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The regional consequence of a disaster: Assessing employment transition during economic recovery

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Orientation: Large-scale events such as disasters, wars and pandemics disrupt the economy by diverging resource allocation, which could alter employment growth within the economy during recovery.

Research purpose: The literature on the disaster–economic nexus predominantly considers the aggregate performance of the economy, including the stimulus injection. This research assesses the employment transition following a disaster by removing this stimulus injection and evaluating the economy's performance during recovery.

Motivation for the study: The underlying economy's performance without the stimulus' benefit remains primarily unanswered. A single disaster event is used to assess the employment transition to guide future stimulus response for disasters.

Research approach/design and method: Canterbury, New Zealand, was affected by a series of earthquakes in 2010–2011 and is used as a single case study. Applying the historical construction–economic relationship, a counterfactual level of economic activity is quantified and compared with official results. Using an input–output model to remove the economy-wide impact from the elevated activity reveals the performance of the underlying economy and employment transition during recovery.

Main findings: The results indicate a return to a demand-driven level of building activity 10 years after the disaster. Employment transition is characterised by two distinct periods. The first 5 years are stimulus-driven, while the 5 years that follow are demand-driven from the underlying economy. After the initial period of elevated building activity, construction repositioned to its long-term level near 5% of value add.

Practical/managerial implications: The level of building activity could be used to confidently assess the performance of regional economies following a destructive disaster. The study results argue for an incentive to redevelop the affected area as quickly as possible to mitigate the negative effect of the destruction and provide a stimulus for the economy.

Contribution/value-add: This study contributes to a growing stream of regional disaster economics research that assesses the economic effect using a single case study.

Keywords: disaster; stimulus; economic growth; employment; construction.

Introduction

Large-scale disruption events, such as pandemics, disasters or wars, tend to have lasting effects on society as they force economic activity to adjust. A recent United Nations report on global disasters reveals an increasing occurrence of disasters over the past 50 years, a trend that is projected to increase (United Nations Office for Disaster Risk Reduction 2022). As disasters have wide-reaching effects on society, the economic response and transition during recovery are of value to assess. The economic response, through stimulus intervention, influences the recovery rate for the affected area (Hallegatte & Dumas 2009). Quick response in the reconstruction of the affected economy should mitigate the short-term negative effect of the event and potentially benefit some sectors.

Devastating disasters often lead to instant loss of infrastructure and human capital and could take years to replace (Shabnam 2014). Several studies (González, London & Santos 2021; Loayza et al.

2012; Wu & Guo 2021) have found negative economic effects associated with disasters and how they reduce gross domestic product (GDP) growth. Alternatively, the damage caused by a disaster could foster positive outcomes by replacing old technology with new technology through investment during the recovery period. This could lead to improved productivity and potentially higher economic growth in the long run. Hallegatte and Dumas (2009) provided a theoretical model based on the Solow growth model and revealed a short-term benefit to productivity because of stimulus injection. However, they do not find long-run growth for the affected economy.

In assessing the relationship between disasters and economic growth, the literature predominantly considers the aggregate performance of the economy. In other words, studies include the stimulus injection in assessing economic performance. As a result, the performance of the underlying economy and the benefit from the stimulus remain mostly unanswered, especially on a regional level. It remains unknown how sectoral employment transitions during the recovery period after an earthquake. The value of the stimulus injection could, to a large degree, affect the performance of economic recovery and influence the relationship between economic growth and disasters. This article contributes to the literature by assessing the employment transition during recovery from stimulus-forced injection for a regional economy.

Utilising the historical association between economic and building activity for Canterbury, New Zealand, a comparison between the actual economic performance and a counterfactual outcome is provided. Additionally, an annual regional input–output (IO) model is used to quantify the economy-wide benefit of the investment stimulus above the counterfactual to reveal the employment transition of the regional economy and various sectors. The counterfactual level of economic activity represents the underlying economy without the additional stimulus and enables an assessment of both short- and long-term employment movements within the economy. The short-term benefit from the investment stimulus gives way to the underlying economy's long-term growth, enabling the transition to demand-driven activity 10 years after the earthquakes.

Canterbury is one of the 16 administrative regions within New Zealand and contributes 12.5% to the New Zealand economy. In 2010–2011, the region was affected by a series of earthquakes that resulted in large-scale damage in the region, especially within Christchurch, the region's largest city. Christchurch had an estimated population of 510 500 in June 2010 (Statistics New Zealand 2022). Significant damage to the city's infrastructure was reported, and the central business district (CBD) was partially closed for up to 2 years. Beyond the CBD, the damage affected approximately 167 000 properties and general infrastructure with a total replacement value estimated at NZ$40 billion (2015 values) (Wood, Noy & Parker 2016). The damaging effect of large-scale disasters on the economy requires attention on a regional level to provide insight that will improve decision-making for recovery.

