Global Factors and Trend Inflation

Güneş Kamber[1] Benjamin Wong[2]

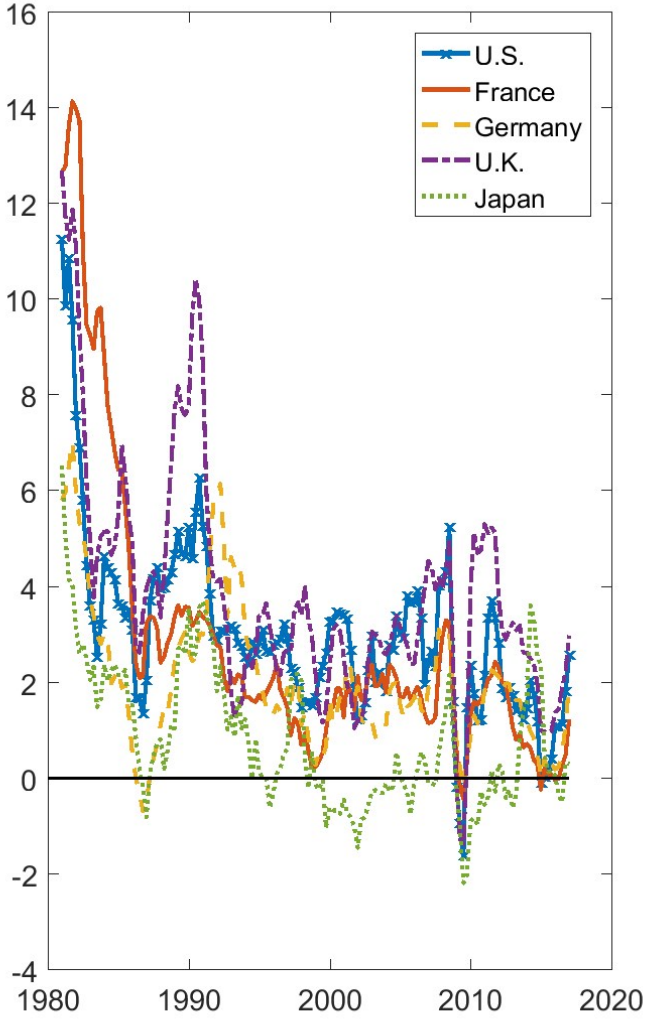
[1]Bank for International Settlements

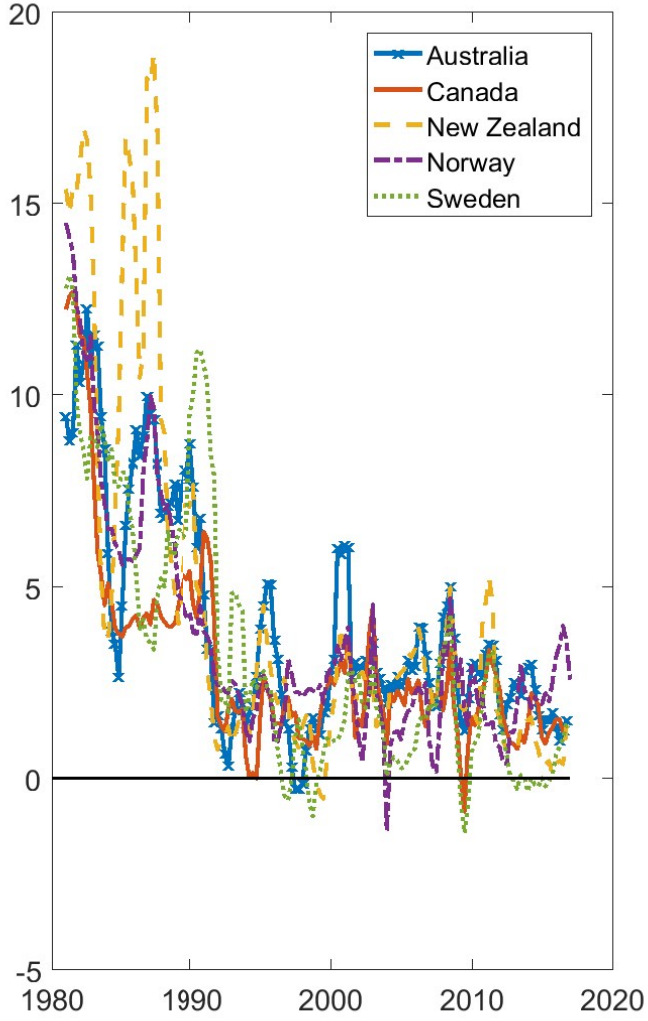
[2]Reserve Bank of New Zealand

The views do not necessarily represent those of the Bank for International Settlements and the Reserve Bank of New Zealand

ECB Conference
Understanding Inflation
Lessons from the Past, Lessons for the future?
September 21-22, 2017

Inflation Co-Moves a Lot!





Introduction

1. Extensively verified (Ciccarelli and Mojon, 2010; Neely and Rapach, 2011; Mumtaz and Surico, 2012)
2. Why?
   - Common shocks (i.e. commodities)
   - Policy (Cecchetti and Watson 2007)
   - Global slack hypothesis (Borio & Filardo, 2007; Bianchi and Civelli 2015)

Monetary Policy Implications

Monetary Policy Implications

"... are central banks still masters of their domestic monetary destinies? Or have they become slaves to global factors?" – *Carney (Jackson Hole, Aug 29, 2015)*

Monetary Policy Implications

> *"... are central banks still masters of their domestic monetary destinies? Or have they become slaves to global factors?" – Carney (Jackson Hole, Aug 29, 2015)*

- It depends...

Monetary Policy Implications

"... are central banks still masters of their domestic monetary destinies? Or have they become slaves to global factors?" – Carney (Jackson Hole, Aug 29, 2015)

- It depends...
- Issue of whether global factors are more permanent or transitory
  - *cf* central banking doctrine to "look through" one off or transitory movements in inflation
  - Theoretically, foreign shocks can affect inflation in the long run only if they are systematically accommodated

Monetary Policy Implications

> *"... are central banks still masters of their domestic monetary destinies? Or have they become slaves to global factors?" – Carney (Jackson Hole, Aug 29, 2015)*

- It depends...
- Issue of whether global factors are more permanent or transitory
  - *cf* central banking doctrine to "look through" one off or transitory movements in inflation
  - Theoretically, foreign shocks can affect inflation in the long run only if they are systematically accommodated

What We Do

- Set up a model to estimate trend inflation
- Decompose trend inflation and the inflation gap into components driven by foreign and domestic shocks

More Precisely...

- We study the role of foreign shocks on inflation dynamics on a group of 5 advanced inflation targeters (Australia, Canada, New Zealand, Norway, and Sweden) and another 10 heterogeneous Asian economies
  - We construct trend inflation and the inflation gap consistent with a FAVAR forecasting model.
  - We quantify the effect of foreign shocks on trend inflation and the inflation gap

More Precisely...

- We study the role of foreign shocks on inflation dynamics on a group of 5 advanced inflation targeters (Australia, Canada, New Zealand, Norway, and Sweden) and another 10 heterogeneous Asian economies
  - We construct trend inflation and the inflation gap consistent with a FAVAR forecasting model.
  - We quantify the effect of foreign shocks on trend inflation and the inflation gap

Three Key Results

1. Foreign shocks are more important for the inflation gap than trend inflation (i.e. they are more transitory in nature)
2. A large share of foreign shocks reflects commodity price, and especially oil price, shocks.
3. Inflation targeting may have negated the effect of foreign shocks on trend inflation.

What we are NOT doing

What we are NOT doing

1. We are not evaluating Globalization hypothesis (ala Borio and Filardo)
   - Though one may think about extending our framework in that direction

What we are NOT doing

1. We are not evaluating Globalization hypothesis (ala Borio and Filardo)
   - Though one may think about extending our framework in that direction
2. We are not estimating global Philips Curves
   - ...but we take a broader view of foreign shocks

What we are NOT doing

1. We are not evaluating Globalization hypothesis (ala Borio and Filardo)
   - Though one may think about extending our framework in that direction
2. We are not estimating global Philips Curves
   - ...but we take a broader view of foreign shocks
3. We are not claiming global shocks do not matter for inflation determination
   - Though we are claiming that they may matter less for policy if one mostly cared about the trend

Concept of Trend Inflation

- We extract trend inflation consistent with the permanent component of a Beveridge-Nelson (1981) decomposition
  - We will assume inflation evolves as a driftless random walk.
  - Long run expectation of the cycle is zero
  - $\tau_t = \lim_{j \to \infty} \mathbb{E}_t \pi_{t+j}$
  - Inflation gap: $\tilde{\pi}_t = \pi_t - \tau_t$
  - Concept of trend is identical to "trend" from a Unobserved Components model (e.g. Stock and Watson 2007, Mertens 2016)
- Forecasting model is an international FAVAR with some bells and whistles

The BN Decomposition

Consider the forecasting model in companion form (e.g. AR(p), VAR(p), VECM)

$$\mathbf{y_t} = \mathbf{B}\mathbf{y_{t-1}} + \boldsymbol{H}\boldsymbol{\nu_t}$$

Let $\Delta\pi_t$ be the k^{th} variable in $\mathbf{y_t}$, therefore (see Morley, 2002)

$$\begin{aligned} \tau_t &= \pi_t + \mathbf{e_k}\mathbf{B}(\mathbf{I}-\mathbf{B})^{-1}\mathbf{y_t} \\ \tilde{\pi}_t &= -\mathbf{e_k}\mathbf{B}(\mathbf{I}-\mathbf{B})^{-1}\mathbf{y_t}. \end{aligned}$$

