Westpac Institutional Bank

Disasters in history

A review

The 22 February Christchurch earthquake will play a part in shaping New Zealand's economic fortunes in the years to come. In this bulletin, we review the historical evidence on natural disasters and their aftermath to help shed light on what this process might look like. We find that:

- **While major earthquakes can cause enormous destruction, they don't tend to disrupt developed economies for long.**
- **They usually prompt significant rebuilding, with attendant increases in price and wage pressures.**
- **The long-run impact on growth is unclear. While there is some evidence that disasters accelerate existing trends of economic decline, there is no consistent impact (positive or negative) on the prospects of already growing regions.**
- **Population losses after disasters depend on the degree of local damage. Most people return to habitable areas, and those who move don't tend to move far.**

What does this mean for Christchurch? If the city follows the example of history, we should see reconstruction – and a period of rapidly rising wages and housing costs - rather than depopulation and decline. Christchurch was a growing and economically viable city before the quakes, and has no serious rival as the South Island's main urban centre.

For New Zealand as a whole, the example of other developed countries points to economic disruption being short-lived, even though it's likely to be longer lasting in Christchurch itself. So far, retail and confidence data have borne this out, with economic momentum outside Christchurch holding up remarkably well.

There is no strong reason, based on patterns in other countries, to assume that New Zealand's growth prospects have changed as a result of the earthquakes. It's possible that the quakes have accelerated a long-term trend of departures to Australia. Migration data have shown an unusually high number of long-term overseas departures from Christchurch in the past three months. That number – around 1000 people so far – comes on top of an ongoing high rate of departures by non-Cantabrians across the Tasman.

But the historical evidence doesn't point to a major exodus. When people move, they tend to move close to home. So we are more likely to see a population shift within Christchurch than outside it – away from the 'red zones' to habitable parts of the city. So far, in the six weeks after the quake, 6.5% of Christchurch households had their mail redirected, and in June 7% of Christchurch students were still going to a different school than before the quake - a similar proportion to the 6.5% of Christchurch dwellings in the red and orange zones. And of the relocated households, 80% have moved within Christchurch (a larger proportion of re-enrolled students are going to schools outside the city).[1]

We begin our survey by taking a birds-eye view, reviewing the statistical evidence on the links between disasters and growth, and studies looking at the impact of disasters on population trends. We then drill down into four particular disasters – the 1931 Hawkes Bay quake, the 1995 Kobe quake, the 2010 Chile earthquake, and New Orleans after Hurricane Katrina – to get a better sense of what the economic aftermath of a disaster actually looks like.

Disasters and economic growth: the international evidence

All disasters are different – in terms of severity, the industries they hit, the official response, and the underlying economic circumstances at the time. A number of academic studies have attempted to cut through the fog by analysing a very large disaster database maintained by Catholic University of Louvain, in Brussels.[2] The data set records disasters by type and severity (number of deaths and people requiring emergency assistance, best estimate of economic damage). The studies match this data set to economic data in different countries to get a sense of the *indirect* economic impact – how the disaster affects subsequent economic growth.

The lessons from this work for a post-earthquake New Zealand are generally positive: developed countries tend to recover from disaster quickly; earthquakes tend to *boost* growth in subsequent years, as destroyed areas are rebuilt; and in the long run, there is no clear evidence that quakes on the scale of the Canterbury earthquakes affect growth either way.

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Rich countries recover rapidly

A consistent message coming out of these studies is that disasters affect rich countries and developing countries differently: for developed countries, there is no clear sign of disasters denting growth beyond the very short term, whereas the economies of poor countries can suffer a lot more. This could be because the initial disruption is less than for poor countries, or because rich countries have the resources to bounce back more quickly. The literature does suggest that the direct cost of disasters is less for countries with higher incomes and better social and economic conditions. (The average estimated damage caused by natural disasters is 0.6% of GDP for OECD countries, as opposed to over 2% for non-OECD countries – and the divergence is much bigger when we look at the upper end of the range of damage.[3]) And governments of rich countries are able to borrow to cushion their economies through the period of disruption, whereas in developing countries public spending, revenues and debt all tend to shrink after a disaster, exacerbating its initial impact.[4]

Earthquakes are followed by reconstruction-led growth

Another message emerging from the literature is that not all types of disaster are created equal: while droughts cause a fraction of the physical damage that earthquakes do, for example, they tend to hurt growth, whereas quakes tend to boost growth for a period. For rich countries one estimate is that quakes tend to harm growth one year after the event, but raise growth by year two – and the cumulative impact after 4 years is positive.[5] This is not too surprising: droughts reduce the supply of essential economic inputs – food and water – whereas earthquakes cause damage to buildings and physical infrastructure. That's an enormous hit to a country's wealth, but repairing the damage creates work.