The following section provides a literature review on disasters and economic growth. The 'Methodology' section outlines the research approach and is followed by the results and discussion. The article concludes with the 'Conclusion' section and provides avenues for future research.

Literature review

Disasters and the economy

Disasters affect the functioning of economic systems through negative impacts on assets, labour, production and consumption (Hallegatte & Przyluski 2010). The economy moves away from equilibrium, and the subsequent response and recovery within the economic system add to the uncertainty. Understanding of the disaster–economic relationship at a regional level remains limited, but continues to grow within the literature, driven by a need to value the economic impact locally. The relationship between disasters and economic growth has mixed results in the literature. This is because of the complexities in assessing disasters as they vary in type, with the main distinction between meteorological and geological disasters (Atsalakis, Bouri & Pasiouras 2021), duration (González et al. 2021) and scale (Shabnam 2014). The increasing availability of disaster data has assisted researchers in understanding the disaster–economic nexus. An early study by Kunreuther and Fiore (1966) on the economic recovery of Alaska after a major earthquake cautions that areas affected by a disaster are faced with an information problem. The author highlights the problems in collecting accurate information during the period immediately after the disaster, which makes decision-making difficult, especially at the government level.

Capturing the occurrence of disasters in formal databases have proved helpful in assessing their impact. This allows for various approaches to be applied and enables the assessment of policy and strategy formulation during an economic recovery. Several studies (Atsalakis et al. 2021; Guo et al. 2015; Wu & Guo 2021) use disaster information from the Emergency Events Database (EM-DAT) and combine it with GDP data to assess the relationship between the economy and disasters. The results provide insight into describing the disaster–economic nexus. However, these studies mainly focus on the national or even global level and tend to use economic indicators, mainly GDP, which includes the stimulus injection from the recovery period.

Various economic indicators to assess the impact of disasters are used throughout literature. These range from GDP per capita (Loayza et al. 2012), production functions (in estimating GDP) (Albala-Bertrand 1993; Hallegatte & Dumas 2009), night-time lights (Klomp 2016; Kocornik-Mina et al. 2020) and impulse response models (Dyason 2022; Zhou & Chen 2021). This highlights the complexity of assessing the relationship between disasters and economic activity. For example, the results are further sensitive to the period under assessment and changing the dates could affect the outcome. Atsalakis et al. (2021) found that changing the assessment date and using a quarter-on-quarter (QQ) approach positively affect economic growth after a disaster. An assessment of existing disaster–economic literature by González (2022) reveals that the occurrence of natural disasters reduces economic growth in the short term. The low levels of economic growth is mostly evident in developing economies where limited stimulus injections occur after the event. Hallegatte and Dumas (2009) found that delayed reconstruction of the affected economy in the short term deepens the duration of the negative consequences after a disaster. Therefore, providing stimulus as quickly as possible after the event is important.

Sub-national assessment of the disaster–economic growth nexus continues to expand, but remains limited. A provincial study of China by Guo et al. (2015) for the period 1985–2011 found that the disaster type affects economic growth. Their study divides disasters into meteorological and geological disasters and assesses two periods. Their results reveal that meteorological disasters promote economic growth during one of the periods, while geological disasters do not. A similar study by Wu and Guo (2021) on China found comparable results and emphasised that the result could be explained because of a higher number of meteorological disasters (such as floods) near coastal areas. Floods in China occur relatively often, compared with meteorological disasters that tend to occur in rural, less densely populated areas. Panwar and Sen (2020) studied the effects of flooding on sub-regional economies in India in both the short and long term. Their results reveal an initial negative growth effect in several sectors, including manufacturing and services, extending into the long run, apart from agriculture, which after an initial decline, revealed a positive growth in the long run.

On earthquakes, the literature reveals a strong construction component during recovery. The rate of recovery after the 1964 Anchorage earthquake in housing and public facilities was relatively rapid for the city, with most construction work completed within a year (Kunreuther & Fiore 1966). This, supported by a sizable construction industry in the city, led to the fast recovery. A similar result from a recent study by Fischer (2021) in Iran found that earthquakes benefit construction jobs in the adjacent regional economies and provide a source of labour to the affected area.