Iterating will yield (see Morley and Wong, 2017)

$$\begin{aligned} \Delta\tau_t &= \mathbf{e_k}(\mathbf{I}-\mathbf{B})^{-1}\mathbf{H}\boldsymbol{\nu_t} \\ \tilde{\pi}_t &= -\mathbf{e_k}\left\{\sum_{\mathbf{i=0}}^{\mathbf{t-1}} \boldsymbol{B}^{\boldsymbol{i+1}}(\mathbf{I}-\mathbf{B})^{-1}\mathbf{H}\boldsymbol{\nu_{t-i}}\right\} - \mathbf{e_k}\boldsymbol{B}^{\boldsymbol{t+1}}(\mathbf{I}-\mathbf{B})^{-1}\mathbf{e_k}'\boldsymbol{\Delta}\pi_{\mathbf{0}}. \end{aligned}$$

Two Interpretations of the Multivariate BN Representation (Morley and Wong, 2017)

$$\begin{aligned}\Delta\tau_t &= \mathbf{e_k}(\mathbf{I}-\mathbf{B})^{-1}\mathbf{H}\boldsymbol{\nu_t} \\ \tilde{\pi}_t &= -\mathbf{e_k}\left\{\sum_{\mathbf{i=0}}^{\mathbf{t-1}} \boldsymbol{B}^{i+1}(\mathbf{I}-\mathbf{B})^{-1}\mathbf{H}\boldsymbol{\nu}_{t-i}\right\} - \mathbf{e_k}\boldsymbol{B}^{t+1}(\mathbf{I}-\mathbf{B})^{-1}\mathbf{e_k}'\boldsymbol{\Delta}\pi_0.\end{aligned}$$

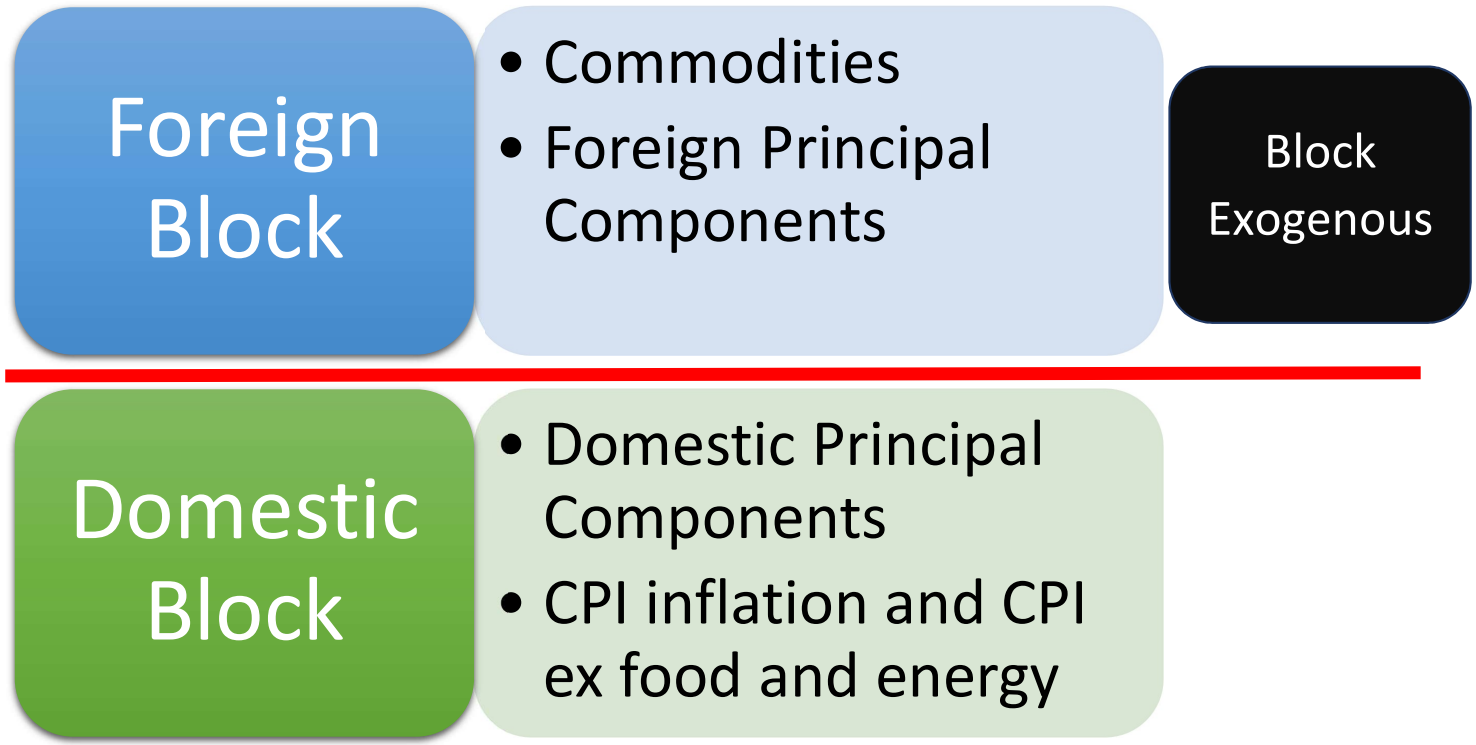
1. Sources of information
   - All the variables feed into the estimate of trend inflation and the inflation gap through their forecast errors
2. Structural Interpretation
   - Overlay standard structural VAR tools (i.e. replace $\boldsymbol{\nu_t} = \mathbf{A}\boldsymbol{\epsilon_t}$).
   - We can tell what drives (opposed to just modeling) the trend and cycle (e.g. UC models)
   - We will identify our foreign shocks through using standard SVAR tools.
   - This representation allows us to do variance decompositions, historical decompositions and decompose inflation between two arbitrary periods through the shocks

Model Overview

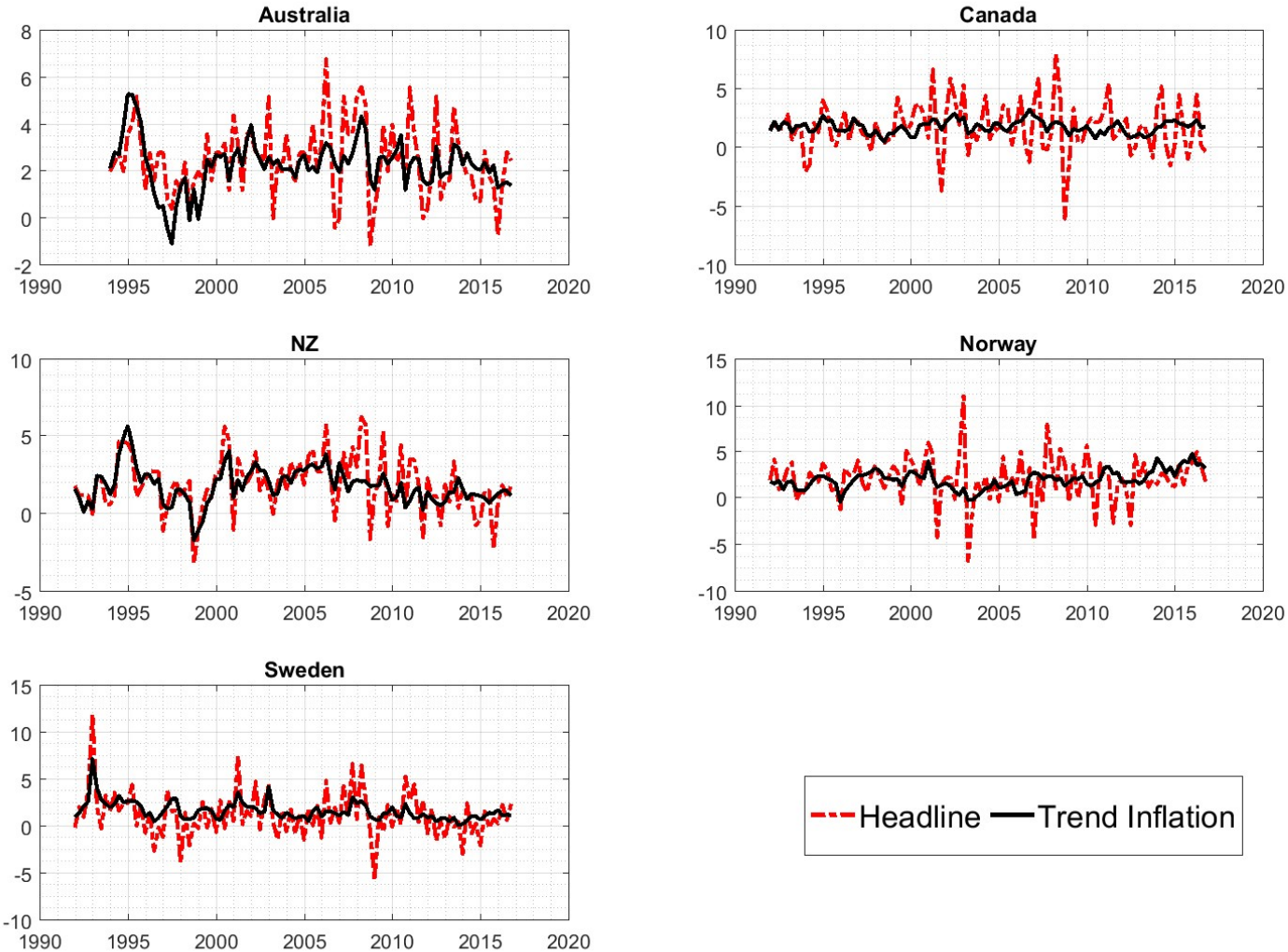
- 2 Main Blocks, 4 Sub-blocks
  1. Commodities sector: Energy, Minerals and Metals, and Agriculture (Fernandez, Schmitt-Grohé and Uribe, forthcoming)
  2. Principal components from large dataset of U.S., U.K., Japan, France and Germany
  3. Principal components from large dataset of domestic variables
  4. Common stochastic trend between CPI and CPIxFE
- We apply standard BVAR shrinkage given sample size and number of variables Prior
- Block exogeneity identify foreign shocks (e.g. Zha 1999; Justiano and Preston 2020).
- We will decompose the share of foreign and domestic shocks on the constructed BN trend and cycle

