# How many jobs? A leading indicator model of New Zealand employment

Edda Claus and Iris Claus

NEW ZEALAND TREASURY

WORKING PAPER 02/13

JUNE 2002

**NZ TREASURY WORKING PAPER SERIES 02/13**

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**MONTH/YEAR**

June/2002

**AUTHORS**

Edda Claus
The Treasury
Langton Cresent
Canberra ACT 2600
AUSTRALIA

Email EClaus@treasury.gov.au
Telephone 61-2-6263 2808
Fax 61-2-6263 2734

Iris Claus
The Treasury
1 The Terrace
PO Box 3724
Wellington
NEW ZEALAND

Email Iris.Claus@treasury.govt.nz
Telephone 64-4-471 5221
Fax 64-4-499 0992

**ACKNOWLEDGEMENTS**

We would like to thank Richard Downing, Leo Krippner and Robert Lamy for valuable comments and Joanne Archibald for helpful suggestions about the data. The paper has also benefited from comments by participants of a seminar at the Reserve Bank of New Zealand and the 2001 Australasian Macroeconomic Workshop in Adelaide and two anonymous referees.

**NZ TREASURY**

New Zealand Treasury, PO Box 3724, Wellington 6008,
NEW ZEALAND

Email information@treasury.govt.nz
Telephone 64-4-472 2733
Website www.treasury.govt.nz

# Abstract

This paper constructs a composite index of leading indicators of New Zealand employment. The choice of variables and their weights in the composite index are determined by their concordance with employment. The composite index is included in an indicator model to forecast quarterly employment growth. The indicator model explains about 67 percent of the quarterly variation in employment, in sample, and correctly predicted the direction of next period employment almost 80 percent of the time, out of sample.



**JEL CLASSIFICATION** C53 (forecasting, mathematical and quantitative methods), E37 (forecasting, macroeconomics)

**KEYWORDS** Composite index of leading indicators, forecasting, employment

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## 1 Introduction

Forecasts play a key role in formulating fiscal and monetary policy in New Zealand. Under the Fiscal Responsibility Act 1994, which sets out the principles of responsible fiscal management, The Treasury is required to prepare forecasts of the New Zealand economy that incorporate the impact of the short-term fiscal intentions and long-term fiscal objectives of the government of the day. The Reserve Bank of New Zealand Act 1989 provides the legislative framework for conducting monetary policy and requires the Reserve Bank of New Zealand to publish assessments of the New Zealand economy, which provide the basis for setting policy to maintain inflation within the target band.

The main tool used by The Treasury to produce *medium-term* projections is a large structural macroeconomic model, the New Zealand Treasury Model (NZTM), and for the Reserve Bank of New Zealand the Forecasting and Policy System (FPS).[1] However, large-scale structural models are generally not well suited to making *short-term* assessments as they focus on the medium-term dynamics of the economy. To help evaluate short-term fluctuations and cyclical turning points, statistical techniques and econometric forecasting tools, such as indicator models, are used instead.

The purpose of this paper is to develop a composite index of leading indicators of New Zealand employment that can be used to forecast quarterly employment growth. One advantage of composite indexes is that they allow incorporating information from many variables that could not be included in time series forecasts with short sample periods. Moreover, composite indexes may be less subject to instability due to policy changes. For example, the composite index of leading indicators of New Zealand employment includes firms' employment intentions. It is hard to imagine any government policy that could substantially or permanently alter the relationship between employment intentions and actual job growth.

The remainder of the paper is organised as follows. Section 2 outlines the construction of a composite index of leading indicators. Section 3 develops such an index for New Zealand employment. The choice of component variables and their weights in the

[1] NZTM is described in (Szeto 2002). A discussion of FPS can be found in (Hunt, Rose and Scott 2000).

composite index are determined by their concordance with employment. The composite index of leading indicators is then included, as an explanatory variable, in a single-equation model to forecast quarterly employment growth. The indicator model is described in section 4 and its out-of-sample forecasting performance is evaluated relative to two benchmark models in section 5. Conclusions are presented in section 6.

# 2 Constructing a composite index of leading indicators[2]

The idea of using leading economic indicators in business cycle forecasting was originally developed by (Mitchell and Burns 1938) at the National Bureau of Economic Research (NBER). A composite index of leading indicators is the (generally) weighted average of several component series. Composite indexes are constructed because they tend to be more reliable as a cyclical indicator than any of its components taken individually. This is partly because much of the independent measurement error and other noise in the component series is smoothed out in an index.

The algebraic construction of a composite index of leading indicators involves two main steps: (i) standardisation and weighting of the individual component series, and (ii) standardisation and cumulation of the composite value. Both steps are explained in more detail in this section, while the selection of variables to include in an index of New Zealand employment is discussed in section 3.

## 2.1 Standardisation and weighting of individual component series

The first step in the construction of a (quarterly) composite index of leading indicators is to calculate quarter-to-quarter symmetrical percentage changes, $Y_t$, for each individual component j of the composite index

$$Y_t^j = 200 * \frac{X_t^j - X_{t-1}^j}{X_t^j + X_{t-1}^j} \quad (1)$$

where $X_t^j$ denotes component j at time t. For series that contain zero or negative values, or that are already in index or percentage form, the following formula is used instead

$$Y_t^j = 200 * (X_t^j - X_{t-1}^j) \quad (2)$$

For series that are a difference of two series (such as the interest spread) or a ratio, equation (3) is used

$$Y_t^j = X_t^j \quad (3)$$

[2] The section partly follows (Zarnowitz and Boschan 1975). See also (Green and Beckman 1993).