Construction and the economy

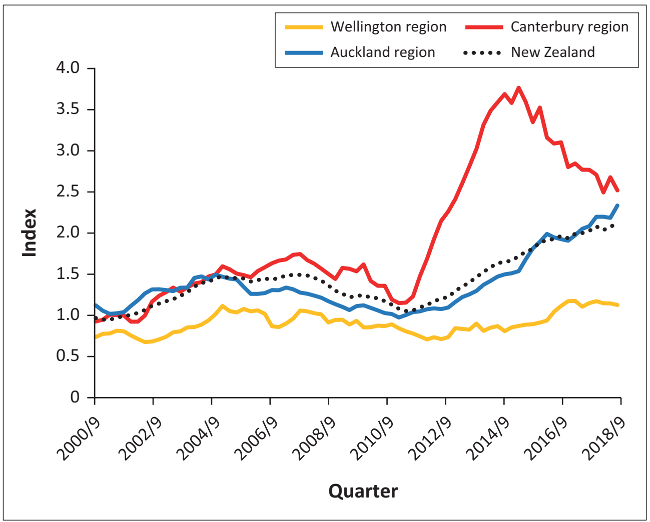
Within the economic theory, the relationship between economic growth and construction is well recognised, where increasing investment leads to a growing economy. By the early 1990s, many empirical studies revealed a positive correlation between output growth and infrastructure investment (Giang & Pheng 2011). While there is a positive association, the relationship between infrastructure investment and economic growth is not linear (Osei, Aglobitse & Bentum-Ennin 2017).

Construction activity associated with infrastructure investment has strong backward linkages with the rest of the economy, supporting industries such as manufacturing (Gundes 2011). Construction is considered a dynamic sector, which is highly visible (Pheng & Hou 2019), especially because it supports inter-industry relationships with other sectors in the economy. The IO analysis supports this focus on backward linkages within the Canterbury economy, which is expected to benefit more from earthquake reconstruction than service-oriented industries.

Furthermore, various studies have assessed the contribution of construction activity to the economy. Strassmann (1970) found evidence that a high growth value added from the construction sector supports economic growth. Various later studies supported this and identified the value add from construction to GDP as between 3% and 5% (Lopes Ruddock & Ribeiro 2002; Pheng & Leong 1992). Lopes et al. (2002) demonstrated that a construction value add of 4% to GDP is associated with sustained economic growth. The pre-earthquake contribution of construction value add within the Canterbury economy was 5.2%, which increased to 7.8% during the peak of the recovery and has since returned to the 5% range. Wigren and Wilhelmsson (2007) studied the importance of building investment and its effect on economic growth in Western Europe as the share of total construction decreased from 10% to 7% of GDP. They found that infrastructure investment has a positive effect on short-run economic growth, but only a weak effect on long-term growth. This implies that a sustained volume of construction is required in support of economic growth.

Methodology

This empirical analysis combined two approaches to assess employment transition resulting from a disaster. The data, sourced from Statistics New Zealand, include regional building consent and employment data, while regional GDP data are sourced from Infometrics. Firstly, the relationship between building consent and economic activity is established for the regional economy before the disaster. Dyason (2022) recommends a regional analysis of this relationship to determine whether it is stable, as found by Giang and Pheng (2011), and consistent in its contribution (Lopes et al. 2002). This is required, as mixed results within the literature on the relationship are possible because of the structure of the regional economy. The Canterbury region revealed a stable economic–consent relationship relative to the national economy prior to the earthquake in 2011 (see Figure 1). Fig 1 reveals the building consent and economic activity relationship for selected regions in New Zealand. The relationship is shown as a 12-month moving average and indexed to the national ratio starting on June 2000. During the 10-year period prior to the 2011 Canterbury earthquakes, the region's building consent and GDP relationship remained relatively stable in relation to the national ratio. After 2011, this relationship changed significantly as a result of the rebuild stimulus injection and remained high up to 2019. In comparison, a similar relationship is evident for Auckland, which continues to extend beyond 2011 and remains for the duration of the time series. In contrast, this relationship is not



Source: Statistics New Zealand, 2021, *New Zealand business demography statistics: At February 2021, Stats* NZ, Infometrics 2021

FIGURE 1: Consent–gross domestic product index, 2000–2019 – Index to New Zealand Q2:2006.

apparent for Wellington as it remains below the national ratio throughout the 20 years.

The relative stable relationship prior to 2011 for Canterbury, coupled with the continued stable relationship between Auckland and the national economy, suggests that the national ratio reveals the long-term equilibrium for Canterbury. The declining ratio for Canterbury since 2016 reveals a return from a high-rebuild environment to a demand-driven environment within the economy. This long-run equilibrium has support within the Keynesian economics literature, where aggregate demand and supply adjust towards each other, similar to how prices adjust to the cost of production in the long run (De-Juan 2005).

The national ratio is applied as the counterfactual – which implies going back to the period prior to the earthquake and constructing building activity as if the earthquake did not take place. In other words, it represents the extension into the future of Canterbury's pre-shock long-run building and economic activity relationship. This assumption, on the counterfactual, is frequently found in academic literature. The studies performed by Kohli, Szyf and Arnold (2012) and Loser and Fajgenbaum (2012) are examples of similar approaches to developing counterfactual values for predicting future worldwide GDP based on historical relationships. Similarly, Fingleton and Palombi (2013) used historical coefficients to obtain counterfactual wage levels to explore how local economies retain their long-run growth after a major shock.