Sample: 1994Q1 - 2016Q4 for Australia, 1992Q1 - 2016Q4 for the other four benchmark inflation targeters (Canada, New Zealand, Norway and Sweden)

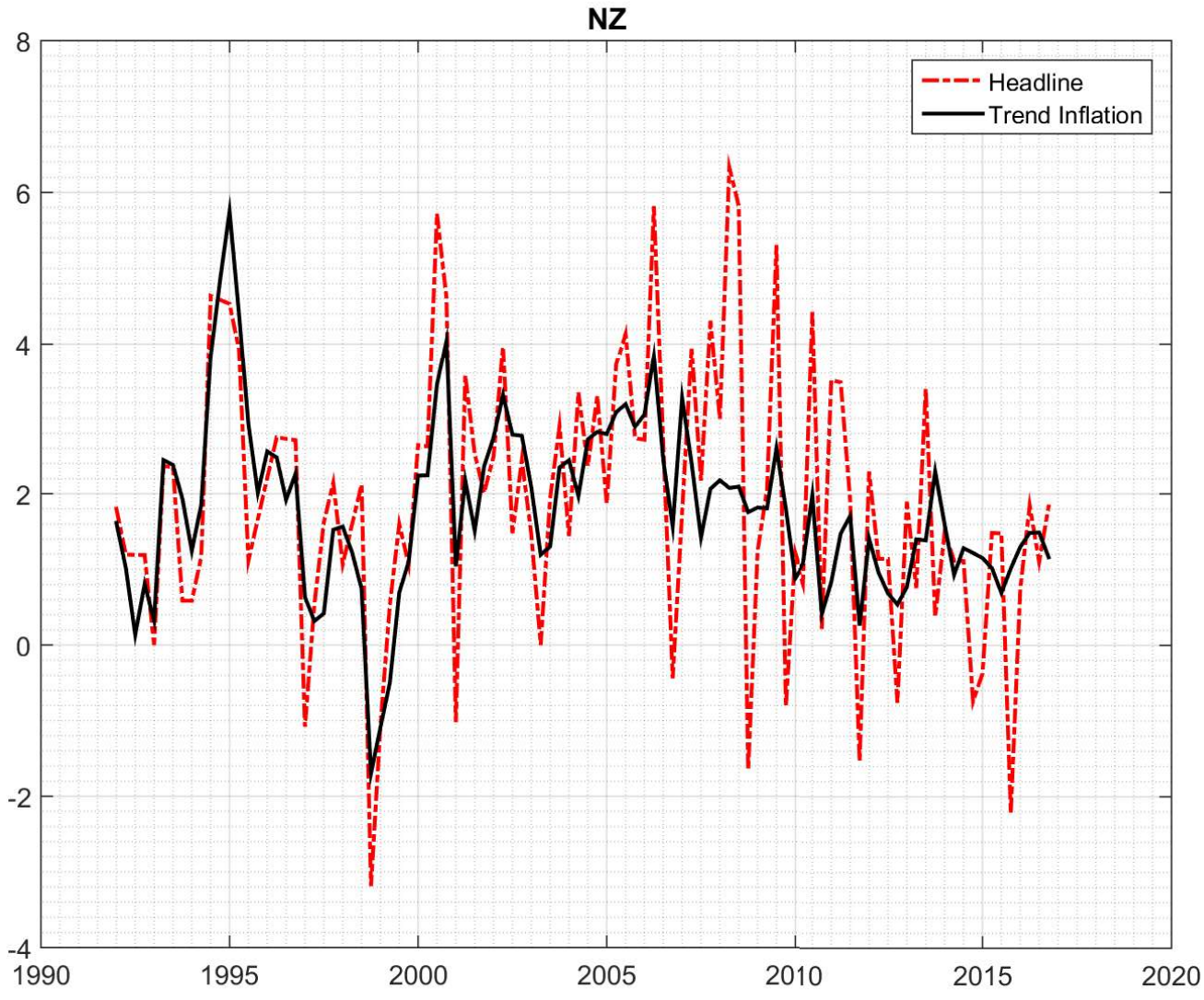
Overview of our model



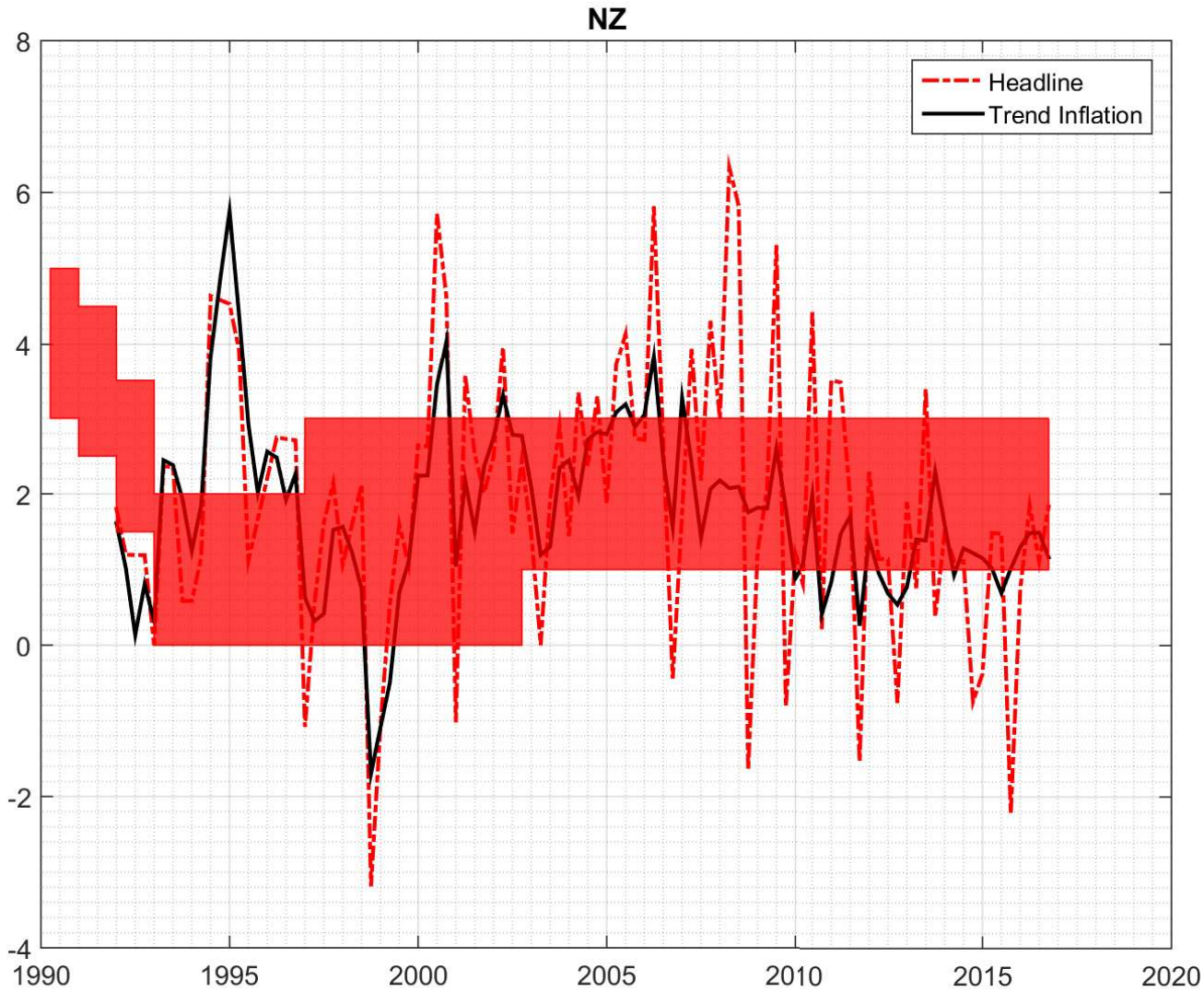
Trend Inflation (Benchmark)



