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Keywords

FAVAR, uncertainty shocks, small open economy

JEL Classification

C15, C32, E32

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International spill-overs of uncertainty shocks: Evidence from a FAVAR*

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September 27, 2016

Abstract

This paper analyses the international spill-overs of uncertainty shocks originating in the US. We estimate an open economy, structural factor-augmented vector autoregression (FAVAR) model that identifies US uncertainty shocks and estimates the impact of these uncertainty shocks on the US economy, major world economies and a small open economy, namely New Zealand. The data-rich nature of our model allows us to investigate different transmission channels from the US to the rest of the world. We find the confidence channels, measured by the expectations surveys, are particularly important in the transmission of the uncertainty shock to a small open economy.

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1 Introduction

Since the Global Financial Crisis (GFC), there has been a growing interest in understanding the relationship between economic uncertainty and business cycles. The empirical literature finds that elevated uncertainty can account a sizeable portion of business cycle fluctuations.¹ Most of these studies, however, focus on the impact of domestic uncertainty shocks, mainly in the US context.

This paper contributes to the literature by providing empirical evidence on the international spill-overs and transmission channels of uncertainty shocks. To this end, we develop an empirical model, in which we take New Zealand as a case study, and estimate the effects on the US and New Zealand economies of uncertainty shocks originating in the US.²

New Zealand is generally considered to be a text book small open economy. Having a high degree of trade and capital openness and being a price taker on the international commodity markets it exports to, there are numerous channels through which a US uncertainty shock could flow through to affect a small open economy like New Zealand. Our empirical model, an international Factor-Augmented VAR (FAVAR), employs a large macroeconomic dataset from the US, a number of other major economies and New Zealand.³

New Zealand's small open status means transmission of uncertainty shocks originating in the US is likely to be unidirectional. We can, therefore, be confident in thinking our foreign (US) uncertainty shocks is truly exogenous and not contaminated by any New Zealand influences; this gives us confidence we are correctly identifying the uncertainty shock in our model. The data-rich nature of the FAVAR allows us to investigate the impact of the uncertainty shock on many different aggregates and prices in a number of countries.

¹Stock and Watson (2012), for example, argue that financial disruptions and heightened uncertainty shocks are the primary cause of the 2007-2009 recession in the US. Leduc and Liu (2016), Alexopoulos and Cohen (2009), Bloom (2009), Bachmann et al. (2010), Baker et al. (2012) all look at how uncertainty interacts with the United States (US) business cycle. By distinguishing between financial and uncertainty shocks, Caldara et al. (2016) find that both shocks played a significant role in the evolution of business cycles in the US. over the past forty years.

² The existing work on the international transmission of uncertainty shocks mostly focus on the impact of uncertainty shocks on a small set of variables. For example, Mumtaz and Theodoridis (2015) estimate the transmission of the US volatility shocks to the United Kingdom using a six variable structural VAR with stochastic volatility. Chudik and Fratzscher (2011) use a GVAR approach to examine the transmission of US liquidity and risk shocks during the Global Financial Crisis to a number of countries. However, although they are able to use a larger number of countries the number of variables which can be examined in each country is limited.

³The FAVAR model, relative to smaller VARs, has the advantage that it is less likely to suffer from omitted variable bias and issues of non-fundamentality (see Forni and Gambetti (2014))

We find that an uncertainty shock originating in the US causes a persistent decline in real activity and inflation in the US economy. In addition, the uncertainty shock leads to a fall in credit growth and asset prices. In response to the fall in inflation and domestic activity the US policy rate falls. These responses, in particular the dynamics of output and inflation, suggest that uncertainty shocks can be characterised as a negative demand shock in the US as suggested by [Leduc and Liu \(2016\)](#). However our results show that following the uncertainty shock, the US dollar exchange rate appreciates against all major currencies. This is contrary to the dynamics of the US exchange rate following a typical demand shock ([Clarida and Gali \(1994\)](#) and [Farrant and Peersman \(2006\)](#)) and is more consistent with the “flight to safety” type behaviour ([McCauley and McGuire \(2009\)](#)).

The uncertainty shock results in a synchronised fall in economic activity, inflation, stock prices and interest rates across major economies. However, we find more diverse responses in international commodity prices and exchange rates. For example, oil prices fall more than the prices of other commodities such as agricultural goods. Similarly, the exchanges rates responses are relatively less synchronised.

In the case of New Zealand, output, consumption and investment all fall in response to the US-based uncertainty shock. On the inflation side, both tradable and non-tradable inflation decline resulting in lower short-term interest rates. Therefore, the uncertainty shock appears like a global demand shock for a small open economy. We find financial and confidence channels to be more significant than the trade channel. Through making New Zealand’s exports cheaper in world price terms, a fall in the New Zealand exchange rate, and a decline in commodity prices in response to the uncertainty shock, appear to moderate the effects on New Zealand’s export volumes.

Our paper complements the existing literature on the international effects of uncertainty shocks, by providing a parsimonious way to summarize the interactions between many countries and many variables. Indeed, the existing work on the international transmission of uncertainty shocks mostly focus on the impact of uncertainty shocks on a small set of variables. For example, our paper builds on [Mumtaz and Theodoridis \(2015\)](#) who estimate the transmission of US volatility shocks to the United Kingdom using a six variable structural VAR with stochastic volatility. [Chudik and Fratzscher \(2011\)](#) use a GVAR approach to examine the transmission of US liquidity and risk shocks during the Global Financial Crisis to a number of countries. However, although they are able to use a larger

number of countries the number of variables which can be examined in each country is limited. Finally, there are recent contributions that employ the FAVAR approach to examine the effects of uncertainty shocks but they only focus on the domestic transmission of uncertainty shocks in the US (Mumtaz and Theodoridis (2016), Popp and Zhang (2016), Caggiano et al. (2014)). Our approach is probably closest to Hirata et al. (2012) who use a FAVAR approach to examine the properties and drivers of house price fluctuations for a number of countries.

The remainder of the paper is structured as follows: Section 2 introduces the empirical framework, and discusses estimation and identification, section 3 presents and discusses the results. Section 4 presents the results of several robustness checks. Section 5 concludes.

2 Empirical Framework and Data

2.1 Estimation and identification

We estimate the FAVAR model as proposed by Bernanke et al. (2005). We use principal component analysis to extract two sets of factors, domestic (F_t) and foreign (F_t^*), from the domestic and foreign datasets respectively. We model the joint dynamics of the extracted factors and the uncertainty index (U_t) by a reduced form VAR as follows:

$$\begin{bmatrix} U_t \\ F_t^* \\ F_t \end{bmatrix} = \beta(L) \begin{bmatrix} U_{t-1} \\ F_{t-1}^* \\ F_{t-1} \end{bmatrix} + u_t, \quad (1)$$

where U_t is a measure of uncertainty, F_t^* and F_t are sets of foreign and domestic factors respectively, $\beta(L)$ is a conformable lag polynomial of order p and u_t are the reduced form residuals. The structural disturbances follow $u_t = \Omega^{1/2}\varepsilon_t$, with $\varepsilon \sim N(0, 1)$ and $\Omega = A_0(A_0)'$ where A_0 is the matrix of contemporaneous coefficients.

We use the Cholesky factorisation of the reduced-form residuals to identify the orthogonal, structural uncertainty shocks. More specifically, we order the variables in the following order: uncertainty measure (U_t), international factors (F_t^*) and domestic factors (F_t), which assumes that uncertainty does not respond to the current quarter information contained in the domestic and foreign factors. Furthermore, we impose block exogeneity restrictions such that uncertainty and foreign factors don't respond to NZ factors. Therefore $\beta(L)$ is:

$$\begin{bmatrix} \beta_{11}(L) & \beta_{12}(L) & 0 \\ \beta_{21}(L) & \beta_{22}(L) & 0 \\ \beta_{31}(L) & \beta_{32}(L) & \beta_{33}(L) \end{bmatrix} \quad (2)$$

We assume that our large dataset can be represented as a linear combination of the latent factors as:

$$\begin{bmatrix} X_t^* \\ X_t \end{bmatrix} = \begin{bmatrix} \Lambda^{F^*} & 0 \\ \Lambda^F & \Lambda^D \end{bmatrix} \begin{bmatrix} F_t^* \\ F_t \end{bmatrix} + \begin{bmatrix} e_t^* \\ e_t \end{bmatrix}, \quad (3)$$

where X_t^* and X_t are vectors of observables for foreign and domestic blocks, respectively. Λ^{F^*} , Λ^F and Λ^D are matrices of factor loadings. Finally e_t^* and e_t are vectors of idiosyncratic, zero mean, disturbances. This structure, in particular the matrix Λ^F , ensures that we incorporate the effects of foreign factors in the domestic block. Once we estimate the impulse responses of the factors in response to an uncertainty shock, the factor loadings are used to calculate impulse responses for all variables in our dataset.

We use the approach by [Bai and Ng \(2002\)](#) for determining the number of factors to be estimated from the observed data. Given our relatively small sample size, we include 3 domestic and 5 foreign factors in estimation based on the results from the most conservative AIC3 criteria.⁴

In order to control for the effect of foreign factors on the domestic block, we estimate domestic factors following an iterative approach as in [Boivin and Giannoni \(2007\)](#) and [Charnavoki and Dolado \(2013\)](#). Starting from an initial principal component estimate of F , denoted by F^0 , we iterate through the following steps:

1. Regress X_t on F_t^0 and foreign factors F_t^* to obtain λ_F .
2. Compute $\widetilde{X}_t = X_t - \lambda_F * F_t^*$ to eliminate the contemporaneous effects foreign factors on X_t .
3. Estimate F_t^1 as the first K-5 principal components of $\widetilde{X}_t$.
4. Back to 1

We estimate the model by Generalised Least Squares (GLS) for the period 1995Q1-2015Q2 using two lags.

2.2 Data

We use quarterly data covering the period 1995Q1 to 2015Q2. The sample size is constrained by the data availability outside the US. The dataset is divided into two blocks: international and domestic blocks. The international block is composed of data from the

⁴Results are available upon request

US and other major world economies such as Australia, Canada, China, Japan, the UK, Switzerland and the Euro area. For the US, we use an updated version of [Bernanke et al. \(2005\)](#) dataset.⁵ We also include various measures of commodity prices in the world block. Overall our international dataset comprises 205 individual data series.

The domestic (New Zealand) block comprises a detailed dataset including disaggregated GDP components, prices and survey data, as well as a range of financial variables. In total, we have 115 individual data series for New Zealand which allows us to explore the alternative transmission channels to New Zealand economy in detail.⁶

Our baseline uncertainty measure is based on [Jurado et al. \(2013\)](#). More specifically, we use the financial uncertainty measure they construct as the volatility of the purely unforecastable component of the future values of a large number of financial variables. [Jurado et al. \(2013\)](#) find that their measure differs substantially from other commonly used measures of uncertainty and argue that their measure is a better proxy than other measures imply.