The counterfactual model for the regional building activity is provided as:

$$B_n = (W_n/R_n) \times C_n \qquad \text{[Eqn 1]}$$

where B_n is the counterfactual value of building activity at time n. W_n/R_n is the association between building activity and economic activity for period n, while C is the regional GDP in the corresponding period (n).

The result of the model represents the long-term value of building activity associated with the counterfactual scenario. It also allows for quantifying the difference between the actual historical values and the counterfactual value of building activity. The study postulates that the difference between the counterfactual value and the actual value of building activity represents an investment stimulus in response to the earthquake recovery.

Secondly, an IO model of the Canterbury economy is used to measure the interdependence between sectors of the economy that respond to the final demand for (1) the actual historical value of building activity and (2) the counterfactual level. The economy-wide benefit resulting from the earthquake recovery injection is separated from the official regional data through the IO model results to reveal the employment transition, from the investment stimulus, after the disaster.

Input–output models are frequently used to assess the effect of shocks on the economy (Bai et al. 2022; Dyason 2022). Economists use the model to measure the impact on the economy. The flexibility of the IO model is beneficial, as it enables economic assessment of various economic measures from a shock to the economy. The IO model reveals the linkages among firms in the different industries within the regional economy (Munroe & Biles 2005).

The IO relationship is expressed as:

$$X_I = \sum X_{ij} + f_i \qquad \text{[Eqn 2]}$$

where the total output of sector (X_i) is equal to inter-industry sales of all the other sectors ($\sum X_{ij}$) and the sales to final demand (f_i). These transactions are used to estimate the technical coefficients (A_{ij}) and reveal the total direct input requirements for each industry per unit of output. The technical coefficient is defined as the quantity of intermediate inputs required by one sector from another sector to supply a unit of output (X_j):

$$A_{ij} = X_{ij}/X_j \qquad \text{[Eqn 3]}$$

In regional IO analysis, these values correspond to inputs purchased within the region to reveal the employment transition in the regional economy. The framework of the IO model makes it possible to measure the economy-wide impact of a shock in the economy and can be applied for specific events, such as the investment injection in response to a disaster.

The model is limited to inter-industry relationships of the particular year, which reduce the ability of the model to adjust to changing ratios or proportionality. This limitation is overcome in this research by applying two IO models based on different years, 2013 and 2017. This allows some flexibility within the results.

Removing the economy-wide impact on employment from the investment stimulus, through the IO model, reveals the performance of the counterfactual economy or, in other words, the underlying economy during recovery (see Dyason 2022):

$$EMP_{ue} = [EMP_{t-1}]_n - [B_n (X)_n] \quad \text{[Eqn 4]}$$

where EMP_{ue} represents total employment of the underlying economy $[EMP_{t-1}]_n$ represents the regional economy's historical, official employment level and $B_n (X)_n$ represents the economy-wide injection from the stimulus activity measured through the IO model. The underlying value represents the difference in the value of building activity for a period (n) less than the value of the counterfactual building activity. This allows for assessing employment transition without the additional impact of the investment stimulus in response to the disaster. The IO model is completed for each year from 2012 to 2021 to reveal the employment transition.

Ethical considerations

This article followed all ethical standards for research without direct contact with human or animal subjects.

Results

The investment meant to drive the recovery of economies after a disaster tends to hide the actual loss in economic activity resulting from the event. To assess the performance of the regional economy, removing this investment could provide insight into the transition of sectors from a stimulus injection. The 2010–2011 Canterbury earthquakes provide an example of a regional economy affected by a disaster and subsequent investment stimulus from the government and insurers to rebuild the damaged infrastructure. Applying a pre-earthquake long-run economic–building activity relationship for Canterbury and extending it beyond the disaster event provide a counterfactual level of building activity, which reveals the normal demand driven level of building activity within the economy. Figure 2 illustrates the historical building consent value and the counterfactual value, where the activity (W_n/R_n) reflects the national economy.

The counterfactual value reveals the short- to long-term injection in building activity in response to the earthquake. Within the first year of the earthquake, the value of building activity quickly outpaced the value of activity visible prior to the event. The investment continued to increase and peaked during 2015 as houses, commercial, public infrastructure and other buildings were repaired or rebuilt. Since the peak, a gradual decrease in the actual value of consents is visible, while the value of the counterfactual building activity continues to increase. By 2020, the actual value of building activity and the counterfactual scenario converged and remained stable. The duration of the convergence is nearly 1 year, indicating that the counterfactual scenario portrays a realistic representation of building activity for the region.