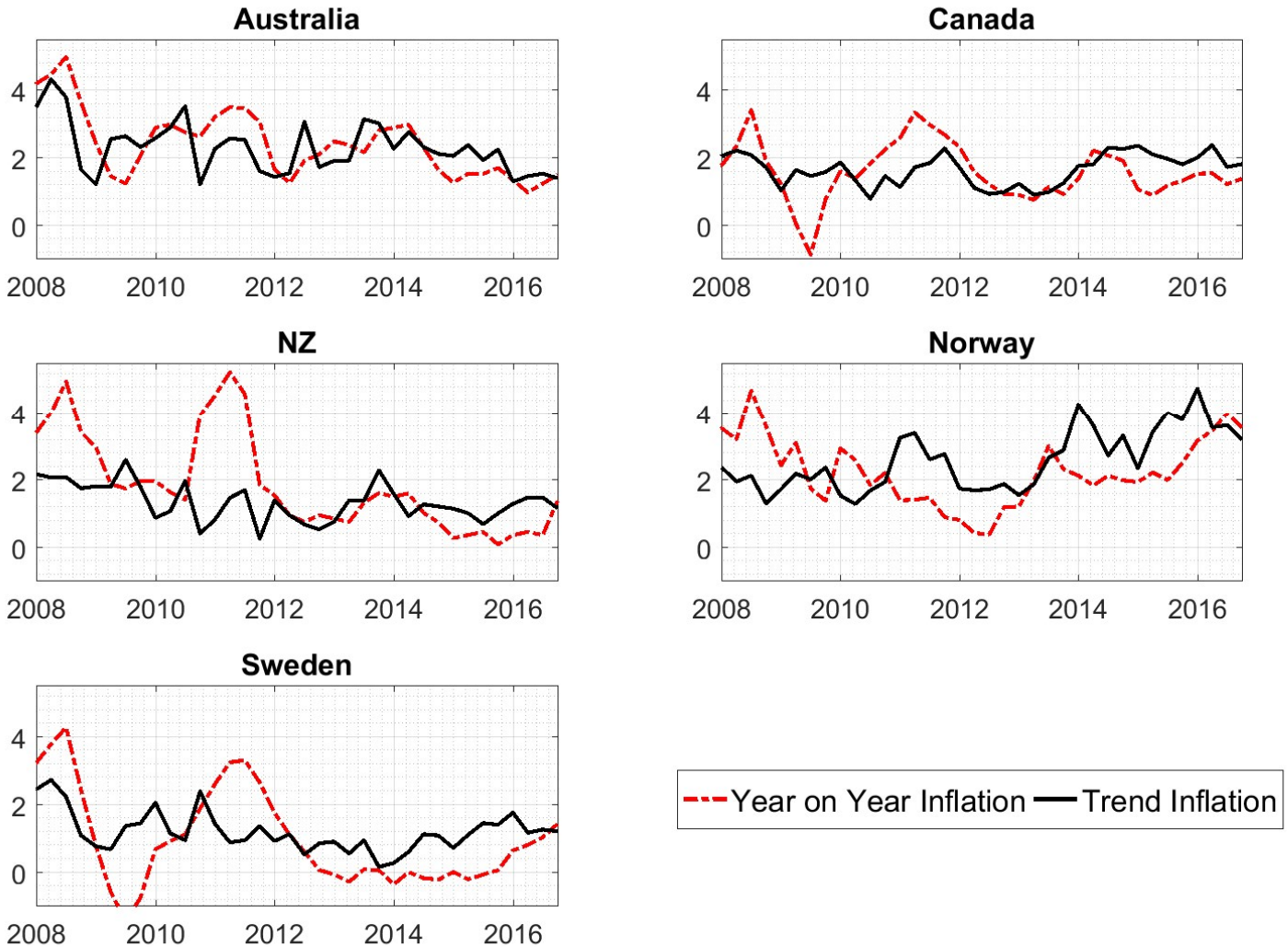
New Zealand Trend Inflation



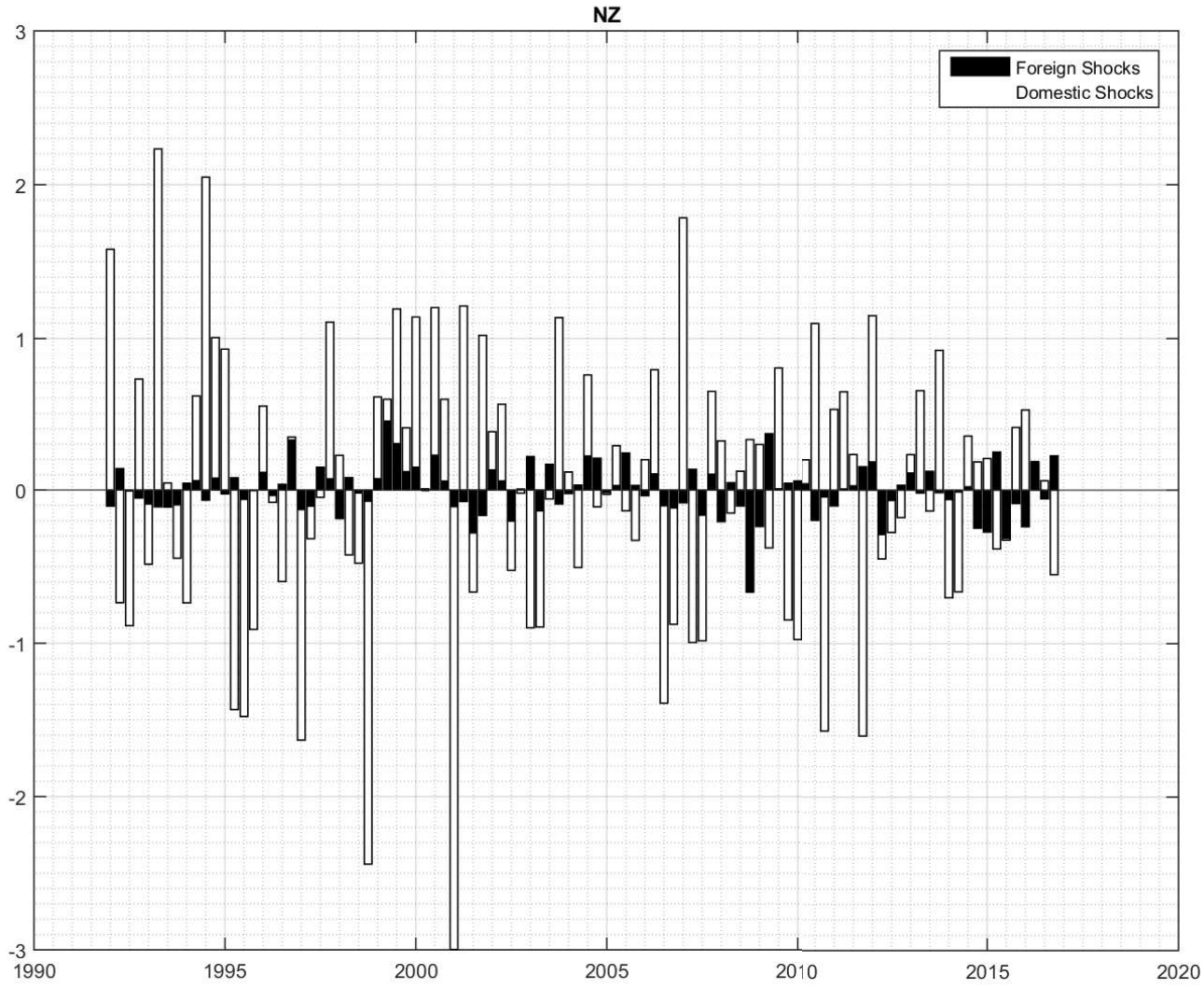
New Zealand Trend Inflation



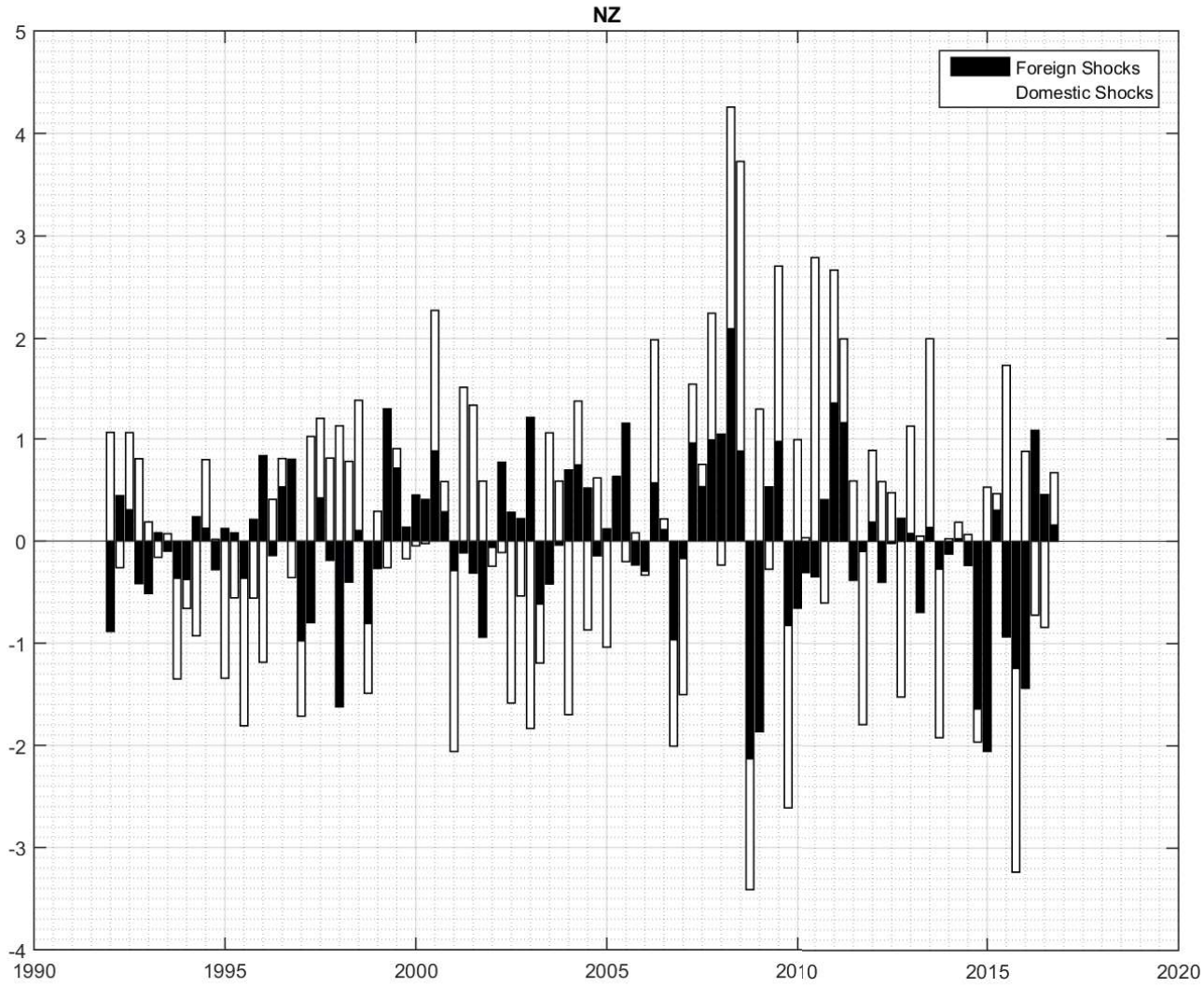
Trend Inflation (Benchmark)



Decompose $\Delta\tau_t$



Decompose c_t



FEVD Inflation Gap

Recall $\tilde{\pi}_t \approx -\mathbf{e_k}\left\{\sum_{\mathbf{i=0}}^{\mathbf{t-1}} \boldsymbol{B}^{\boldsymbol{i+1}}(\mathbf{I}-\mathbf{B})^{-1}\mathbf{H}\boldsymbol{\nu}_{\boldsymbol{t-i}}\right\}$
where $\Delta\pi_t$ be the k^{th} variable and the foreign shocks be the first N^* shocks, $\boldsymbol{\epsilon_t} = \boldsymbol{A}^{-1}\boldsymbol{\nu_t}$.

