nzier
authoritative analysis

1990   1993   1996   1999   2002   2005   2008   2011

QSBO performance indices
How useful are they?

About NZIER

NZIER is a specialist consulting firm that uses applied economic research and analysis to provide a wide range of strategic advice to clients in the public and private sectors, throughout New Zealand and Australia, and further afield.

NZIER is also known for its long-established Quarterly Survey of Business Opinion and Quarterly Predictions.

Our aim is to be the premier centre of applied economic research in New Zealand. We pride ourselves on our reputation for independence and delivering quality analysis in the right form, and at the right time, for our clients. We ensure quality through teamwork on individual projects, critical review at internal seminars, and by peer review at various stages through a project by a senior staff member otherwise not involved in the project.

NZIER was established in 1958.

Acknowledgements

Authorship

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Key points

This paper assesses the predictive power of performance indices, constructed from Quarterly Survey of Business Opinion (QSBO) data, to forecast economic activity.

Performance indices are used worldwide as indicators of activity in key sectors. We construct four industry-level performance indices using QSBO data:

- Performance of Manufacturing Index (PMI)
- Performance of Construction Index (PCI)[1]
- Performance of Traders Index (PTI)[2]
- Performance of Services Index (PSI).

We use the Granger Causality (GC) test to examine the predictive power of these four indices.

We find that the indices perform well in providing estimates of the current quarter's economic growth for each sector well ahead of official data, and as leading indicators for the next quarter.

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[1] The construction sector includes both the construction activity and building materials sector.

[2] "Traders" captures responses from the retail and wholesale sectors.

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1. Introduction

This paper assesses the predictive power of industry-level performance indices constructed from NZIER's *Quarterly Survey of Business Opinion (QSBO)* data.

The QSBO has proven to be an excellent and very timely indicator of economic activity in New Zealand 2 to 3 months ahead of official data. This is illustrated with an example in Figure 1.

Figure 1 Timeliness of QSBO as a forecasting tool
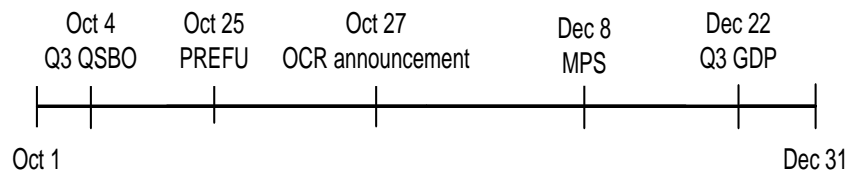
Notes: (1) PREFU = Pre-election Economic and Fiscal Update; MPS = Monetary Policy Statement. (2) Oct 4 is the release date for the September QSBO, the indices are compiled before this date.

Source: NZIER

NZIER includes individual QSBO series, like trading activity or hiring intentions, as explanatory variables in its forecast models. But, as Stock and Watson (2000) note, "an alternative to selecting a few predictors is to pool the information in all of the candidate predictors, averaging away idiosyncratic variation in individual series".

With this in mind, this paper constructs four economic performance indices that pool variables from the QSBO, and then tests how useful they are as indicators of economic activity ahead of official statistics releases. The four indices are:

- Performance of Manufacturing Index (PMI)

- Performance of Construction Index (PCI)

- Performance of Traders Index (PTI)

- Performance of Services Index (PSI).

2. Performance indices

The QSBO is a quarterly survey of a sample of 2,200 firms in the manufacturing, services, construction and merchant sectors.

Each quarter, respondents are asked about their businesses, looking at whether actual activity in the last three months, and planned activity in the next three months, has increased, decreased or remained unchanged. For most questions, respondents are asked to compare the last three months (or next three months) with the same time in the previous year. We use this information to construct industry-level 'experienced' and 'expected' indices.

We use answers to a small number of questions to construct diffusion indices. These answers are chosen to capture key aspects of business performance. This practice reflects that for similar indices overseas. The QSBO questionnaires are customised for each sector. This means that some indicators are not available for some sectors (see Table 1).

