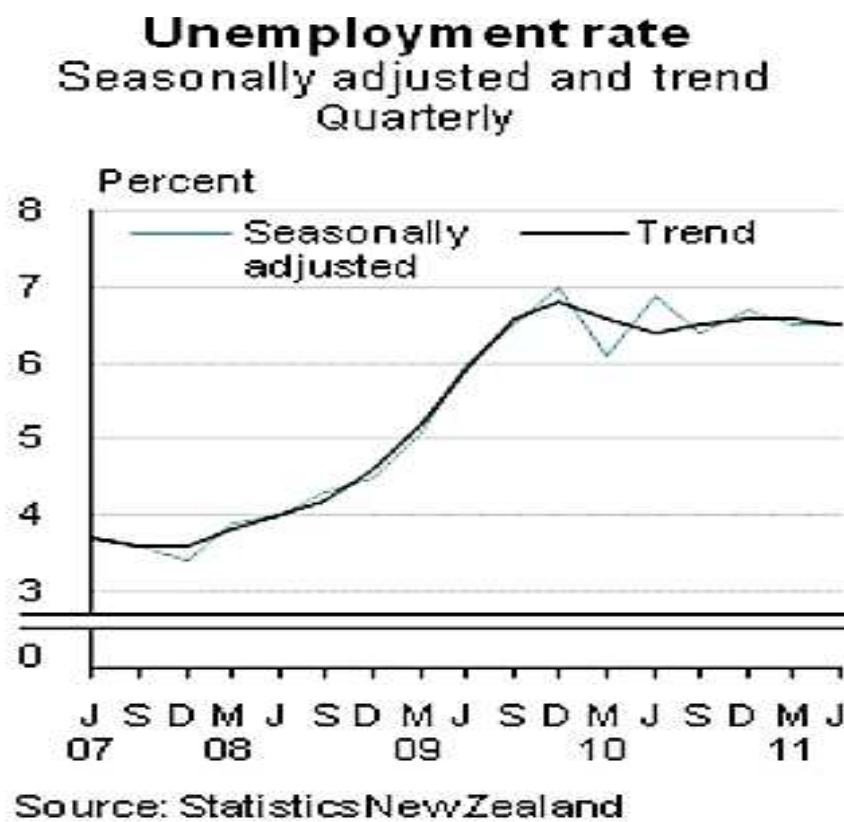


Figure 3: Quarterly Unemployment rate, 2007-2011

As seen in Figure 3, there has been an increase in the seasonally adjusted unemployment rate over the last two years in the national labour market; which increased to 6.7 percent for the September quarter 2010 from 6.4 percent for the June 2010 quarter. Rates have subsequently improved, falling to 6.3 percent in December 2011. A decline in the number of people unemployed nationally can be

partially explained by the impact of the earthquakes on the labour market (Statistics NZ, 2011c).

However, the Canterbury annual unadjusted labour market estimates appear to move in the opposite direction, when compared to the national estimates. Table 3 indicates a 0.9 percent increase in the annual unemployment rate in Canterbury and a 0.3 percent decrease in national unemployment for the year to June 2011. There was an enormous annual increase of 17.8 percent in the number of people unemployed in the Canterbury region, whereas a reduction of 3.5 percent nationally for the year to June 2011.

Table 3: Unadjusted annual key labour market outcomes for the June 2011 quarter

Unadjusted annual changes for the June 2011 quarter		
	Canterbury	National
	Annual change	Annual change
Unemployment rate	+0.9	-0.3
Unemployed	+17.8%	-3.5%
Employed	-3.6%	+2.0%
Not in the labour force	+3.6%	+0.2%
Labour force participation	-1.4	+0.3
Actual hours	-1.3%	+1.8%

Source: Statistics New Zealand

Table 4 demonstrates that the unemployment in Canterbury increased further to 5.7 percent during the year to December 2011 from 5.3 percent the year before, via the Household Labour Force Survey. In comparison, the national annual average unemployment rate remained at 6.5 percent during the year to December 2011. Overall, the unemployment rate in the Canterbury region to date is still lower than the national rate (Statistics NZ, 2011b), but the relative position has clearly deteriorated following the earthquakes.

Table 4: Key labour market data for the Canterbury region

	Canterbury		New Zealand	
HLFS Indicator	year to December 2010	year to December 2011	year to December 2010	year to December 2011
Participation rate, ann ave	70.0%	68.0%	68.1%	68.4%
Employment rate, ann ave	66.3%	64.1%	63.6%	63.9%
Unemployment rate, ann ave	5.3%	5.7%	6.5%	6.5%

Source: HLFS, Statistics New Zealand

Private consumption, as the largest GDP component, was also negatively affected by the earthquakes. According to the 2011 pre-election economic and fiscal update, growth in household consumption has fallen below the rate of income growth (NZ Treasury, 2011c).

Gross household saving, as shown in Figure 4, on the other hand, had turned positive in 2010 for the first time since 2000 and is continuing to grow. Meanwhile, the debt-to-income ratio is declining. Changing in saving behaviour is contributed by job insecurity, loss in wealth, failure of finance companies as well as asset value reduction triggered by the earthquakes. Change in saving behaviour is expected to be persistent. It resulted in lower consumption growth than it would have been otherwise (English, 2011a). Note that the increasing trend of household saving is also attributable to the global financial crisis and the increasing global uncertainty. Moreover, the increased level of domestic uncertainty resulting from the earthquakes is likely to exacerbate the trend as people naturally become more cautious.

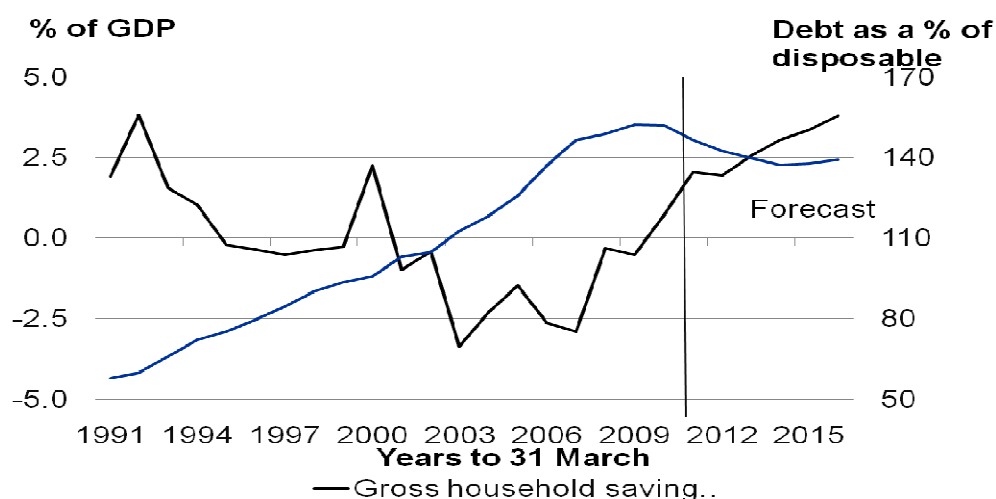


Figure 4: Gross household saving (in % of GDP), 1991-2015

In regard to economic growth, rebuilding Canterbury provides internal opportunities and impetus for domestic economic growth in a fragile global economic environment. Much of the rebuild cost is met by the insurance and re-insurance companies, which mean that the progress of growth is largely independent of the state of the world economy. (NZ Treasury, 2011)

In addition, the earthquakes have had a significant impact on the pattern of population as well. Figure 5 exhibits a downward trend in net migration of individual taxpayers in Canterbury from December 2010 to April 2011. The rate of individual taxpayers migrating from Canterbury has sharply increased since February 2011. There have been more people moving overseas from Christchurch (4,000) between March and July 2011, relative to 2,400 over the same period last year (CERA, 2001, P. 4). Furthermore, with the intention of reducing exposure to catastrophic risks, high-skilled workers who are able to receive a higher skill premium, are more likely to migrate overseas. The decline of the domestic population has also contributed to a reduction in national productivity, which is one of the main measures responsible for economic growth. It is essential for

policymakers to take into account policies, which can retain and attract high skilled labour when responding to the earthquakes.