However, there is no agreement about an ideal measure of uncertainty. Figure 1 shows some of the commonly used measures of uncertainty in the literature. We also estimate and plot the first principal component estimated from the five measures. It can be seen that all measures show a general countercyclical pattern and rise during major economic disruptions such as the Asian crisis and the recent global financial crisis. In section 4, we check the robustness of our results by using a number of these alternative measures and the principal component measure of uncertainty.

[Figure 1 about here.]

3 Empirical Results

In this section, we present the results from our estimation. Section 3.1 presents and discusses the estimated factors. Section 3.2 presents impulse responses of the US variables to our baseline measure of uncertainty. Sections 3.3 and 3.4 present the impulse responses for the rest of the world and the New Zealand variables respectively.

⁵This dataset includes 116 individual data series covering a broad range of macroeconomic and financial variables. We use data from various sources including national statistics agencies. Most of the data is retrieved using HAVER.

⁶Table 2 in the appendix lists all the data used in the estimation as well as the transformation applied to each raw data. All variables are demeaned and standardised prior to the estimation.

3.1 Factors

Figure 2 plots the estimated factors. We remain agnostic about what the factors represent aside from splitting them into foreign and domestic blocks.

[Figure 2 about here.]

It is, however, informative to see how much of the variance in some key series are explained by the factors using the R-squared, which is shown in table 1.

[Table 1 about here.]

For quarterly growth in GDP the factors explain as little as 12% for Australia to around 71% for the Euro area; with the R-squared for Canada, U.K. and US all being in the high-50s or 60s. A considerable proportion of world commodity prices is explained by the factors (88%), which is encouraging given this is a likely channel through which an uncertainty shock would be transmitted to New Zealand. Furthermore, 69% of the variance in the oil price, a key variable in the global economy, is explained by the factors. The heterogeneity of R-squared numbers we observed across countries for GDP is also present for nominal exchange rates and inflation. Our factors generally explain between 30% and 75% of individual country exchange rates, with the exception of the Euro Area where they only explain 17%. Japan (20%), along with Australia (28%), is also on the outlier for inflation, with the R-squared for inflation in the other countries generally being between 40% and 80%. The R-squared for short-term interest rates ranges between 42% for Japan and 95% for the US.

New Zealand factors explain significant portion of the variance in 90 day rates, GDP, unemployment rate and the exchange rate; the R-squared on inflation is also reasonably high at 59%. These reasonably high R-squared values give us a degree of comfort that the domestic factors are capturing the New Zealand economy well.

3.2 Impulse responses - US Economy

Figure 3 shows the impact of a one standard deviation shock to the level of uncertainty on key US variables.

[Figure 3 about here.]

Following the shock, we observe a statistically significant decline in activity where GDP falls by around 0.1 per cent and unemployment rate increases by approximately 0.15 percentage points. The responses of GDP and unemployment remain significant for approximately one and two years respectively.

The components of the GDP show a similar response; both consumption and investment fall persistently. Durables consumption, which can potentially be deferred by consumers relatively easily, falls more than the consumption of services. However, the fall in consumption services is more persistent. Both residential and non-residential investment decline although the impact is more persistent for non-residential investment. On the capital input side, capacity utilisation also falls with a hump shaped response where the response peaks around 5 quarters. Inflation also falls, reflecting the downturn in economic activity. As a result of falling inflation and reduced economic activity, the US interest rates decrease by approximately 20 basis points. These results are in line with those obtained by [Caggiano et al. \(2014\)](#).

On the financial side, asset prices in the US respond significantly to the uncertainty shock. The stock market exhibits the sharpest fall in response to the uncertainty shock which falls by approximately 1.5 per cent. As discussed in section 3.3, the significant response of US stock prices is consistent with the responses of the stock prices around the world. Reflecting the slowdown in residential investment, house prices respond negatively to the uncertainty shock falling by around 0.1 per cent within a few quarters. The BAA corporate bond spread over the Fed funds rate increases by approximately 15 basis points indicating that the increased uncertainty leads to agents facing a higher risk premium on their borrowing.

US dollar exchange rate appreciates in response to the uncertainty shock which is consistent with a model of international risk sharing, where a shock to consumption in the US (brought about through more household saving owing to precaution owing to increased uncertainty) would see an appreciation in the exchange rate to make imported consumption goods cheaper. Alternatively it is consistent with the common perception in financial markets that the US dollar is a safe haven currency and thus in times of increased uncertainty capital flows out of currencies perceived to be more risky to the US dollar.

[Leduc and Liu \(2016\)](#), on the basis of their DSGE and VAR modelling, concluded that uncertainty shocks in the US act like aggregate demand shocks. Our model yields similar results for output, inflation and labour market variables. However, the exchange rate

appreciation and the increase in the corporate bond spreads are not fully consistent with an aggregate demand shock interpretation. A typical domestic demand shock would have yielded a depreciation in the exchange rate.

3.3 Impulse Responses - World Economy

Figure 4 shows the responses of key variables to a one standard error shock to the uncertainty index. The increased uncertainty leads to contraction in activity across all major economies. Consequently, inflation falls in all countries and monetary authorities respond by lowering interest rates.

The world economy also experiences an immediate and synchronised fall in stock prices. The fall in stock prices in the world economy is comparable to those of the US stock prices.

World commodity prices decline for all commodity groups. Oil price shows the largest fall followed by the fall in the price of metal commodities. The decline in the price of agricultural raw materials is relatively more subdued. The differences in the magnitudes of the commodity price responses seem to reflect the different income elasticities - agricultural products, which typically have a low income elasticity, are more affected than metals and oil.

Exchange rates depreciate in all countries except the US, Japan and Switzerland. The behaviour of exchange rates in the latter group of countries is consistent with their reserve currency status and the flight to safety behaviour commonly observed during uncertain times.

[Figure 4 about here.]

3.4 Impulse Responses - New Zealand Economy

Figures 5-7 show the responses of selected variables for the New Zealand economy to uncertainty.

In response to the uncertainty shock the real activity declines in New Zealand. The real GDP growth, consumption and investment all fall in response, with investment falling the most. Unemployment rate increases by approximately 0.2 per cent. The increase in the unemployment rate persists for around 9 quarters. The capacity utilisation falls significantly in response to the shock and return to its pre-shock level after 2 years following

the shock. Both tradable and non-tradable inflation fall where the fall in tradable inflation can largely be attributed the fall in oil prices.

While the fall in world output acts as a drag on New Zealand exports, there are also a number of offsetting effects that lead to an increase in exports. The depreciation of the New Zealand dollar and the fall in commodity prices contribute positively to the export growth. Imports, on the other hand, decline due to lower economic activity and the lower exchange rate resulting in an improvement in the trade balance.

Figure 6 shows that New Zealand dollar exchange rate falls against every major currency (in a trade weighted sense). The largest falls in the New Zealand dollar occur against the US dollar and Japanese yen, which is consistent with increase in risk aversion during highly uncertain times as investors substitute away from small country currencies such as the New Zealand dollar. For example, at the height of the global financial crisis in 2008, and following the 9/11 events, the New Zealand dollar, along with many other currencies, depreciated significantly against the US dollar. The fall in the New Zealand dollar is also related to the fall in the commodity prices. The commodity currency nature of the New Zealand and the Australian dollars probably explain the relative stability of the New Zealand dollar against the Australian dollar.⁷

[Figure 5 about here.]

[Figure 6 about here.]

Figure 7 shows the responses of macro-financial and expectations/confidence variables in the New Zealand economy. On the macro-financial side the fall in the credit growth is very persistent and peaks around six quarters. In line with falling prices and lower demand, interest rate falls. The magnitude of the interest rate fall is similar to the falls in other advanced economies. Despite falling interest rates, all asset prices and credit falls sharply. Figure 7 suggests that the dynamics of expectations can be important in understanding the macroeconomic dynamics in New Zealand. Both QSBO (Quarterly Survey of Business Opinions) and RBNZ based survey measures indicate that economic agents' expectations about future activity sharply deteriorate. In particular, there is striking conformity between the dynamics of expected unemployment based RBNZ survey

⁷ It should be noted that the New Zealand/Australia exchange rate is one of the most stable pair of freely floating currencies, whose relative peak to trough variance is around one third of that of the New Zealand/US dollar exchange rate for example.

and actual unemployment dynamics following the uncertainty shock. Expected and actual GDP also follow somewhat similar patterns. The falls in survey measures without a corresponding fall in exports, suggest that confidence channels are particularly important in the transmission of uncertainty shocks.

[Figure 7 about here.]

4 Robustness

We examine the robustness of our results from two perspectives. First, we investigate whether our results are robust to using other measures of uncertainty that are commonly used in the literature. Second, we compare our results with the effect of uncertainty shock derived from a small-scale two country structural VAR.

4.1 Alternative measures of uncertainty

We check the robustness of our findings to three alternative measures of uncertainty. The first measure we consider is the implied volatility index of SP 500 (VIX). VIX has been particularly popular in studies investigating the impact of uncertainty shocks and enables us to compare our results directly to these studies. As the second measure, we use the Economic Policy Uncertainty Index suggested by [Baker et al. \(2016\)](#). We construct our third measure as the first principal component obtained from the five alternative measures of uncertainty that are commonly used in the literature. These measures comprise the VIX index, Bloom’s uncertainty index, the Michigan Survey, our baseline measure by [Jurado et al. \(2013\)](#) and the forecast disagreement which constructs a measure of uncertainty as the per cent difference between the 75th percentile and the 25th percentile of the 1 quarter ahead projections for the quarterly level of the US GDP (see [Figure 1](#)).

The results shown in [Figures 8 and 9](#) indicate that our results are fairly robust to using alternative measures of uncertainty.

[Figure 8 about here.]

[Figure 9 about here.]

4.2 Comparison with a small-scale VAR

In this section, we document the effect of uncertainty shock derived from a small-scale two country structural VAR. The VAR comprises a subset of the variables used in the FAVAR analysis namely the uncertainty index (approximated with [Jurado et al. \(2013\)](#)), the US and New Zealand unemployment rates, inflation rates, interest rates and the New Zealand/USD exchange rate. We impose block exogeneity to prevent New Zealand variables having an impact on the US variables. Similar to our model specification, we order the uncertainty index as the first variable followed by the US and New Zealand variables and identify the uncertainty shock recursively using a Cholesky identification scheme.

Figure 10 plots the responses of each variable in the VAR to a one standard deviation shock to uncertainty. Overall, the results are qualitatively similar to the ones we obtain from FAVAR although we observe some sizeable differences in the magnitudes of the responses. We also find that the response of New Zealand’s inflation obtained from the simple VAR is not statistically significant. The results confirm that the identified transmission channels are sensitive to the information contained in the VAR.