The next step is to standardise the transformed series to prevent a volatile component from dominating changes in the composite index. Each transformed component variable is standardised by dividing it by its historical average without regard to sign, i.e.,

$$S_t^j = \frac{Y_t^j}{\frac{1}{T-1}\sum \left| Y_t^j \right|} \tag{4}$$

where T denotes the number of observations.

The transformed and standardised series, $S_t^j$, are then combined into a composite variable using equation (5)

$$I_t = \sum w^j * S_t^j \tag{5}$$

where $I_t$ is the raw composite value and $w^j$ the individual weight of each series normalised to sum to one. One way to aggregate the components $S_t^j$ is to assume equal weights. However, a number of alternative weighting schemes are available to better reflect the relationship and the importance of each component with the reference series, employment in our case. (Choosing the weights is discussed further in the next section.)

## 2.2 Standardisation and cumulation of the composite value

The purpose of the second step, standardisation and cumulation of the composite value, is to transform the raw composite value $I_t$ so that it has the same historical average (without regard to the sign) as the reference series. The standardised composite value, $I_t^s$, is obtained as

$$I_t^s = \frac{I_t}{\frac{\sum |I_t^j|}{\sum |R_t^j|}} \tag{6}$$

where $R_t^j$ is the symmetrical percentage change of the reference series (employment). The standardised composite value $I_t^s$ is then transformed into an index using the formula in equation (7)

$$CI_t = \frac{I_{t-1}^s * (200 + I_t^s)}{(200 - I_t^s)} \tag{7}$$

where $CI_t$ is the standardised composite index.

# 3 A composite index of leading indicators of New Zealand employment

The first step in developing a composite index of leading indicators is to identify potential component series. When constructing a composite index, it is useful to start on a broad basis with a large number of variables and then drop variables that do not add information. This way no potential information is excluded. Composite indexes do not attempt to explicitly identify the sources of variation in the reference series. Rather the approach focuses on finding variables that tend to be affected by the same shocks as the reference series but earlier than the reference series.

## 3.1 Selection of initial series

To construct a composite index of leading indicators of New Zealand employment (CI) we started with about 140 series that broadly cover the different sectors of the New Zealand economy.[3] The first step in the analysis consisted of graphing the data with employment and calculating some descriptive statistics, such as correlation coefficients.

The 140 or so series that we considered can be grouped into eight main categories: (i) aggregate economic activity, (ii) consumption, (iii) investment, (iv) trade, (v) financial and monetary variables, (vi) business and consumer confidence, (vii) labour market indicators, and (viii) foreign variables. These indicators were thought to lead New Zealand employment for the following reasons.

### Aggregate economic activity, consumption and investment

Employment growth generally lags output growth and a rise or fall in domestic demand or its components should give some indication about future employment growth. The housing market has been particularly important in New Zealand. Following the deregulation of domestic financial markets in the mid-1980s, households gained access to finance previously not available. This led to an increase in household borrowing and strong gains in the housing sector. Moreover, during the mid-1990s an increase in permanent long-term migration led to demand pressures and increased demand for housing, which in turn contributed to an upswing in employment.

### Trade indicators

Since the economic reforms in the mid-1980s and early 1990s, New Zealand has undergone significant trade liberalisation and become one of the most open countries in the OECD. The share of exports in output has increased from about 25 percent in 1985 to around 35 percent currently and the export sector is a growing employer.

### Financial and monetary variables

Financial and monetary indicators, such as interest and exchange rates, interest spreads and the money supply, are potential leading indicators of employment as they capture the effects of monetary policy on economic activity. Until the mid-1980s, consumer price

[3] A complete list of the variables is included in Appendix A.

inflation was at double-digit rates except for the price, rent and wage freezes in 1983-84. Dissatisfaction with the systematic under-performance of the New Zealand economy compared to other countries during the 1970s and 1980s prompted the government of the day to embark on a period of comprehensive economic reforms. Macroeconomic stability through fiscal restraint and monetary policy focused on reducing inflation was one of the key themes, leading to a period of high and rising real interest rates.

### Consumer and business confidence indicators

Following the structural and fiscal adjustments, disinflation and a collapse in the New Zealand sharemarket, the rate of economic growth in New Zealand was poor and unemployment high. However, since the end of the recession in the early 1990s, New Zealand's economic performance has been improving and growth was particularly strong during the mid-1990s. Consumer and business confidence were likely important contributors to these swings in economic activity.

### Labour market indicators

Labour market indicators, including hours worked or employment intentions, are direct leading indicators of future employment. Typically, hours worked, for example, rise prior to increases in total employment. This is because it is easier for employers to have employees work over-time than to hire additional staff. As most workers are only willing to work over-time for a limited period of time, new staff are generally employed if the workload remains high for a prolonged period of time. So, growth in hours worked often leads employment changes.

### Foreign variables

As New Zealand is a small open economy heavily reliant on exports, foreign activity is an important contributor to economic performance. Strong growth in its trading partners ultimately translates into more jobs in New Zealand. Historically, New Zealand's growth was importantly influenced by economic activity in the United Kingdom. However, since the late 1980s and 1990s trade has shifted towards the economies of Australia, the United States, Japan and other Asian countries, and New Zealand has benefited from lengthy economic expansions in some of these countries, in particular the United States.