There is no clear evidence that quakes harm long-run growth

The verdict on the long-run impact of natural disasters is unclear, but we can probably conclude that earthquakes, specifically, have no significant impact on a country's long-term growth prospects. That's the common finding of papers that reach opposite conclusions on the long-term impact of climatic disasters such as droughts and floods.[6] In theory, of course, it could go either way: capital destruction could lead to capital renewal, which gives a country an economic edge (it's possible to help explain Japan's and Germany's economic outperformance after World War II that way[7]), or it could mean that a country foregoes growth-enhancing investment while it replaces what it lost. The data don't come out in favour of either story.

Disasters and population trends: two surveys

While the big statistical studies focus on growth, we found two authors who use case studies to draw conclusions about how disasters affect population trends. This can give us additional insights into the long-run consequences of disasters at the local, as well as national level. There are three main lessons we take from this work:

Economically viable areas continue to grow

Our first study, by Jacob Vigdor, compares population movements after war-time bombing in Japanese and German cities, the 1871 Chicago Fire, the 1906 San Francisco earthquake, and Hurricane Katrina.[8] Most cities returned to their pre-disaster population trends within one or two decades. The exceptions – Dresden after 1945, and New Orleans after Hurricane Katrina – were already experiencing population decline before experiencing damage. Vigdor argues that in fast-growing cities, disasters trigger a building boom until the pre-disaster housing stock is restored. Things are different in cities with a housing overhang from better days. In those cities, disasters produce a new equilibrium with fewer houses, higher house prices, and lower population. Consistent with this, Vigdor estimates that New Orleans house prices were well below replacement cost before Katrina, and documents persistent house price and rent rises in the city, years after the hurricane.

People return to the habitable areas

Based on evidence from New Orleans, Kobe, and Dade County (the part of Florida hardest hit by Hurricane Andrew), the second study, by Tom Love, concludes that the population impact of a disaster (at least in the first few years) depends on the degree of damage to housing in the area, with the percentage of inhabitants returning to little-damaged areas being very high.[9] For example, in New Orleans return rates after 1 year were predictably low in 'uninhabitable' or 'destroyed' areas, but close to 100% in the least damaged areas, and 80% in damaged but habitable areas. In Kobe, there was also a close link between the amount of housing damage in a suburb, and the degree of population loss. Of the other cities we look at, census data show that the Hawkes Bay saw 11% population growth between 1926 and 1936 (around the same as the national average) – but that was largely due to population growth in less damaged Hastings. Heavily damaged Napier experienced zero growth over the period.

Displaced people tend to move short distances

Based on Hurricane Andrew, Love tentatively concludes that people who move after a disaster tend to move close to home – 80% of those who moved after the hurricane remained within Dade County or the neighbouring county. Other case studies seem consistent with this. Following the 1995 quake, Kobe saw accelerating growth in the suburbs at the expense of the inner city (suggesting movement within the city). So did Hastings at the expense of Napier after the 1931 Hawkes Bay quake. New Orleans doesn't fit the pattern – survey data show that most of the population movement in the year after Katrina was outside Louisiana, rather than between parishes – but Love argues that this fact is hard to interpret given how close New Orleans is to the Mississipi border.

Three earthquakes and a hurricane

There are many aspects of the economic aftermath of disasters that these studies don't address, such as employment, consumption, exchange rates, inflation, or industrial structure. To do so - even at the risk of cherry-picking - we take a closer look at four specific disasters: the 1931 Hawkes Bay earthquake, the 1995 Kobe earthquake, the 2010 Chile earthquake, and Hurricane Katrina (2005). Of these, two (Katrina and Kobe) are well-known and widely discussed; the Hawkes Bay quake is

New Zealand's biggest natural disaster before the Christchurch earthquakes; and apart from Chile's and New Zealand's similarities as commodity exporters, the Chile earthquake is one of the few disasters which were large enough (relative to the economy) to leave a clearly visible trace in the economic data.