[Figure 10 about here.]

5 Conclusions

We study the transmission of uncertainty shocks originating in the US to several major advanced economies, including New Zealand, by means of a FAVAR. The data-rich nature of the FAVAR enables us to examine the effects on a number of countries and to disentangle the role of different transmission channels. We find that the uncertainty shock has a demand-type effect on the US economy with activity, inflation and interest rates all falling. However, the increase in the US dollar exchange rate and the corporate bond-spreads in response differentiate the uncertainty shock from a typical demand shock.

Following an uncertainty shock, we observe a synchronised fall in economic activity, inflation, stock prices and interest rates in every major economy in our sample. However, we observe a much less synchronisation in the responses of commodity prices and exchange rates: Although all commodity prices fall, oil and metal prices fall more relative to agricultural commodity prices. While the exchange rates of the commodity currencies

(Australia, New Zealand and Canada) fall, not every currency depreciates in our sample. Consistent with their safe-haven status, the exchange rates of the US, Switzerland and Japan appreciate.

In the case of New Zealand, economic activity and (GDP, consumption and investment) inflation fall and unemployment rate rises. New Zealand dollar exchange rate depreciates consistent with the decline in the economic activity, and the fall in commodity prices. From a policy perspective, the dynamics of inflation and output do not present a trade-off from a monetary policy perspective especially in an inflation targeting framework. We find a smaller role for the trade channel on the transmission of uncertainty shocks to New Zealand. On the other hand, we find that financial variables such as exchange rates, long-term interest rates and stock prices, and the confidence measures play a relatively larger role in transmitting the uncertainty shock.

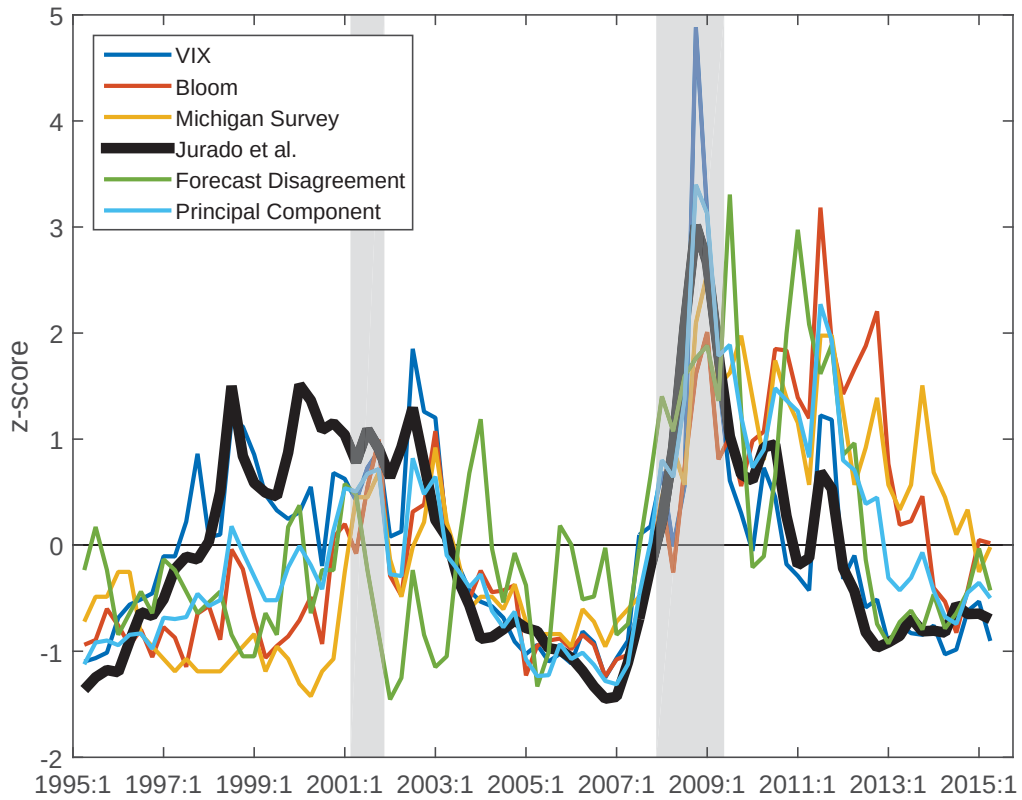
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Figure 1: Alternative Measures of Uncertainty



Notes: The shaded vertical bars indicate the NBER-dated recession dates in the United States. Sample: 1995Q2-2015Q2. The VIX: Implied volatility Index, which shows the market's expectation of 30-day volatility in S&P 500, source: Haver Analytics. Bloom: A measure of consumers' perceived uncertainty, source: <http://www.policyuncertainty.com> Michigan Survey: Michigan Survey of Expectations, source: University of Michigan. Jurado: An econometric estimate of the volatility of the purely unforecastable component of the future values of a large number of financial variables, source: <http://www.sydneyludvigson.com/data-and-appendixes>. Forecast disagreement: The variance of the 1-year ahead GDP growth forecasts from the Survey of Professional Forecasters, source: Federal Reserve Bank of Philadelphia.

Figure 2: Principal Component Estimates of Domestic and Foreign Factors

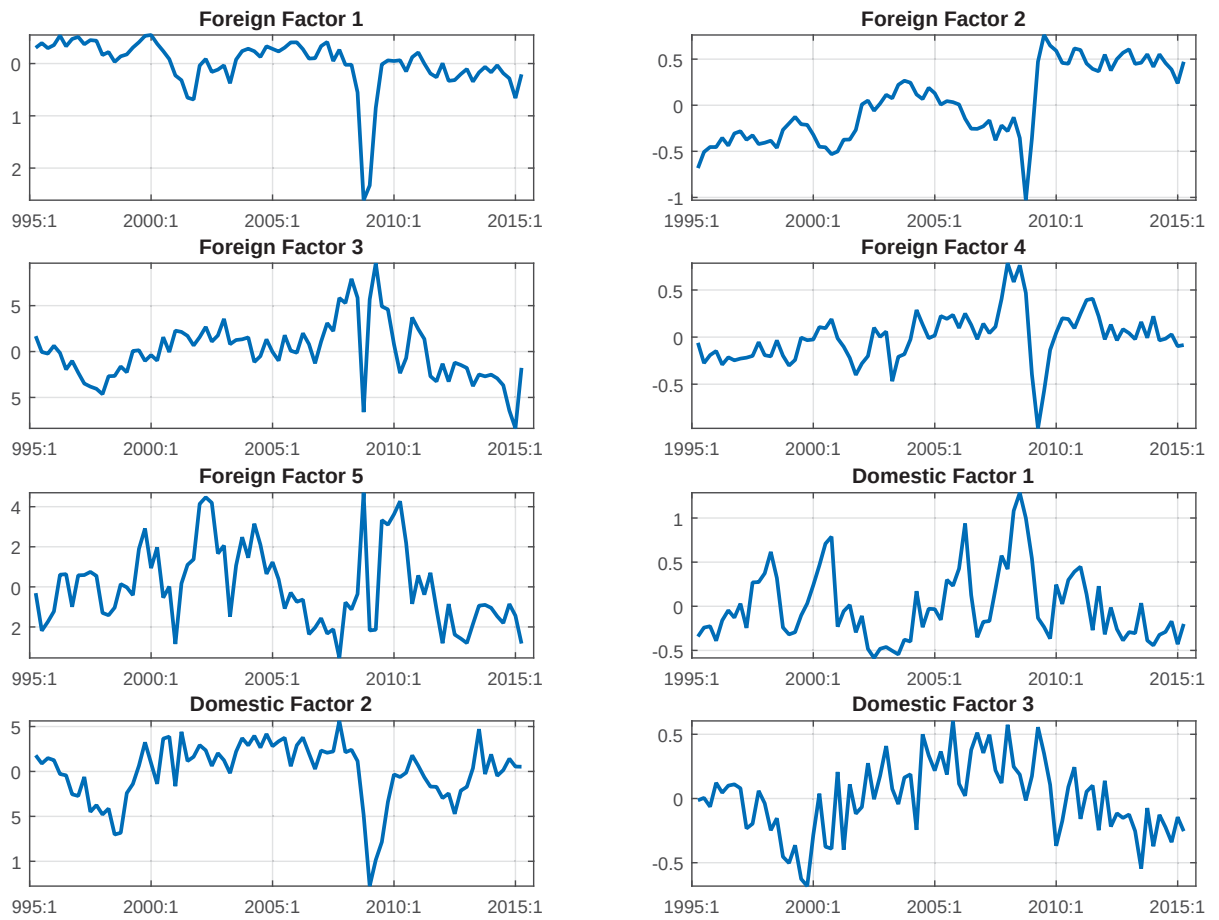
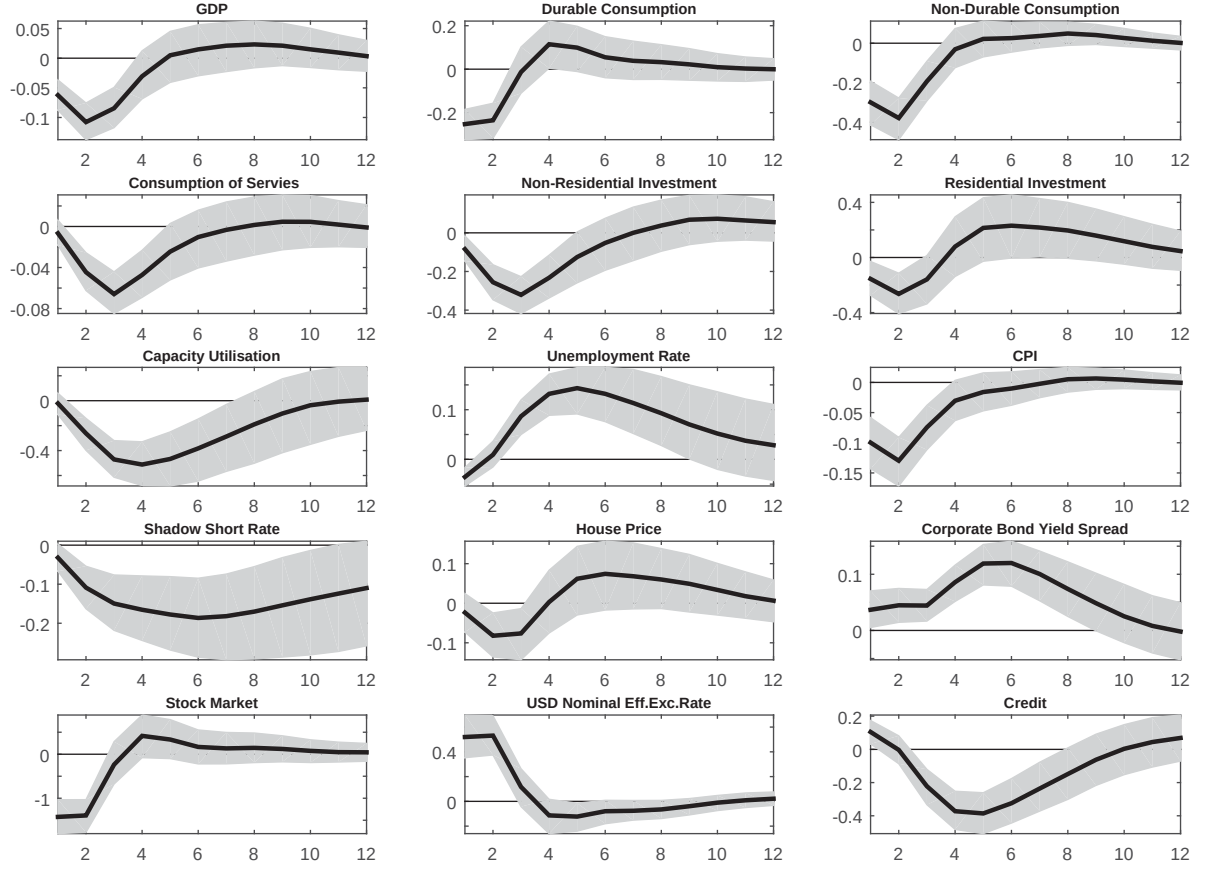
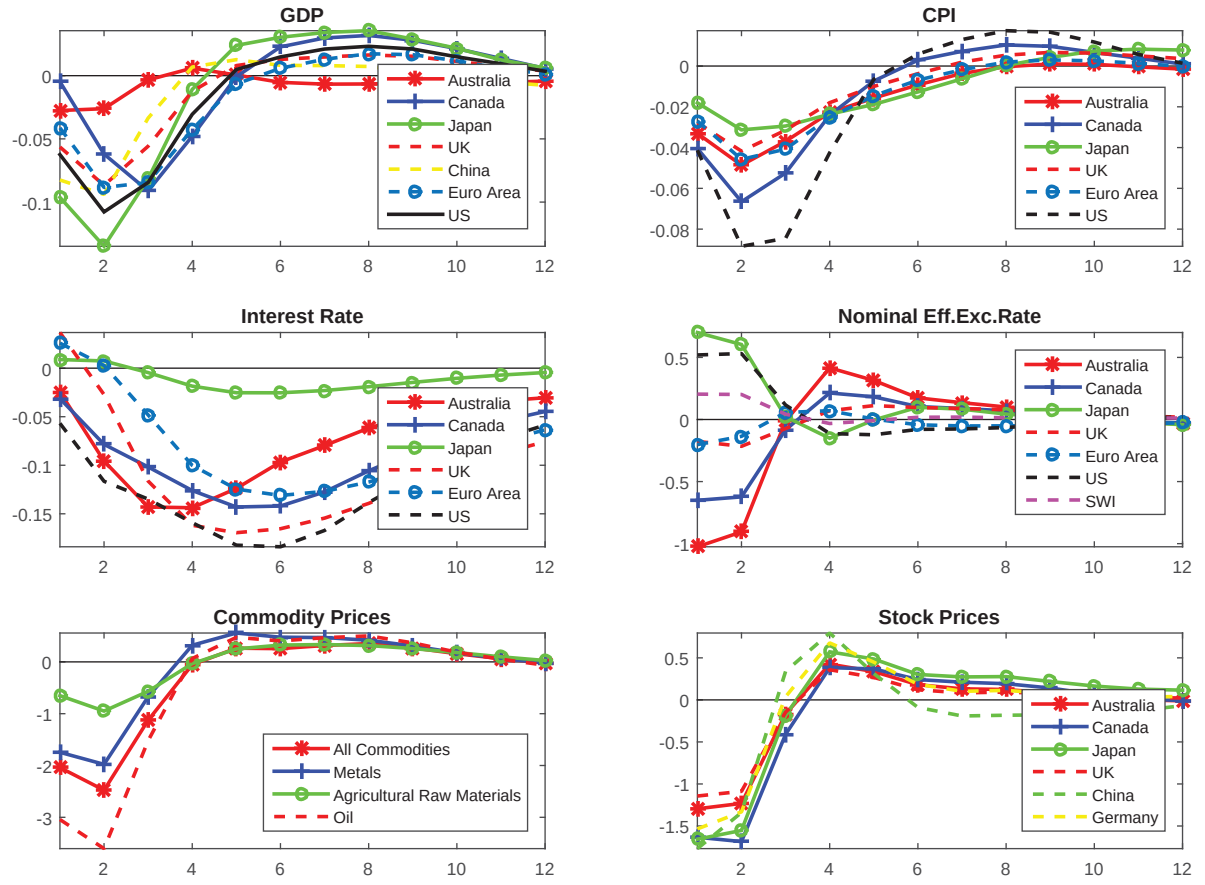