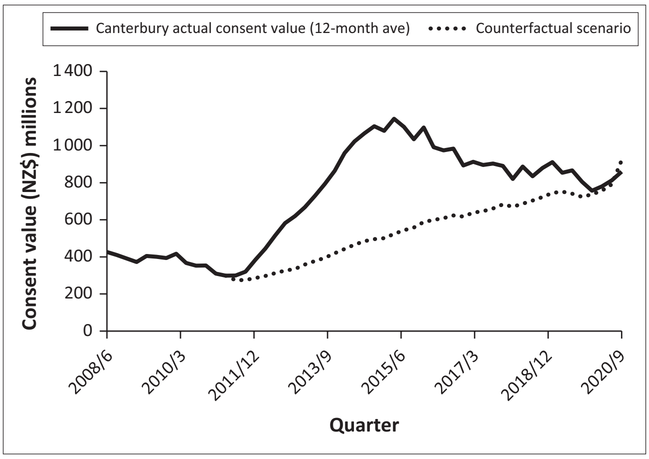


FIGURE 2: Historical value and counterfactual value of building activity, Canterbury.

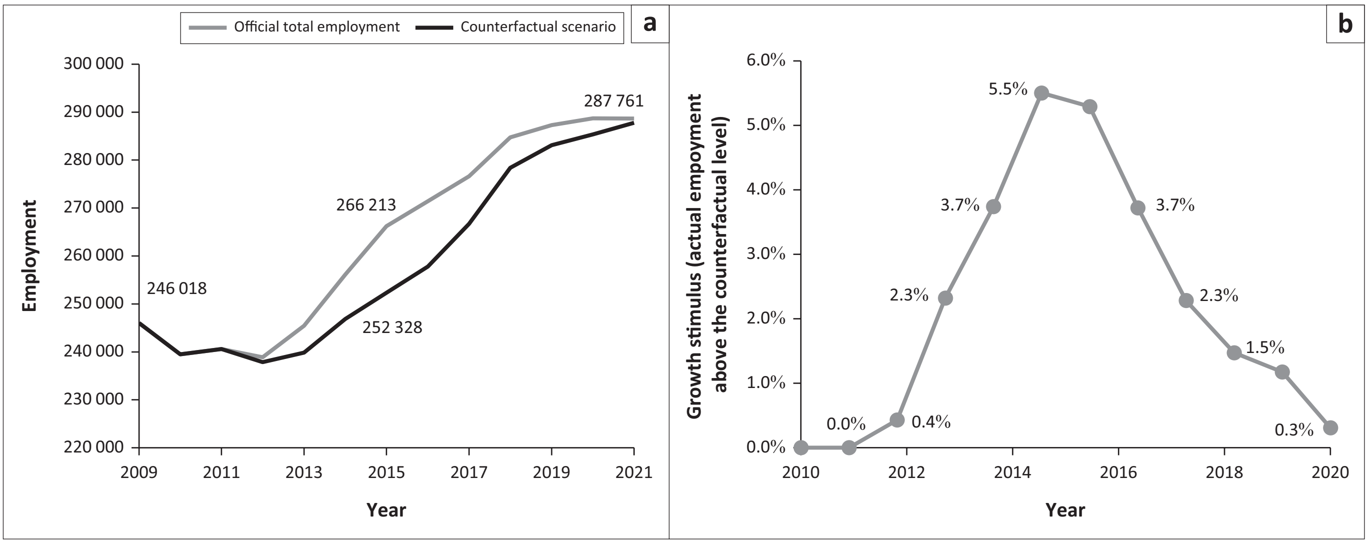
TABLE 1: Input–output results of elevated building activity, 2012–2021.

Year ending March	Value of elevated building activity (NZ$/mil)	Economy-wide employment impact (number of jobs)
2012	169	1048
2013	890	5513
2014	1503	9192
2015	2265	13 856
2016	2233	13 661
2017	1628	9959
2018	1041	6367
2019	688	4206
2020	550	3351
2021	145	889

The annual difference between the building and counterfactual values is estimated from 2012 to 2021 and is included in the IO assessment model. The IO matrix provides a framework of inter-industry relationships for the Canterbury economy for a particular year. Distributing the additional value of building activity within the model allows the IO model to apply these interdependencies and quantify the economy-wide employment associated with the elevated levels of building activity.

The value of elevated building activity increases from $169 million in 2012 and peaks at $2.2bn in 2015, and steadily decreases from there onwards (see Table 1). The result of the economy-wide impact from the elevated level of building activity is summarised in Table 1. The results reveal the additional employment, throughout the economy, created as a result of the elevated building activity for the region.

The annual employment level for the counterfactual scenario is revealed by removing the additional employment estimated annually (through the IO model) from official regional employment data. The result, illustrated in Figure 3a, shows an initial divergence in employment, which continues to increase annually for the first 5 years – the stimulus peaked in 2015 and declined from 2016. The performance of the underlying economy during 2012 and 2013 remains low, with a slight decline in employment initially, before it picks up from 2013 onwards. As a result of the stimulus injection, the widening gap between actual employment and the



Source: Statistics New Zealand, 2021, *New Zealand business demography statistics: At February 2021*, Stats NZ, Wellington.