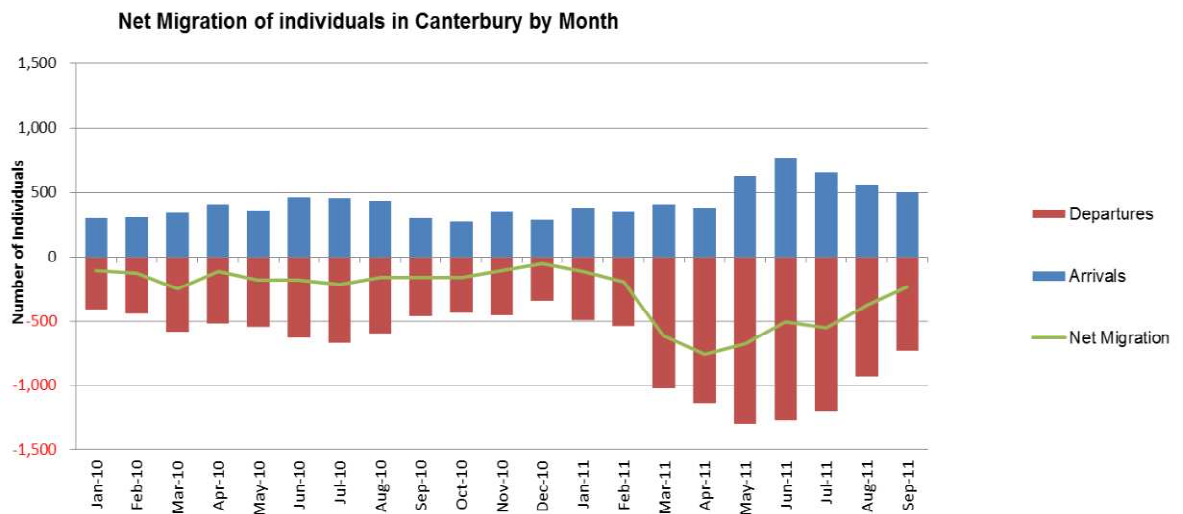


Figure 5: Net Migration of individuals in Canterbury by Month, from January 2010 to September 2011. Source: Inland Revenue

In summary, the Canterbury earthquakes are seen as a chronic event, with overwhelming human and economic consequences that will persist for a long period of time. As aftershocks are still occurring, early official cost estimates could prove unreliable and the final cost remains uncertain with various issues such as building standards still to be resolved; revisions are likely to continue for some years until all insurance claims have been settled. Furthermore, disturbance to the land surface, such as soil liquefaction and subsidence has posed economic and insurance problems for rebuild. The recovery in Canterbury could be prolonged by land remediation, which is likely to further lift the total cost of claims stemming from claim handling expenses, temporary accommodation, etc. (Bollard & Hannah, 2012, p. 6-7).

Construction is a key sector to drive demand for occupational skills and boost the region's economy during the rebuilding period. While aftershocks continue, extensive repairs and rebuilds were suspended,

but when they begin, it is likely to take more than five years. Manufacturing, as a key sector in the region, will continue to generate substantial value of export revenue in the future in spite of the initially disrupted by the quakes.

National GDP growth was lower in 2011 than it would have been otherwise. The earthquakes shocked national GDP mainly in the first half of 2011 due to the disruption to economic activities. The regional GDP fell significantly due to sharp declines in business and consumer confidence. The impact on goods and services was relatively limited. There is an increasing trend of current account deficits after exceptional re-insurance claims were treated as capital transfers, rather than current transfers. There are consequences in the labour market, over the year to September 2011, Canterbury regional unemployment increased from 4.8 percent to 5.5 percent. In contrast, the national unemployment is quite stable around 6.5 percent following the quakes. However, a larger net migration loss arising from the quakes may further dampen economic activity and productivity.

3.2 Implications for Fiscal policy

The Canterbury earthquakes have had a devastating impact on the Government's fiscal position in terms of the government's accounts and debt sustainability due to a need for the relief and recovery in the affected areas (NZ Treasury, 2011b, p. 97). Central and local government also confront considerable expenses in relation to the emergency and rescue responses, welfare transfers and safety services. On the other hand, the insurance sector is well-placed in New Zealand with 80 percent of Christchurch's capital being insured. A large proportion of this cost was covered by insurers, large global re-insurers as well as the Earthquake commission (EQC), which is discussed in more detail below. The relative high level of insurance and re-insurance coverage in New Zealand makes capital of less concern than in other disaster-hit countries like Japan, Haiti or China. Nevertheless, assessing the value of these claims is subject to a high degree of uncertainty and time consuming due to some exceptional aspects, such as Christchurch CBD closure, land remediation and building regulations adjustment. Moreover, with the risk of ongoing costs stemming from the aftershocks, insurers are reluctant to cover for new risks or even quit from the market. The availability of insurance policy that covers overall exposure to Canterbury became limited. Without sufficient available resources timely, the main reconstruction is yet in progress, the timing of the rebuild is, therefore, still subject to change (Bollard & Hannah, 2012, pp. 6-11).

There are two ways that natural disasters may affect a country's fiscal position. One is the direct impact on an economy primarily via expenditure channels, involving expenses for relief and response, for example, the cost of reconstructing or restoring damaged infrastructures, state-owned assets and land. The other type of impact generated via a variety of transmission channels in the market, works indirectly through reductions in output and wealth;

subsequently, resulting in a decline in tax revenue in terms of personal and corporate sectors combined with an increase in social outlays such as short-term income support.

Noy and Nualsri (2007) suggest that the direction of the macroeconomic impacts of natural disasters is still in doubt due to contrary results obtained by using different underlying growth models. Under neoclassical theory, output growth rate is expected to be higher after a natural disaster given that it provides an opportunity to replace depreciated or even obsolete capital stocks and update existing technologies. On the other hand, a negative relationship between growth rate and the presence of natural disasters was drawn when applying endogenous growth models. It is based on the assumption that human and physical capital, along with technology, is destroyed due to a disaster, causing disruptions to production.

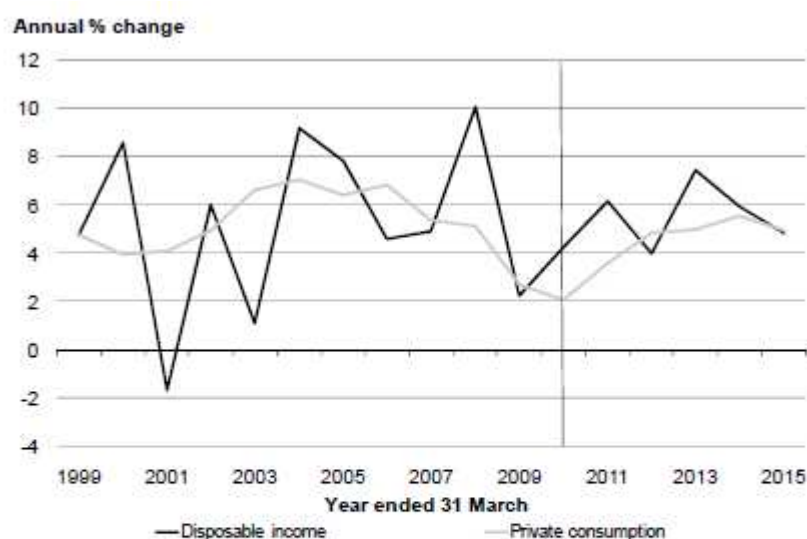
On the expenditure side, the amount needed for the recovery possibly differs from the actual costs of the ruined capital resulting from a natural disaster. In the face of a large magnitude disaster, due to widespread adverse impacts on human capital, more funds are required to support and assist victims to survive. It is likely to delay the timing of the reconstruction in the affected area, and thereby lead to potential administrative expenses that clearly exacerbate its public account. Alternatively, it is also possible that the fiscal burden may be lighter than expected if much of the destroyed infrastructures and assets were becoming obsolete or even unnecessary; thus replacement is relatively less expensive (Noy & Nualsri, 2008).

Table 5: Estimates of the damage caused by earthquakes (NZ\$ billion)

	Residential	Commercial	Infrastructure	Total
<i>Budget Update</i>	9.0	3.0	3.0	15.0
<i>Pre-election Update</i>	13.0	4.0	3.0	20.0

Source: The Treasury

According to the Government's June Budget (2011), the combined financial cost of the first two major earthquakes is estimated to be around \$15 billion, for repair and replacement of the damaged infrastructure and properties over the next seven years. However, ongoing aftershocks create a high level of uncertainty around the cost and timing of the rebuilding. The damage estimates have been revised to be \$20 billion or up to \$30 billion in October 2011, including claims for business interruption, consequential loss and other non-rebuild related costs by the Treasury (Table 5). At the aggregate level, in the aftermath of the Canterbury earthquakes, national private saving was seen to turn into positive for first time in a decade. Meanwhile, private consumption, as seen in Figure 6, fell slightly following the September 2010 quakes. Households and businesses started to exercise caution in their spending, despite receiving increased disposable income over the same period (NZ Treasury, 2011a, p. 1). In contrast, household spending was assumed to grow, given that the restoration of personal belongings of directly affected residents is required (NZ Treasury, 2011b, p. 96).



Sources: Statistics New Zealand, The Treasury

Note: Disposable income has been adjusted for insurance receipts in 2011.

Figure 6: Private consumption and disposable income growth, 1999-2015

Moreover, there is abundant empirical literature supporting the theoretical insights of expansionary effects of fiscal expansion in times of economic contraction introduced by Giavazzi & Pagano (1990). In other words, there is a substitute relationship between private and public consumption. Natural disasters pose financial challenges for households; as a result, households tend to spend less with increased uncertainty about the future. Therefore, a reduction in private consumption may generate expansionary pressures on the public sector. In hard times, the government is supposed to expand its spending, partly for the purpose of coping with the negative effects of weak domestic demand and thereby restore growth.

On the revenue side, Tax, levies, infringement fines, fees, investment income received by the government are counted as government revenue. It is difficult to quantify the impact of the disasters on each source of the government revenue. Macroeconomic variables usually react to a crisis in different ways. A disaster cost assessment would

be useful for some institutions, State-Owned Enterprises (SOEs) or other agencies to evaluate the importance and the efficacy of existing mitigation programmes. International aid agencies and multilateral organisations could also benefit from these evaluations in the way of planning and organising their operating programmes.

