Regional labour market spillovers

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Key findings

- Changes in employment levels in one region can affect other regions, though the impact varies around the country.
- Auckland and Waikato generate the largest regional spillovers, meaning jobs created or destroyed here have the largest impact on the rest of the country.
- Taranaki, Southland, and the Upper South Island have the smallest spillovers.
- Regions in the North Island produce more spillovers than those in the South Island.
- Information about regions with the largest spillovers can be used to improve the accuracy of national unemployment forecasts.
- During the post-COVID-19 pandemic recovery, changes in unemployment in the North Island may affect the rest of the country more than changes in unemployment in the South Island.
- However, COVID-19 may change the structure of these relationships. By tracking how they change in the early stages of the recovery, we can adapt the model to help forecast unemployment when conditions stabilise.

Introduction

The purpose of this paper is to identify how unemployment in New Zealand’s regional labour markets can spill over and affect unemployment in other regions.

We can use this information to identify the regions whose labour market cycles lead and lag the rest of New Zealand. This, in turn, can improve the national dataset to better forecast national unemployment.

These insights help the Reserve Bank better understand the direction of the labour market in New Zealand, and how to set monetary policy to support maximum sustainable employment.

Why does an understanding of regional labour markets matter?

Job creation (or destruction) in one region can spill over into other regions. Rising employment in one region increases employment in another, as jobs created by successful firms can create demand for goods and services that benefit other regions’ labour markets. On the other hand, where regions compete for workers, employment in one region may cause unemployment in another.

The underlying patterns of how New Zealand’s regional labour markets influence each other has been relatively unexplored until now. By understanding these regional relationships, we can better forecast national economic outcomes.

If quarterly data indicates the regions that generate the largest spillovers are strong economically, we can expect future conditions for the country to be stronger than otherwise. Similarly, if regions which tend to generate the smallest spillovers are holding up in an otherwise weak economy, this may be a sign of future weakness nationally. It is therefore possible to more accurately forecast national unemployment by focusing on the data in the leading regions rather than those whose labour markets tend to lag the rest of the country.

Since the model relies on historical data, it is possible that spillovers from the COVID-19 economic shock may spread differently and the observed effects may differ.

How does this paper build on previous work?

Hall and McDermott (2004, 2011) find that different regions experience differences in business cycles. They do not, however, examine spillovers between regions.
Davis and Haltiwanger (1992) and Maré and Timmins (2004) study job flows between and within regions, and find that the vast majority of job reallocation occurred within regions—and little occurred between regions. These studies did not examine which regions had the strongest and weakest impacts on other regions.

Eaqub and Stephenson (2014) provide a descriptive analysis of New Zealand’s regional economies. This includes a principle component analysis of regional economic drivers, but is limited by data availability, and does not examine spillovers.

Greenaway-McGrevy, Grimes, and Holmes (2016) use a dynamic factor model (DFM) with regional housing data across Australia and New Zealand to identify housing markets as leaders and laggards. This demonstrates the use of DFMs for forecasting regional variables. They find that the largest Australian regions have the most influence on the rest of Australia and New Zealand. They also find that smaller Australian regions which are close to the large hubs have more influence on both the Australian and New Zealand markets than the larger New Zealand regions do.

The seminal Diebold and Yilmaz (2009) paper on estimating asset return spillovers in global equity markets develops a highly flexible methodology for estimating spillover effects of any nature. This methodology is outlined in this paper’s technical appendix.\(^1\)

We build on the understanding of New Zealand’s regions highlighted by the aforementioned studies of New Zealand regional economies by using the spillovers model from Diebold and Yilmaz (2009), and the regional forecasting approach with a DFM inspired by Greenaway-McGrevy, Grimes, and Holmes (2016).

**How do we estimate regional spillovers and use regional data to forecast national unemployment?**

We apply the spillover estimation framework of Diebold and Yilmaz (2009) to quarterly data on regional unemployment for New Zealand. This involves using a Bayesian vector autoregression (BVAR) to identify what proportion of the variation in each region’s unemployment rate were caused by earlier changes in unemployment spilling over from other regions.

For forecasting, we use a simple dynamic factor model (DFM) in the form of a factor-augmented vector autoregression (FAVAR). For forecasting national unemployment we care about how the different regions contribute to the movements in national data, rather than just other regions. As a result, we add the national unemployment rate into the spillover BVAR and identify leading regions by their contribution to the movement in national unemployment.\(^2\) We then use only the regions identified here as leaders in the DFM.

In the forecasting exercise, we compare the one-quarter ahead forecasts of the regional DFM model to the forecasts of an autoregressive (AR) model of order 2. We begin the historical dataset at Q1 1998, and implement the forecasting exercise at Q3 2013 and Q4 2019.

**Our key findings**

Our results indicate that Auckland and Waikato ‘lead’ the regional labour markets by generating the greatest spillovers into other regions. Taranaki, Southland, and the Upper South Island ‘lag’ the rest of the country, generating minimal spillovers. Activity in the leaders is more likely to influence the wider national labour market than activity in other regions.

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1 A recent study of Germany labour markets by Fedorets, Lottmann, and Stops (2019) estimates regional and occupational spillovers in German labour markets using matching functions, with use of novel German microdata. They found that regional spillovers were positive and significant. Such a methodology may be possible in the future in New Zealand.

2 We use seasonally adjusted data, with unemployment rates taken at their level. For the forecasting exercise with the regional DFM model, we use first-differences.
There is a notable difference between the North and South islands. In fact, the leaderboard of regional spillovers is almost geographical in nature, but for Taranaki (Figure 1).

Figure 1: Ranking of regions by highest-to-lowest unemployment spillovers

The results indicate strong interconnectedness between regions in the Upper North Island. This may be driven by international net migration into Auckland spilling over into the closest regions, or by Auckland absorbing workers from their nearest neighbours.