A diffusion index indicates the degree to which answers to the survey questions are spread. To calculate the diffusion index, we assign a value 1 to 'increase', 0.5 to 'no change', and 0 to 'decrease' for each of the responses to questions on employment, production, etc. The responses are then summed.

The scores for each of the indicators are assigned equal weights when calculating the diffusion index. This is consistent with international practice as most indicators internationally use equal weights. Further, the economics literature does not provide guidance on appropriate weights.

A diffusion index reading above 50 points indicates activity is expanding; below 50 indicates it is declining while 50 is neutral. The distance from 50 indicates the strength of expansion or contraction. For example, at 100 points, all respondents indicate expansion; at 0 all respondents are indicating contraction.

Table 1 Components of diffusion indices by sector

Indicators	Manufacturers	Construction	Traders	Services
Numbers employed	√	√	√	√
New orders received	√	√	√	n/a
Productivity	√	√	n/a	n/a
Deliveries in NZ	√	√	n/a	n/a
Export sales	√	√	n/a	n/a
Profitability				√
Stock – raw material	√	√	n/a	n/a
Stock – finished goods	√	√	n/a	n/a
Sales in NZ	n/a	n/a	√	n/a
Deliveries from overseas	n/a	n/a	√	n/a
Volume of services	n/a	n/a	n/a	√

Notes: n/a means not available; "√" indicates the indicator is selected for the diffusion index.

Source: NZIER

3. Related literature

Performance indices similar to those presented here are widely used as leading indicators for economic activity and turning points.

Table 2 summarises the relevant literature. Most studies focus on manufacturing given its historical importance to these economies. The one New Zealand study of an index using QSBO data is for the construction industry.

The most significant sectors in New Zealand – services and manufacturing – have not received the same scrutiny. This report addresses that gap.

Table 2 Summary of performance of related performance indices

Brief review of selected studies

Country	Index studied	Findings	Reference
US	Manufacturing	Performs well in predicting economic activities and direction of monetary policies.	Kauffman (1999) and Koenig (2002)
UK	Manufacturing	Is successful in predicting recessions although the correlation between the index and official statistics has broken down since the recent recession.	Ellis (2010)
Australia	Manufacturing	Works well when predicting business turning points but not general economic performance.	Harding (2001)
	Manufacturing	Has no correlation with GDP but is significantly correlated with investment by the manufacturing industry.	Aylmer and Gill (2003)
NZ	Construction	Tracks official housing construction growth and the depth of the housing construction 'business cycle' well.	Holmes et al (2010)

Source: NZIER

4. Graphical assessment of performance

Historical trends of the QSBO diffusion indices of businesses' experience are graphed against sector GDP to provide a first assessment of the indices.

The key conclusions to draw from these graphs is that the indices:

- track sector GDP reasonably well
- give a reasonably good indication of economic turning points and their scale in advance of official statistics.

Figure 2 PMI vs manufacturing GDP

GDP annual % change, left scale; PMI index, right scale
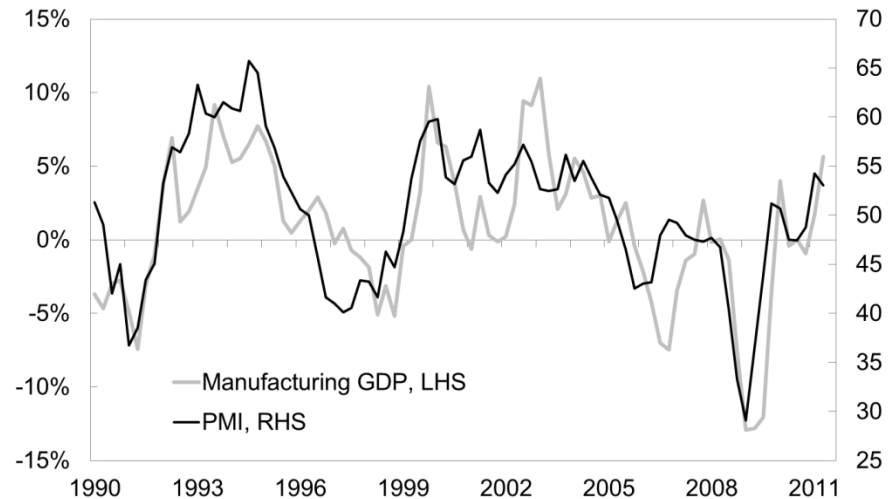
Source: Statistics NZ, NZIER

