

Shocked by the world

An open economy FAVAR for New Zealand

Özer Karagedikli and Leif Anders Thorsrud

RBNZ and Norges Bank

16 December 2010

Outline

- 1 Motivation
- 2 Empirical Model
- 3 Results
- 4 Conclusion

Outline

- 1 Motivation
- 2 Empirical Model
- 3 Results
- 4 Conclusion

The views expressed here are the views of the authors and do not necessarily represent the view of the Reserve Bank of New Zealand or the Norges Bank.

Errors all belong to Leif Anders Thorsrud!

The views expressed here are the views of the authors and do not necessarily represent the view of the Reserve Bank of New Zealand or the Norges Bank.

Errors all belong to Leif Anders Thorsrud!

Twitter version

- Will have some 'conventional' results
- Some 'controversial' results
- When we have an empirically 'controversial/irregular' results: what do macroeconomists do?
- Call them **PUZZLES**

The world is not enough?

- Kose, Otrok and Whiteman (2003, AER): common drivers of world economic activity/business cycles
 - Also regional and country specific drivers
- Mumtaz and Surico (forthcoming, JEEA) international drivers of domestic inflation rates
 - Evidence of same international drivers at product level Monacelli and Sala (2009, JMCB) and Karagedikli, Mumtaz and Tanaka (2010)
- Neely and Rapach (2009) international influences together (world and region) explain half of inflation variability

At the same time

- Justiniano and Preston (2009, JIE) show that the world shocks explain very little of domestic variables in structural models
- This issue is also present in the DSGE model of the RBNZ (Benes et al 2009)
- Justiniano and Preston (2009) propose 'correlated shocks'

Our aim

- Analyse the effects of regional and world shocks on New Zealand economy
 - World demand, supply and interest rate shocks
 - Regional demand and supply shocks
 - Domestic monetary policy shock
- By using a Factor Augmented Bayesian VAR (FA(B)VAR)

Why FAVAR?

The FAVAR

- Factor augmented vector autoregression, Bernanke, Boivin and Eliasch (2005)
- Alleviate problem of omitted variable bias, use large data sets
- Better identification, no anomalies

i-FAVAR literature

- FAVAR has been used in international context previously:
- Boivin and Giavonni (2007)
 - Reichlin criticism of Boivin and Giavonni approach:
“[i]n order to estimate the effect of global forces, we need to identify global shocks and their propagation”.
- Mumtaz and Surico (2009, JMCB) for the UK economy
- Eickmeier (2010)
- Baumeister, Liu and Mumtaz (2010), TV-SV FAVAR

Our value added

- A three variable 'factor - VAR' represent the world economy reasonably well
- Addition of regional shocks in addition to the world shocks
 - Taking Kose, Ortok and Whiteman (2003) seriously
- Analysing transmission to a commodity exporter, New Zealand

Why region?

- Australia's importance for New Zealand
 - Free labour and capital mobility, similar institutions
 - Largest trading partner
 - Influence of Australian financial institutions in NZ
- Dungey and Fry (2003) and Hall and McDermott (2008), Coleman and Karagedikli (2010)

Outline

- 1 Motivation
- 2 Empirical Model**
- 3 Results
- 4 Conclusion

The model: A FAVAR

Model, the observation equation:

$$\begin{bmatrix} X^{act*} \\ X^{pri*} \\ X^{r*} \\ X^{act**} \\ X^{pri**} \\ X^D \\ X^{Dr} \end{bmatrix} = \begin{bmatrix} \lambda_{i,act*} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \lambda_{i,pri*} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \lambda_{i,r*} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \lambda_{i,act**} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \lambda_{i,pri**} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \lambda_{i,D} & \lambda_{i,R} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & \lambda_{i,R} \end{bmatrix} \begin{bmatrix} F^{act*} \\ F^{pri*} \\ F^{r*} \\ F^{act**} \\ F^{pri**} \\ F^D \\ R \end{bmatrix} + \epsilon, \quad (1)$$

Model, the transition equation:

$$\begin{bmatrix} F_t \\ R_t \end{bmatrix} = \beta(L) \begin{bmatrix} F_{t-1} \\ R_{t-1} \end{bmatrix} + u_t, \quad (2)$$