The table below summarises key features of these events as well as what we know of the Canterbury quakes. The four disasters highlight the divergent impact of disasters on growing and declining regions. Two of our four case studies, the Hawkes Bay and Chile, were growing regions (albeit in or just out of recession) that saw strong growth in the period following the disaster, boosted by reconstruction activity (despite ongoing aftershocks in the case of Chile). In Kobe, not to mention New Orleans, the aftermath was less rosy. We've already touched on the economic difficulties of pre-Katrina New Orleans. Kobe was sharing the challenges of an aging, post-bubble Japan, and Kobe's port also permanently lost ground to competitors as a result of the quake.

But the four disasters also show that economic disruption tends to be localised and short-lived. Economic activity in the Hawkes Bay and Chile appears to have bounced back after a few months. And while disruption appears to have lasted longer in Kobe, and activity in Louisiana didn't return to pre-Katrina levels for more than a year, the data also show economic disruption being short-lived in Japan as a whole, and in other regions hit by Hurricane Katrina (notably Mississippi).

The final common theme of the case studies we looked at is that disasters tend to be followed by a lift in inflation pressures as reconstruction ties up resources – the exception is Japan, which was on the road to deflation. Even New Orleans saw sharp increases in wages, house prices and rents, as the post-Katrina floods destroyed entire suburbs and more people left the city than were needed to help it recover.

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Five disasters: key features

	Date(s)	Size of affected area	Economic context	Damage	Economic recovery	Reconstruction	Long-term impact
Christchurch	4 Sep 2010 22 Feb 2011	Canterbury 9% of NZ population in 2009	NZ struggling to gain momentum, but commodity prices high	Magnitude 7.1 and 6.3 earthquakes, numerous aftershocks. Widespread liquefaction. 181 deaths. Estimated damage 7.7% of NZ GDP	Activity has rebounded but remains weak	?	?
Hawkes Bay New Zealand	3 Feb 1931	5% of NZ's population in 1926	Great Depression, low commodity prices	Magnitude 7.2 earthquake, fires. Damage mainly in Napier. 256 deaths. Estimated damage 2.3% of NZ GDP	Little data but by all acounts rapid	Rapid, peaked in 1933, caused population influx and price pressures	No obvious impact. Population growth centred in Hastings
Kobe	17 Jan 1995	Hyogo Prefecture 4% of Japanese GDP in 1994	Japan struggling to exit recession	Magnitude 7.2 earthquake, fires. 100,000 buildings destroyed, major port damage. 5297 deaths. Estimated damage 2.1% of Japan GDP	Rapid for Japan, slower in Kobe	Large-scale and protracted – big projects took more than 5 years. No clear stimulus effect at national level	Population took 10 years to recover. Precipitated relative decline of Kobe Port.
New Orleans	29 Aug 2005	Louisiana 0.5% of US GDP in 2004	Long-term economic decline	80% of city flooded. Low-lying areas destroyed. 1833 deaths. Estimated damage 1% of US GDP	Took more than a year	Focussed on high-lying areas. Wage and price pressures	Significant long-term population loss
Chile	27 Feb 2010	Over 50% of Chile's population	Rapid exit from 2009 recession; high commodity prices	Magnitude 8.8 earthquake, tsunamis. 562 deaths. Estimated damage 19% of Chile GDP	Rapid	Rapid. Contributed to economic rebound and caused rising wage and price pressures	Too soon to tell – but Chile has continued to grow strongly amid commodity boom

Sources: GDP estimates taken from IMF, damage estimates taken from www.emdat.be, Chapple (1997).

Hawkes Bay

Context

In 1931 New Zealand was in the midst of the Great Depression. Unemployment was soaring as world commodity prices plunged and the government cut spending. The Hawkes Bay district contained about 5% of New Zealand's population at the time (mostly in Napier and Hastings). The local economy was farm-based, like much of the rest of New Zealand at the time, with Napier and Hastings the major service centres. Napier's port was the 5th largest in New Zealand by value of shipping.[10]

Damage

A magnitude 7.8 earthquake struck the Hawkes Bay around 11 am on 3 February 1931. It was followed by major aftershocks and fires. About 256 people died and over 454 were wounded. While both Napier and Hastings suffered major damage, most of the destruction was in Napier, which was closer to the epicentre. The damage was mainly to commercial property, rather than (mostly wooden) residential buildings. The quake also caused severe damage to Napier's port. Recent estimates of capital losses from the quake are around £3.4mn, or 2.3% of New Zealand's 1931 GDP.[11]

Disruption

Comparing available measures of Hawkes Bay economic activity to national averages in the years after the quake doesn't reveal strong signs of long-lasting economic disruption, except for port activity. Electricity was restored within a month, gas within 2 months, and the available evidence is that road and rail networks were repaired rapidly. The local nature of the disruption is suggested by the fact that New Zealand share prices didn't fall in the months after the quake.[12]

Reconstruction and long-run effects

There are clear signs of a construction and manufacturing boom following the quake, and of accompanying wage and inflation pressures. While the data is patchy, unusually strong Hawkes Bay population growth in the year to April 1931 hints at an influx of migrants in the months after the quake, possibly arriving in anticipation of the rebuild. Judging from construction spending data the boom appears to have lasted 3-4 years, peaking in 1933 (the trough of the Great Depression). Inflation pressures (as measured by rents, manufacturing wages and retail food prices) were highest in 1933 as well.