## 3.2 The final choice of variables and their weights

The final choice of variables to include in the composite index of New Zealand employment was based on their concordance with employment. The concordance statistic, which measures the proportion of time employment and a leading indicator move in the same direction, is calculated as follows

$$C_{emp\ i} = \frac{1}{T}\sum (S_{emp,t} * S_{i,t}) + (1 - S_{emp,t}) * (1 - S_{i,t}) \qquad (8)$$

where $\{S_{emp,t}\}$ is a series equal to one when the change in employment is zero or positive and zero when the change in employment is negative. The series $\{S_{i,t}\}$ for the indicator series is defined accordingly and T denotes the sample size for which both series are

available.[4] As a proportion, the values that $C_{emp\,i}$ can take are bounded between zero and one.

The concordance statistic was used instead of correlation coefficients as correlation coefficients mix amplitude and duration measures, and the amplitude of a particularly large swing that is common to two variables may dominate the covariance of the two series. The concordance statistic avoids this problem.

Concordance statistics were calculated for employment and lags of all potential component series. Lagged concordance was considered as the objective is to build a composite index of *leading* indicators (rather than of coincident indicators).[5] Series with the largest degree of concordance, lagged one quarter or more, were then included in the composite index. The weight of each component series was determined as follows

$$w_i = \max\left(\frac{1}{T}\sum(S_{emp,t} * S_{i,t-k}) + (1 - S_{emp,t}) * (1 - S_{i,t-k})\right) \tag{9}$$

for $k = 1, ..., 4$. For example, if last quarter job ads, move in the same direction as this period employment 80 percent of the time, then their weight (in equation 5) is 0.8 divided by the sum of (non-normalised) weights. Moreover, if job ads have a large weight in the composite index, then the composite index is likely to lead employment by one quarter as the concordance is largest between employment and job ads lagged one quarter.

Alternatively, we could have used equal weights for all component series. However, the restriction of equal weights decreased the concordance (and correlation) between the composite index of leading indicators and employment, and worsened the forecasting performance of the indicator model.

## 3.3 The final composite index of leading indicators

The composite index of leading indicators of New Zealand employment was constructed for the period 1985Q2 to 2001Q4 and includes retail sales, new dwelling consents, inventories, short-term overseas arrivals, the spread between the 5 year government bond yield and the 30 day bank bill rate, the Reserve Bank of New Zealand's trade weighted index (TWI) of the exchange rate, employment intentions, and job advertisements.[6] No foreign activity variable was included in addition to overseas arrivals and the TWI.

All series are released before employment with the exception of inventories. This should make the index particularly useful for forecasting.[7] Inventories are only available up to 2001Q3 and no change is assumed for 2001Q4. Moreover, no job advertisements data are available prior to 1990Q1 and the weights of the component series (and the composite

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[4] We also considered the concordance between employment and the inverse of indicator series to account for possible inverse relationships.

[5] Note that although lagged concordance was considered to help determine the component series to include in the composite index and their weights, all component series are included contemporaneously in the composite index (see equation 5).

[6] A description and plot of the raw data used in the index are contained in Appendix B. The sample was dictated by the availability of data for the spread, the TWI and employment intentions.

[7] None of the domestic aggregate economic activity variables in Appendix A are published before employment.

index) were calculated for two periods, 1985Q2 to 1990Q1 and 1990Q2 to 2001Q4. The sets of weights for the component series are reported in Table 1 for the two periods.

Over the first period, 1985Q2 to 1990Q1, inventories, the interest spread and the TWI have the largest weight (0.65 or 0.17 normalised), followed by employment intentions (0.55 or 0.14 normalised). The weights for new dwelling consents and overseas arrivals are 0.5 (or 0.13 normalised), while retail sales with 0.4 or 0.1 normalised have the smallest weight.

Interestingly, for the second period, the weight for retail sales, at 0.72, is almost twice as large as in the first period. This is likely a reflection of the improved economic performance during the 1990s. The increasing weight on retail sales probably also reflects the growing size of employment in the retail sector.[8] The weight on overseas arrivals also increases over the second period from 0.5 to 0.74, probably as foreign trade and overseas economic activity gained importance following the trade liberalisation of the reforms. The normalised weight for retail sales, at 0.13, is higher than in the first period and the only weight that increases when adding employment ads to the index. The normalised weight of overseas arrivals remains at 0.13, while the weight of all other variables is lower (0.12 normalised). Job ads are a particularly good leading indicator and have the largest weight at 0.81 or 0.14 normalised.

***Table 1 - Weights of the components in the composite index of leading indicators***

| | 1985Q2 to 1990Q1 | 1990Q2 to 2001Q4 |
|---|---|---|
| retail | 0.40 | 0.72 |
| | *0.10* | *0.13* |
| consent | 0.50 | 0.66 |
| | *0.13* | *0.12* |
| inventories | 0.65 | 0.68 |
| | *0.17* | *0.12* |
| arrivals | 0.50 | 0.74 |
| | *0.13* | *0.13* |
| spread | 0.65 | 0.66 |
| | *0.17* | *0.12* |
| TWI | 0.65 | 0.70 |
| | *0.17* | *0.12* |
| intentions | 0.55 | 0.66 |
| | *0.14* | *0.12* |
| Ads | n/a | 0.81 |
| | | *0.14* |