Identification

- 6 identified factors: world activity, price and interest rate factor, regional activity and price factor
- Factors: Diagonal structure, but no restrictions on the sign of the loadings
 - World activity factor is estimated from the activity data for example

Shocks: Standard VAR tools

- i) Cholesky: World influences region and domestic block, region influences domestic block, but not world. Domestic block influence only domestic block
 - Ordering; activity, prices, interest rates
- ii) Sign restrictions

Identification cont'd

Sign restrictions:

$$\begin{bmatrix} u^{act*} \\ u^{pri*} \\ u^{r*} \\ u^{act**} \\ u^{pri**} \\ u^D \\ u^{Dr} \end{bmatrix} = \begin{bmatrix} + & + & - & 0 & 0 & 0 & 0 \\ + & - & - & 0 & 0 & 0 & 0 \\ + & - & + & 0 & 0 & 0 & 0 \\ \times & \times & \times & + & + & 0 & 0 \\ \times & \times & \times & + & - & 0 & 0 \\ \times & \times & \times & \times & \times & \times & 0 \\ \times & \times & \times & \times & \times & \times & + \end{bmatrix} \begin{bmatrix} \varepsilon^{demand*} \\ \varepsilon^{supply*} \\ \varepsilon^{r*} \\ \varepsilon^{demand**} \\ \varepsilon^{supply**} \\ \varepsilon^D \\ \varepsilon^R \end{bmatrix} \quad (3)$$

The data

- 388 variables from 28 countries, 50% domestic
- International and regional block: Activity, price and short interest rate measures
- Domestic block: Activity, prices and disaggregated prices, wages, long and short interest rates, exchange rates, immigration and expectations

- Quarterly and monthly data
- Stationary, and normalised
- Sample: 1992Q4 – 2007Q4

Estimation

Two step procedure

Factors

- Principal component analysis; 3 domestic factors, 1 factor from each of the other blocks
- Additional rotation to correctly identify domestic monetary policy shock

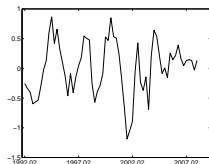
VAR

- Bayesian VAR; independent normal-Wishart prior
- 2 lags

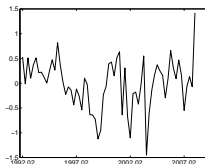
Outline

- 1 Motivation
- 2 Empirical Model
- 3 Results**
- 4 Conclusion

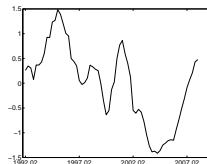
The factors



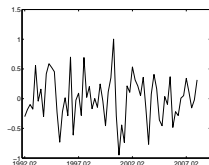
World activity



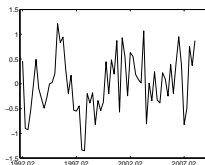
World price



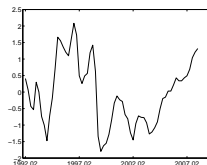
World Interest rate



Regional activity



Regional price



90 Day interest rate

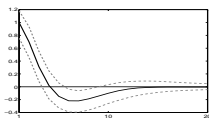
Variance decomposition cont'd

On average:

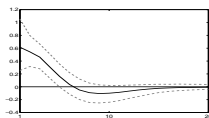
	World			Region		Domestic		R^2
	Act	Pri	R	Act	Pri	NZ	OCR	
Int'l blk	0.50	0.34	0.16	0.00	0.00	0.00	0.00	0.27
Reg'l blk	0.27	0.12	0.18	0.20	0.23	0.00	0.00	0.20
Dom'c blk	0.15	0.15	0.06	0.02	0.02	0.53	0.07	0.35