FIGURE 3: (a) Summary of results for Canterbury employment, 2009–2021. (b) Growth stimulus in employment from investment injection, 2010–2021.

underlying economy became prominent in 2013. Figure 3b illustrates the scale of the benefit from the stimulus as total employment because of the investment peaks at 5.5% above the employment in the underlying economy. From there, the underlying economy remains strong, leading to a convergence between actual employment and employment. By 2021, the results show that the additional benefit from the earthquake stimulus has diminished almost entirely and the market drives building activity.

The employment transition affects sectors differently, and the IO model allows for a detailed assessment at this level. The stimulus injection in the built environment benefits some industries more than others. Figure 4 compares the actual employment level and growth since 2009 with the counterfactual employment scenario for various economic sectors. The benefit is significant within the construction sector, supporting similar observations by Fischer (2021) and Kunreuther and Fiore (1966), to a lesser extent, services within the economy (Gundes 2011).

Discussion

The Canterbury region in New Zealand experienced several large-scale disruption events in the past decade, of which the 2010–2011 earthquakes have been the most damaging (for the built environment). The damage was especially evident within Christchurch, New Zealand's second-largest city. Stimulus in the form of government grants and insurance claims provided the means towards recovery. This stimulus injection created employment opportunities as resource allocation adjusted to pre-disaster economy activity.

The results reveal that this adjustment in the economy pushed employment above the demand-driven level of activity to peak at 5.5% above the underlying economy during recovery (see Figure 3b). Stimulus-driven employment increased slowly within the first year (2012) and remained above the underlying economy. As recovery continued and the rebuild continued, the gap in employment between the underlying economy and stimulus-driven employment increased, creating an additional 1022 jobs in the first year, peaking after 4 years from the earthquake at 13 856 jobs above the underlying economy. Between 2014 and 2015, the official employment growth of 4.3% outpaced the employment growth of the underlying economy of 2.9% (see Figure 5). During this time, the stimulus-driven employment creation outpaced the employment growth of the underlying economy. The divergence between the actual employment and the value of employment for the underlying economy resembles a (normal) distribution curve (see Figure 3b). The steep rise leading up to the peak is followed by a similar period of decreasing growth from 2016 onwards. The period after the peak reveals that the underlying economy employment growth is outpacing the growth of the stimulus-driven employment (see Figure 5). In 2021, the additional employment created by the stimulus appeared to have dissipated as employment and growth of both are at similar levels.

The long-term employment growth of the regional economy since the earthquakes, supports the results from previous studies in the literature, particularly from Albala-Bertrand (1993), which states that disasters in advanced economies tend not to reduce output, but support growth through the replacement of capital goods.

On a sector level, the stimulus reveals a benefit for manufacturing, wholesale trade, professional service and real estate services. However, construction employment benefited most from rebuilding infrastructure, residential and commercial property, creating 4.8 jobs for every million dollars of building activity in the Canterbury region. This result supports the existing disaster literature where geological events, such as earthquakes, cause greater damage per event when compared with meteorological events (Klomp 2016). The additional employment in construction-related activity is therefore not surprising and similar to the results from Fischer