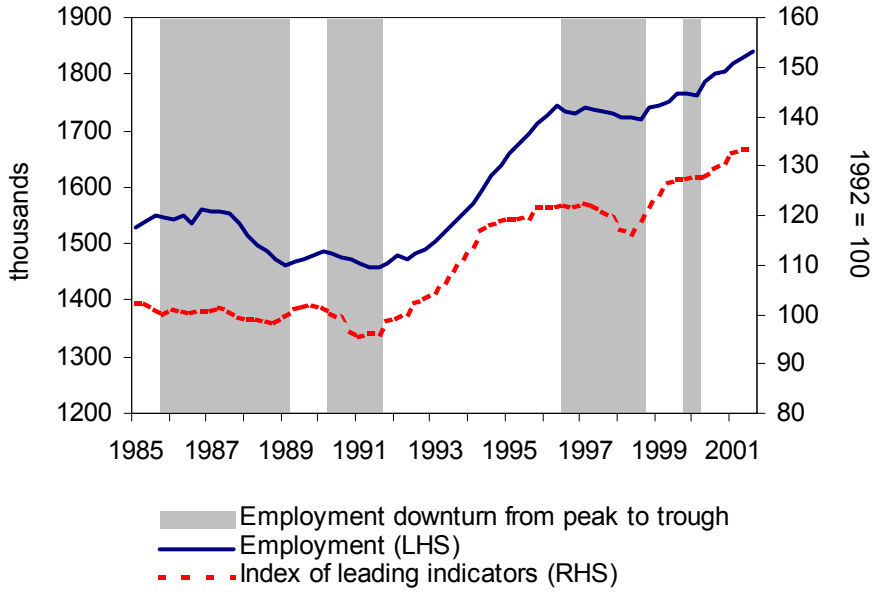
Normalised weights are reported in italic.

[8] Employment in the wholesale and retail sector (ANSIC definition) increased from around 19 percent of total employment in 1986 to 22 percent in 2001.

The composite index of leading indicators is plotted together with employment in Figure 1. The shaded areas in Figure 1 indicate employment downturns from a peak to a trough, where a peak is defined as the quarter prior to at least two consecutive declines in employment and a trough is defined as the quarter prior to at least two consecutive increases in employment.

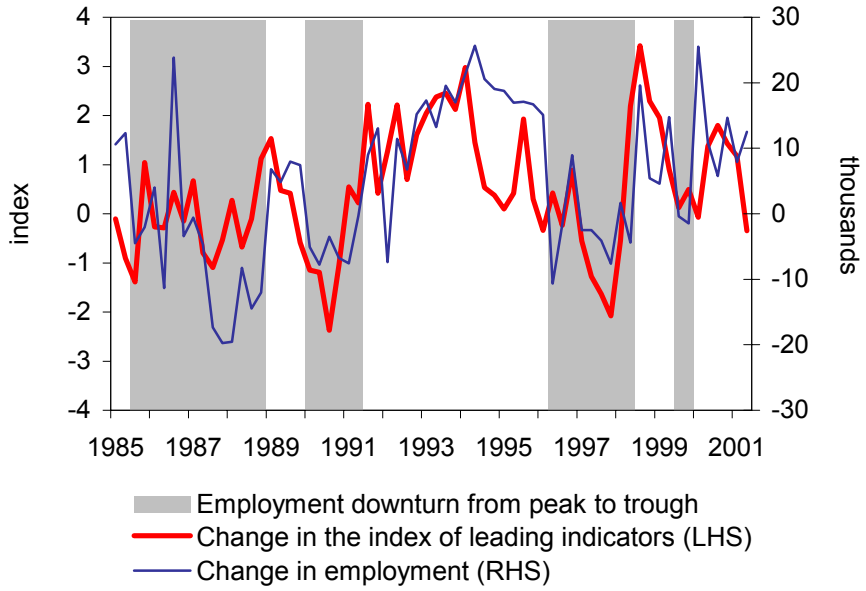
Employment was hard hit by the economic reforms in the mid-1980s and early 1990s and fell for the six years from 1986 to 1991, apart for 1986Q3 and 1989Q3 to 1990Q3. It rebounded following the end of the recession, in the early 1990s, and grew strongly for several years. From 1996Q4 to 1998Q4, employment once again fell as a result of tight monetary policy in response to inflation pressures from strong growth in the mid-1990s, the negative impact from the Asian financial crisis on foreign demand and two consecutive droughts. Since 1999, employment has been growing steadily apart for two quarters of decline in 2000Q1 and 2000Q2.

***Figure 1 - Employment and the composite index***




The composite index of leading indicators appears to be effective in signalling cyclical movements in employment. This can be seen from Figure 2, which plots the change in the composite index and employment. The composite index appears to be trending downward prior to a downturn in employment and rebounding before actual employment starts increasing. The relationship between the composite index and employment is evaluated more formally in the next section.

***Figure 2 - Change in employment and the composite index***




# 4 A forecasting model of New Zealand employment growth

To evaluate the forecast ability of the composite index of leading indicators we included the index in a forecasting model of quarterly employment growth. Following (Auerbach 1982), the model includes lags of the composite index and past changes of employment only. We did not attempt to identify other series not included in the index that might help in forecasting New Zealand employment growth.

The model is estimated using ordinary least squares (OLS) over the period 1987Q2 to 2001Q4. Statistical significance, residual based tests and forecasting performance led to the selection of the following specification

$$\Delta EMP_t = \alpha_0 + \alpha_1 \Delta CI_{t-1} + \alpha_2 \Delta CI_{t-5} + \alpha_3 \Delta CI_{t-7} + \alpha_4 \Delta EMP_{t-1} + \varepsilon_t \qquad (10)$$

where $\Delta$ is the first difference operator, $EMP_t$ employment at time $t$, $CI_{t-k}$ denotes the composite index of leading indicators at time $t-k$ for $k = 1, 5, 7$, $\varepsilon_t$ is a white noise error, $\alpha_0$ denotes a constant and $\alpha_i$ are coefficients, for $i = 1, ..., 4$. The results of the estimation are reported in Table 2.