Figure 3: Responses of Key US Macro Variables to 1 s.d Shock to Uncertainty



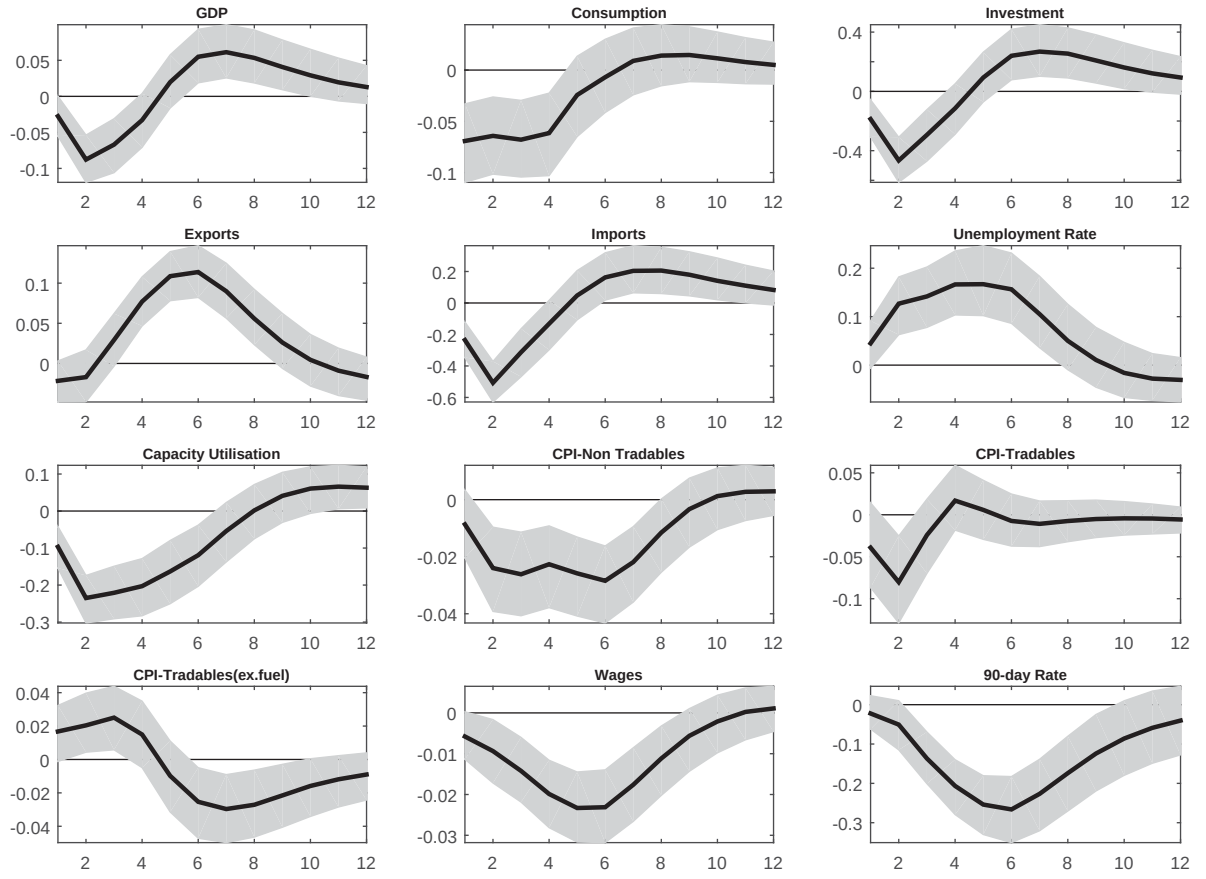
Notes: The solid line represents median responses of the variables to a one- standard-deviation increase in the innovations to uncertainty. The shaded area represents the 68 per cent confidence bands of the estimated median impulse responses.

Figure 4: Responses Across the World to Uncertainty Shock



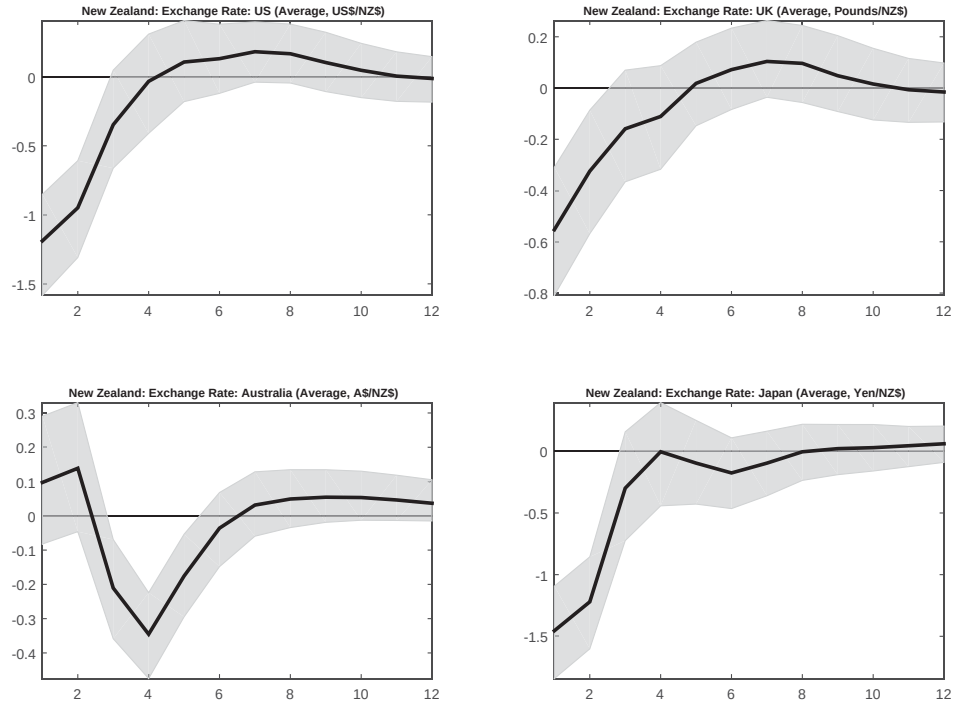
Notes: The lines represents median responses of the variables to a one- standard-deviation increase in the innovations to uncertainty.