World is a (S)VAR

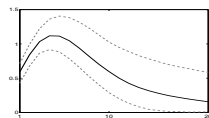
A World SVAR



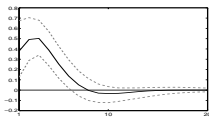
World Activity



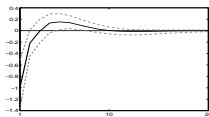
World Prices



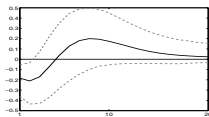
World Interest Rates



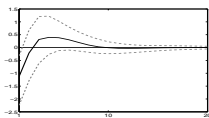
World Activity



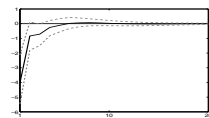
World Prices



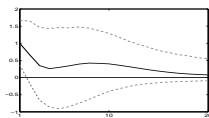
World Interest Rates



World Activity

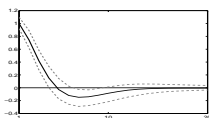


World Prices

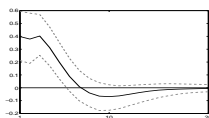


World Interest Rates

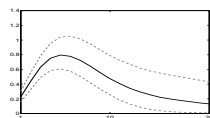
A world SVAR



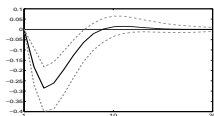
World Activity



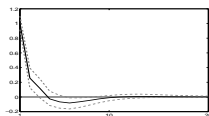
World Prices



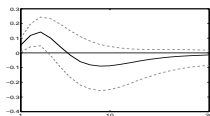
World Interest Rates



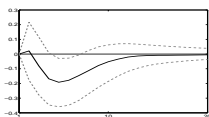
World Activity



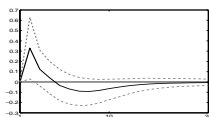
World Prices



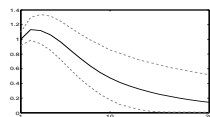
World Interest Rates



World Activity



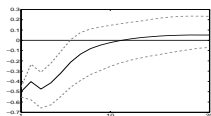
World Prices



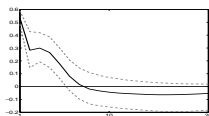
World Interest Rates

Responses to Domestic Monetary Policy Shocks

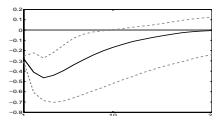
Domestic monetary policy shock



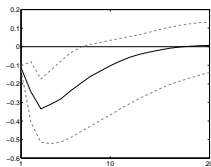
GDP



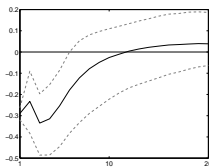
Unemployment



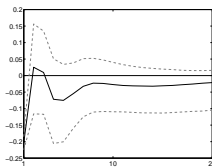
House Prices



Household consumption

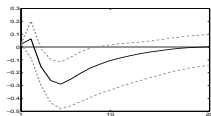


Investment

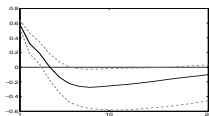


Inflation Expectations

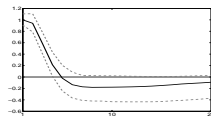
Domestic monetary policy shock



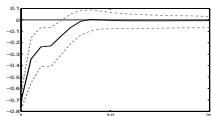
Capacity utilisation



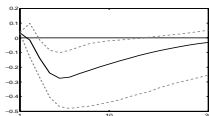
Exchange Rate



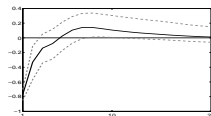
R90D



Inflation

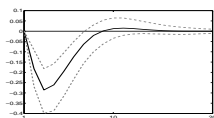


Non-tradable inflation

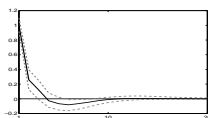


Tradable Inflation

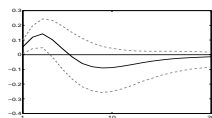
Negative international supply shock



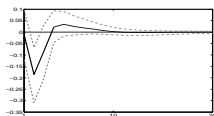
World Activity



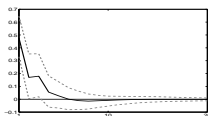
World Prices



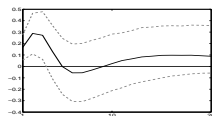
World Interest Rates



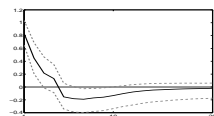
Regional Activity



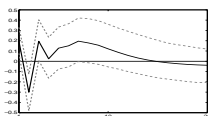
Regional Prices



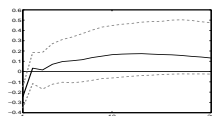
R90D



Tradable Inflation

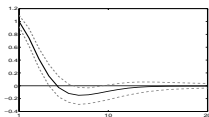


GDP

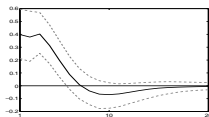


Real TWI

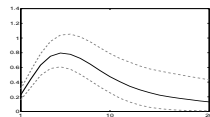
Int'l demand shock - PUZZLE



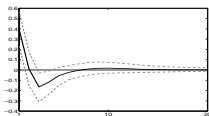