FEVD Inflation Gap

Recall $\tilde{\pi}_t \approx -\mathbf{e_k}\left\{\sum_{\mathbf{i=0}}^{\mathbf{t-1}} \boldsymbol{B}^{\boldsymbol{i+1}}(\mathbf{I}-\mathbf{B})^{-1}\mathbf{H}\boldsymbol{\nu}_{\boldsymbol{t-i}}\right\}$
where $\Delta\pi_t$ be the k^{th} variable and the foreign shocks be the first N^* shocks, $\boldsymbol{\epsilon_t} = \boldsymbol{A}^{-1}\boldsymbol{\nu_t}$.

$$\begin{aligned}
\tilde{\pi}_{\mathbf{t+h}} - \mathbb{E}_{\mathbf{t-1}}\tilde{\pi}_{\mathbf{t+h}} &= \mathbf{e_k}\left\{\sum_{\mathbf{i=0}}^{\mathbf{h}} \boldsymbol{B}^{\boldsymbol{i+1}}(\mathbf{I}-\mathbf{B})^{-1}\mathbf{H}\boldsymbol{\nu}_{\boldsymbol{t+h-i}}\right\} \\
Var(\tilde{\pi}_{\mathbf{t+h}} - \mathbb{E}_{\mathbf{t-1}}\tilde{\pi}_{\mathbf{t+h}}) &= \mathbf{e_k}\left\{\sum_{\mathbf{i=0}}^{\mathbf{h}} \boldsymbol{B}^{\boldsymbol{i+1}}(\mathbf{I}-\mathbf{B})^{-1}\mathbf{H}\boldsymbol{\Sigma}_{\boldsymbol{\nu}}((\mathbf{I}-\mathbf{B})^{-1})'(\boldsymbol{B}^{\boldsymbol{i+1}})'\right\}\mathbf{e_k}'.
\end{aligned}$$

$$FEVD^{gap} = \frac{\sum_{j=1}^{N^*}\left[\mathbf{e_k}\left\{\sum_{\mathbf{i=0}}^{\infty}\boldsymbol{B}^{\boldsymbol{i+1}}(\mathbf{I}-\mathbf{B})^{-1}\right\}\mathbf{HAe_j'}\right]^2}{\mathbf{e_k}\left\{\sum_{\mathbf{i=0}}^{\infty}\boldsymbol{B}^{\boldsymbol{i+1}}(\mathbf{I}-\mathbf{B})^{-1}\mathbf{H}\boldsymbol{\Sigma}_{\boldsymbol{\nu}}((\mathbf{I}-\mathbf{B})^{-1})'(\boldsymbol{B}^{\boldsymbol{i+1}})'\right\}\mathbf{e_k}'}.$$

FEVD Trend Inflation

Recall $\mathbf{e_k}(\mathbf{I} - \mathbf{B})^{-1}\mathbf{H}\boldsymbol{\nu_t}$

FEVD Trend Inflation

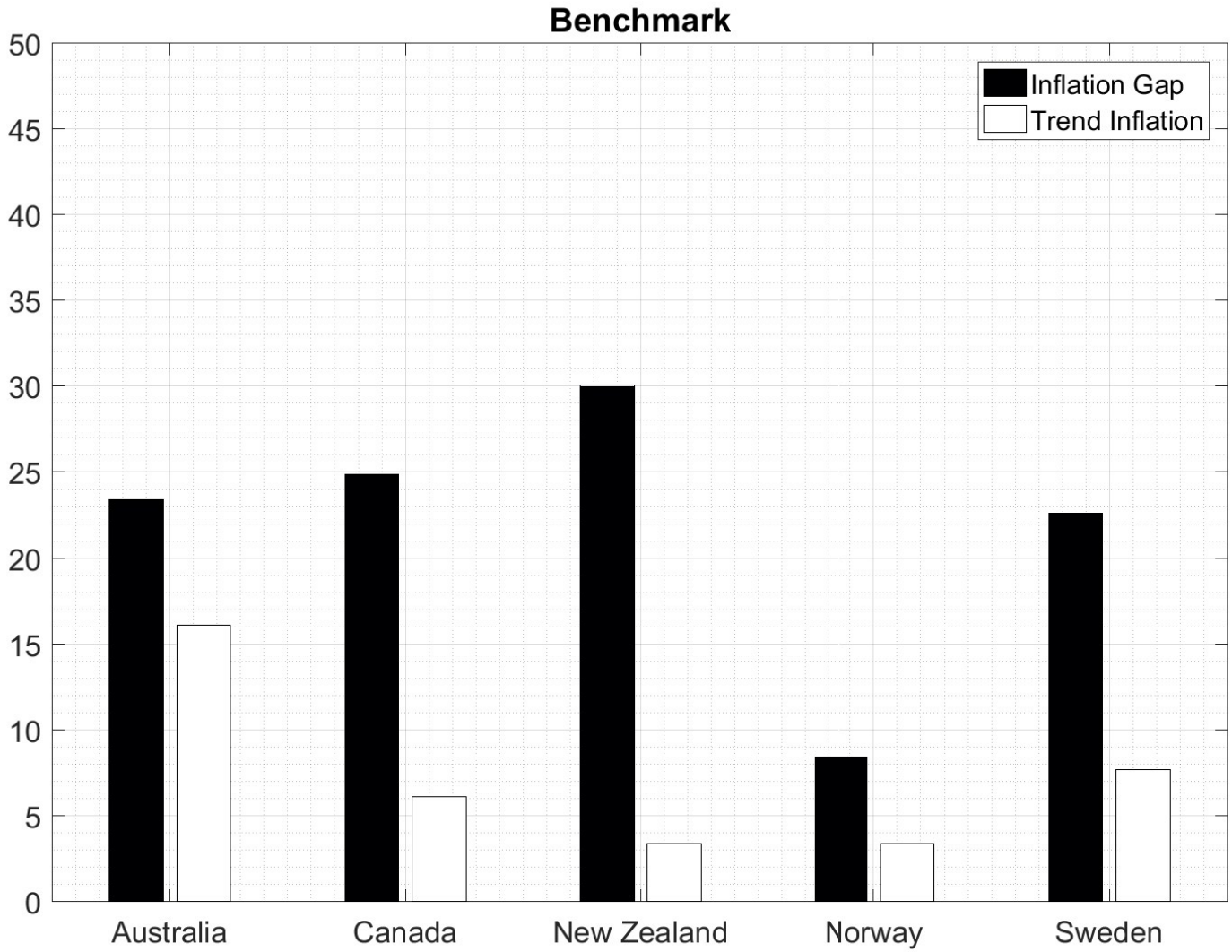
Recall $\mathbf{e_k}(\mathbf{I}-\mathbf{B})^{-1}\mathbf{H}\boldsymbol{\nu_t}$

$$Var(\boldsymbol{\Delta\tau_t} - \mathbb{E}_{\boldsymbol{t-1}}\boldsymbol{\Delta\tau_t}) = \mathbf{e_k}(\mathbf{I}-\mathbf{B})^{-1}\mathbf{H}\boldsymbol{\Sigma_\nu}((\mathbf{I}-\mathbf{B})^{-1})'\mathbf{e_k}'.$$

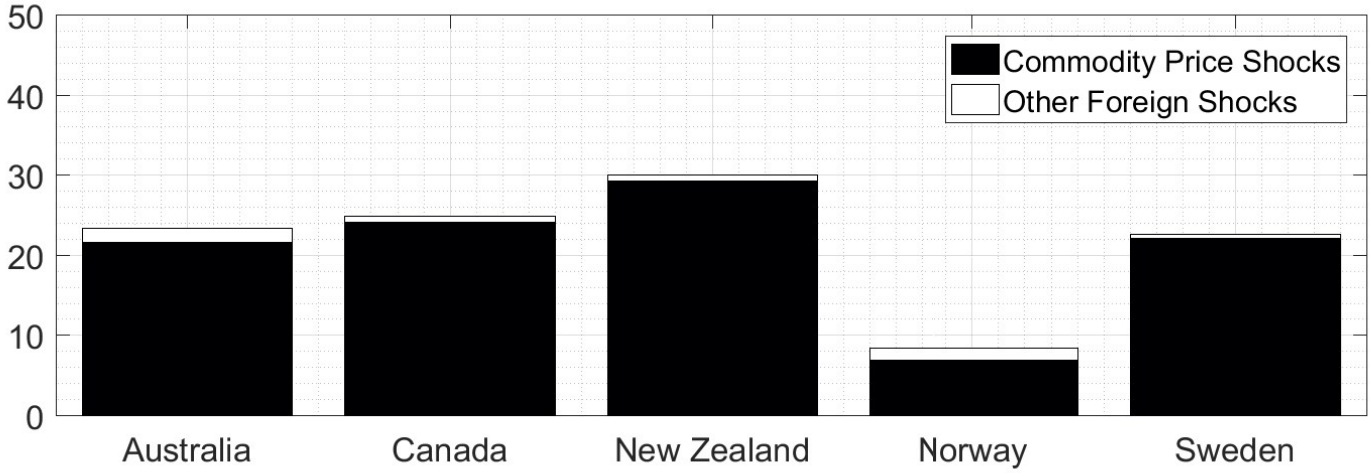
$$FEVD^{\Delta\tau} = \frac{\sum_{j=1}^{N^*}\left[\mathbf{e_k}(\mathbf{I}-\mathbf{B})^{-1}\mathbf{H}\mathbf{A}\mathbf{e_j}'\right]^2}{\mathbf{e_k}(\mathbf{I}-\mathbf{B})^{-1}\mathbf{H}\boldsymbol{\Sigma_\nu}((\mathbf{I}-\mathbf{B})^{-1})'\mathbf{e_k}'}.$$