Noy & Nualsri (2008) suggest that such estimates assist the government to understand the importance of insuring against losses associated with disasters through an alternative risk transfer such as catastrophic bonds (CAT bonds), or through its international reserves such as sovereigns' precautionary savings. It is vital for natural disaster-prone countries such as the Philippines, to take precautions and adopt developed insurance mechanisms to secure against the depressing fiscal outcomes. Developing countries generally behave pro-cyclically to a disaster, which leaving them in a worse situation. It seems to be more urgent for developing countries to adopt these hedging approaches to protect themselves from fiscal hardship.

Following a natural disaster, for the time being at least, tax revenue will decline, largely attributable to reductions in GST caused by provisional halt of business along with short-term loss of sales (White, 1997, P. 336). Inland Revenue (IRD) (2011) released changes in the taxation with Canterbury earthquake measures in response to the quakes. It includes tax relief for employers' welfare contributions to employees, extension of the redundancy tax credit as well as tax relief for donated trading stock. Under current tax system, the government forecasts a \$5 billion loss at least in revenues over the next four years (NZ Taxation, 2011). The reduced tax revenue further worsens its fiscal position. As a result, the government would need to raise funds for the additional funding requirements necessitated by the emergency (White, 1997, P. 336).

Lis & Nickel, (2009) undertook an analysis evaluating the impact of large scale extreme weather incidents on public finances by employing a generalised-method-of-moments (GMM) system with a sample of 138 countries from year 1985 to 2007. A combination of panel fixed effects and instrumental variable fixed effects are estimated in the study. The regression results indicate that the changes in budget balances associated with natural disasters tend to be higher in developing countries than those in developed economies. In addition, these findings imply that an economy's coping ability with these emergency incidents relies on the initial position of the country. In other words, in order to better handle a natural event, the objectives of policymakers are to achieve sound fiscal positions, raise the level of GDP per capita, maintain fiscal sustainability as well as develop the degree of resilience of their economy.

Ilzetzki & Vegh, (2008) observed that fiscal responses to the disaster events appear to be counter-cyclical in developed countries; with governments increasing spending and reducing taxes after natural disasters while emerging governments are seen to act pro-cyclically. The reasons for these different fiscal behaviours are unknown.

Although the Treasury forecasts that the negative impact of disasters on GDP will be offset or even exceeded by post-disaster fiscal stimulus, resources tend to shift from more productive public investment such as infrastructure projects to restoring or replacing less or non-productive assets, e.g. housing. There is more to it; this fiscal stimulus is likely to affect governments' balance sheet for a long term, and hence the borrowing costs will be inverted. That is; it will be more costly to finance for the recovery of the affected regions in the future.

Furthermore, future prospects and growth are likely to be limited due to long-term public finance indebtedness of affected nations (Noy,

2009). There is also a possibility for crowding out effects which will cause an increase in interest rates; consequently, investment from the private sector reduces due to the rising borrowing costs. Countries with rational financial environment (i.e., more extended domestic credit, further foreign exchange reserves and relatively closed capital accounts) appear to be more capable of withstanding the immediate disaster shock with fewer spillovers to future production. Therefore, creating and retaining a sound financial system helps a country to better handle, and then overcome the adverse effects of natural disasters on its economy (Noy, 2009). Political position is also one of the determinant variables of the budgetary impact of the disaster events.

Countries with a higher degree of the government accountability, that is, more democratic and transparent constitutions, tend to have more aggressive public responses to disasters compared with autocratic governments. For that reason, detailed political description of post-disaster recovery is required to facilitate the identification of the policy changes as part of the secondary effects of the disaster shocks. Disaggregated budgetary data seem to be more constructive than those of aggregated in this context to investigate the effect on the components of fiscal balances. However, one challenge for researchers is that it is difficult to collect disaggregated fiscal data (i.e., sub-national statistics) since they are mainly available at the national level provided by the International Monetary Fund (IMF) (Noy & Nualsri, 2008).

In New Zealand, there is a unique Government-owned institution established in 1945, called the Earthquake commission (EQC) which provides natural disaster insurance coverage to the owners of residential properties. EQC is funded by a levy on domestic insurance policies and placed into the Natural Disaster Fund (NDF). As the EQC is a key element in New Zealand's mitigation strategy, its role,

purpose and performance are specifically detailed below in section 3.4.

However, in the aftermath of the major Canterbury earthquakes, the government faces property damage compensation to homeowners through the EQC, the cost of repairing uninsured essential public infrastructure and government buildings, social transfers such as health and welfare support packages as well as expenses associated with the purchase of residential properties in the red zone.³

The damage estimates provide an initial point for evaluating the potential implications for the public accounts and the balance of payments. The forecast earthquake-related public expenditure is around \$13.6 billion. The largest part of the cost is the payment to homeowners via the EQC, around \$11.7 billion prior to the December 2011 aftershocks. At the end of June 2011, costs related to welfare and emergency responses are estimated at \$363 million. Over the 2010/2011 year, the Government's operating deficit has been noticeably deteriorated. The resulting pressure on the fiscal debt position was observable. In early 2012, New Zealand's long-term sovereign rating was downgraded to 'AA' by Standard and Poor's (Bollard & Hannah, 2012, p. 8).

As observed earlier, the earthquakes also have an impact on the balance of payments. The current account deficit rose to 4.3 percent of GDP for the year ended September 2011 up from 3.0 percent for the year ended June 2010. This indicates that the earthquakes lead to deterioration in trade balance through increased imports and decreased exports of goods and services.

³ The residential red zone where the land has suffered significant and extensive damage, the remediation maybe uneconomic and there is an increased likelihood of further damage.

The estimated inflow of reinsurance was around \$12.5 billion, as discussed above; it has subsequently been reclassified as a capital transfer. Current account deficit trend continues to widen while balance of payments as a whole is likely to be a temporary surplus for the first time since 1973 (NZ Treasury, 2011c, p. 96). In the September 2011 quarter, the capital account balance returned to deficit from a temporary surplus in the June 2011 quarter when large re-insurance claims were featured (Statistics NZ, 2011c).

The limits of the national fiscal buffer have been stretched by the earthquakes and the ability to absorb future shocks has become weaker. With the intention to return to operating surplus in the short-term and return net debt to prudent level in the long-term, economic imbalances and vulnerabilities will be lessened through reducing further borrowing, increasing national saving as well as restoring the fiscal buffer via low debt (NZ Treasury, 2011b, pp. 42-43).

The large increased cost to the government will partially and necessarily flow through to increased debt. A Canterbury Earthquake Recovery Fund of \$5.5 billion has been created and included in the Crown account from 2011 in order to meet these costs associated with the earthquakes with transparency ensured. Capital generated from the Canterbury Earthquake Kiwi Bond will also add into the Fund. The Fund will be terminated once the final costs of the earthquakes become available (NZ Treasury, 2011b, p. 100). The EQC had reserves of \$5.6b in the Natural Disaster Fund before the first earthquake on 4 September 2010. The shortfall will be reflected in the Crown accounts, and will contribute to an increase in net Crown debt (Table 6) (EQC, n.d., para. 1).

Table 6: Forecast earthquake expenses (impact on the operating balance before gains and losses)

Year ending 30 June	2011	2012	2013	2014	2015	2016	Total	Budget
\$million	Actual	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Update
Local infrastructure	160	883	128	128	128	128	1,555	1,162
State-owned assets	46	16	15	-	-	-	77	85
Welfare support and emergency services	363	116	27	27	21	-	554	521
AMI insurance contingency	335	-	-	-	-	-	335	500
Red Zone properties	653	194	-	-	-	-	847	-
Other costs	36	1,336	115	58	62	7	1,614	-
Yet to be allocated	-	270	120	45	45	45	525	3,239
Canterbury Earthquake Recovery Fund	1,593	2,815	405	258	256	180	5,507	5,507
EQC	7,471	225	156	125	-	-	7,977	3,050
ACC	7	-	-	-	-	-	7	181
Other SOEs and CEs	16	-	-	-	-	-	16	40
Total Crown	9,087	3,040	561	383	256	180	13,507	8,778

Source: The Treasury

The Treasury assumes that the economic activity will return to pre-earthquake levels in five years from 2011. As shown in Table 7, for the year ending June 2015, the fiscal policy stimulus is expected to be withdrawn and operating balance return to surplus with growing surpluses thereafter. After an initial increase, annual average growth deteriorates to 2.4 percent at the end of the forecast period. Net Core Crown debt peaks at 29 percent of GDP and declines gradually beyond 2015.