Lagged changes in the composite index of leading indicators are statistically significant determinants of employment growth and have the expected positive sign. The composite index lagged one quarter has the largest coefficient. This is not surprising given that at one lag, job ads, the component series with the largest weight, is strongly correlated with employment. Lags five and seven of the composite index are also statistically significant and reflect the often long delay with which employment adjusts to changes in economic

conditions. An F-test rejected the null hypothesis that lags two, three, four and six are jointly significant.[9]

***Table 2 - Estimation results***

| Variable | Coefficient | Standard error | T-statistic | P-value |
|---|---|---|---|---|
| $\alpha_0$ | -1.080 | 1.074 | -1.005 | 0.319 |
| $\Delta EMP_{t-1}$ | 0.145 | 0.103 | 1.407 | 0.165 |
| $\Delta CI_{t-1}$ | 5.528 | 0.894 | 6.183 | 0.000 |
| $\Delta CI_{t-5}$ | 2.448 | 0.811 | 3.017 | 0.004 |
| $\Delta CI_{t-7}$ | 2.054 | 0.821 | 2.504 | 0.015 |
| R-squared | 0.668 | F-statistic | | 27.180 |
| Adjusted R-squared | 0.644 | P-value (F-statistic) | | 0.000 |

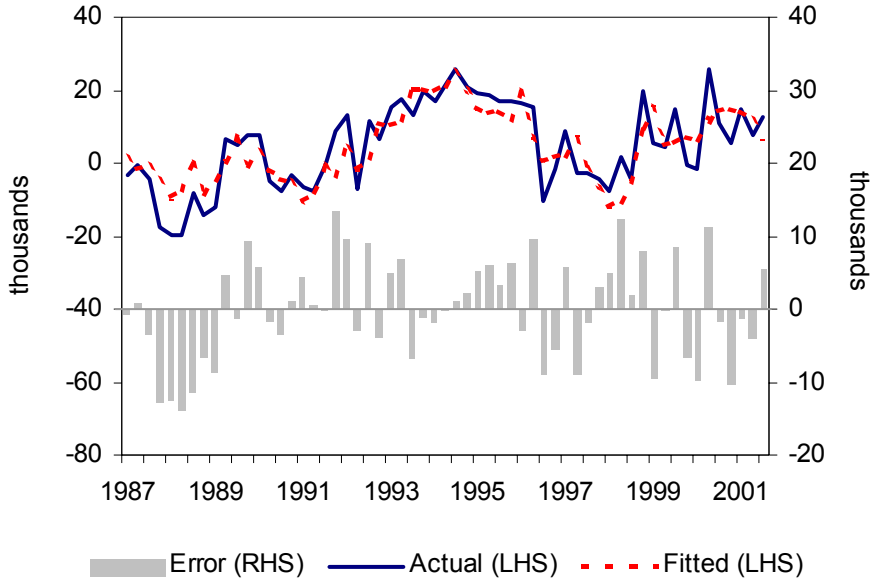
Lagged employment changes are not significant, but were included to correct for first-order serial correlation. The (Durbin and Watson 1951) statistic, which tests for first-order serial correlation in the residuals, indicated that the equation with lagged changes of the composite index only was mis-specified as it rejected the null hypothesis of no positive autocorrelation. Including past employment growth, the Durbin-Watson test can no longer reject the null hypothesis of no autocorrelation (positive or negative).

The R-squared statistic indicates the proportion of variability in employment growth explained by past changes in the composite index and past employment growth. According to this statistic, the model explains about 67 percent of the variation in employment. An F-test confirms that past changes in the composite index and employment are jointly significant determinants of employment growth.

Fitted, or in-sample predictions, of the indicator model and actual employment growth are plotted in Figure 3. Actual and predicted employment changes tend to move closely together, which suggests that the composite index is a good indicator of employment growth. The model identifies most turning points and produces white noise errors. The (Jarque and Bera 1987) test could not reject the hypothesis of normally distributed residuals. Recursive stability tests revealed stable coefficients over the estimation period – the CUSUM test and CUSUM of squares test (Brown, Durbin and Evans 1975) did not reject the null hypothesis of parameter constancy at conventional levels of significance.

[9] The lag structure does not appear to be sensitive to the sample.

***Figure 3 - Actual and fitted employment growth***




# 5 Forecast performance relative to two benchmark models

To assess the out-of-sample forecast performance of the indicator model, we estimated two benchmark models for comparison: (i) a univariate ARIMA (2,1,3) model of employment growth and (ii) a two-variable vector autoregression (VAR) model including employment growth and changes in the composite index of leading indicators.[10]

To evaluate the forecast performance of the indicator model and the two benchmark models, we generated out-of-sample forecasts using a fixed length, rolling window, time varying coefficient approach for the period 1996Q1 to 2001Q4. With this technique, we first estimated all three models over the period 1987Q2 to 1995Q4. The estimated coefficients from each model were used to forecast employment growth one quarter ahead. The models were then rolled forward one quarter and re-estimated. We repeated this process until the last observation was reached. This led to 24 one-quarter-ahead out-of-sample forecasts.

Out-of-sample forecasts of employment growth from the indicator model and the two benchmark models, plotted in Figure 4, all appear to follow actual employment growth quite closely. To compare the forecast performance of the three models more formally, we calculated the mean absolute forecast error (MAE), the root mean squared forecast error (RMSE) and the U-Theil for each model. The smaller the values of the MAE and the RMSE are, the more accurate, on average, the forecast of a model. The smaller the value

[10] A lag length of five was determined by minimising the Schwarz information criterion.

of the U-Theil, the better the model performs compared to a naïve forecast of no change.[11] The results are reported in Table 3.