Figure 3 PCI vs construction GDP

GDP annual % change, left scale; PCI index, right scale

Source: NZIER

Figure 4 PTI vs merchants GDP

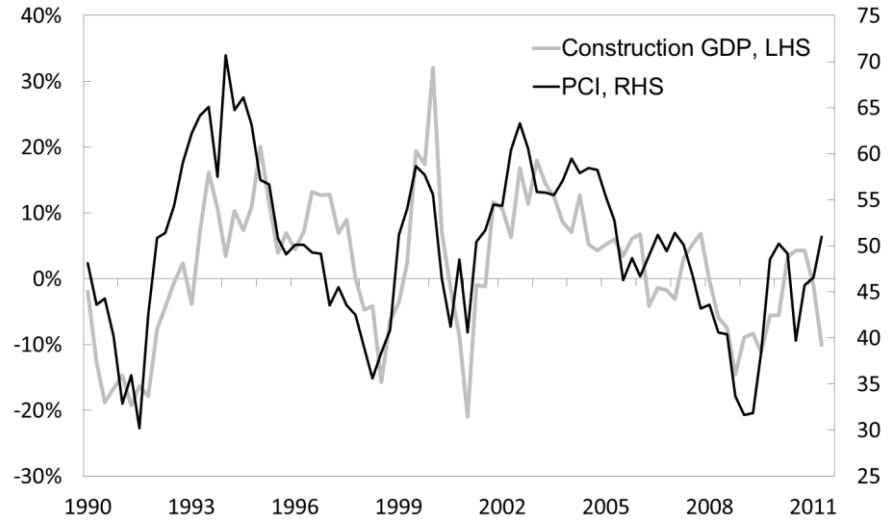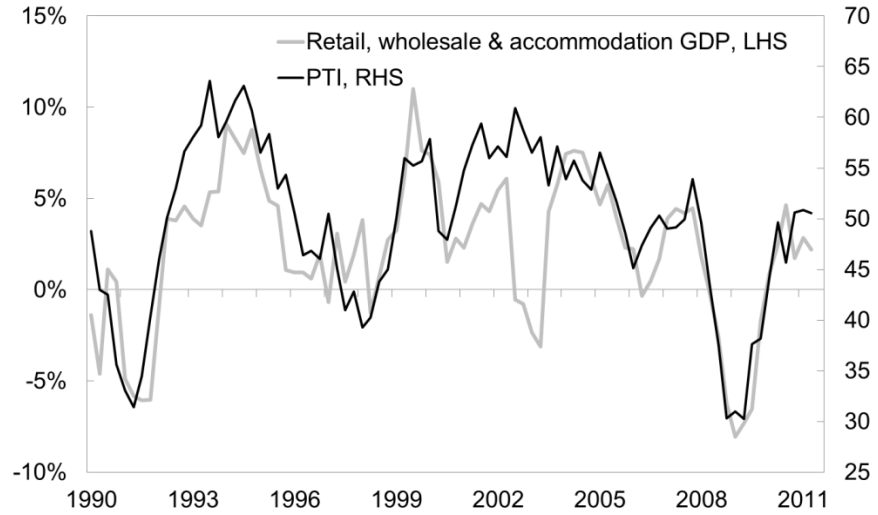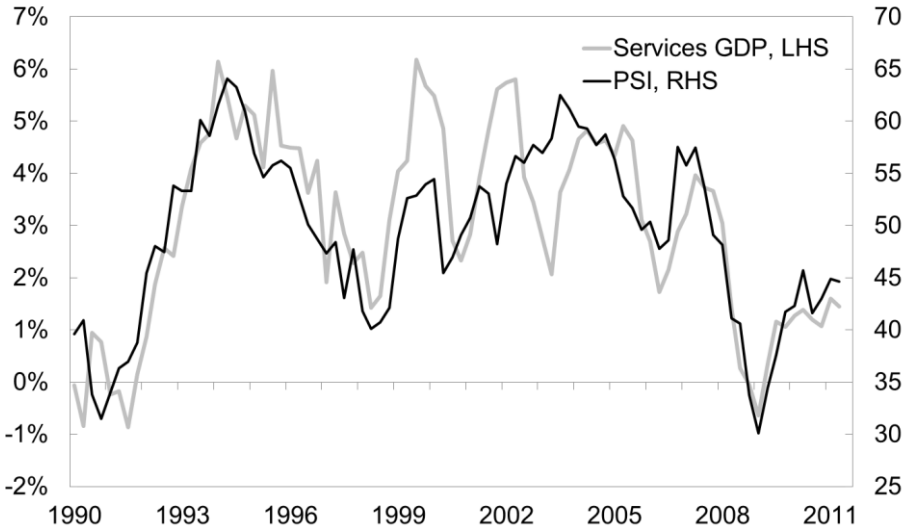GDP annual % change, left scale; PTI index, right scale