Table 7: Summary of the Treasury's main economic and fiscal forecasts

	2011	2012	2013	2014	2015	2016
	Actual	Forecast	Forecast	Forecast	Forecast	Forecast
Economic (March years, %)						
Economic growth ¹	1.6	2.3	3.4	3.3	2.9	2.4
Unemployment rate ²	6.5	5.8	5.2	4.9	4.7	4.7
Fiscal (June years, % of GDP)						
Operating balance ³	-9.2	-5.1	-2.0	-0.4	0.6	1.2
Net debt ⁴	20.0	25.4	28.5	28.9	29.0	28.2

Notes: 1 Real production GDP, annual average percentage change

2 Percent of labour force, March quarter, seasonally adjusted

3 Total Crown operating balance before gains and losses

4 Net core Crown debt excluding the New Zealand Superannuation Fund and advances

Sources: Statistics New Zealand, The Treasury

There is a range of options available to the government: expanding foreign currency borrowing, selling of government securities such as

treasury bonds or liquidating official foreign currency reserves (White, 1997, pp. 336-337). However, further borrowing is restricted by the level of existing government debt and the tax burden previous to disaster. If the level of indebtedness has already been high, creditors would require higher interest rates to compensate higher, credit risk which means the borrowing costs of government debt are lifted. In these circumstances, borrowing may not be a desirable option to spread the heavy tax burden on its residences. In the September 2011 quarter, New Zealand's net international liabilities were \$148.2 billion which accounted for 72.9 percent of GDP. The government needs to make an effort to avoid sovereign credit rating downgrade which may lead to higher borrowing cost, making it more difficult to finance budget deficit. Therefore, there is little room for fiscal operation and raising tax rates seems to be more favourable although deadweight loss may take place.

Nevertheless, governments generally face a temptation to go too far with public spending in terms of government consumption and payment due to the crisis, because of the fact that GDP will be increased with the contribution of these fiscal stimuli. Nevertheless, the quicker recovery expectation that relies on the assumption of expansionary fiscal policy determined by the figures of output growth rate is misleading since it ignores the opportunity costs and resources wastage. This is not the only shortcoming of exercising expansionary fiscal policy; potential risks and negative consequences are also existent. Recent American and European sovereign debt crises are typical examples to exhibit the risks and likely harmful outcomes of excess government borrowing from overseas. It is difficult for a government to repay massive debts when global economic activity is depressed, especially countries that have economies reliant heavily on exports. Domestic currencies will be depreciated if the current account deficits become larger which means that more money will be

required to pay off the international indebtedness, thereby creating a vicious circle.

Historically in New Zealand, there have been significant swings in the public sector investment in infrastructure. In the face of fiscal pressures, cut in capital spending appears to be a straightforward option. The Canterbury earthquakes have highlighted the crucial role that infrastructure plays in the economy as an enabler of economic growth and quality of life. Most of the network infrastructure in terms of transport, communications, energy, water and social services in Christchurch was disrupted intermediately after each earthquake. It will take many years for all services to be fully restored. (National Infrastructure Unit, 2011, pp. 15-54)

Subsequent to the Canterbury earthquakes, methods for financing the government's share of the rebuild are proving controversial. Approximately \$800 million of new spending, which was intended to be placed in the June budget, was cut by the government. Finance Minister Bill English suggested overseas borrowing to finance the shortfall, spreading the burden over time. However, Green Party co-leader Russel Norman argued that an alternative of imposing a levy on higher earners has an advantage of saving millions of dollars in interest relative to the national debt. According to Green Party estimates, \$1 billion a year can be raised by a temporary levy on income. English then pointed out that the levy could extinguish the economic growth (Hartevelt, 2011).

International paradigms can be used for references. Following the Tohoku earthquake tsunami disaster in March 2011, the Japanese government proposed to freeze its child allowance and other programmes like farmer income subsidies and free secondary education plan, impose a temporary reconstruction tax on all fossil fuels which are taxed at low rates to fund the disaster recovery

package (JCER, 2011). The Australian government delivered disaster response funding through three measures in the aftermath of a series of floods during 2010 and 2011. The majority of funds were, however, financed by compressing government spending; including removing some green programmes such as the Green Car Innovation Fund and industry assistance and also by delaying some infrastructure projects. The balance derived from a one-year progressive levy on income earners who receive over \$50,000 a year and it does not apply on someone directly affected by the floods (Gillard, 2011).

The international experiences demonstrate the feasibility of these potential options for the New Zealand government to fund Canterbury recovery when facing short-term fiscal pressures. Deferral or cancellation of government investment elsewhere is one option. The government could also discover the areas where are relatively charged at a low taxes currently and impose an additional temporary or permanent tax on them, and thus avoid potential disincentive costs to the greatest extent possible. The Australian government was in a better financial position at the time of raising a levy after recent floods. It should be considered in New Zealand even if it may conflict with the smooth pace of economic recovery.

In brief, clearly, the impacts of the Canterbury earthquakes on the New Zealand's fiscal and international debt position are considerable through both increased costs and reduced tax revenue. Public expenditure and loss of revenue related to the quakes is forecast to be around \$13.6 billion and \$5 billion respectively over the next five years (Bollard & Hannah, 2012, p. 8). Moreover, the current account deficit has been widened with deterioration in the trade balance. An estimated \$12.5 billion of re-insurance payments from non-residents is likely to push the balance of payments into a surplus for the short term (NZ Treasury, 2011c, p. 96).

Rebuilding Canterbury as one of the Government's top priorities involves considerable demands on financial funds. There is a variety of options for the government to source the funds to rebuild the affected areas and supply the essential welfare and aid to those directly affected local residents after a natural disaster. It is likely for the government to let the costs flow through to debt given that it allows the burden to be borne and repaid over time.

However, if the government debt, especially external debt is already high prior to disasters, further borrowing may not be a desirable choice due to the higher costs. Prior to the earthquakes, the fiscal position have had weakened significantly due to decreased tax revenue through the introduction of a tax package and increased expenses in response to the 2008/2009 global financial crisis. The government official debt was relatively low. However, there has had been continued operating deficits. Cash deficits have to be funded either by raising debt or reducing financial assets. Net core Crown debt was expected to increase. The government also increased concerns about the level of private/SOE debt. Overall Debt level concern has been rising and the earthquakes have further exacerbated the overall fiscal position.

Moreover, Government debt is forecast to peak earlier than it would have been otherwise. Raising a levy seems to be preferable with the intention of financing the damage caused by disasters with low credit downgrading risk. Learnt from the international experiences, subduing construction sector or government programmes elsewhere in New Zealand will also assist the rebuild.

3.3 Implications for Monetary policy

Major natural disasters clearly have the potential to result in substantial disruptions to short-term economic activity and financial markets. During and after a major natural disaster, the Central Banks face both policy and operational challenges to achieve and maintain a stable and operative monetary system (White, 1997, p. 332). The RBNZ has been giving increasing attention on how monetary policy can be managed appropriately in response to a disaster.

For more than a decade, the RBNZ, as the guardian of the monetary system in New Zealand, has been aware of the significance of promoting a sufficient preparation and ensuring an appropriate capacity to respond to crises effectively which allows the Bank to maintain a well-functioning monetary system in the face of various financial, economic or natural challenges.

New Zealand's economy is less diversified relative to other natural disaster-prone economies, such as Japan and the U.S., it has relatively less ability to absorb the economic shock resulting from a natural disaster (White, 1997, pp. 332-333). Besides, New Zealand's financial sector is moderately developed, meaning that its financial market is reasonably globally integrated. Both of the above arguments make the issues more complicated for New Zealand monetary authorities to cope with. Having observed before, balance of payments is likely to be affected following a natural disaster, in which case the value of domestic currencies seems to be negatively influenced, resulting in fluctuations in exchange rate (White, 1997, p. 333).

In New Zealand, the RBNZ is independent of the government and it conducts the monetary policy with the guideline of the policy target agreement (PTA). The primary objective of monetary policy currently

is to maintain price stability in the medium term. The official cash rate (OCR) has been employed as a key instrument of monetary policy. The current PTA targets yearly increases in the Consumers Price Index (CPI) within the range of 1 to 3 percent per annum on average. In addition, the RBNZ monitors and supervises its financial and banking system for the purposes of promoting soundness and efficiency in the financial system. It also makes some observations about developments in New Zealand financial system, such as advances in information technology. The RBNZ is capable of meeting a considerable range of economic and financial system issues due to its ability to deploy a full kit of economic and financial tools. It has been prepared to make policy responses to risks and crises (RBNZ, n.d.).

Canterbury comprised approximately 12 percent of New Zealand's GDP as a whole in 2003. Declines in economic activities, resulting from the earthquakes, in terms of household consumption expenditure, residential investment and tourism, are likely to hold back New Zealand's Economic growth for a longer period than expected (Statistics NZ, 2011b).

There has been one disaster after another; prior to the earthquakes, New Zealand had already experienced weak economic activity in terms of consumer spending and business investment due to 2008 global economic recession. On top of that, the economic disruption caused by the quakes is likely to flow into the rest of the country through an increased net migration loss, indicating that business sentiment and consumer confidence are critical factors responsible for economic growth. Low interest rates generally stimulate consumption, investment as well as production. Positive confidence results have been seen subsequent to 50 basis points deduction of Official Cash Rate to 2.5 percent in March 2011 following the February quake. In the aftermath of natural disasters, initial inflation

effects, such as higher insurance premiums triggered by a temporary supply shortage, should be accommodated. Action is required to be taken by the Bank before the inflationary pressures have become generalised (Bollard, 2011).

There are also operational challenges that monetary authorities face in the event of a major natural disaster since it usually leads to an unanticipated price shock. In the short run, the prices of some goods and services in the local area may increase sharply, particularly cost of construction. The upward pressure on price is higher in the case of disrupted transportation services due to shortage of essential goods.