***Figure 4 - Out-of-sample forecasts of employment growth***

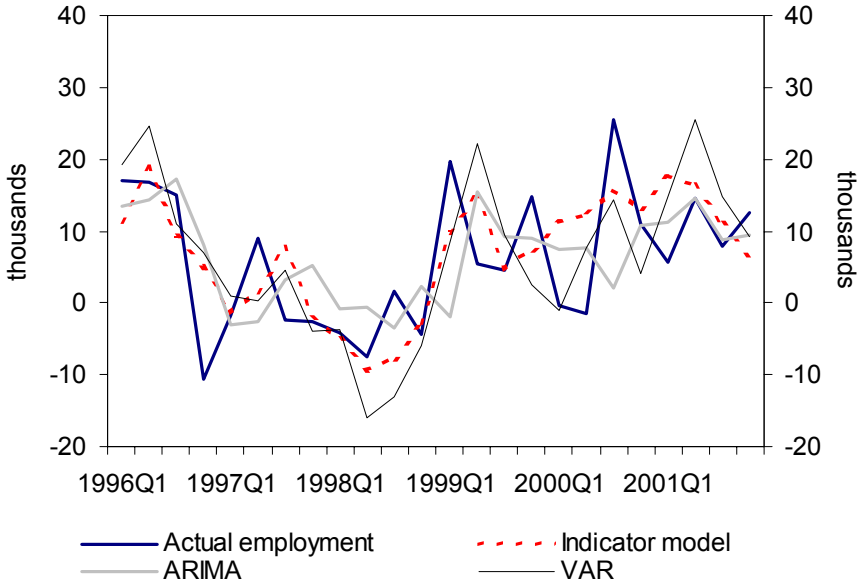



Table 3 shows that the indicator model outperforms both the VAR and ARIMA models in terms of out-of-sample forecast ability. All three evaluation criteria, the MAE, the RMSE and the U-Theil statistic, are lower for the indicator model than for the two benchmark models. The VAR model outperforms the ARIMA model in terms of the RMSE and U-Theil. The composite index thus appears to be particularly useful in forecasting employment changes.

***Table 3 - Relative performance of the indicator model***

| | MAE * | RMSE * | U-Theil |
|---|---|---|---|
| indicator model | 6.238 | 7.744 | 0.693 |
| ARIMA (2, 1, 3) | 6.967 | 9.310 | 0.834 |
| VAR model | 7.464 | 8.900 | 0.797 |

* in thousands

[11] The U-Theil is calculated as the root mean squared forecast error of the model divided by the root mean squared forecast error of the naïve model of no change.

Finally, Table 4 reports the 2x2 confusion matrices for the three models. The confusion matrix records the number of times a model correctly predicted the direction of next period employment growth out of sample.[12] The upper diagonal (upper-left) element records the number of times a model correctly predicted an increase in employment growth, while the lower diagonal (lower-right) element reports how often the model correctly forecast a decrease. For example, the indicator model correctly predicted fourteen rises and five declines in employment growth. The off-diagonals report the number of times a model missed the direction of employment changes. The lower-left (upper-right) off-diagonal element records the number of actual moves in employment growth that were up (down) while the predicted changes were down (up).

***Table 4 - Confusion matrices***

| | | actual outcome | | | | | |
|---|---|---|---|---|---|---|---|
| | | indicator model | | ARIMA (2, 1, 3) | | VAR | |
| model prediction | | 14 | 4 | 12 | 6 | 14 | 4 |
| | | 1 | 5 | 3 | 3 | 1 | 5 |

The results in Table 4 suggest that the indicator model and the VAR model forecast the direction of next period employment growth reasonably well. The indicator and VAR models have five false signals each, which is better than the ARIMA with nine false signals. The indicator and VAR models correctly forecast the direction of employment almost 80 percent of the time compared to about 63 percent for the ARIMA. Both the indicator and VAR models predicted employment growth to increase when it actually fell more often than they predicted employment growth to fall when it actually increased. The out-of-sample forecast performance of the indicator and VAR models suggests that the composite index of leading indicators is a good predictor of employment changes.

# 6 Concluding remarks

In this paper, we constructed a composite index of leading indicators of New Zealand employment that was then used in an indicator model to forecast quarterly changes in employment. The indicator model is able to explain about 67 percent of the quarterly variation in employment, in sample, and correctly predicted the direction of next period employment almost 80 percent of the time, out of sample. The composite index of leading indicators thus appears to be a good predictor of employment changes.

[12] See (Paquet, Fauvel and Zimmermann 1999).

A VAR model including changes in the composite index and employment produces results only slightly worse than the indicator model. Thus, to produce out-of-sample forecast for more than one quarter ahead, the indicator model, which can be interpreted as a restricted VAR, could be re-estimated as a VAR (using seemingly unrelated regression estimation). The estimation of the indicator model as a restricted VAR is left for future work.