Figure 5: Responses of New Zealand Variables to 1 s.d shock to Uncertainty



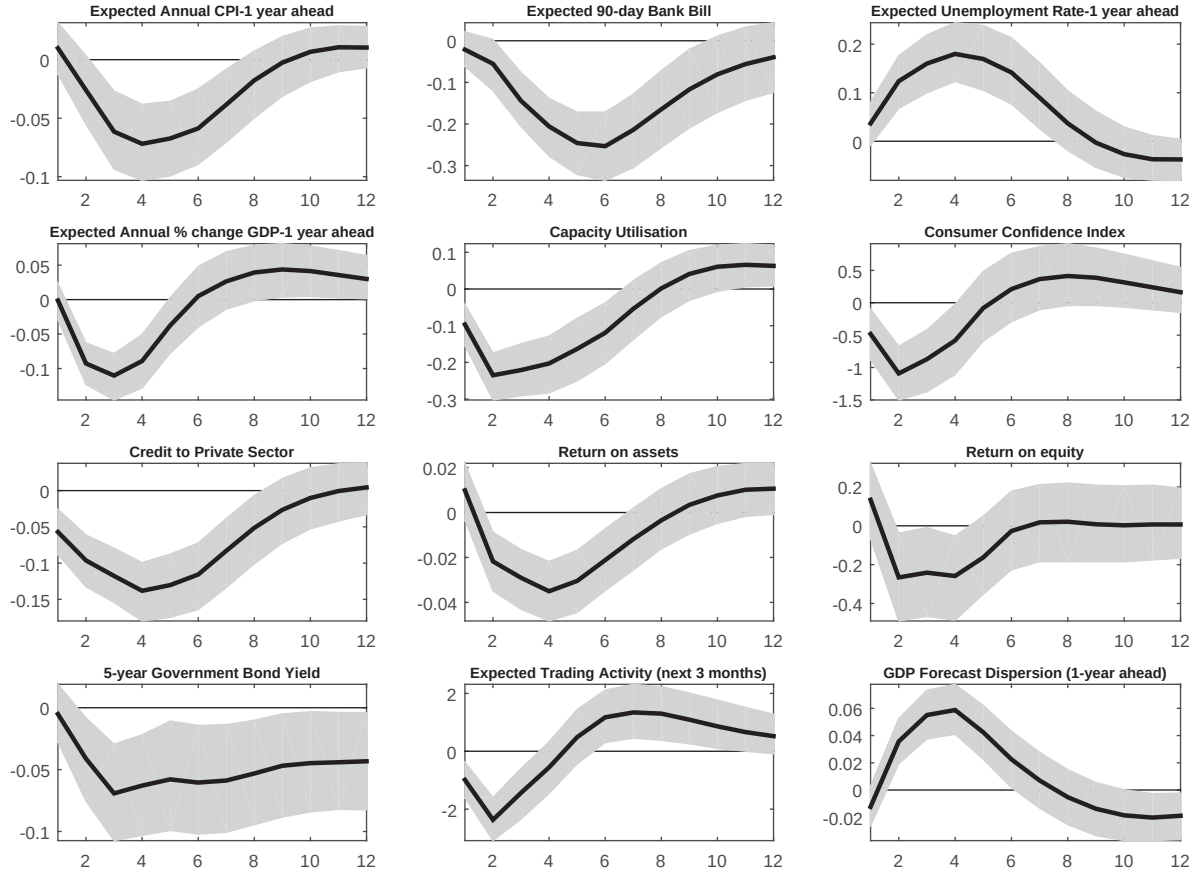
Notes: The solid line represents median responses of the variables to a one- standard-deviation increase in the innovations to uncertainty. The shaded area represents the 68 per cent confidence bands of the estimated median impulse responses.

Figure 6: Exchange Rates



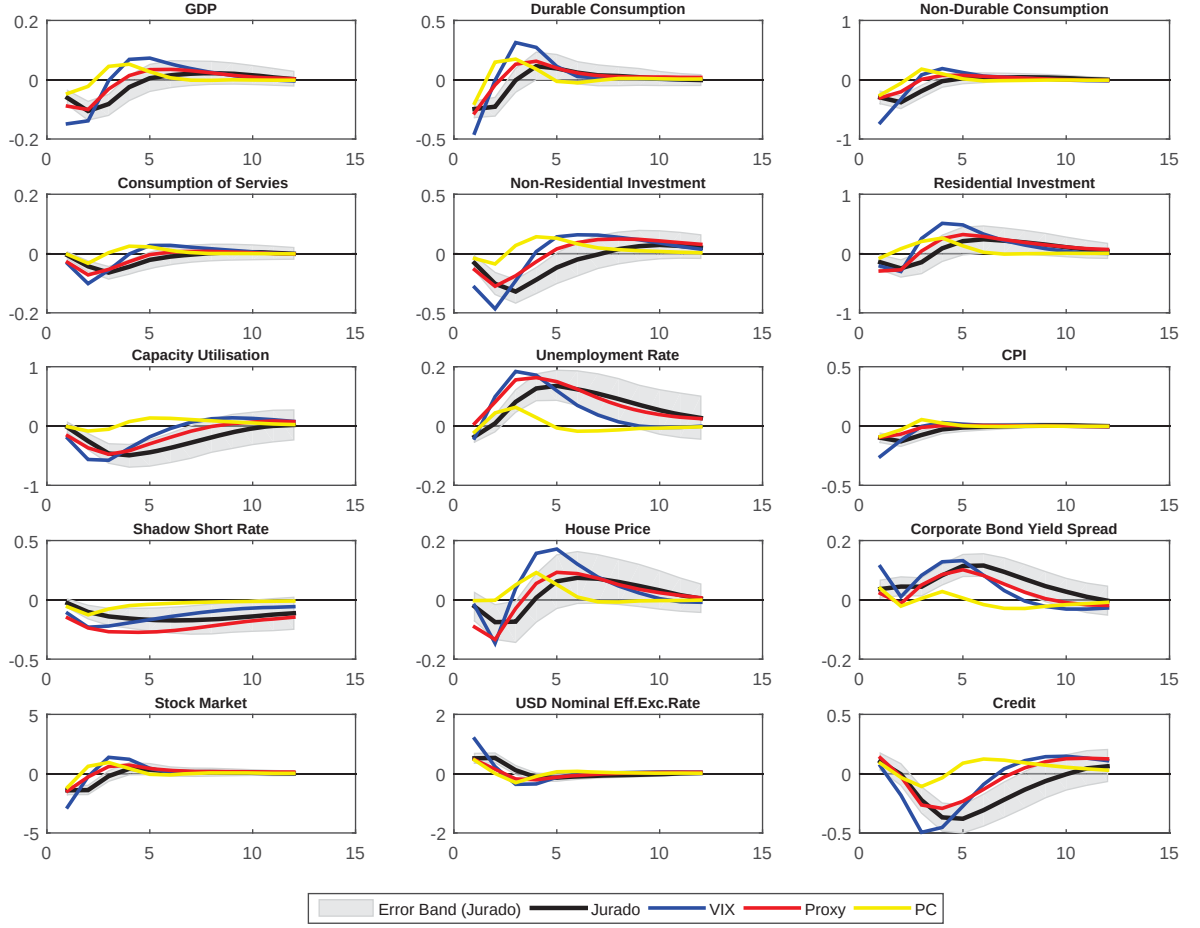
Notes: The solid line represents median responses of the variables to a one- standard-deviation increase in the innovations to uncertainty. The shaded area represents the 68 per cent confidence bands of the estimated median impulse responses.

Figure 7: Responses of Selected NZ Macro Variables to 1 s.d shock to Uncertainty



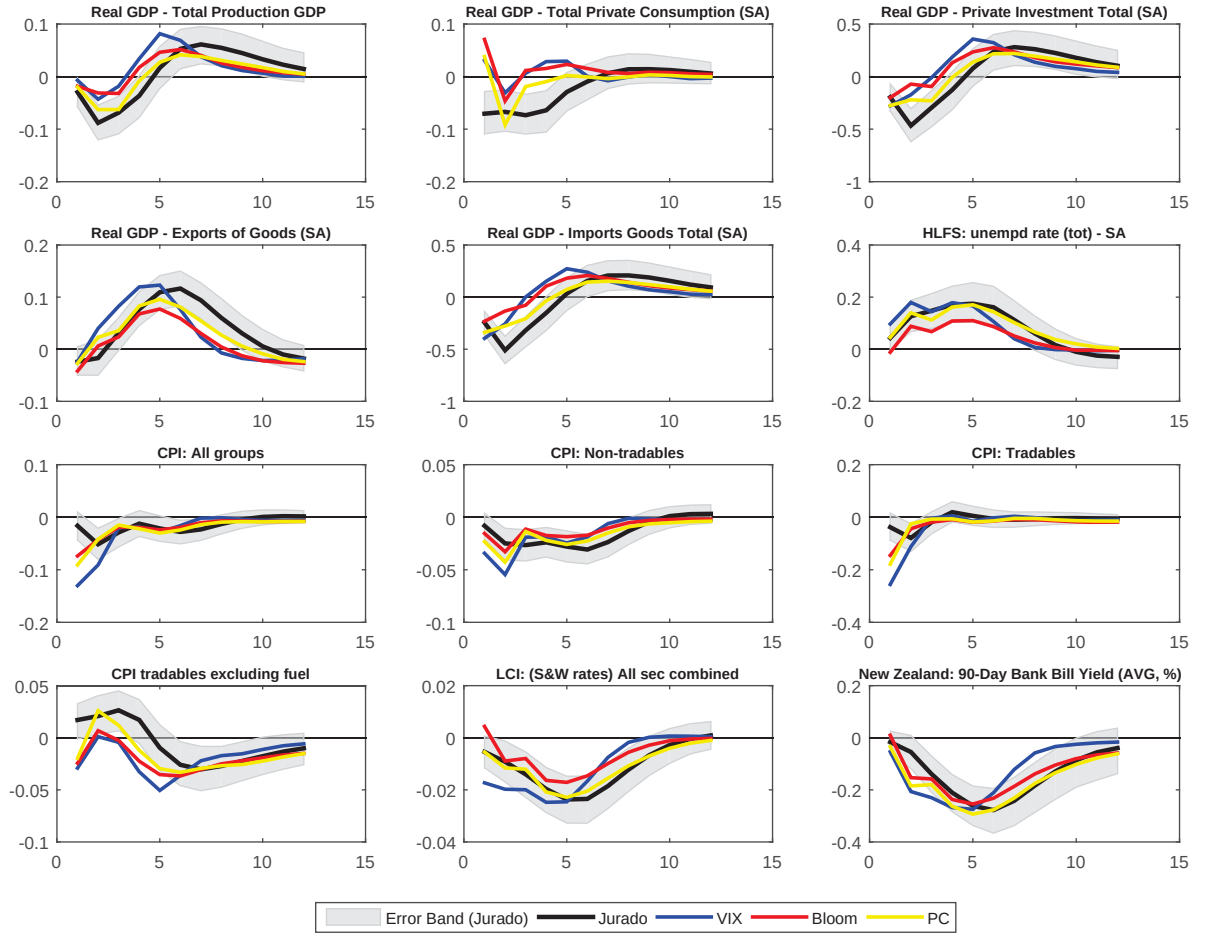
Notes: The solid line represents median responses of the variables to a one- standard-deviation increase in the innovations to uncertainty. The shaded area represents the 68 per cent confidence bands of the estimated median impulse responses.