Furthermore, domestic currency depreciation might be caused by a natural disaster in the disaster-affected country when foreign investors, financial institutions or government sell their reserves of the currency into the market in order to mitigate the potential risks (Skoufias, 2003, p. 1089). An increase in the cost of the imported goods is reflected into local CPI. Local rents might also increase due to the increased construction costs. Contractionary monetary policy, therefore, appears to be an effective alternative to stabilise the price level. However, the effect on inflation of a change to the monetary policy instruments is hard to predict and may not as impressive as expected. It depends on the capacity of the economy and its financial market to absorb and adapt the shocks. There is a high possibility that the level of real economic activity is restrained by changes in policy. At the same time, financial institutions such as banks are willing to provide more liquidity via high rates to individuals and corporations who are facing massive uncertainties and difficulties in the aftermath of a natural disaster (White, 1997, p. 338).

Note that the indirect effects can promote general inflationary pressures in the market. For example, construction costs increase in other regions outside the affected areas as the competition of

materials and the skilled labour related to the construction industry become aggressive. Likewise, the pay rates are also likely to increase in other industries which demand the same skilled labour. Accordingly, there is an upward pressure on personal income due to the increased cost of living induced by a rise in the cost of production. Therefore, a contingency plan seems to be valuable in ensuring that the impact of the disasters on the level of inflation is transitory and settled before spilling over into generalised inflation. The second round price level effects of such shock would be left for market forces to determine (White, 1997, p. 338).

A scenario analysis undertaken by Savage (1997) for the EQC concludes that the inflation effects caused by a major natural disaster might not be large enough to change inflation environment in New Zealand. This is also supported by other considerations. First, essential goods such as food and clothing are most likely supplied for a period after disasters by the government to those most vulnerable victims. So the prices of these goods were relatively stable. Second, the suppliers of goods and services in the market tend to keep the prices at the market affordable level to gain a reputation in this abnormal situation. Besides, some of the initial price level impacts are merely temporary. Shortage situation, for example, will be improved once transport services are recovered. Then, the original local prices increase of some goods and services would be possibly reverted ultimately (White, 1997, p. 338-339).

The degree of intervention from the Central Banks needs to be carefully considered. Only the direct effects of the shock on the price level should be accommodated by monetary policy for avoiding generalised inflation (White, 1997, p. 338). Besides, as expectations of the future course of monetary policy determine current private economic behaviour, Unanticipated expansionary monetary policy Shocks that are likely to increase the level of output and employment

temporally beyond the potential level (Clarida, Gali, & Gertler, 1999, p. 1665). This unexpected increase in the money supply eventually drives up inflation at least in the long-term. Therefore, an effort towards greater transparency in monetary policy should be made to assist in shaping private sector inflation expectations.

For this reason, the RBNZ should focus on the median run. A Kiwi Inflation Targeting Technology (KITT) model was introduced to replace the previous Forecasting and Policy System (FPS) model in 2009 by the RBNZ. This new model provides a strong basis for forecasting and monetary policy guidance, ensuring that monetary policy is effective in controlling inflation within the economy. It allows the Bank to determine the way in which shocks or unexpected events develop through the economy. As many economic factors are involved, it normally takes a long time for a change to the OCR to affect the economy. Thus, monetary policy decisions are reliant on the predictions of the future state of the economy. The KITT model is designed to facilitate the Bank in the forecast process (Lees, 2009, p. 5).

Following a comprehensive natural disaster, information is likely to be the most demanded intermediately by financial markets. It is extremely important for the Reserve Bank to inform the market with relevant information, even though only basic pieces can be given at the earliest time, such as the scope of the operational financial system, the plan the Bank intend to adopt and the time frame for further information. By informing the markets, uncertainty would be more or less reduced, contributing to the maintenance of market stability. Loss of business confidence caused by a major nature disaster may have a serious impact on New Zealand's economic prospects.

Some of the financial organisations, particularly multinationals, may withdraw from the New Zealand market temporarily at least, to avoid any potential risks. Subsequently, in an open economy, this is likely to result in fluctuations in the financial market price variables such as interest rates and exchange rates due to increased demand of the transactions. Therefore, it is crucial for the RBNZ to establish a framework of independent backup telecommunication system for emergency information provision. Likewise, if the foreign exchange dealers have left the market, it would be useful for the Reserve Bank to support the exchange market by locating a new trading range until bidirectional trades are reset rather than defending a particular exchange rate. By informing the markets after an unexpected shock, the degree of uncertainty and variability is possibly moderated and thereby avoid financial market failure to the greatest extent possible (White, 1997, pp. 334-338).

Prior to the September 2010 earthquake, the world economy was showing slight of recovery from the 2008/2009 recession. Although domestic demand was subdued in New Zealand, moderate near-term GDP growth was expected. Inflationary pressures were, therefore, predicted to pick up with the growing economy. Given this, the RBNZ increased the OCR by 25 basis points to 3.0 percent at the end of July 2010 (Bollard, 2010).



Figure 7: Annual changes on Consumer Price Index in New Zealand, 2008-2011

Table 8: Official Cash Rate (OCR), 2008-2011

Time	2008 Q1	2008 Q2	2008 Q3	2008 Q4	2009 Q1	2009 Q2	2009 Q3	2009 Q4	2010 Q1	2010 Q2	2010 Q3	2010 Q4	2011 Q1	2011 Q2	2011 Q3	2011 Q4
OCR	8.25	8.25	7.50	5.00	3.00	2.50	2.50	2.50	2.50	2.75	3.00	3.00	2.50	2.50	2.50	2.50

Source: RBNZ

Annual CPI was 1.5 percent for the year to the September 2010 quarter and it increased sharply to 4.0 percent for the year to the December 2010 quarter shortly after the earthquake. The RBNZ left the OCR unchanged at 3.0 percent in December 2010, given that household spending, corporate investment and the pace of economic growth remained weak. The RBNZ reduced the OCR by 50 basis points to 2.5 percent shortly following the February aftershock, although the inflation was higher than the target (4.0 percent in the December 2010 quarter). Over the next seven consecutive reviews, the OCR has been kept unchanged at 2.5 percent. Historically, when there was an inflationary pressure, the OCR was increased by the RBNZ (Figure 7 and Table 8). These unusual actions taken by the RBNZ are the outcomes of the consideration of the deepening Euro

crisis and ongoing aftershocks in Canterbury (Bollard & Hannah, 2012, p. 10).

However, Guender and Cook (2010) suggest that bilateral exchange rate has turned out to be more sensitive to the short term changes in interest rate over time with empirical evidence from New Zealand and Australia. It explains that exchange rates respond to the introduction of the new OCR in New Zealand becomes accelerated which makes it inconsistent with uncovered interest parity. Therefore, extra attentions should be given when adjusting OCR as the main instrument of monetary policy. It appears that there are several motives supporting us to remain supportive.

Moreover, New Zealand monetary system requires the RBNZ to develop a prosperous and efficient financial system. White (1997, p. 337) argues that other than providing information when it is possible, the Bank should also respond to a natural disaster with added liquidity to those that are at risk from resolution failure for a short period. In the case of the Canterbury earthquakes, a number of small business owners found difficulties in arranging to pay income tax on time; IRD offered business earthquake assistances such as extensions for filing and paying tax. A wage subsidy for employees of small businesses severely disrupted by the earthquakes was provided by Work and Income (WINZ).

In order to provide an appropriate sense of perspective of the situation to the market, economic costs analysis using all available facts ahead of time, containing capital and property damages and lost production at the national economy level and on the government's accounts, would be required by the markets. Even early analysis, no matter it is likely to be inaccurate, would help financial institutions to make the right decisions at the time and, therefore, it more or less reduces the degree of the financial market turbulence. It is

noteworthy that there has a capacity to respond and accommodate the anticipated significant economic effects effectively in an unpredictable situation. The estimated material disruptions to the economy also provide a foundation for evaluating the suggestions for the government financial statements and the balance of payments. The majority of the costs of reinstating ruined private capital stock are largely met by the EQC. Having observed the implications for the balance of payments in previous section, the EQC is discussed in detail in section 3.4 (White, 1997, pp. 335-337).

The key objective of monetary policy in the medium term is price stability in New Zealand, just like most of other OECD countries, which allows it to look beyond short term fluctuations. While inflation can reallocate the real cost, it cannot bring the loss of real income back. Monetary policy as one of the largest components of macro policy is required to seek an appropriate means to counteract the real economic impact of disasters. However, economic downturn will emerge with fragile economic activity after quakes. These events have tested the effectiveness of the current monetary legislation. Inflation expectations stayed elevated as a result of an increase in GST in 2010 and other policy changes (RBNZ, 2011). Monetary policy management should focus on the near-term downside economic risks to economic activity such as fragility in tourism and construction, and obstacles resulted from damaged infrastructure and resources; thereby remaining low OCR until signs of recovery in respect of confidences and economic activity emerge is appropriate in this situation (Bollard, 2011).

The operational infrastructure of the financial system could also be disrupted by a major disaster. Access to bank accounts by individuals, corporations and financial organisations could be limited following a disaster at least in the directly affected region, because electricity supply is essential for branch operations and maintenance of bank

dealing. Bank branches have to remain closed or operate on a limited basis when customer account records are unable to access electronically without power supply. It is also noteworthy for the Reserve Bank to be equipped to support banking and payments systems against the effects of a natural disaster, aiming to minimise any possibility of loss of confidence in the solvency of any commercial banks (White, 1997, p. 339).