# Appendix A: Series considered in the construction of the composite index of leading indicators[13]

***Domestic aggregate economic activity***
real production-based gross domestic product (GDP)
real expenditure-based GDP
real production-based GDP: manufacturing
real production-based GDP: construction
real production-based GDP: wholesale trade
real production-based GDP: transport and storage
real production-based GDP: communications
real production-based GDP: services
real production-based GDP: change in total stocks

***Consumption***
private consumption (real)
private consumption of housing (real)
private consumption of durables (real)
private consumption of non-durables (real)
net tourist consumption (real)
total household consumption (real)
electricity generation: sales to custumers
retail sales excluding automotive and personal services

***Investment***
new dwelling consents
total dwellings
REINZ number of dwellling sales
market investment (real)
market investment in plant and machinery (real)
non-residential market investment (real)
total investment in plant and machinery (real)
non-residential total investment (real)

***Trade***
merchandise imports
merchandise exports
exports (real)
exports of goods (real)
volume of merchandise exports
volume of merchandise imports

[13] All data are seasonally adjusted apart for interest and exchange rates and price indexes.

exports of meat and meat products (real)
livestock slaughter
dairy exports (real)
arrivals, overseas visitors

***Financial and monetary variables***

consumer price index adjusted for the introduction / increase in the goods and services tax (CPI)
food price index
monetary conditions index (MCI)
MCI divided by CPI
1 year government bond yield
2 year government bond yield
5 year government bond yield
10 year government bond yield
30 day bank bill yield
60 day bank bill yield
90 day bank bill yield
10 year government bond yield minus 1 year bond government bond yield
10 year government bond yield minus 2 year bond government bond yield
10 year government bond yield minus 5 year bond government bond yield
5 year government bond yield minus 1 year bond government bond yield
5 year government bond yield minus 2 year bond government bond yield
10 year government bond yield minus 30 day bank bill yield
10 year government bond yield minus 60 day bank bill yield
10 year government bond yield minus 90 day bank bill yield
5 year government bond yield minus 30 day bank bill yield
5 year government bond yield minus 60 day bank bill yield
5 year government bond yield minus 90 day bank bill yield
call rate
NZD/AUD exchange rate: average 11am
NZD/USD exchange rate: average 11am
trade weighted index (TWI): average 11am
NZD / AUD exchange rate: end of period
NZD / USD exchange rate: end of period
TWI with end of period bilateral exchange rates
total billings on New Zealand credit cards
total advances on credit cards outstanding
notes and coins held by the public

M1
M1 divided by CPI
M2
M2 divided by CPI
M3
M3 divided by CPI
resident M3
resident M3 divided by CPI
private sector credit
resident private sector credit
domestic credit
resident domestic credit
New Zealand stock exchange capital total: price index (NZSE)
NZSE divided by CPI

***Business and consumer confidence***
Quarterly Survey of Business Opinion (QSBO): general business situation
QSBO: find skilled labour
QSBO: find unskilled labour
QSBO: limiting factor -- labour
QSBO: limiting factor -- capital
QSBO: limiting factor -- other
QSBO: new investment in buildings
QSBO: new investment in plant and machinery
QSBO: number of employees (past three months)
QSBO: overtime worked (past three months)
QSBO: labour turnover (past three months)
QSBO: average costs (past three months)
QSBO: average selling price (past three months)
QSBO: profitability (past three months)
QSBO: number of employees (next three months)
QSBO: overtime worked (next three months)
QSBO: labour turnover (next three months)
QSBO: average costs (next three months)
QSBO: profitability (next three months)
QSBO: economy-wide capacity utilisation
National Bank Business Outlook (NBBO): commercial construction intentions (next 12 months)
NBBO: residential construction intentions (next 12 months)

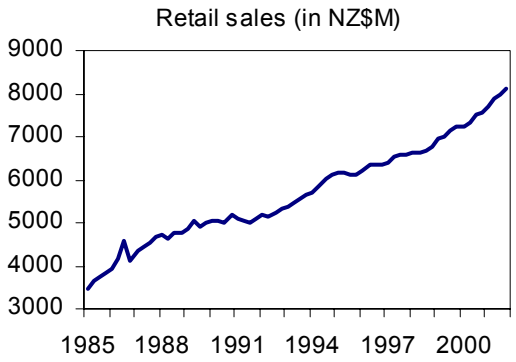
NBBO: employment expections, total all sectors (next 12 months)
NBBO: business confidence, total all sectors (next 12 months)
NBBO: activity outlook, total all sectors (next 12 months)
NBBO: investment intentions, total all sectors (next 12 months)
Wholesale Trade Survey (WTS): sales
WTS: stocks
WTS: stock to sales ratio
consumer confidence, one network news, Colmar Brunton poll

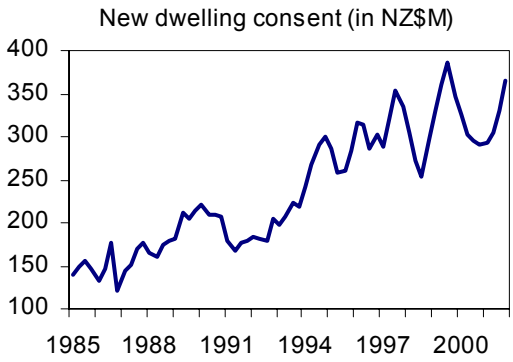
***Labour market indicators***
Household Labour Force Survey (HLFS) hours worked
HLFS: unemployment rate
HLFS: participation rate
ANZ job advertisement
permanent and long-term migration, net actuals
external migration, total arrivals
long-term migration, arrivals
Quarterly Employment Survey: total paid hours, all industries
average ordinary time wages divided by CPI