World Activity



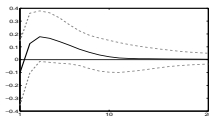
World Prices



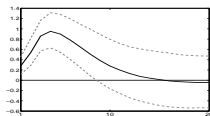
World Interest Rates



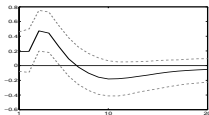
Regional Activity



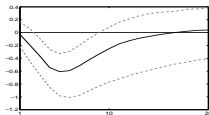
Regional Prices



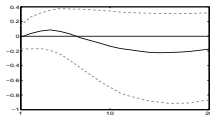
R90D



Inflation

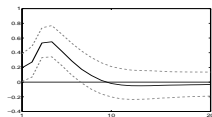


GDP

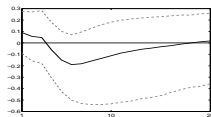


Real TWI

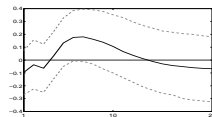
Int'l demand shock - PUZZLE



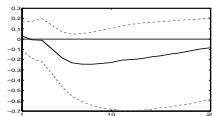
Inflation expectations



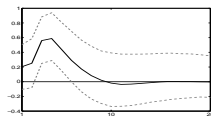
Capacity Utilisation



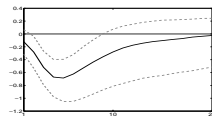
Unemployment rate



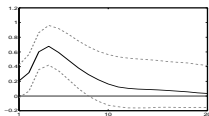
Non-tradable



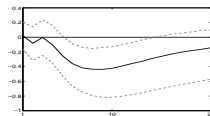
Tradable



Consumption



Import Prices



Terms of Trade

Is this 'negative' transmission from world new?

- **Not really!** Corsetti et al (2008) show effects depends on (explicitly) import and export elasticities and (implicitly) import and export shares
- In the case of UK: Mumtaz and Surico (JMCB, 2009) find the same result.
- In the case of New Zealand: Buckle et al (2002, Treasury SVAR)
- In the case of New Zealand: Haug and Smith (2008, RBNZ)

Or?

- An identification or econometric problem:
- However, the world demand shock seems well identified
- No NZ data in the world 'activity' block. Hence NZ GDP is not loaded onto the World Activity factor
- Earlier VAR lit: US as the foreign economy vs Factor approach (common driver of the world)

Variance decomposition

	World			Region		Domestic		R^2
	Act	Pri	R	Act	Pri	NZ	OCR	
CU	0.03	0.11	0.04	0.05	0.06	0.67	0.04	0.45
CU Man	0.03	0.17	0.06	0.04	0.06	0.60	0.03	0.39
Inf exp 1y	0.25	0.29	0.02	0.01	0.05	0.37	0.01	0.38
Inf exp 2y	0.13	0.29	0.03	0.03	0.08	0.41	0.03	0.23
Com Pri	0.33	0.16	0.01	0.02	0.01	0.47	0.02	0.16
R TWI	0.00	0.04	0.03	0.06	0.11	0.69	0.06	0.79
Emp	0.11	0.18	0.02	0.03	0.10	0.44	0.12	0.56
Unemp	0.04	0.22	0.06	0.05	0.05	0.50	0.10	0.33
Wages	0.04	0.02	0.09	0.03	0.17	0.63	0.01	0.71
Cons	0.28	0.11	0.00	0.02	0.04	0.51	0.03	0.44
GDP	0.22	0.09	0.01	0.04	0.03	0.54	0.07	0.50
Inv	0.18	0.09	0.01	0.04	0.02	0.60	0.05	0.34
Imp	0.24	0.11	0.01	0.03	0.02	0.57	0.03	0.20
Exp	0.04	0.23	0.06	0.08	0.05	0.39	0.16	0.07
CPI	0.10	0.34	0.04	0.02	0.10	0.34	0.06	0.53
NT CPI	0.04	0.07	0.01	0.03	0.15	0.66	0.04	0.41
House P	0.27	0.09	0.01	0.01	0.09	0.49	0.05	0.75
TR CPI	0.12	0.29	0.04	0.04	0.02	0.43	0.05	0.62
90 Day	0.36	0.04	0.06	0.08	0.02	0.31	0.11	1.00
Imp Pri	0.27	0.23	0.03	0.01	0.02	0.44	0.01	0.43
ToT	0.11	0.13	0.04	0.02	0.25	0.33	0.12	0.58