In summary, even though reconstruction in Canterbury is driving up demand for construction works, the level of overall economic activity in New Zealand is likely to be low for some time due to delays in the rebuilding process caused by ongoing aftershocks. In the aim of promoting a sound and efficient financial system, it is also beneficial for the RBNZ to provide relevant information and support to the financial markets in order to avoid potential market failure caused by an unexpected disaster. There will be an upward pressure on retail interest rates relative to OCR with increasing bank funding costs over 2012 as a result of deepening financial difficulties in the international financial markets. Note that an increase in GST, in 2010, may also contribute to the upward inflationary pressure. However, uncertainties around the global perspective together with subdued domestic demand conditions continue to develop. The RBNZ cut the OCR by 50 basis points to 2.5 percent shortly after the February 2011 aftershock and has kept them unchanged so far. Overall, it is prudent to remain the OCR at the low level for now until the signs of robust recovery and increasing underlying inflationary pressures emerge.

3.4 The impact of natural disasters on insurance and international re-insurance markets

A major natural disaster usually has a significant impact on the insurance and global re-insurance markets, which eventually influences the government's accounts. The re/insurers have been learning about the catastrophic risks over time through the recurring and new experiences. The rate structure and its operational focus may be adjusted and shifted to the changed situation when updating insurance coverage. Natural disasters, then, also pose a test for arrangement of existing national insurance and it may result in significant revisions. As the fiscal policy response to a natural disaster, to some extent, depends on the insurance agreements, it is important for the government to examine the insurance industry in terms of the provision, arrangement and settlement in the country in the aftermath of disasters.

Theoretically, individuals, especially homeowners are likely to suffer a large financial loss after a natural disaster. This risk of loss can be eliminated by and across insurers, as the purpose of insurance is to provide coverage for those unforeseen factors. However, Born and Viscusi (2006, p. 72) reveal that the insurers who write homeowner's insurance coverage, that is a type of property insurance covers private homes, often face as large challenges as individual homeowners do. A major catastrophe poses various problems for the insurance industry. In the absence of sufficient re-insurance, which is a new insurance contract purchased by an insurance company (the re-insurer) from another (the insurer), the original insurer may not be able to cover all claims at time of an event. If the losses are bigger enough than the value of premiums that was collected from the coverage, the firm may choose to withdraw from the market, where vulnerable to catastrophic risks, or not to renew some policies in the affected area, or even has to file for bankruptcy.

A New Zealand's domestic-owned residential insurer AMI were struggled with earthquake-related claims since the September 2010 earthquake; the government announced a \$500 million support package in capital into the company in April 2011 if AMI's reserves were exhausted, to avoid possible significant disruptions and ensure an orderly rebuild of Canterbury. Insurance Australia Group Limited (IAG) agreed to purchase AMI in December 2011, and as part of the agreement, the government would take over ownership of AMI's Canterbury earthquake-related claims. As a result, earthquake affected AMI policyholders were protected from the potential default and other uncertainties through the acquisition (English, 2011b).

However, compared with Japan and other disaster-prone countries, New Zealand has a relatively higher level of insurance coverage including private and public insurances and the EQC in reducing the risks resulting from natural disasters.

In New Zealand, a unique public institution, called the Earthquake Commission (EQC) is operated by the government for disaster damage compensation associated with residential property such as dwellings and land immediately around the dwellings to homeowners since 1945. A Natural Disaster Fund, collected from levies on all private insurance premiums and investment income has built up over more than sixty years. Between 27 and 33 percent of the Fund was invested in the global entities in order to ensure assets of the commission are held outside the region and are not affected in the event of a natural disaster. Any remaining obligations are underwritten by the government guarantees (EQC, n.d.).

Before the Canterbury earthquakes, there was around \$5.6 billion in the Fund; the EQC also carried re-insurance covers with a number of large reinsures to reduce its own risk. Nonetheless, due to numerous aftershocks, the revised cost estimates to the EQC, at around \$11.7

billion in August 2011, exhausted the Fund, leaving the Government to pay for any shortfall and liable for any future disasters (Hartevelt, 2011b).

Theoretically, the policy rate structure, at least in areas subject to such catastrophic risks is to be influenced. Firms tend to either subsequently charge a higher rate to an event to compensate the losses in that disaster year in order to obtain low loss ratios to remain viable and profitable in these high-risk regions, or reduce the quantity of coverage (Born and Viscusi, 2006, pp. 56-57). Moreover, a catastrophic event can sometimes be an ongoing activity, which exacerbates re/insurers' level of financial loss. In the case of the Canterbury earthquakes, to date, thousands of aftershocks have occurred since the September 2010 quake. The large number of these aftershocks has created a high degree of uncertainty around New Zealand's insurance industry. On top of that, unfavourable weather conditions, such as severe wind, rain or hail could further undermine the reconstruction effort.

However, only half of the insured businesses in Canterbury had held business interruption cover at the time of the September 2010 quake. Being the most important business cover in protecting business property and cash flow during a sudden unforeseen event, the business interruption policy covers short term financial loss arising from the interruption to a business and it also often includes prevention of access to the premises. Sales of this cover have increased dramatically thereafter. Premium and excess of the business commercial insurances, including the business interruption cover have sharply lifted up. As of May 2011, the premium for the property policies associated with catastrophic risk had increased by 40 to 60 percent. The earthquake excess had also increased from 1 percent of the loss incurred to 2.5, 5 and 10 percent in Auckland, Christchurch and Wellington respectively (Hueber, 2011).

Following the Canterbury earthquakes, the global re-insurance rates for the property catastrophe re-insurance cover are set to treble for some New Zealand insurers since re-insurers endeavour to retrieve the material losses caused by previous quakes in Canterbury. There has been adequate re-insurance capacity available, but it is challenging for the small domestic insurers to negotiate affordable prices and terms with the re-insurers although increases in re-insurance rates are likely to be passed onto policyholders.

Opportunely, emerging higher local prices may generate attraction to global re-insurers, thus no considerable getaway of the international re-insurers from New Zealand had been observed (NZPA, 2011).

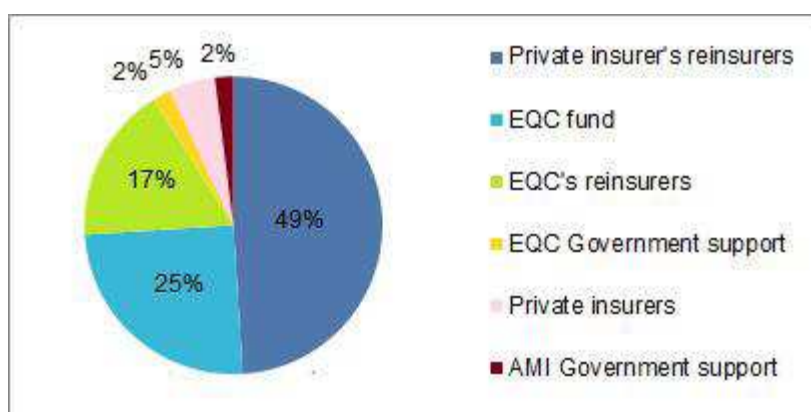


Figure 8: Distribution of Canterbury earthquake insurance claims
Source: Reserve Bank of New Zealand, Financial Stability Report, November 2011

The distribution of the earthquake-related claims is shown in Figure 8, indicating that 49 percent of the total Canterbury earthquake-related claims was covered with the private insurer's re-insurers; 25 percent of the claims fell on the EQC's Natural Disaster Fund and 17 percent on the EQC's re-insurers, indicating 40 percent ($17 / (17 + 25) = 0.4$) of the EQC's liabilities are obligated by the global re-insurers (NZ parliament, 2011b). Therefore, the significance of the re-insurance in eliminating the risks borne domestically is obviously seen. Renewal time for all of EQC's re-insurance contracts will be at the end of 2013. The increased costs of the re-insurance policies

would inevitably pass through to New Zealand policyholders as it seems that the EQC has no effective assets to leverage, except for government guarantees (Dykstra, 2011, part 2).

Globally, 2010 and 2011 were busy years for natural disasters. The cumulative impact of the universal catastrophe losses, including Japan's earthquake in March 2011-the fifth strongest earthquake recorded worldwide-was enormous. However, according to the global professional services company, Towers Watson, the March 11 Japanese earthquake and subsequent tsunami would neither severely affect the capital of Japan's insurance industry nor the worldwide re-insurance markets despite its vast financial impacts on the world. The reason behind this is that the majority of the incurred loss is either uninsured or undertaken by the Japanese government.

Additionally, the tsunami has caused a major nuclear incident, the cooling systems of the Fukushima Nuclear Power Plants has been knocked out. Most arrears related to the nuclear exposure had not been notably privately insured and the Japanese government therefore assumed the costs. Of the insured loss, only about 30 to 40 percent was reinsured internationally. Accordingly, the world re-insurance market was not borne significant losses from this event; most of the loss was absorbed inside the country. This is in contrast to Hurricane Katrina in 2005; losses of the global re-insurance market during 2010-2011 were expected to be less than earnings. Besides, the need to require increased catastrophe rates around the globe after 2011 is not as urgent as after Katrina. Therefore, the rating agencies did not anticipate seeing the same type and levels of financial downgrades as observed in 2005 and 2006 (Towers Watson, 2011).