Figure 8: Responses of US Variables to Alternative Uncertainty Measures



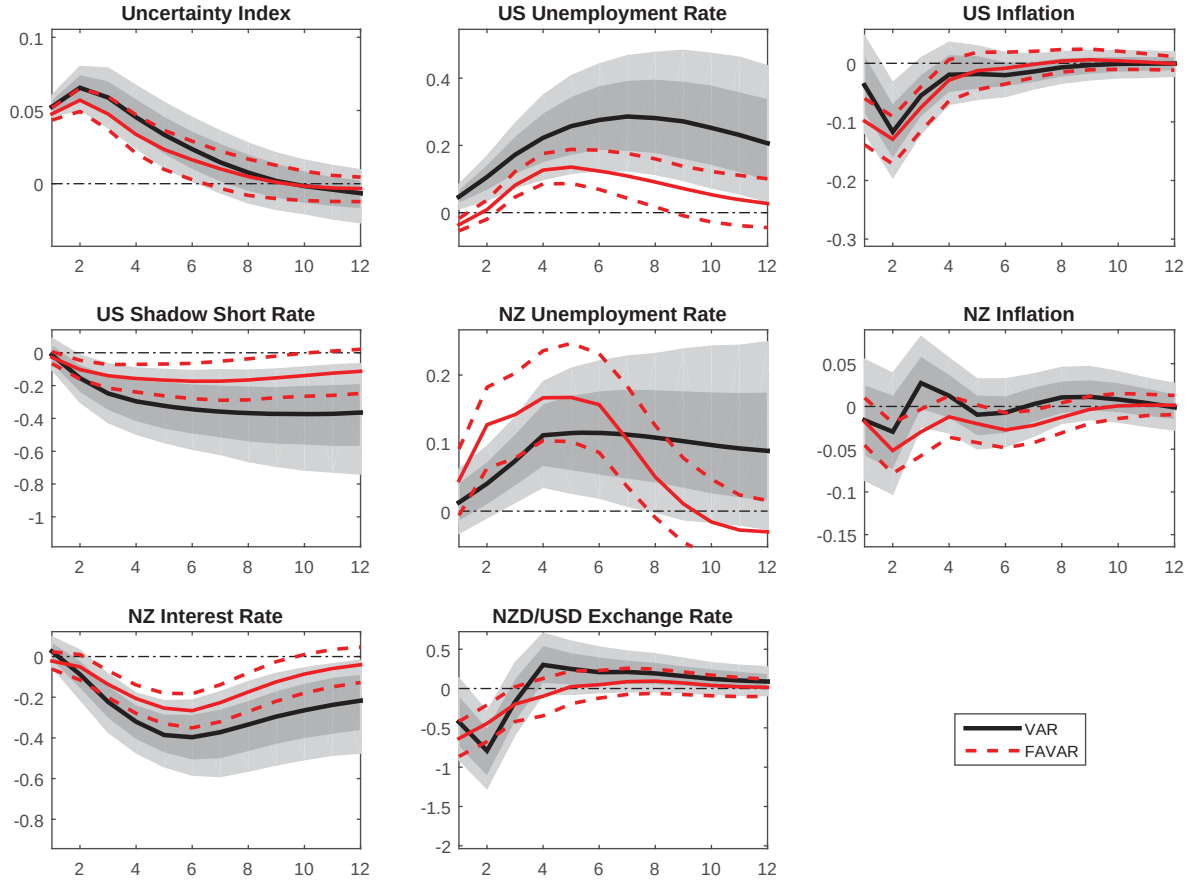
Notes: The solid lines represent the median responses of the variables to a one-standard-deviation increase in the innovations to uncertainty using the baseline index, Bloom's measure, VIX and the principal component measures of uncertainty. The grey shaded area represents the 68 per cent confidence bands of the estimated median impulse responses obtained from the baseline FAVAR.

Figure 9: Responses of NZ Variables to Alternative Uncertainty Measures



Notes: The black, yellow, red and blue solid lines represent the median responses of the variables to a one-standard-deviation increase in the innovations to uncertainty using the baseline index, Bloom's measure, VIX and the principal component measures of uncertainty. The grey shaded area represents the 68 per cent confidence bands of the estimated median impulse responses obtained from the baseline FAVAR.

Figure 10: Dynamic Responses of Key Variables (Simple VAR vs. FAVAR)



Notes: The solid black line represents median responses of the variables to a one-standard-deviation increase in the innovations to uncertainty in simple VAR. The light and dark grey shaded area represents the 68 and 84 per cent confidence bands of the estimated median impulse responses. The red solid line represents median responses of the variables to a one-standard-deviation increase in the innovations to uncertainty in FAVAR. The dashed red lines represent the 68 per cent confidence bands of the estimated median impulse responses

Table 1: Explanatory Power of Factors for Selected Variables

Foreign Variables	R squared
Australia: Gross Domestic Product (SA, Mil.Chn.Q3:12-Q2:13.A\$)	12%
Canada: Gross Domestic Product (SA, Mil.Chn.2007.C\$)	64%
Japan: Gross Domestic Product (SA, Bil.Chn.2005.Yen)	29%
UK: Gross Domestic Product (SA, Mil.Chained.2011.Pounds)	58%
US: Gross Domestic Product (SAAR, Bil.\$)	66%
China: Gross Domestic Product (SA, Bil.2010.Yuan)	27%
Euro Area: GDP	71%
World: Commodity Price Index: All Commodities (2010=100)	88%
World: Non-fuel Primary Commodities Index (2010=100)	69%
World: Commodity Price Index: Metals (2010=100)	65%
World: Commodity Price Index: Agricultural Raw Materials (2010=100)	53%
World: Commodity Price Index: Food & Beverage (2005=100)	46%
Dubai Oil Price	69%
Australia: Nominal Effective Exchange Rate (2010=100)	75%
Euro Area: Nominal Effective Exchange Rate (Avg, NSA,2010=100)	16%
Japan: Nominal Effective Exchange Rate (Avg, NSA,2010=100)	34%
United Kingdom: Nominal Effective Exchange Rate (Avg, NSA,2010=100)	43%
United States: Nominal Effective Exchange Rate (Avg, NSA,2010=100)	63%
China, PR: Nominal Effective Exchange Rate (2010=100)	43%
Australia, Consumer Price Index, SA	28%
Canada: Consumer Price Index (SA, 2002=100)	48%
EA 11-18: Monetary Union: Index of Consumer Prices(SA/H, 2005=100)	63%
Japan: Consumer Price Index (SA/H, 2010=100)	20%
U.K.: Harmonized Index of Consumer Prices [HICP] (SA, 2005=100)	44%
US CPI-U: All Items (SA, 1982-84=100)	82%
Australia: Official Cash Rate (EOP, %)	83%
Canada: Overnight Money Market Financing Rate [Target] (EOP, %)	90%
U.K.: Bank of England Official Bank Rate (EOP, %)	94%
Japan: Call Rate: Uncollateralized 3-Month (EOP, %)	42%
US: Federal Funds [effective] Rate (% p.a.)	95%
Domestic Variables	
Real GDP - Total Production GDP	58%
CPI: All groups	61%
CPI: Non-tradables	37%
CPI: Tradables	63%
HLFS: unempd rate (tot) - SA	76%
New Zealand: Trade-Weighted Exchange Rate Index (Oct-31-14=76.44)	78%
New Zealand: 90-Day Bank Bill Yield (AVG, %)	87%
Export Price Index -All Merchandise	76%
Import Price Index Total Merchandise Imports	78%
QSBO: Ecnmy wide - Gen bus sit: SA, net	69%
New Zealand: Capital Index: NZSX All Indexes (EOP, Jun-30-86=1000)	33%

Table 2: Data

Index	Transformation	Description
Domestic	Block	
1	2	Real GDP - Total Household Consumption (SA)
2	2	Real GDP - Total Private Consumption (SA)
3	2	Real GDP - Total Govt Consumption (SA)
4	2	Real GDP - Private Investment Total (SA)
5	2	Real GDP - Govt Investment Total (SA)
6	2	Real GDP - Total Investment (SA)
7	2	Real GDP - Imports Goods Total (SA)
8	2	Real GDP - Imports Services (SA)
9	2	Real GDP - Imports Total (SA)
10	2	Real GDP - Exports of Goods (SA)
11	2	Real GDP - Exports of Services (SA)
12	2	Real GDP - Exports Total (SA)
13	2	Real GDP - Gross National Expenditure (SA)
14	2	Real Prod GDP - Manufacturing - Total (SA) (HOTP, prior to 87q2: RBNZ backdate)
15	2	Real GDP - Total Production GDP
16	2	Real GDP - Private Investment Dwellings (SA) – WARNING rough RB
17	2	QMS - Sales: Total exc meat and dairy (qtly real SA)
18	2	HLFS: emp (tot) - SA
19	2	HLFS: unemp (tot) - SA
20	2	HLFS: Tot no of act hrs wrkd each wk - (SA)
21	2	HLFS: Tot lab force - SA
22	2	HLFS: not in lab force (tot) - SA
23	0	HLFS: Lab force particpation rate (tot) - SA
24	0	HLFS: unempd rate (tot) - SA
25	2	QES: Tot gross earnings: Tot All Ind - SA
26	2	QES: Tot paid hrs: Tot All Ind - SA
27	3	LCI: (S&W rates) All sec combined
28	2	perm & long-term migration - arrivals s.a.
29	2	perm & long-term migration - departures s.a.
30	2	HLFS: Wrkng age pop (tot)- SA
31	3	Housing value % HHold disposable income
32	3	Currency
33	2	Notes & coin held by the public (sa)
34	2	M1 (sa)
35	3	M2
36	3	M3
37	3	PSC
38	3	PSCR
39	2	QUARTERLY HOUSE PRICE INDEX -QUOTABLE VALUE- s.a.
40	2	HPI: Total NZ (for houses, flats, home and income) (sa)
41	3	PPII - Agriculture
42	3	PPIO - Agriculture
43	3	PPII - Manufacturing
44	3	PPIO - Manufacturing
45	3	PPII - Wholesale Trade
46	3	PPIO - Wholesale Trade
47	3	PPII - Retail Trade
48	3	PPIO - Retail Trade
49	3	PPII - All Industries
50	3	PPIO - All Industries
51	3	CPI: Goods component
52	3	CPI: Serv. component
53	3	CPI: All groups
54	3	CPI: All groups less Food (group)
55	3	CPI: Non-tradables
56	3	CPI: Tradables