The Hawkes Bay mostly returned to pre-quake trends (in terms of its position relative to New Zealand) by the late 1930s, although the relative importance of Napier's port continued to decline. Census data indicate that the Hawkes Bay population grew at the same rate (11%) as the national population from 1926 to 1936 – but this population growth was concentrated in less-damaged Hastings, while Napier saw zero growth over the decade.

Kobe

Context

With 1.5mn residents, Kobe contained about 1.2% of Japan's population in 1995, and surrounding Hyogo Prefecture made up 4% of Japan's 1994 GDP. Kobe was still a major manufacturing city, with its port Japan's largest at the time, and the 6th largest container port in the world. But in the early 1990s Japan was struggling to emerge from recession after the bursting of the late 1990s property bubble – after contracting in 1993, GDP growth was still spluttering in 1994.

Damage

The magnitude 7.2 earthquake which struck Kobe around 5 am on 17 January 1995 was accompanied by unusually violent horizontal and vertical thrust. Over 5000 people died. 100,000 buildings were destroyed, almost 300,000 severely damaged. Much of the damage was caused by subsequent fires. The port suffered major damage from the quake and liquefaction. Overall, the cost has been assessed at US$100bn, or over 2% of Japan's GDP.[13]

Disruption

Japanese industrial production fell 2.6% in January, but had fully recovered by March, and it's hard to detect any quake impact in GDP. Reports suggest longer-lasting local disruption. Major utilities took 3-5 months to restore, rail networks 5 months, and most roads 7 months. After a year port traffic was still 30% below pre-quake levels, and only two thirds of central Kobe's shops had re-opened.

Reconstruction and long-run effects

There are no clear signs of inflation pressures in the years after the quake, but perhaps they were dominated by the slump that Japan was in at the time. Rebuilding was quite drawn out. The process was highly centralised, involving major land readjustment and urban redesign. This meant a halt on building to allow time for planning (up to 2 years for major redevelopment projects). Of the 62 major commercial buildings demolished after the quake, only 19 were scheduled to be rebuilt in 1996, and overall only 20,000 consent applications had been filed (for 120,000 destroyed buildings). Major construction projects were still going on in 2003.[14]

After the quake, Kobe's port lost market share. There were long-lasting declines in cargo traffic after 1995, and by 2008, Kobe had slipped to be Japan's fourth busiest port, eclipsed by other Asian ports.[15] The quake also had a long-lasting impact on Kobe's population. It's estimated that 2.5% of the population left the city permanently, and it took 10 years for Kobe's population to return to pre-disaster levels.[16]

Chile

Context

When the earthquake struck Chile on 27 February 2010, the country was emerging from gobal recession. The price of copper, Chile's key commodity export, was back near pre-recession levels. After falling nearly 5%, GDP began recovering in June 2009, and was close to its pre-recession peak by the time of the quake. Unemployment had fallen from 10% in July 2009 to 9.5% in January 2010.[17]

Damage

The Chilean earthquake was one of the strongest ever recorded, at 8.8 on the Richter scale. Felt strongly in six regions containing about 80% of Chile's population, the quake caused major damage in the capital, Santiago (population: 6.7mn), and the city of Concepcion (290,000), and triggered a tsunami which inundated Chile's south-central coast, damaging port facilities and devastating fishing towns. Chile's copper mines – mostly in the north of the country – suffered relatively little damage, but transport systems were destroyed. Spates of large (magnitude 6.5 and above) aftershocks occurred in March 2010 and early 2011, though the damage appears to have been relatively minor. The earthquake and tsunami are estimated to have caused US$30bn in damage, or 19% of Chile's GDP.