These unforeseen earthquakes in Canterbury have dealt a big financial blow to the private insurers; especially to those south island

focused small firms. Having said that, the New Zealand government has offered a support programme for a local private insurer, AMI, the Crown was ready to take control over the company and take care of its earthquake-related claims. However, this effort is controversial and has caused wide public debates. On equity grounds, subsidy programmes from the government is necessary to guard and assure the welfare of its residences, including the business owners. On the other hand, the costs were sourced from the tax revenue which means each single taxpayer had contributed to this rescue project. It is possible to initiate Political instability if the public is highly sensitive and disagreeable to the arrangement. In an open market-directed economy, the government intervention should be limited by allowing the market forces to freely set the market variables.

In the rest of the world, there is no publicly-owned insurance institution that covers natural disasters. Therefore, disaster insurance coverage provided by the private insurers is restricted or/and expensive along with high excess, for example, excess is 10 to 20 percent of the insured site value in California due to the unwillingness of the private insurers to expose themselves to large uncertainties. As a result, lots of homeowners prefer to bear the risks themselves rather than carry an insurance cover. The Hurricane Katrina in the U.S. had highlighted some aspects of the deficiencies of the disaster-specific insurance covers in the disaster-vulnerable areas. Since the majority of the residential properties in the Gulf region were not insured with the flood cover, the costs of the damage were largely borne by the homeowners. Ultimately, the US federal government arranged an unprecedented disaster-assistance payment so as to settle the resulting fear and uncertainty in the society. Moral hazard⁴

⁴ Moral hazard in this context means that an individual or institution has a tendency to act less carefully than it otherwise would, because the costs are not borne by the party taking the risk.

problem should be taken into account when making this type of assistance, because people are likely to forgo the disaster insurance altogether and expect the government's support in the future. This contributes to a conflict and imbalance in insurance activities in the market (Dykstra, 2011, part 2).

The EQC does, however, mean that, like Japan, a significant proportion of risk is borne domestically. It is unique in that it is levied on insurance contracts, but includes an element of social insurance, protecting the uninsured. The presence of the levy does not materially affect the operation of the market. The universality of EQC distribution also minimises moral hazard issues.

In the face of the Canterbury earthquakes without the EQC, much of the estimated EQC's liability (\$11.7 billion) would have been borne by the local households. Having observed that 40 percent of the claims lodged with the EQC were re-insured overseas (\$4.2 billion); the government, therefore, would have also borne a relatively higher share of the costs. Other costs such as temporary welfare to the affected local residents would be higher as well. There would be a higher rate of people who suffering from the psychological injury and the social dislocation stress. In addition, the impact of the earthquakes on the domestic economy is likely to be more severe with the further declined consumer and business confidence. The level of uncertainty would certainly be higher. It implies that it may be possible that it takes longer for New Zealand to recover from the earthquakes to its pre-disaster levels.

On the other hand, the earthquakes have also highlighted the weaknesses of the EQC. When encountered with more than 400,000 claims from all of the earthquakes and its aftershocks, the performance of the EQC, was more or less unsatisfactory. There was a recent independent review of EQC's response capability in 2009.

Prior to the September 2010 Canterbury quake, several concerns had been raised but not yet addressed. Unsurprisingly, the EQC has been facing difficulties and an increasing criticism on many of concerns, including:

- No acceptable claim processing times
- Lack of public communication with contractors and homeowners
- Duplication of effort for claims assessment and inspections with EQC and the private insurers
- Holding back the payments for repairs to contractors
- No shop front where public can obtain information from policyholders are struggling to get their insured damaged property repaired due to the low efficiency in the EQC's operation systems (Dykstra, 2011, part 2).

Furthermore, the Labour Party argues that the system of the EQC clearly needs to reconfigure. Risk exposures to natural disasters have been underestimated and not been adequately accounted for; therefore, the premiums have not been charged correctly. Collecting EQC levies through rates based on the ratable values rather than insurance would be more appropriate. The universal levies will make the system fairer as each homeowner makes the payments. Goff also claims that the cap on EQC payouts, (\$100,000 on property, and \$2,000 on contents), is not reasonable and needs to be increased as the costs of house values and the building have been increasing dramatically since the cap was set in 1993 (TVNZ, 2011). Note that it is the first look, as private insurance picks up the balance, moral hazard issues are minimised.

In the short run, the availability of the new insurance covers has been fallen in the region. It has been affected those who had not seriously insured at the time of the earthquakes. The EQC had announced that a triple rate of levies would be charged from February 2012. In the long run, once the reassessments of risk exposures and

opportunities for New Zealand market have been completed by insurers and re-insurers, new policies in Canterbury are supposed to be available for new customers. A review or reform of the EQC is expected within the next few years. The structure and arrangement of public and private insurance in relation to catastrophic risks would be influenced by the earthquakes in New Zealand (NZ Parliament, 2011b, p. 2).

In summary, the Canterbury earthquakes provided significant challenges for the insurance and re-insurance markets. Both the merits and weaknesses of the EQC have been highlighted. The EQC presents some peace of mind and certainties to New Zealanders following a natural disaster. The insurance sector also interacts with the fiscal position. An inflow of re-insurance transfers into the capital account of balance of payments could be partially offset by deterioration in the trade balance. Therefore, regardless of the slow pace of the claim evaluation and settlement in Canterbury, the EQC plays a significant role to protect homeowners' wealth in the aftermath of natural disasters. The Canterbury earthquakes have provided an opportunity for the rest of the world to be better aware of the importance of intuitions such as the EQC as a mean for being better prepared for the future in terms of mitigating disaster impact at the community, central and local government level, as well as, the population at large. However, several aspects of the EQC, such as the levying method and the amount of the maximum payout caps, might need revision to ensure its effectiveness in responding to future disasters.

3.5 Recommendations for disaster strategic plans

The Canterbury earthquakes have also severely tested the effectiveness of the national emergency management system in terms of the preparedness, response, mitigation, and recovery strategies. Generally speaking, the Government responses were immediate and noteworthy, with various departments and ministries involved. International experience has emphasized that reduction or avoidance in the disaster risks is achievable through the process of prevention, preparedness and mitigation. Bollard (2011) suggests that the preparedness is desirable, but always be a challenging task.

Even though, policymakers worldwide have been increasingly aware of the significance of planning in advance of the disasters in order to better manage risks, progress has been slow. Historical records reveal that countries that are well equipped and prepared have fared much better in reducing costs on the efforts of relief, reconstruction and recovery, in addition to, reduction in the rate of casualty.

For example, over 3,000 people were killed in the 2004 hurricane Jeanne in Haiti, while there was zero mortality in Cuba after experiencing a similar scale of storm. In Cuba, a comprehensive approach for each type of potential natural disaster has been organised to each locality after an examination of risks and vulnerabilities for each region. Community networks, emergency warnings, regular trainings are well equipped and served. Each resident has a clear mission and is ready to participate once any particular natural disaster is predicted by the system. People are educated with precautions about what to avoid and how to act at each phase of the preparation, response and recuperation. There is a list of activities to pursue, such as preparing drinking water reserves; pruning of trees that affect electric cables and repairing earthquake-prone and dangerous buildings; offering exceptional attention to

vulnerable groups such as pregnant women, children, and the aged; ensuring neighbourhood communication in case of electricity failure; reinforcing doors, windows and roofs as well as staying alert to authority updates (Bermejo, 2006, pp. 16-17). The Cuban experience illustrates the effectiveness of the disaster mitigating strategic preparations.

Moreover, the World Bank introduced a community-based disaster risk management (CBDRM) approach in which vulnerable communities engaged in the detection, analysis, treatment, monitoring and assessment of the disaster risks to develop their capability. It involves structural capacity-building of the governments and communities to implement disaster risk programmes, development in local disaster preparedness skills, structural (e.g., public works) and non-structural measures (e.g., Legislation) to limit hazard impacts, and social risk management, which helps the vulnerable to cope with the impact of natural hazards through Risk Transfer and Financing Mechanisms. The CBDRM measures have been proven to be reasonably successful by international experience (The World Bank, 2008, pp. 43-56)

Some prevention works have been undertaken in New Zealand. According to the New Zealand Ministry of Civil Defence and Emergency Management (2008), a technical standard on National tsunami siren system has been developed and tested successfully in Waitakere City, Auckland. A formal training session carried out to volunteers and seismic instruments were installed by GNS around Auckland. However, this needs to be extended across the country. Awareness through public broadcasts and education intuitions seems to be useful. Strong links between central government agencies and the community are crucial to coordinate each other and implement disaster preparedness systems efficient.

New Zealand's location has a variety of potential natural threats, including earthquakes, cyclones, volcano eruptions, tsunamis, landslides, floods, snow storms, etc. Strategic planning and preparedness need to be equipped at all levels. Policymakers should keep in mind that each type of natural disasters requires different preparations. Assistance for the development of disaster planning from the expert nations such as Cuba where has been recognised as a best practice model by United Nations (UN) officials is crucial. A developed national Civil Defence System has been operating in Cuba for rapid disaster relief and recovery through supporting and coordinating regional systems all over the country. Lessons gained from the Cuban experiences and exercises to New Zealand are to launch disaster risk management programmes in education, engage large-scale skilful emergency response teams in the social organisations as well as provide comprehensive approaches to each type of natural disasters with early warning system using low cost measures (Bermejo, 2006).