Source: NZIER

Figure 5 PSI vs services sector GDP

GDP annual % change, left scale; PSI index, right scale

Source: NZIER

5. Granger Causality test methodology

We use the Granger Causality (GC) test to assess the ability of the PMI, PCI, PTI and PSI to predict official GDP in the corresponding sector. The test considers whether the official statistics can be explained by the indices in the current and past quarters.

Econometric specification of the GC test

The econometric specification of the GC test used for experienced activity indices is shown in equation 1 below:

$$\text{GDP growth}_{\text{current quarter}} = a_1 \text{QSBO indices}_{\text{current quarter}} + a_2 \text{QSBO indices}_{\text{last quarter}} + ... + a_n \text{QSBO indices}_{\text{n quarters ago}} + e_n \qquad (1)$$

where n indicates the number of periods we examine QSBO indices up to, and e_t is an uncorrelated error term[1].

We test whether $a_1, a_2 ... a_n$ are jointly significantly different from zero. If they are, we say the QSBO indices up to n periods 'Granger-cause' the official statistics. In other words, QSBO indices up to n periods can be used to predict the official statistics of interest.

A detailed explanation of the GC test is provided in Appendix A.

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[1] The error term e_n is the difference between our predicted value and actual value at time period n. Therefore, the smaller e_n is, the more accurate our prediction is.

6. Test results

This paper tests the predictive power of QSBO indices from two perspectives:

- contemporaneous indicator test – ability of the 'experienced' indices to predict the current quarter's GDP growth ahead of the release of official statistics
- leading indicator test – ability of the 'expected' indices to predict the coming quarter's GDP growth.

Data

The data series we used for each tests are:

- contemporaneous indicator test – experienced index for each of the four sectors versus annual percentage change in GDP for the sector
- leading indicator test – expected index for each of the four sectors versus annual percentage change in GDP for the quarter ahead for the sector.

We used the annual percentage change in the official GDP data for the relevant sector. This is conceptually consistent with the nature of the indices. The indices were constructed based on businesses' own assessment of their experienced and expected performance compared to the situation a year ago.

Data used in this paper is from NZIER's internal database for QSBO, collected on a quarterly basis and covers the time period from the March 1990 quarter to the June 2011 quarter. We also sourced official GDP data from Statistics NZ. All the series used are seasonally adjusted. We included two lags for the GC test given the indices are designed for short term forecasting.