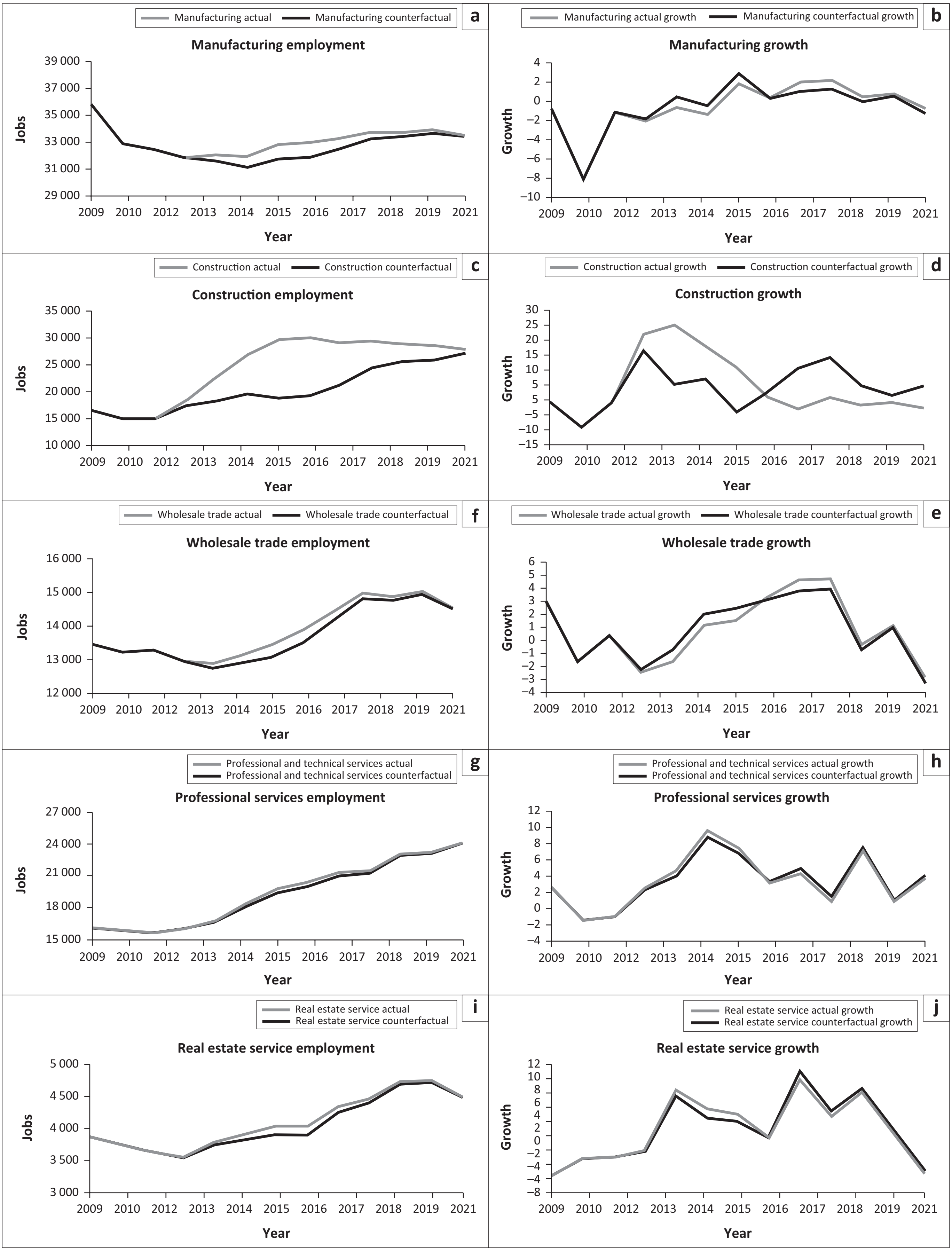
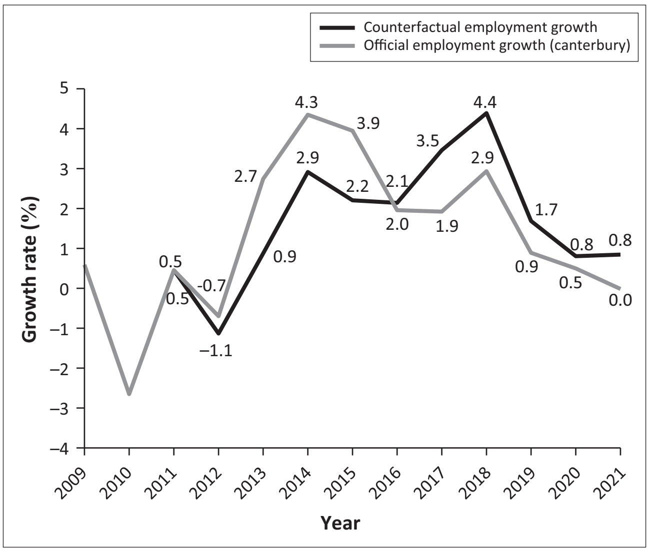


FIGURE 4: Employment transition per sector, 2009–2021 (a-j).



Source: Statistics New Zealand, 2021, New Zealand business demography statistics: At February 2021, Stats NZ, Author's calculations

FIGURE 5: Employment growth, 2009–2021.

(2021), who revealed similar strong growth in construction employment after a disaster in Iran.

Employment increased rapidly between 2011 and 2013, peaking at a growth rate of 25% by 2013. Construction employment peaked in 2016 and remained high and above construction employment of the underlying economy. In support of results from Fischer (2021), who found that spillover effects benefit construction employment for adjacent regional economies, this result reveals a multi-year benefit to construction employment for the region. The transition of construction employed through annual growth reveals a rapid stimulus-driven increase initially, which declines and crossover with the underlying economy by 2016.

For the other sectors, employment is supported above the underlying economy and provides up to 3.4% stimulus in employment at the peak of the investment injection. A similar trend in employment transition is evident where stimulus-driven injection drives growth up to 2016, at which point growth rates crossover, and the underlying economy drives growth onwards. By 2019, the additional stimulus-forced benefit in employment disappears for most other sectors.

This study finds evidence that aligns with the existing literature on the path of economic growth during the recovery, namely that the stimulus injection provides a period of increasing economic activity (Chhibber & Laajaj 2008; Fischer 2021; Klomp 2016). While the duration for elevated employment transition remains in place for 10 years, growth revealed increasing return for 5 years, followed by a period of declining return (growth). This second period is characterised as demand-driven growth rather than stimulus-driven growth.