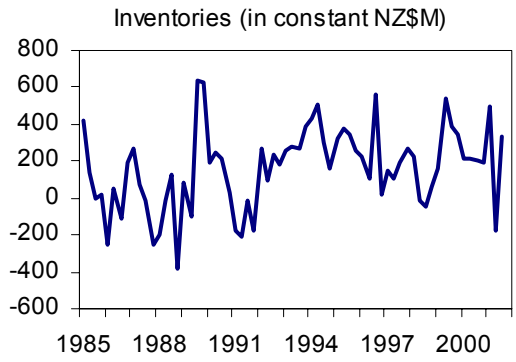
***Foreign variables***
ANZ commodity price index
US industrial industrial production, total index
Conference Board US composite leading indicator
Conference Board US coincident leading indicator
National Association of Purchasing Management (NAPM): purchasing managers' index
NAPM: production index
NAPM: new orders index
NAPM: deliveries index
NAPM: inventories index
NAPM: employment index
NAPM: commodity price index
NAPM: imports index
NAPM: new export orders index
NAPM: US help wanted index
3 months US Treasury notes
10 year US Treasury notes
10 year US Treasury notes minus three months US Treasury notes
US M1 divided by US consumer price index

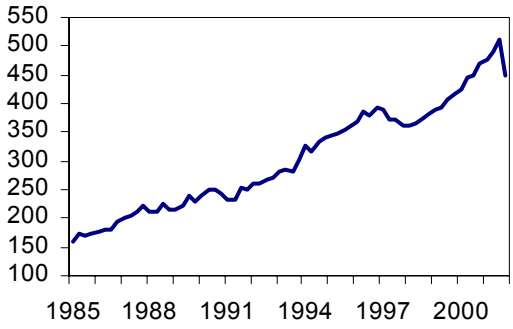
# Appendix B: Data and data sources

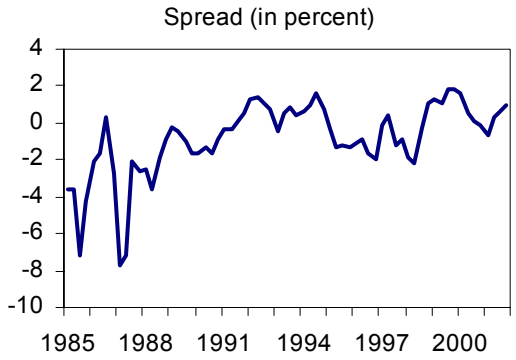
| | |
|---|---|
| employment | HLFS official employed. Thousands. Seasonally adjusted. Source: Statistics New Zealand. |
| retail | Retail sales excluding automotives and personal services. New Zealand dollar million. Seasonally adjusted. Source: Statistics New Zealand and Reserve Bank of New Zealand. |
| consent | New dwelling consents. New Zealand dollar million. New Zealand dollars. Seasonally adjusted. Source: Statistics New Zealand. |
| inventories | Change in total stocks. Constant New Zealand dollar million. Seasonally adjusted. Source: Statistics New Zealand. |
| arrivals | Short-term migration: arrivals, overseas visitors. Thousands. Seasonally adjusted. Source: Statistics New Zealand. |
| spread | 5 year government bond yield minus 30 day bank bill yield. Percent. Source: Reserve Bank of New Zealand. |
| TWI | Trade weighted index with end of period bilateral exchange rates. Source: Reserve Bank of New Zealand. |
| intentions | Number of employees, next three months. Index. Seasonally adjusted. Source: New Zealand Institute of Economic Research Quarterly Survey of Business Opinion. |
| ads | ANZ job advertisements, three main centres. Thousands. Seasonally adjusted. Source: ANZ. |

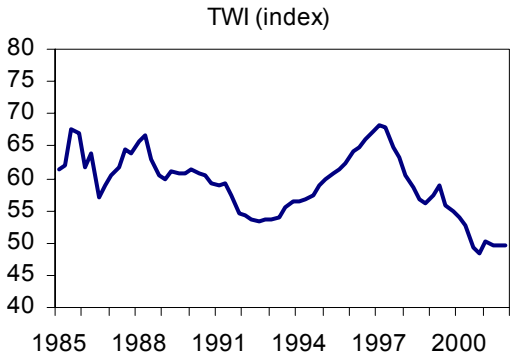

Retail sales (in NZ$M)
9000
8000
7000
6000
5000
4000
3000
1985 1988 1991 1994 1997 2000

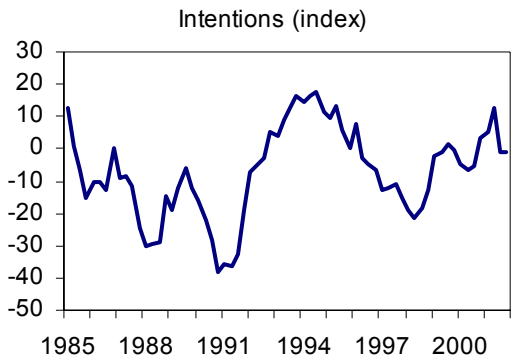

New dwelling consent (in NZ$M)
400
350
300
250
200
150
100
1985 1988 1991 1994 1997 2000


Inventories (in constant NZ$M)
800
600
400
200
0
-200
-400
-600
1985 1988 1991 1994 1997 2000


Arrivals (in thousands)
550
500
450
400
350
300
250
200
150
100
1985 1988 1991 1994 1997 2000


Spread (in percent)
4
2
0
-2
-4
-6
-8
-10
1985 1988 1991 1994 1997 2000


TWI (index)
80
75
70
65
60
55
50
45
40
1985 1988 1991 1994 1997 2000


Intentions (index)
30
20
10
0
-10
-20
-30
-40
-50
1985 1988 1991 1994 1997 2000


Job advertisement (in thousands)
30
25
20
15
10
5
1985 1988 1991 1994 1997 2000

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