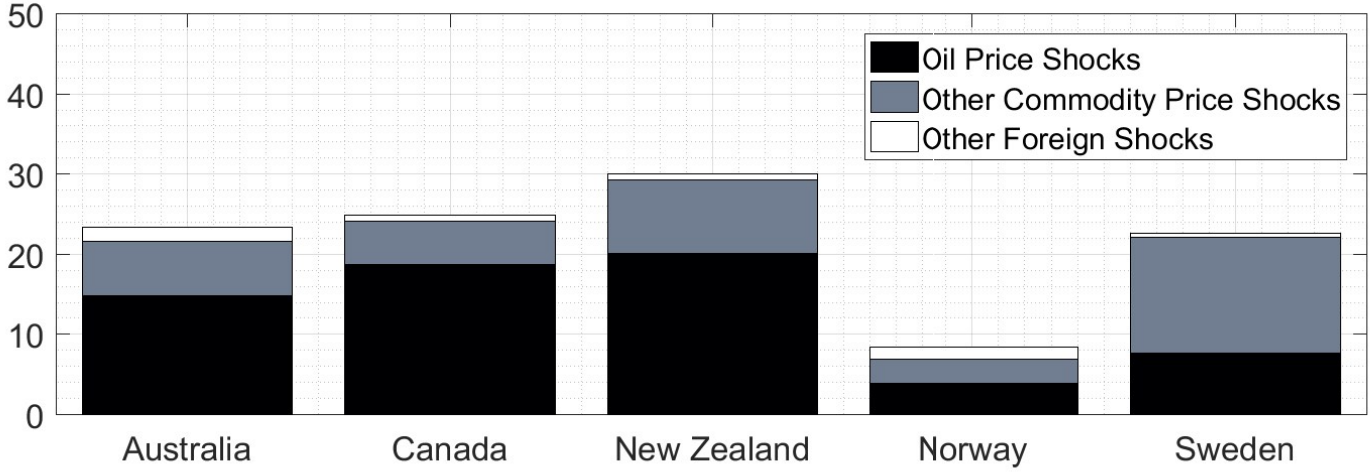
Share of Foreign Shocks

Asian Countries



Share of Foreign Shocks





Decompose two low inflation periods

1. Great Recession: 2008Q1 - 2009Q1 Go to Figure
2. Oil Price Collapse: 2014Q3 - 2016Q1 Go to Figure

$\pi_t = \tau_t + \hat{\pi}_t$

Decompose two low inflation periods

1. Great Recession: 2008Q1 - 2009Q1 Go to Figure
2. Oil Price Collapse: 2014Q3 - 2016Q1 Go to Figure

$$\pi_t = \tau_t + \hat{\pi}_t$$

$$\pi_{t+h} - \pi_t = [\tau_{t+h} + \hat{\pi}_{t+h}] - [\tau_t + \hat{\pi}_t]$$

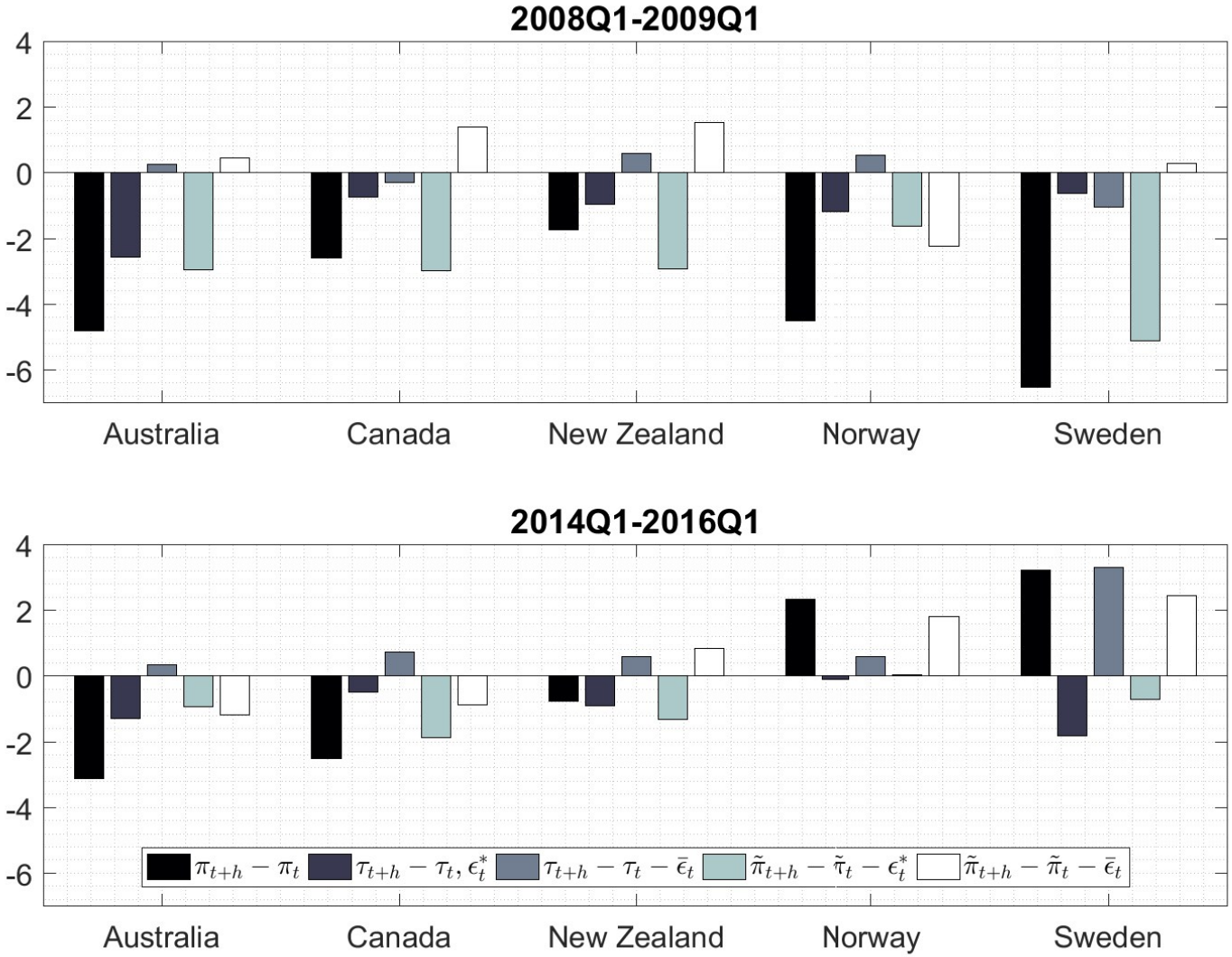
Decompose two low inflation periods

1. Great Recession: 2008Q1 - 2009Q1 Go to Figure
2. Oil Price Collapse: 2014Q3 - 2016Q1 Go to Figure

$$\pi_t = \tau_t + \hat{\pi}_t$$

$$\begin{aligned}
\pi_{t+h} - \pi_t &= [\tau_{t+h} + \hat{\pi}_{t+h}] - [\tau_t + \hat{\pi}_t] \\
&= [\tau_{t+h} - \tau_t] + [\hat{\pi}_{t+h} - \hat{\pi}_t] \\
&= \sum_{j=0}^{h} \Delta\tau_{t+j} + [\hat{\pi}_{t+h} - \hat{\pi}_t] \\
&= \underbrace{\sum_{j=0}^{h} \Delta\tau^F_{t+j} + [\hat{\pi}^F_{t+h} - \hat{\pi}^F_t]}_{\text{from foreign shocks}} + \underbrace{\sum_{j=0}^{h} \Delta\tau^D_{t+j} + [\hat{\pi}^D_{t+h} - \hat{\pi}^D_t]}_{\text{from domestic shocks}}
\end{aligned}$$