Table 2: Data

Index	Transformation	Description
57	3	CPI tradables excluding fuel
58	3	Import price index - Petroleum and Petroleum Products
59	3	Import price index - Total Non-Commodity Manufactured Goods
60	3	Import Price Index - Total Non-Oil Commodity Goods
61	3	Import Price Index Total Merchandise Imports
62	3	Import Price Index Capital Goods - Total
63	3	Export price index - Dairy Products (Agricultural)
64	3	Export price index - Meat (Food and Beverages)
65	3	Export price index of Total Manufactures
66	3	Export Price Index -All Merchandise
67	2	Value of Total Merchandise Exports (excludes re-exports) - s.a.
68	2	OTI Value of Total Merchandise Imports - s.a.
69	0	QSBO: Ecnmy wide - Gen bus sit: SA, net
70	0	QSBO: Ecnmy wide - Domestic trading activity - past 3 mths, SA
71	0	QSBO: Ecnmy wide - Domestic trading activity - nxt 3 mths, SA
72	0	RBNZ survey of exp (business) - Exp Ann CPI - 1 year from now
73	0	RBNZ survey of exp (business) - Exp Ann CPI - 2 years from now
74	0	RBNZ survey of exp (business) - Exp 90-day Bank Bill - End current qtr
75	0	RBNZ survey of exp (business) - Exp 90-day Bank Bill - 3qtrs from now
76	0	RBNZ survey of exp (business) - Exp HLFS Unemployment Rate - 1 year ahead
77	0	RBNZ survey of exp (business) - Exp HLFS Unemployment Rate - 2 years ahead
78	0	RBNZ survey of exp (business) - Exp Quarterly CPI - End cur qtr
79	0	RBNZ survey of exp (business) - Exp Qtr CPI - next qtr
80	0	RBNZ survey of exp (business) - Exp Qtr (S.A.) GDP - Previous quarter
81	0	RBNZ survey of exp (business) - Expected Quarterly (S.A.) GDP - Current quarter
82	0	RBNZ survey of exp (business) - Expected Annual % change GDP - 1 year ahead
83	0	RBNZ survey of exp (business) - Expected Annual % change GDP - 2 years ahead
84	0	QSBO - ECONOMY-WIDE - Gen. bus. situation - Seasonally Adjusted
85	0	QSBO - ECONOMY-WIDE - Capacity Utilisation
86	0	QSBO - ECONOMY-WIDE - Exporters Capacity Utilisation
87	0	QSBO - ECONOMY-WIDE - PAST 3 MONTHS - No.s emp
88	0	QSBO - ECONOMY-WIDE - NEXT 3 MONTHS - Domestic Trading Activity (s.a.)
89	0	QSBO - ECONOMY-WIDE - PAST 3 MONTHS - Domestic Trading Activity (s.a.)
90	0	WESTPAC-McDERMOT-MILLER - Consumer Confidence Index
91	0	MARKETSCOPE/UMR SURVEY OF EXP OF INFLATION - Current Inflation
92	0	MARKETSCOPE/UMR SURVEY OF EXP OF INFLATION - Net % Exp Higher Inflation (12 Mths)
93	0	MARKETSCOPE/UMR SURVEY OF EXP OF INFLATION - Exp Inflation (12 Months) - Median
94	3	Total Dwellings - New - value (quarterly total)
95	2	BUILDING WORK PUT IN PLACE - DWELLINGS - TOTAL - SA
96	2	REAL BUILDING WORK PUT IN PLACE - RESIDENTIAL - S.A. (new method)
97	2	REAL BUILDING WORK PUT IN PLACE - NON-RESIDENTIAL - S.A. (new method)
98	2	REAL BUILDING WORK PUT IN PLACE - ALL BUILDINGS - S.A. (new method)
99	2	New Zealand: Nominal Effective Exchange Rate (2010=100)
100	2	New Zealand: Real Eff Exchange Rate: Consumer Price Basis (2010=100)
101	2	New Zealand: Exchange Rate: US (Average, US\$/NZ\$)

Table 2: Data

Index	Transformation	Description
102	2	New Zealand: Exchange Rate: UK (Average, Pounds/NZ\$)
103	2	New Zealand: Exchange Rate: Australia (Average, A\$/NZ\$)
104	2	New Zealand: Exchange Rate: Japan (Average, Yen/NZ\$)
105	2	New Zealand: Trade-Weighted Exchange Rate Index (Oct-31-14=76.44)
106	0	New Zealand: 90-Day Bank Bill Yield (AVG, %)
107	0	New Zealand: 5-Year Government Bond Yield (%)
108	0	New Zealand: 10-Year Government Bond Yield (AVG, %)
109	2	New Zealand: Terms of Trade (SA, 2005=100)
110	2	New Zealand: Capital Index: NZSX All Indexes (EOP, Jun-30-86=1000)
111	2	New Zealand: Gross Index: NZSX All Indexes (EOP, Jun-30-86=1000)
112	2	New Zealand: Industrial Production excl Construction (SA, Q3.09-Q2.10=100)
113	0	Return on assets
114	0	Return on equity
115	0	NZ GDP Forecast Uncertainty
Foreign Block		
1	2	Australia: Nominal Effective Exchange Rate (2010=100)
2	2	Australia: Real Eff Exch Rate: Based on Consumer Prices (2010=100)
3	2	Euro Area: Nominal Effective Exchange Rate (Avg, NSA,2010=100)
4	2	Euro Area: Real Effective Exchange Rate based on rel. CPI (2010=100)
5	2	Japan: Nominal Effective Exchange Rate (Avg, NSA,2010=100)
6	2	Japan: Real Effective Exchange Rate: Consumer Price basis (2010=100)
7	2	United Kingdom: Nominal Effective Exchange Rate (Avg, NSA,2010=100)
8	2	U.K.: Real Effective Exch Rate: Consumer Price basis (2010=100)
9	2	United States: Nominal Effective Exchange Rate (Avg, NSA,2010=100)
10	2	US: Real Effective Exch Rate: Consumer Price basis (2010=100)
11	2	China, PR: Nominal Effective Exchange Rate (2010=100)
12	2	China, PR: Real Effective Exch Rate: Consumer Price basis (2010=100)
13	2	Canada: Nominal Effective Exchange Rate (Avg, NSA,2010=100)
14	2	Canada: Real Effective Exchange Rate: Consumer Price Basis (2010=100)
15	2	Switzerland: JP Morgan Broad Nominal Effective Exchange Rate
16	0	Australia: Official Cash Rate (EOP, %)
17	0	Canada: Overnight Money Market Financing Rate [Target] (EOP, %)
18	0	U.K.: Bank of England Official Bank Rate (EOP, %)
19	0	Australia: 3-Month Bank Accepted Bills (AVG, %)
20	0	U.K.: 3-Month London Interbank Offered Rate: Based on British Pound (AVG, %)
21	0	Japan: Call Rate: Uncollateralized 3-Month (EOP, %)
22	0	U.K.: 3-Month London Interbank Offered Rate: Based on British Pound (EOP, %)
23	0	EA 11-19: 3-Month Average Money Market Rate
24	0	Australia: 5-Year Treasury Bond Yield (EOP, %)
25	0	Australia: 10-Year Treasury Bond Yield (AVG, %)
26	0	Canada: 1-Year Treasury Bill Yield [Last Wednesday] (EOP, %)
27	0	Canada: 5-Year Benchmark Bond Yield [Last Wednesday] (EOP, %)
28	0	Canada: 10-Year Benchmark Bond Yield (AVG, %)
29	0	EA 11-18: 5-Year Benchmark Government Bond Yield (AVG, %)
30	0	EA 11-18: 10-Year Benchmark Government Bond Yield (AVG, %)
31	0	Japan: 1-Year Benchmark Government Bond Yield (AVG, % p.a.)
32	0	Japan: 5-Year Benchmark Government Bond Yield (AVG, % p.a.)
33	0	Japan: 10-Year Benchmark Government Bond Yield (AVG, % p.a.)
34	0	U.K.: 1-Year London Interbank Offered Rate: Based on British Pound (%)
35	0	U.K.: Government Bonds, 5-Year Nominal Par Yield (AVG, %)
36	0	U.K.: Government Bonds, 10-Year Nominal Par Yield (AVG, %)
37	2	Australia: Gross Domestic Product (SA, Mil.Chn.Q3:12-Q2:13.A\$)
38	2	Canada: Gross Domestic Product (SA, Mil.Chn.2007.C\$)
39	2	Japan: Gross Domestic Product (SA, Bil.Chn.2005.Yen)
40	2	U.K.: Gross Domestic Product (SA, Mil.Chained.2011.Pounds)