Panwar and Sen (2020) found that other disasters, such as flooding, positively impact agriculture output and that this benefit does not spill over to other sectors over the long run. In contrast, this study on earthquakes finds long-run benefits for other industries beyond construction.

This research supports the results from Lopes et al. (2002) related to the relationship between construction and economic growth within the context of disasters. In particular, the growing construction output after a disaster occurs during the first stage of economic recovery. As recovery winds down, construction activity repositions to its long-term sustainable level near 5%. Within Canterbury, this level was reached in 2020, suggesting that the additional benefit from the stimulus has finished and employment within the economy and the sectors is driven by market demand rather than stimulus.

Recently, coronavirus disease (COVID-19) has affected the economy through demand and supply dynamics within the built environment. The impact of government regulations related to the pandemic, which predominantly limited the movement of people (Hall et al. 2021), does not reveal significant adjustments in the built environment – the 2021 employment in Figure 3a is unchanged from 2020. For one, the impact on the built environment because of COVID-19 did not damage the built environment, but led to fiscal and monetary adjustments affecting demand and supply. Assessing how fiscal and monetary policy responses affected the built environment provides an opportunity for future research.

Conclusion

Large-scale events such as disasters, wars and pandemics disrupt the economy by diverging the allocation of resources. The allocation could alter during recovery when compared with its pre-event period. The 2010–2011 Canterbury earthquakes provide an opportunity to assess how investment stimulus during recovery affects employment and its transition before and after the disruption. The study contributes to a growing regional disaster economics research that assesses the economic effect using a single case study of Canterbury in New Zealand. A counterfactual level of economic activity is quantified based on the historical, pre-earthquake relationship between economic and building activity and is estimated for a 10-year period up to 2021. The counterfactual level of economic activity represents the underlying economy; in other words, an economy not affected by disruption provides a basis for the comparison of employment transition driven by investment stimulus in the regional economy. The long-term relationship between economic and building activity was disrupted during the rebuild; however, the results show a return to a similar relationship from 2020 onwards. This finding indicates a return to a demand-driven level of building activity within the regional economy and the completion of earthquake stimulus injection.

The employment transition results, estimated by applying a regional IO model, reveal a 10-year period of elevated employment. The transition of employment is characterised by two distinct periods. The first period, which lasted 5 years, is employment growth driven by the stimulus injection, and the second period of 5 years is driven by employment growth within the underlying economy. Intuitively, one would expect that employment levels will decline below historical growth in the period after the rebuild has ended, similar to business cycles. This research finds that while overall employment growth started to decline after the construction peak, 5 years after the earthquake, the economy converged rather than diverged with the demand-driven level of building activity. Furthermore, the converging of actual building activity with the counterfactual level remains similar within the year affected by the COVID-19 pandemic. This suggests that the counterfactual level of building activity, which represents the national level of economic activity and building activity, has reached a long-term equilibrium without reducing further.

The results suggest that any additional employment benefit from a stimulus in the built environment has subsided after a decade. The underlying economic assessment suggests that employment within the economy would have reached a similar value by 2021 even without the stimulus injection. The transition of total employment reveals two distinct phases, starting with a period of increasing returns and a peak (5 years), followed by diminishing growth that converges with market demand growth (5 years). The findings of this study suggest that the short-term response in stimulus injection after the Canterbury earthquakes was timely to limit the negative consequences of the disaster in support of the finding of Hallegatte and Dumas (2009).

On a sector level, the built environment stimulus benefitted construction employment most and, to a lesser extent, provided additional employment in manufacturing, wholesale trade and professional services. The findings of this research on disasters provide decision-makers with evidence based on an actual event to help with funding decisions in the aftermath of future disasters. Recommendations from the results reveal that the value of construction activity could be used to assess the performance of regional economies to determine the strength and performance of the underlying economy following a disaster. With an expected increase in disasters, attention towards the benefits of investment stimulus in mitigating the initial negative impact is called for. The negative effect of a disaster could be mitigated with immediate support through investment stimulus to provide employment benefits for the affected economy. Support for reconstruction of the built-environment will largely benefit the construction and related services industry, with stronger backward linkages to manufacturing and technical and professional services related to construction. Finally, the results provide avenues for future research in defining stimulus-driven employment transition. It also allows for research on how the scale of the transition is influenced by, among other things, the change in employment levels and the duration and scale of the disaster on elevated employment.

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Competing interests

The author has declared that no competing interest exists.

Author's contributions

I declare that I am the sole author of this research article.

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Data availability

The data supporting this study's findings are openly available at https://infoshare.stats.govt.nz/default.aspx?

Disclaimer

The views and opinions expressed in this article are those of the author and do not necessarily reflect the official policy or position of any affiliated agency of the author.

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