Decompose Inflation

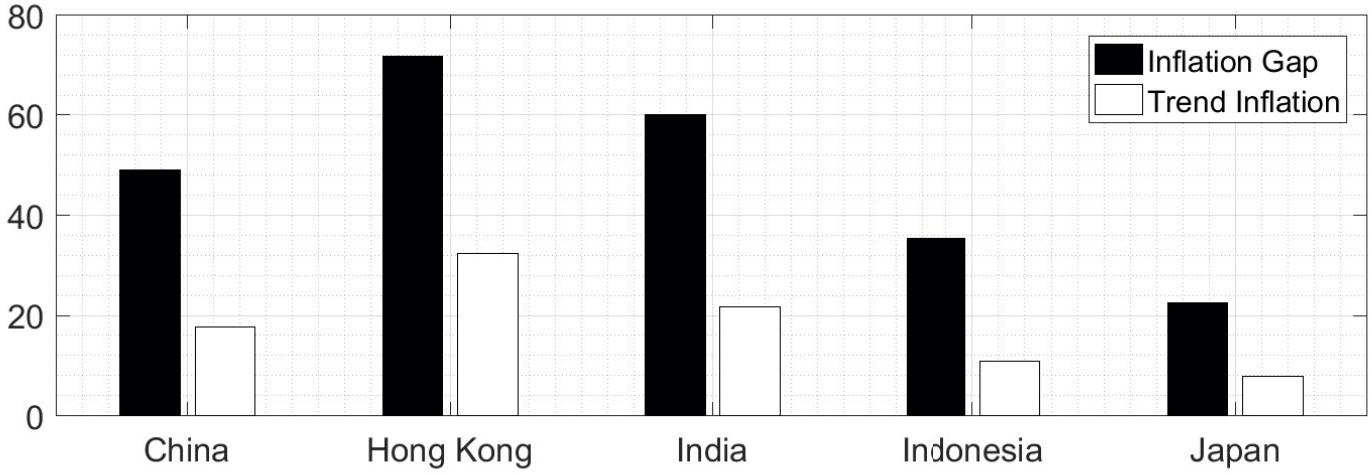


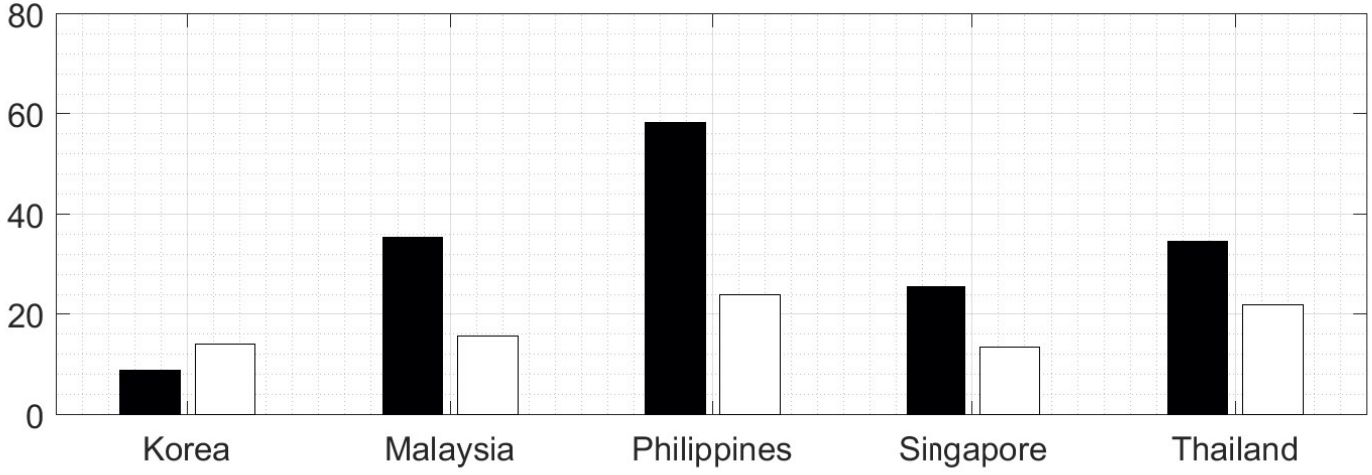
Extending to a Group of Asian Countries

- More heterogeneous
- Robustness/Comparison
- Data is more limited
- Data quality is more of a concern

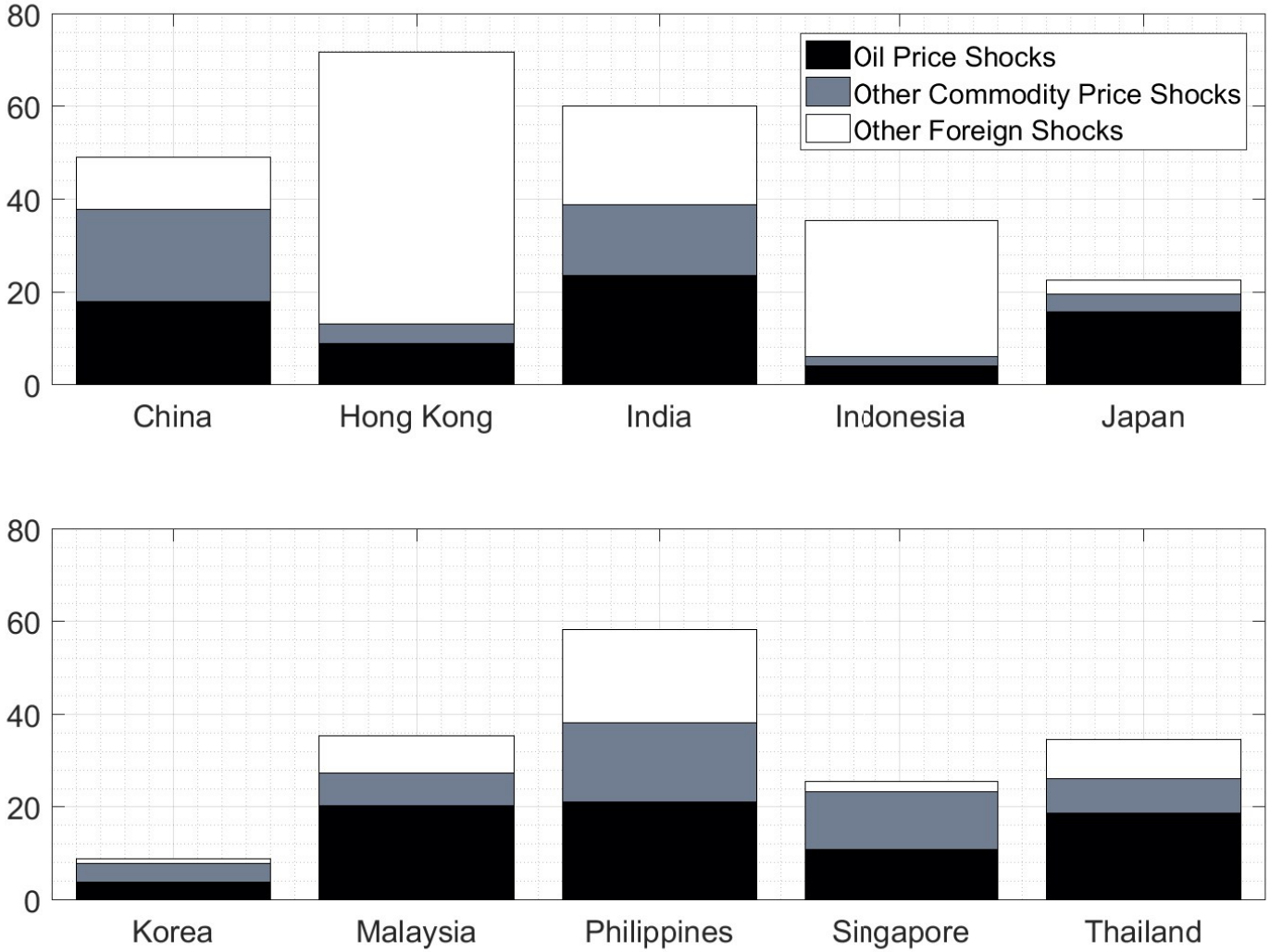
Share of Foreign Shocks

Benchmark





Share of Foreign Shocks



Comparing the Inflation Targeting Benchmark Group Against the Asian Countries

Two main conclusions seem to hold more generally

1. Foreign shocks matter more for the inflation gap than trend inflation.
2. Foreign shocks reflect commodity price and oil price shocks.

Comparing the Inflation Targeting Benchmark Group Against the Asian Countries

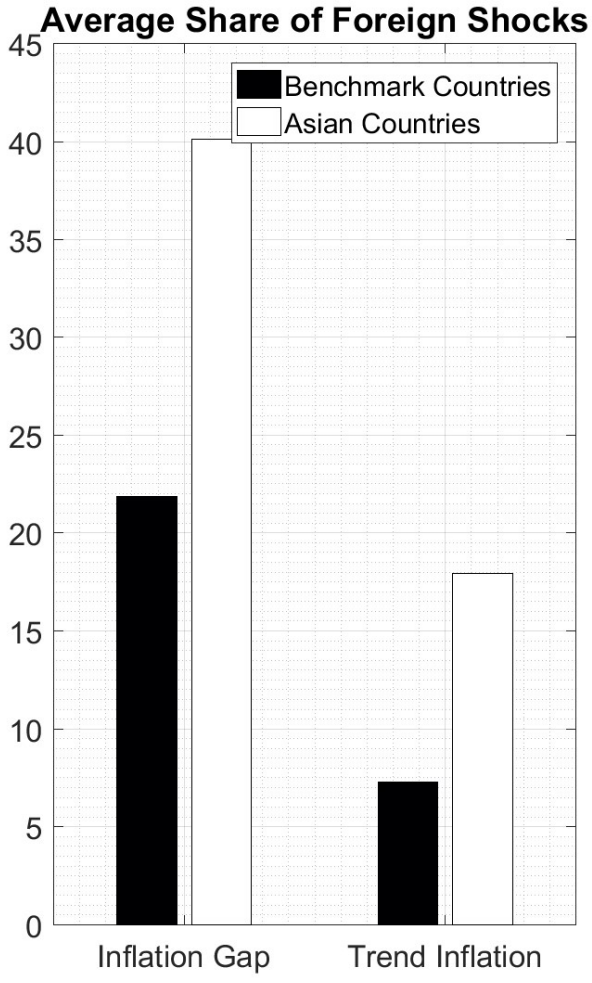
Two main conclusions seem to hold more generally

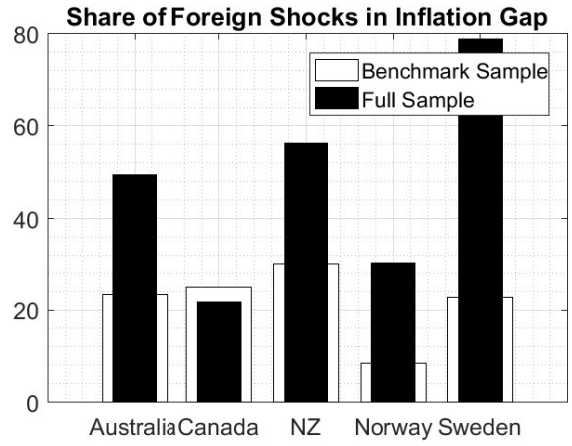
1. Foreign shocks matter more for the inflation gap than trend inflation.
2. Foreign shocks reflect commodity price and oil price shocks.