Table 2: Data

Index	Transformation	Description
41	2	China: Gross Domestic Product (SA, Bil.2010.Yuan)
42	2	EURO Area GDP
43	2	Australia, CPI, SA
44	2	Canada: Consumer Price Index (SA, 2002=100)
45	2	EA 11-18: Monetary Union: Index of Consumer Prices(SA/H, 2005=100)
46	2	Japan: Consumer Price Index (SA/H, 2010=100)
47	2	U.K.: Harmonized Index of Consumer Prices [HICP] (SA, 2005=100)
48	2	Canada: Industrial Price Index: All Commodities (SA, 2010=100)
49	2	EA 18: PPI: Industry excluding Construction (SA, 2010=100)
50	2	Japan: Output Price: Manufacturing (SA, 2005=100)
51	2	U.K.: PPI: Net Output Prices: Manufactured Products (SA, 2010=100)
52	2	Australia: Terms of Trade (SA, 2005=100)
53	2	Japan: Terms of Trade (SA, 2010=100)
54	2	US: Terms of Trade (SA, 2005=100)
55	2	Australia: Import Price Index (SA, Q3.2011-Q2.2012=100)
56	2	Japan: Import Price Index: All Commodities (SA, 2010=100)
57	2	U.K.: Import Price Index: Total Goods (SA, 2011=100)
58	2	Australia: Export Price Index (SA, Q3.2011-Q2.2012=100)
59	2	Japan: Export Price Index: All Commodities (SA, 2010=100)
60	2	Australia: Industrial Production excl Construction (SA, Q3:12-Q2:13=100)
61	2	Canada: Industrial Production: Manufacturing, Mining & Utilities (SA, 2007=100)
62	2	EA 18: IP: Industry excluding Construction (SA/WDA, 2010=100)
63	2	U.K.: Industrial Production excluding Construction (SA, 2011=100)
64	0	Australia: Unemployment Rate (SA, %)
65	0	Canada: Unemployment Rate: 15 Years and Over (SA, %)
66	0	Japan: Unemployment Rate (SA, %)
67	0	U.K.: Unemployment Rate: Aged 16 and Over [3-Mo Moving Avg](SA, %)
68	0	Australia: NAB Business Survey: Capacity Utilization (NSA, %)
69	0	Japan: Operating Rate: Manufacturing (NSA, 2010=100)
70	0	Australia: NAB Business Survey: Capacity Utilization (SA, %)
71	0	Canada: Capacity Utilization: Total Industrial (SA, %)
72	0	EA 17: Capacity Utilization: Manufacturing (SA, %)
73	0	Japan: Operating Rate: Manufacturing (SA, 2010=100)
74	2	Australia: Imports of Goods, cif (SA, Mil.A\$)
75	2	Canada: Imports of Goods, BOP Basis (SA, Mil C\$)
76	2	Japan: Imports of Goods (SA, Bil.Yen)
77	2	U.K.: Imports of Goods (SA, Mil.Pounds)
78	2	Australia: Exports of Goods, fob (SA, Mil.A\$)
79	2	Canada: Exports of Goods, BOP Basis (SA, Mil.C\$)
80	2	Japan: Exports of Goods (SA, Bil.Yen)
81	2	U.K.: Exports of Goods (SA, Mil.Pounds)
82	2	World Bank Commodity Price Index for Emerging Countries: NonEnergy (2010=100)
83	2	World Bank Commodity Price Index for Emerging Countries: Agriculture (2010=100)
84	2	WB Commodity Price Index for Emerging Countries: Metals & Minerals (2010=100)
85	2	World: Commodity Price Index: All Commodities (2010=100)
86	2	World: Non-fuel Primary Commodities Index (2010=100)
87	2	World: Commodity Price Index: Metals (2010=100)
88	2	World: Commodity Price Index: Agricultural Raw Materials (2010=100)
89	2	World: Commodity Price Index: Food & Beverage (2005=100)
90	2	Dubai Oil Price
91	2	G7 Index: Share Price Index (US\$ Dec-31-76=100)
92	2	Australia: Stock Price Index: All Ordinaries (AVG, Jan-01-80=500)

Table 2: Data

Index	Transformation	Description
93	2	Canada: S&P/TSX Composite Index, Close Price (AVG, 1975=1000)
94	2	Japan: Nikkei Stock Average: TSE 225 Issues (AVG, May-16-49=100)
95	2	U.K.: London Stock Exchange: FTSE 100 (AVG, Jan-2-84=1000)
96	2	Germany: Capital Market Indexes: DAX 100 (EOP, Dec-30-87=500)
97	2	Shanghai Stock Exc.
US	Block	
98	2	Industrial Production Index (SA, 2007=100)
99	2	Industrial Production: Mining (SA, 2007=100)
100	2	Industrial Production: Electric and Gas Utilities (SA, 2007=100)
101	2	Industrial Production: Nondurable Manufacturing (SA, 2007=100)
102	2	Industrial Production: Durable Goods [NAICS] (SA, 2007=100)
103	2	Industrial Production: Manufacturing [NAICS] (SA, 2007=100)
104	2	Industrial Production: Final Products (SA, 2007=100)
105	2	Industrial Production: Consumer Goods (SA, 2007=100)
106	2	Industrial Production: Durable Consumer Goods (SA, 2007=100)
107	2	Industrial Production: Nondurable Consumer Goods (SA, 2007=100)
108	2	Industrial Production: Business Equipment (SA, 2007=100)
109	2	Industrial Production: Materials (SA, 2007=100)
110	2	Industrial Production: Durable Goods Materials (SA, 2007=100)
111	2	Industrial Production: Nondurable Goods Materials (SA, 2007=100)
112	2	Personal Income (SAAR, Bil.\$)
113	2	Personal Current Transfer Receipts (SAAR, Bil.\$)
114	2	US: Industrial Production excluding Construction (SA, 2007=100)
115	2	US: Industrial Production: Manufacturing (SA, 2007=100)
116	2	US: IP: Intermediate Goods Nonindustrial Supplies (SA, 2007=100)
117	2	US: Industrial Production: Capital Goods Business Equipment (SA, 2007=100)
118	0	US: Capacity Utilization: Manufacturing (SA, %)
119	0	US: Conference Board: Consumer Confidence (SA, 1985=100)
120	2	US: Total Employees on Nonfarm Payrolls (SA, Thous)
121	2	US: All Employees: Goods-Producing Industries (SA, Thous)
122	2	US: All Employees: Mining (SA, Thous)
123	2	US: All Employees: Construction (SA, Thous)
124	2	US: All Employees: Manufacturing (SA, Thous)
125	2	US: All Employees: Durable Goods Manufacturing (SA, Thous)
126	2	US: All Employees: Nondurable Goods Manufacturing (SA, Thous)
127	2	US: All Employees: Service-Producing Industries incl Government (SA, Thous)
128	2	US: All Employees: Trade, Transportation & Utilities (SA, Thous)
129	2	US: All Employees: Wholesale Trade (SA, Thous)
130	2	US: All Employees: Retail Trade (SA, Thous)
131	2	US: All Employees: Financial Activities (SA, Thous)
132	2	US: All Employees: Government (SA, Thous)
133	2	Civilians Unemployed for Less Than 5 Weeks (SA, Thous.)
134	2	Civilians Unemployed for 5-14 Weeks (SA, Thous.)
135	2	Civilians Unemployed for 15-26 Weeks (SA, Thous.)
136	2	Civilians Unemployed for 27 Weeks and Over (SA, Thous.)
137	2	Civilian Labor Force: 16 yr + (SA, Thous)
138	2	US: Unemployed: 16 Years & Over (SA, Thous)
139	0	US: Civilian Unemployment Rate (SA, %)
140	2	Housing Starts (SAAR, Thous.Units)
141	2	Housing Starts: Northeast (SAAR, Thous.Units)
142	2	Housing Starts: Midwest (SAAR, Thous.Units)
143	2	Housing Starts: South (SAAR, Thous.Units)
144	2	Housing Starts: West (SAAR, Thous.Units)
145	0	Housing Authorized, Not Started: US (EOP, NSA, Thous.Units)
146	2	Manufacturers' Shipments of Mobile Homes (SAAR, Thous.Units)
147	0	ISM Mfg: Inventories Index (SA, 50+ = Econ Expand)

Table 2: Data

Index	Transformation	Description
148	0	ISM Mfg: New Orders Index (SA, 50+ = Econ Expand)
149	0	ISM Mfg: Supplier Deliveries Index (SA, 50+ = Slower)
150	2	Stock Price Index: NYSE Composite (Avg, Dec-31-02=5000)
151	2	Stock Price Index: Standard & Poor's 500 Composite (1941-43=10)
152	2	Stock Price Index: Standard & Poor's 500 Industrials (1941-43=10)
153	2	Shiller Cyclically Adjusted S&P Price to Earnings Ratio (Ratio)
154	0	S&P 500 Composite Price/Operating Earnings Ratio (Ratio)
155	0	Federal Funds [effective] Rate (% p.a.)
156	0	3-Month Treasury Bill Market Bid Yield at Constant Maturity (%)
157	0	6-Month Treasury Bill Market Bid Yield at Constant Maturity (%)
158	0	1-Year Treasury Bill Yield at Constant Maturity (%)
159	0	5-Year Treasury Note Yield at Constant Maturity (%)
160	0	10-Year Treasury Bond Yield at Constant Maturity (%)
161	0	Moody's Seasoned Aaa Corporate Bond Yield (% p.a.)
162	0	Moody's Seasoned Baa Corporate Bond Yield (% p.a.)
163	0	SPREAD1
164	0	SPREAD2
165	0	SPREAD3
166	0	SPREAD4
167	0	SPREAD5
168	0	SPREAD6
169	2	Money Stock: M1 (SA, Bil.\$)
170	2	Money Stock: M2 (SA, Bil.\$)
171	0	Velocity of Money: Ratio of Nominal GDP to Money Supply M2 (Ratio)
172	2	Commercial Paper Outstanding: Nonfinancial Issuers (SA, Bil.\$)
173	2	C & I Loans in Bank Credit: All Commercial Banks (SA, Bil.\$)
174	2	Revolving Consumer Credit Outstanding (EOP, SA, Bil.\$)
175	2	PPI: Finished Goods (SA, 1982=100)
176	2	PPI: Finished Consumer Goods (SA, 1982=100)
177	2	PPI: Intermediate Materials, Supplies and Components (SA, 1982=100)
178	2	PPI: Crude Materials for Further Processing (SA, 1982=100)
179	2	CPI-U: All Items (SA, 1982-84=100)
180	2	CPI-U: Apparel Less Footwear (SA, 1982-84=100)
181	2	CPI-U: Transportation (SA, 1982-84=100)
182	2	CPI-U: Medical Care (SA, 1982-84=100)
183	2	CPI-U: Commodities (SA, 1982-84=100)
184	2	CPI-U: Durables (SA, 1982-84=100)
185	2	CPI-U: Services (SA, 1982-84=100)
186	2	CPI-U: All Items Less Food (SA, 1982-84=100)
187	2	CPI-U: All Items Less Shelter (SA, 1982-84=100)
188	2	CPI-U: All Items Less Medical Care (SA, 1982-84=100)
189	2	Avg Hourly Earnings: Prod & Nonsupervisory: Construction (SA, \$/Hr)
190	2	Avg Hourly Earnings: Prod & Nonsupervisory: Manufacturing (SA, \$/Hr)
191	0	University of Michigan: Consumer Expectations (NSA, Q1-66=100)
192	2	Gross Domestic Product (SAAR, Bil.\$)
193	2	Personal Consumption Expenditures: Durable Goods (SAAR, Bil.\$)
194	2	Personal Consumption Expenditures: Nondurable Goods (SAAR, Bil.\$)
195	2	Personal Consumption Expenditures: Services (SAAR, Bil.\$)
196	2	Private Nonresidential Fixed Investment (SAAR, Bil.\$)
197	2	Private Residential Investment (SAAR,Bil.\$)
198	2	Exports of Goods (SAAR, Bil.\$)
199	2	Exports of Services (SAAR, Bil.\$)
200	2	Imports of Goods (SAAR, Bil.\$)
201	2	Imports of Services (SAAR, Bil.\$)
202	2	National Defense Consumption & Gross Investment (SAAR, Bil.\$)
203	2	Federal Government Nondefense Consumption & Gross Investment (SAAR, Bil.\$)
204	2	US: S&P/CASE-SHILLER HOME PRICE INDEX ,SA

Table 2: Data

Index	Transformation	Description
205	0	US Shadow Rate