Variance decomposition

	World			Region		Domestic		R^2
	Act	Pri	R	Act	Pri	NZ	OCR	
90 day rate	0.36	0.04	0.06	0.08	0.02	0.31	0.11	1.00
Commodity prices	0.33	0.16	0.01	0.02	0.01	0.47	0.02	0.16
Investment	0.18	0.09	0.01	0.04	0.02	0.60	0.05	0.34
Consumption	0.28	0.11	0.00	0.02	0.04	0.51	0.03	0.44
GDP	0.22	0.09	0.01	0.04	0.03	0.54	0.07	0.50
House prices	0.27	0.09	0.01	0.01	0.09	0.49	0.05	0.75
Import prices	0.27	0.23	0.03	0.01	0.02	0.44	0.01	0.43
Import	0.24	0.11	0.01	0.03	0.02	0.57	0.03	0.20
Export	0.04	0.23	0.06	0.08	0.05	0.39	0.16	0.07
Inflation expectations 1y	0.25	0.29	0.02	0.01	0.05	0.37	0.01	0.38
Inflation expectations 2y	0.13	0.29	0.03	0.03	0.08	0.41	0.03	0.23
Unemployment	0.04	0.22	0.06	0.05	0.05	0.50	0.10	0.33
Employment	0.11	0.18	0.02	0.03	0.10	0.44	0.12	0.56
Inflation	0.10	0.34	0.04	0.02	0.10	0.34	0.06	0.53
Tradable inflation	0.12	0.29	0.04	0.04	0.02	0.43	0.05	0.62
Non-tradable inflation	0.04	0.07	0.01	0.03	0.15	0.66	0.04	0.41
Wages	0.04	0.02	0.09	0.03	0.17	0.63	0.01	0.71
Terms of trade	0.11	0.13	0.04	0.02	0.25	0.33	0.12	0.58
Capacity utilisation	0.03	0.11	0.04	0.05	0.06	0.67	0.04	0.45
Exchange rate	0.00	0.04	0.03	0.06	0.11	0.69	0.06	0.79

Robustness

Results not very sensitive to:

- Lag length or ordering of domestic factors
- Different priors

Number of domestic factors can change the estimated transition mechanisms, but additional factors explain little of the domestic economy and makes the VAR even larger

Outline

- 1 Motivation
- 2 Empirical Model
- 3 Results
- 4 Conclusion**

To sum up

Our contribution:

- We have developed a three block FAVAR
- We estimated international and regional shocks as well as a monetary policy shock
- Analysed how these shocks transmit to the New Zealand economy

Main findings

- World shocks explain 40 percent of the forecast error variance at the 2 year horizon
- International co-movements in prices especially important for main macro variables
- Regional price factor important for non tradable inflation in New Zealand
- Very well identified domestic MP shock: No prize or exchange rate anomalies

World Puzzle

- Negative effects from 'favourable' world shocks
 - Similar results presented but not discussed in earlier VAR lit in NZ and elsewhere
- Corsetti et al (2008) - elasticities matter

Future work

- Simultaneous estimation and/or restrictions on the factor loadings
- Test on other small open economies
- Commodities factor
- Financial factors