Wellington generates fewer spillovers than Auckland, despite having similar industries.

It is important to note that the data used here is the unemployment rate—Auckland’s size does not directly enter into the model, yet its economic influence is still clear in the results. The same is not true for Canterbury. These results are similar to Greenaway-McGrevy, Grimes, and Holmes (2016), in that relatively small regions that are close to the largest regions have more influence than some large regions do. This suggests the importance of network effects—the location of regions may be more important to their influence on the rest of the country than their own economic size alone would suggest.

An index can be created to track the total regional spillovers through time. The index indicates that 56% of regional employment surprises can be explained by regional effects. Figure 2 shows this evolve over time, using a 20-quarter rolling window.

Figure 2: Rolling window spillover index of all regions over time, 1998–2020

The index displays a hike in regional spillovers during the Global Financial Crisis (GFC), followed by a significant decline after 2011, from which there has been a steady recovery in the strength of spillovers to pre-crisis levels. This could mean that during times of economic stress, spillovers increase, representing regional contagion, and then fall off during the early recovery, then slowly climb back again as jobs are created.

Another important result is the network effect of bilateral spillovers.

An index can be created to track the total regional spillovers through time. The index indicates that 56% of regional employment surprises can be explained by regional effects. Figure 2 shows this evolve over time, using a 20-quarter rolling window.

Figure 3: Notable regional spillovers

Note: A minimum contribution of 9% in the variance decomposition is used as a cut-off to choose the regions to aid visualisation. The full set of results are in the technical appendix.

Examining the spillovers between regions indicates some spatial clustering. For example, Canterbury and Otago generate significant spillovers with each other, but not to other regions. As mentioned, there are more significant spillovers in the North Island, which appears more interconnected—with the exception of Taranaki.
There are also long-distance spillovers which cannot be explained by spatial correlation. For example, the Bay of Plenty and Canterbury. There is also a link between Taranaki and Southland, not seen on Figure 3 as their spillovers are just under the 9% threshold. These two regions share significant spillovers, despite their distance from one another and despite the two regions generating few spillovers overall.

It is possible that common industries or other economic factors are driving the non-spatial spillovers. We explore these factors through a principal component analysis (PCA).

The PCA can be used to identify patterns in data of high dimension. This allows us to infer which factors are driving activity in different regions, and see where there are similarities and differences across the country. The process condenses the data from across the regions into three new variables that summarise the main factors in the data. These three new variables are called principal components and they can be seen in Figure 4.

There is a common ‘national’ component (PC1) in the data which explains a high proportion of the variation in the data, with a correlation of roughly 30% with each region. It is hard to attribute any economic meaning to component two (PC2), which is highly correlated with Auckland, Gisborne-Hawkes Bay, and Manawatu-Wanganui. Component three (PC3) may have some link to dairy industry activity, with a reasonably high correlation with dairy-sector employment.

Overall, the PCA suggests New Zealand’s regions are primarily influenced by shared national factors, potentially with a secondary role for dairy, and other unidentified factors.

**Forecasting national unemployment with regional factors**

In the forecasting exercise, the unemployment rates in the leading regions provide accurate forecasts of national unemployment when used in a DFM (Figure 5). The regional DFM is particularly accurate in the most recent five quarters of data. This is notable as there were three ‘surprises’ in national unemployment over this period.3

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3 The Q2 2019 outturn was much lower than forecast by statistical forecasts as well as central bank and market forecasts—but correctly predicted by the regional DFM. The Q4 2019 outturn was surprisingly low, but correctly predicted with no forecast error to two decimal places by the DFM. It is possible that this result is merely fortuitous, as the model also accurately forecast the rising unemployment in Q1 2020, partially driven by COVID-19, which the model could not have predicted.
Figure 5: National unemployment rate and forecasts

Figure 5 illustrates the one-step ahead forecasts from the regional DFM, compared with actual data, and forecasts from an AR(2) benchmark model—which is the best-performing statistical model when only national unemployment data is used. This shows that using the data at a regional level yields more accurate forecasts.

The regional DFM is not as accurate in forecasting unemployment during downturns. With a smaller dataset, the model performed at a similar level to the benchmark AR(2) model when unemployment was rising post-2008. This means the regional DFM may struggle to forecast rising unemployment during the early stages of the economy’s recovery after the current COVID-19 pandemic downturn. The technical appendix outlines the performance of the model in more detail, breaking down the improvements in accuracy.

What do our results imply for monetary policy in New Zealand?

New Zealand’s regional labour markets do not move uniformly. Unemployment rates in Auckland and Waikato consistently lead the rest of the country. Southland, Taranaki, and the Upper South Island generally see unemployment change after the rest of New Zealand.

The regions in the North Island create more spillovers across the rest of the country than the South Island—with the exception of Taranaki.

The results can be used to draw tentative conclusions about the nationwide impact of the tourism slowdown due to COVID-19. The smaller spillovers from the South Island suggest the impacts of job losses in the South are likely to remain contained in the most-affected regions. In contrast, a slowdown in Auckland and Waikato would have a greater impact as other regions are more likely to also be affected.

By analysing regional spillovers, we can improve forecasts of the national unemployment rate. By focusing on data from the leading regions, we get a better sense of the direction of the national labour market.

The regional DFM model may struggle to forecast rising unemployment during the early stages of the economic recovery expected after the COVID-19 downturn. However, its performance should improve if and when data volatility eases and economic activity is driven by more traditional relationships rather than a lockdown and travel restrictions. Since it is possible that the underlying structure of the economic relationships between regions will change post-COVID-19, these models will have to be re-estimated to capture such structural changes.
References