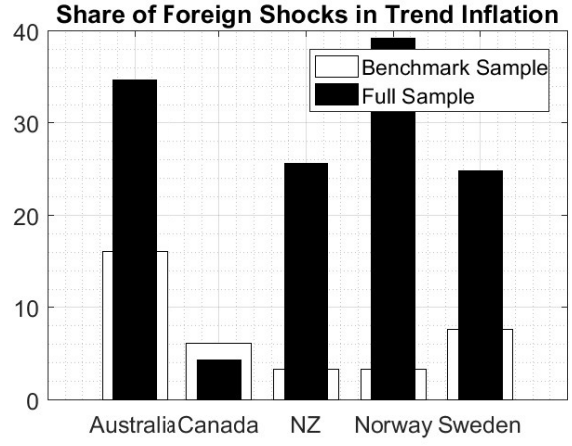
Does inflation targeting matter?

- Natural test for whether inflation is a domestic monetary phenomenon.

Does Inflation Targeting Matter?







Notes: Results for benchmark sample are for the five countries with samples beginning in the 1990s. Full sample refers to estimation for the benchmark countries estimation beginning in: Australia 1990Q1, Canada 1984Q3, New Zealand 1986Q2, Norway 1981Q2, Sweden 1987Q2.

Conclusions

We ask

1. Do foreign shocks matter for inflation?
2. If so, what are the monetary policy implications

Conclusions

We ask

1. Do foreign shocks matter for inflation?
2. If so, what are the monetary policy implications

We develop an open economy model of trend inflation and find

- Foreign shocks are more important for the inflation gap than trend inflation (i.e. they are more transitory in nature).
- A large share of foreign shocks reflects commodity price, and especially oil price, shocks.
- Inflation targeting may have negated the effect of foreign shocks on trend inflation.

Returning to Our Question...

"... are central banks still masters of their domestic monetary destinies?
Or have they become slaves to global factors?"
– Carney

Returning to Our Question...

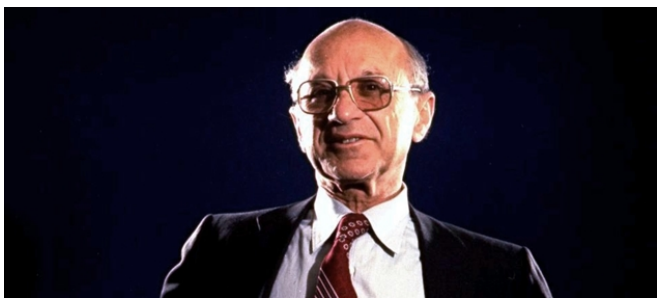
"... are central banks still masters of their domestic monetary destinies? YES!
Or have they become slaves to global factors?"
– Carney

Returning to Our Question...

"... are central banks still masters of their domestic monetary destinies? YES!
Or have they become slaves to global factors?" NO!
– Carney

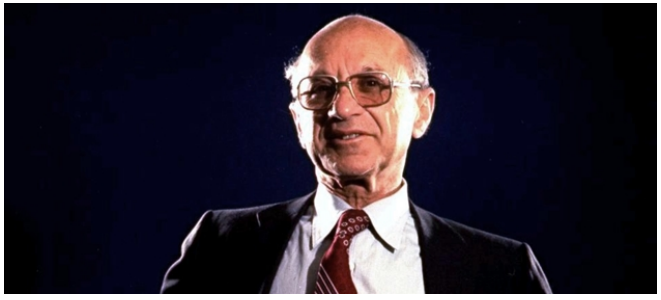
Returning to Our Question...

"... are central banks still masters of their domestic monetary destinies? YES!
Or have they become slaves to global factors?" NO!
– Carney



Returning to Our Question...

"... are central banks still masters of their domestic monetary destinies? YES!
Or have they become slaves to global factors?" NO!
– Carney



"Inflation is always and everywhere a (domestic) monetary phenomenon ..."* – Friedman
*Inserted by Kamber and Wong...

The Priors

VAR slope coefficients

$$\mathbb{E}(\beta_{i,j}^{p}) = 0 \tag{1}$$

$$\mathbb{V}(\beta_{i,j}^{p}) = \begin{cases} \frac{\lambda^2}{p^2}, & \text{if i} = \text{j} \\ \frac{\lambda^2}{p^2}\frac{\sigma_i^2}{\sigma_j^2}, & \text{otherwise} \end{cases}. \tag{2}$$

Error correction term

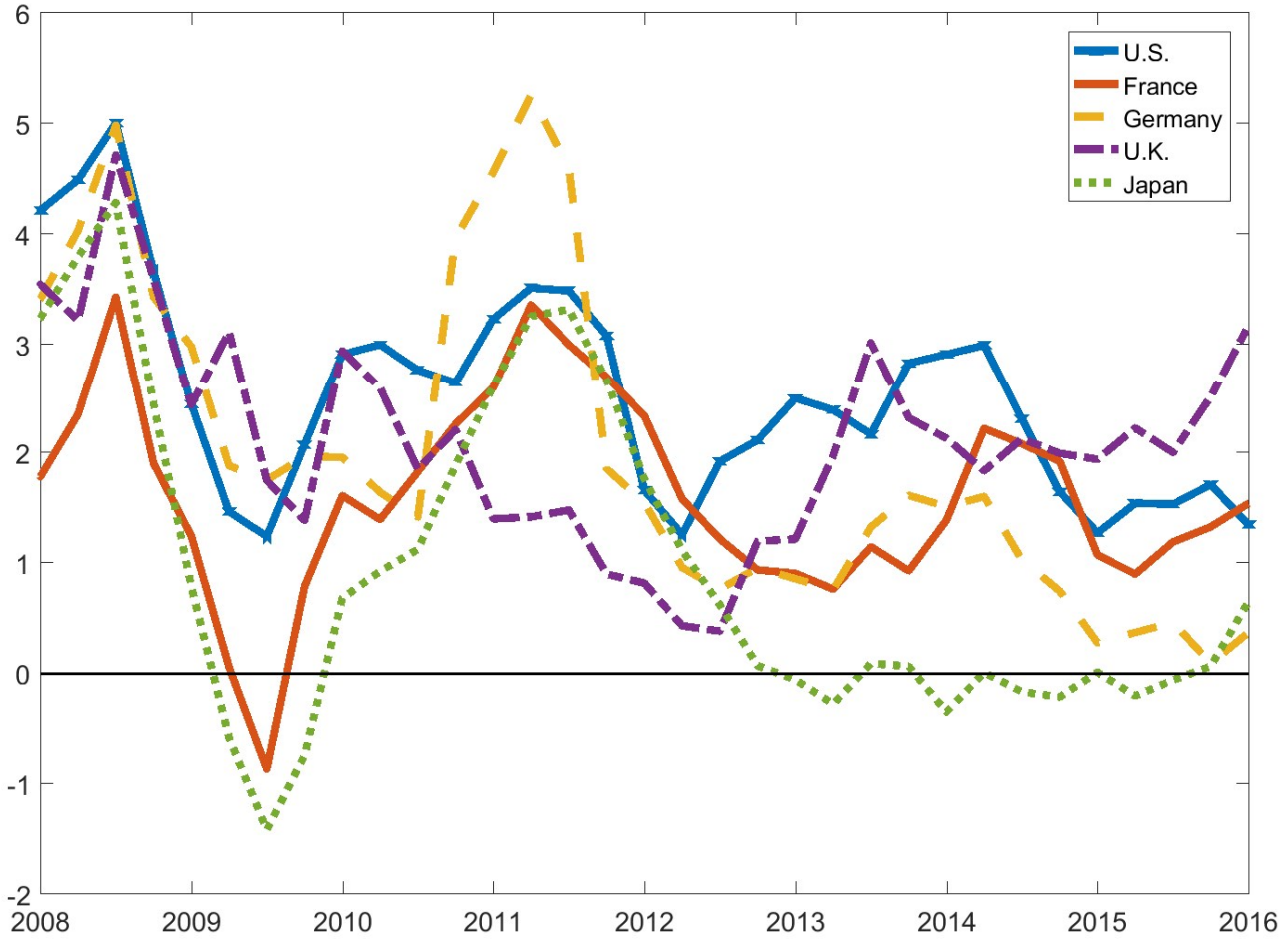
$$\mathbb{E}(\beta^{ec}) = -0.5 \tag{3}$$

$$\mathbb{V}(\beta^{ec}) = \lambda^2 \tag{4}$$

- Estimation using Bayesian estimation with fairly "standard" Minnesota-type prior to obtain shrinkage
- $\lambda = 0.2$ (see Sims and Zha, 1998; Carriero et al., 2015)

Back

Low Inflation Post 2008



Back

Brent Crude Oil Price

Back