Disruption

Despite a fall in consumer confidence, the impact on Chile's economy was sharp, but short-lived. Chile's GDP contracted by 2% in 2010Q1, but bounced back 4% the following quarter, and continued to grow strongly thereafter. Looking at monthly data such as industrial production and employment shows that the disruption was concentrated in March. Some of the strong growth in June reflects a rebound in trade, transport and other services, some reflects reconstruction-related activity – manufacturing, mining and agricultural output all were still below pre-quake levels in the second half of the year.

Reconstruction and long-run effects

While it's too soon to tell the long-run impacts of the quake, Chile's economy has been growing rapidly since June 2010. Reconstruction-related activity appears to have ramped up very quickly - business investment surged in the March quarter, and construction saw very strong growth in June. Post-quake growth has prompted rising wage and inflation pressures, and interest rate hikes. Inflation accelerated from close to zero (Chile was emerging from deflation) to over 2% by mid 2010, and labour cost inflation accelerated from 2.5% in January 2010 to over 5% by the end of the year.

New Orleans

Context

New Orleans was on an economic downtrend well before Hurricane Katrina. After declining in relative terms for over a century, its population began shrinking in absolute terms in the 1960s. Before Katrina, New Orleans was over-represented (relative to the US average) in the entertainment and hospitality industries, and under-represented in manufacturing, finance and and IT industries. Nearly a quarter of the population lived below the poverty line.

Damage

While Hurricane Katrina caused major damage in Mississippi and along the cost of the South-Eastern US, as well as to oil extraction and refining facilities in the Gulf of Mexico, its worst impact was indirect, when it led to breaches of New Orleans's flood protection systems. 80% of the city was flooded for weeks. Nearly 2000 people died. The estimated total damage from Hurricane Katrina was $125bn, or 1% of US GDP.

Disruption

Flooding forced the near-total evacuation of New Orleans, and the economy ground to a halt. Measures of economic activity based on labour market data fell 6% in Louisiana over three months, and only crawled back slowly over the following year. By contrast, in neighbouring Mississippi activity fell 1.6% in September 2005, but had recovered half its losses the following month, and surpassed its pre-hurricane level by January 2006.[18]

Reconstruction and long-run effects

The disaster appears to have hastened New Orleans's demographic decline. After falling 6% in the 5 years before Katrina, the population plummeted and never recovered – in 2009 New Orleans's population was still well below 2005 levels (25% below for New Orleans city, 10% below for the metropolitan area). Given this, it is not surprising that rebuilding has also been limited. By 2008, permits issued and government grants applied for were less than half of the number of houses destroyed in Orleans Parish alone, and new permit issuance had slowed dramatically.[19]

The city did see significant increases in housing costs and labour market pressures, but not sufficient to prompt stronger recovery. According to the American Community Survey, house prices in Orleans Parish were still 47% above 2005 levels in 2009, and rents were 56% higher. And by early 2006 the unemployment rate had fallen below pre-Katrina levels, and wages were rising much faster than the national average - not because the jobs had come back, but because the labour force had shrunk so dramatically. Predictably, jobs growth was mainly seen in the construction industry, while tourism-related workers suffered most.[20]

Endnotes

1. See 'Household Relocations for Canterbury 22 February - 6 April NZ Post Data Analysis', http://www.resilience.org.nz/.
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7. For example, S Gilchrist and J C Williams (2004) 'Transition dynamics in vintage capital models: explaining the postwar catch-up of Germany and Japan', NBER Working Paper 10732.
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12. Chapple, 1997).
13. For descriptions of the Kobe earthquake, see, e.g. Horwich, G (2010) 'Economic Lessons of the Kobe Earthquake', *Economic Development and Cultural Change,* 48-3, and Edgington, D W (2010), *Reconstructing Kobe: The Geography of Crisis and Opportunity*, UBC Press, Vancouver.
14. See Edgington (2010), and Risk Management Solutions (2005), '1995 Kobe 10-year Retrospective', www.rms.com/publications/KobeRetro.pdf.
15. See Chang S E (2000) 'Disasters and Transport Systems: Loss, Recovery and Competition at the Port of Kobe After the 1995 Earthquake', *Journal of Transport Geography,* 8, and http://aapa.files.cms-plus.com/Statistics/WORLD%20PORT%20RANKINGS%2020081.pdf.
16. Horwich (2010).
17. See www.bcentral.cl for most Chilean data. Where not publically available, seasonally adjusted estimates are the author's. Consumer confidence data are from www.adimark.cl.
18. See http://www.philadelphiafed.org/research-and-data/regional-economy/indexes/coincident/.
19. Vigdor (2008), p. 147.
20. Vigdor (2008), pp. 149-150.