Test results

Our results from the GC test show that all of the QSBO indices perform well in both providing information for the current quarter's GDP ahead of the official releases, and as leading indicators for the GDP for the next quarter. PMI and PTI are slighter weaker as a leading indicator. Test results are shown in Table 2.

Table 3 Performance of the QSBO indices

QSBO indices as a contemporaneous indicator			
	F stat	Probability	Causal?
PMI	15.7	0.00	Yes 1%
PCI	11.1	0.00	Yes 1%
PTI	21.8	0.00	Yes 1%
PSI	8.4	0.00	Yes 1%
QSBO indices as a leading indicator			
	F stat	Probability	Causal?
PMI	14.6	0.00	Yes 1%
PCI	10.0	0.00	Yes 1%
PTI	3.6	0.03	Yes 5%
PSI	3.8	0.03	Yes 5%

Source: NZIER

7. Conclusions and implications

Performance indices are used worldwide as indicators of activity in key sectors to assist analysts and decision-makers. An advantage of these indices is that, by pooling information from the series that make up the indices, idiosyncratic variation is smoothed out, and a stable and potentially more robust indicator of direction is constructed.

Our study shows that individual sector diffusion indices from the QSBO are both good coincidental and leading indicators of economic activity.

Appendix A
Granger Causality tests

Bivariate Granger Causality tests examine whether one variable x and its lagged values can be used to predict the current value of another variable y. It tests how much the current value of y can be explained by its own lags and whether adding variable x and lagged values of x can improve the explanation of y.

Variable y is said to be Granger-caused by x if x and its lagged values help to predict y, i.e., if the coefficients on x and its lags are statistically significant (Granger, 1969).

According to Asteriou and Hall (2007), there are four different potential results from a bivariate Granger causality test:

- lagged x terms (in a regression of y on lagged values of y and x) may be statistically different from zero as a group and the lagged y terms are not statistically different from zero. Hence, here we have x Granger-causing y

- lagged y terms (in a regression of x on lagged values of y and x) may be statistically different from zero as a group and the lagged x terms are not statistically different from zero. Hence, here we have y Granger-causing x

- both sets of x and y terms are statistically different from zero (in the two regressions outlined before) and so we have bi-directional causality

- both sets of x and y terms are not statistically different from zero (in the two regressions outlined before) and so x and y are independent of each other.

The Granger Causality tests, in a vector autoregressive model with two stationary variables y and x, involves estimating the following time series regressions:

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + ... + \alpha_k y_{t-k} + \beta_1 x_{t-1} + ... + \beta_k x_{t-k} + \varepsilon_t \tag{2}$$

$$x_t = \gamma_0 + \gamma_1 y_{t-1} + ... + \gamma_k y_{t-k} + \theta_1 x_{t-1} + ... + \theta_k x_{t-k} + u_t. \tag{3}$$

Where ε_t and u_t are uncorrelated error terms and involves testing the joint null hypothesis: $\beta_1 = \beta_1 = ... = \beta_k = 0$ and $\gamma_1 = \gamma_1 = ... = \gamma_k = 0$ in each regression equation.

If $\beta_1 = \beta_1 = ... = \beta_k = 0$, we say x Granger-causes y; and if $\gamma_1 = \gamma_1 = ... = \gamma_k = 0$, we say y-Granger causes x.

We use the PMI, PSI and PCI as the x variable and the official statistics (GDP and employment) as the y variable. First, we test the indices' predictive ability as a leading indicator. For example, the leading indicator test for the PMI examines the PMI's ability to predict the coming quarters' official GDP data (March PMI versus June GDP). Second, we test the ability of the indices to provide contemporaneous information. For example, the test for the PMI's ability to provide contemporaneous information examines how close the current quarter PMI tracks to the GDP official data in the same current quarter although the PMI is usually released nine weeks ahead of official GDP (March PMI versus March GDP).

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