In the face of the Canterbury earthquakes, the New Zealand Government has involved rapidly in ensuring appropriate processes of the response and recovery. Canterbury Earthquake Response and Recovery Act 2010 has been introduced and passed shortly after the September 2010 earthquake. Due to high scale of damage caused by the February aftershock, the Canterbury Earthquake Recovery Authority (CERA) was established and would be working with the local City Council to ensure a timely and coordinated recovery effort for Canterbury for at least the next five years. Also, for the first time, the New Zealand Red Cross have been engaged in recovery domestically (Red Cross, 2011). However, issues in several aspects in terms of strategic disaster prevention and preparedness might need to be addressed.

The local communication networks were disrupted after each earthquake. According to the National Infrastructure Plan (2011), the cost of mobile calls in New Zealand appears to be higher than in most other OECD countries. Easing the control exercised by the telecommunications monopolist, Telecom, over local communication exchanges, allows market competitions. The costs would be then possibly reduced with an increased number of providers that benefits the society anytime regardless of pre or post disasters. Note that private market activity is the mainstream behaviour of the disaster preparedness and planned response. Although Red Cross call centres were set up within 48 hours following the quakes, the services for the directly affected residents is not as flexible and accessible as it provided by the private suppliers for the directly affected residents (Horwich, 2000).

With respect to natural disaster preparation, it is helpful that the government can oversee the construction market to minimise significant damage from happening. Therefore, the safety standard of the public infrastructures and building codes may need to be examined and reviewed periodically. The adoption of the cost effective safety infrastructure based on a private project should be arranged by all involved parties in order to minimise the cost and maximise the efficiency, to the greatest extent, for the entire market (Horwich, 2000). However, the efforts towards the development of advanced infrastructures can be challenging and costly.

Clearly, there were deficiencies in the current national construction standards. In New Zealand, all new buildings are required to comply with the building code while many older ones do not meet the standards. There are a large number of historic structures including notable landmarks in the Canterbury region. Many of these old structures were not earthquake-resistant and have damaged by the earthquakes. Building codes for earthquake design modified

frequently since 1931. (In 1935, 1965, 1976, 1984 and 1992). In 1992, the code shifted structural system from non-ductile design to a ductile approach and required a building to withstand the forces created by ground shaking. The goal was to prevent a building from collapse during a moderate to strong earthquake, however, previous building codes applied solely to new construction. For example, the Canterbury Television (CTV) Building had non-ductile reinforced concrete design which was at risk of fatal collapse (McSaveney, 2009, p. 4). Surprisingly, the building was declared safe by engineers after both the September and December 2010 quakes. The collapse of it in the February 2011 aftershock has revealed that the standard and provision of inspection in New Zealand needed to be reviewed and strengthened in order to avoid the tragedy happening again.

Nevertheless, the death toll following the Canterbury earthquakes was much lower compared with the similar magnitude of earthquakes occurred in Sichuan, China in 2008 and Tohoku, Japan in 2011. It implies that the vulnerability to natural disasters materially relies on the population density and the degree of urbanisation. Building community away from the identified areas of the active fault rupture can mitigate or even avoid the earthquake risks. Evaluating and investigating the level of risks in areas already developed or subdivided, and then proposing and implementing the appropriate construction standards in the areas (Kerr et al., 2003). It may be also helpful to analyse the existing policies related to land use in order to reduce exposed construction vulnerability in the case of natural disasters. Lowering taxes on agricultural land may be supportive to avoid increased urban sprawl (Horwich, 2000)

Generally speaking, New Zealand has responded relatively well to the Canterbury earthquakes. However, the preparedness for a large catastrophe seems not sufficient. Experiences in disaster response from Japan, Cuba and other natural disaster-prone areas have

highlighted the need and effectiveness of establishing the strategic preparation programmes, including educating all residents with precautions and actions to take before and during a natural disaster and drawn on to establish the context and relative scale of the Canterbury earthquakes.

CHAPTER 4

Conclusion

To meet public interest, most reports on the impact of natural disasters emphasise mainly on the direct losses such as the cost of tangible assets, but not on the livelihood of the systematic disruptions to the economy. The Canterbury earthquake and its aftershocks in New Zealand have caused significant damage and comprehensive financial costs. This study builds a rich picture of the potential overall economic losses caused by the Canterbury earthquakes. The cost estimates have increased from \$15 billion to \$20 billion or up to \$30 billion when take into account inflation expectation and increased building quality standard, and it is still subject to change upwards with the occurrence of the ongoing aftershocks. These estimates provide a starting point for accessing the potential implications for economic policies and social institutions.

With regard to the fiscal position, the lessons learnt from the relevant international literature suggest that upward pressure on tax revenue might be irreversible, even though there is a selection of options available for the New Zealand government to finance the reconstruction and the temporary emergency support to affected residents in Canterbury. The damage caused by the earthquakes to the government was estimated to be around \$13.5 billion, which would clearly exacerbate the fiscal deficit. The authorities are expected to let the costs through to debt given that it spreads the burden over time. The debt would therefore peak early. Prior to the earthquakes, New Zealand was already at a high level of external debt, in particular, there were increasing concerns about the level of private or SOE debts. Therefore, New Zealand's overall fiscal position is not encouraging. Total debt should be managed at prudent levels, ensuring a healthy economy. Therefore, additional borrowing is not

an appropriate choice due to the increased costs reflected by higher interest rates and the higher risk of credit downgrade although there is still a capacity to borrow.

Prior to the Canterbury earthquakes, New Zealand was slowly recovering from the 2008/2009 global recession and the domestic economic activity was relative low. Following the earthquakes, sharp decline in consumer and business confidence was observed. Households and businesses were naturally being cautious with spending. Besides, the quakes also caused a reduction in production and exports in Canterbury. Short-term economic activity was, therefore, seriously disrupted. "Policy settings need to support a shift in the drivers of our economic growth" (NZ Treasury, 2010, p. 2). On that basis, the RBNZ cut OCR by 50 basis points soon following the February Canterbury aftershock.

On the other hand, monetary authorities face upward pressure on retail interest rates relative to the OCR over time due to growing bank funding costs caused by the sovereign debt problem in global financial markets and the increased construction sector activity in Canterbury. New Zealand's domestic economic activities and business sentiment remain weak, and recovery is fragile, due to the continuing aftershocks and the deepening euro debt crisis. Therefore, it is prudent for monetary authorities to keep the OCR low at this point until signs of increasing inflationary pressures and robust recovery emerge.

New Zealand's annual inflation was last reported at 1.8 percent in the year to the December 2011 quarter. This slower CPI growth compared with the last four quarters makes its current monetary strategy convincing. It is advisable for the monetary authorities to return to its low-inflation objective gradually with the expected muted

growth of GDP over the next two years. It is likely that the pace of increases will be directed by the speed of recovery.

Fiscal policy response to a natural disaster tends to rely heavily on the assessments of the insurance claims. Insurance provisions and arrangement will then need to be examined and reviewed to respond to future challenges as effectively as possible. A unique Crown entity, the EQC, was established in 1945 in New Zealand, providing natural disaster insurance to residential property owners has produced incredible outcomes through avoiding anxiety of residents in the aftermath of shocks and receiving a large amount of compensations from re-insurance companies overseas. The earthquakes also highlighted the weaknesses of EQC management system. Revised cost estimates to the government will exhaust the Natural Disaster Fund, passing any shortfall on to the government. Concerns such as the means to levy and the maximum payout cap are yet to be addressed by authorities. However, it should be noted that since private insurance picks up the balance over the EQC's maximum payout cap, moral hazard issue is minimised.

The earthquakes have also severely tested the efficacy of existing emergency management in New Zealand. It looks like New Zealand has generally responded to the earthquakes more efficiently compared with other disaster-hit countries such as Japan, and Haiti. The previous international experience has highlighted the importance of strategic planning and preparedness measures in preventing and limiting the scope and intensity of their effects and New Zealand needs to continue efforts in this area.

Previous global experiences have shed some light on the efficacy of the existing disaster prevention programmes. Cuba's contribution to know-how sets a global example for future natural disaster planning.

Moreover, disaster risk reduction programmes offered by the World Bank have been proven to be valuable and effective to eliminate natural disaster risks by the worldwide experiences. The Canterbury earthquakes have revealed a lack of commitment by New Zealand's governments to disaster prevention measures. It might be constructive for New Zealand to improve existing disaster prevention and preparation strategies via further education initiatives for precautions and actions before and during a natural disaster.

The analyses from this research needs to be viewed in light of several limitations. When using a qualitative research approach, it is difficult or impossible to generalise the findings to other populations. In this paper data were not randomly selected, extreme case selection may lead to a reliability issue. In other words, the findings of the study may not reliable or representative of, and apply to and apply to, other types of natural disasters. Future studies using the quantitative approaches can feasibly extend the findings to different types of natural disasters, allowing wider recommendations and general conclusions for policy change in the face of various natural challenges. Furthermore, statistical significance testing could be used in the quantitative approach ensuring it produces reliable results.

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