



Taking DSGE Models to the Policy Environment

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Overview



- Motivations
- Methodology
- Results
- Conclusions and way forward

Motivations



Different approaches might cope equally well in taking DSGE model to data

but

how do they score in terms of policy analysis and forecasting?

Methodology



Comparison between three methods:

1. CNC (Core Non Core)
2. SIP (Shocks In Parameters)
3. GME (Generalised Measurement Error)

Methodology (cont.)



Steps for comparison:

- Take a model
- Take some data
- Apply the three methods
- Compare performance via:
 - variance decomposition
 - contribution over history and forecast
 - flexibility to incorporate judgement

Methodology (cont.)



Take the simple Hansen (JME, 1985) RBC model with indivisible labour:

$$\max \sum_{i=0}^{\infty} \beta^i \left(\ln C_{t+i}^* - \gamma H_{t+i}^* \right)$$

$$K_{t+i+1}^* = (1 - \delta) K_{t+i}^* + A_{t+i}^* \left(K_{t+i}^* \right)^{\alpha} \left(\eta_{t+i} H_{t+i}^* \right)^{1-\alpha} - C_{t+i}^*$$

$$C_t^* = C_{t+i}^* \left[\beta \left(\alpha A_{t+i}^* \left(K_{t+i}^* \right)^{\alpha-1} \left(\eta_{t+i} H_{t+i}^* \right)^{1-\alpha} + 1 - \delta \right) \right]^{-1}$$

$$C_t^* = \frac{1 - \alpha}{\gamma} A_t^* \eta_t \left(\frac{K_t^*}{\eta_t H_t^*} \right)^{\alpha}$$

Methodology (cont.)



- State space solution:

$$f_t = B_{fs} s_t$$

$$s_t = B_{ss} s_{t-1} + B_{s\varepsilon} \varepsilon_t$$

or, if $y_t^* = \begin{bmatrix} f_t' & s_t' \end{bmatrix}'$

$$y_t^* = B_{y^* y^*} y_{t-1}^* + B_{y^* \varepsilon} \varepsilon_t \quad (1)$$

- Stochastic singularity

1. CNC



- Hansen's model (Core) generates

$$y_t^* = B_{y^* y^*} y_{t-1}^* + B_{y^* \varepsilon} \varepsilon_t \quad (1)$$

- Non core model is a VECM:

$$\Delta y_t = \Delta y_t^* + (I - \Phi)(y_{t-1}^* - y_{t-1}) + \Psi z_t + \iota_t$$

$$y_t = B_{yy} y_{t-1} + B_{yy_0^*} y_t^* + B_{yy_1^*} y_{t-1}^* + B_{yz} z_t + B_{y\xi} \xi_t \quad (2)$$

$$z_t = B_{zz} z_{t-1} + B_{zy} y_{t-1} + B_{zv} v_t \quad (3)$$

1. CNC



Putting (1)-(2)-(3) in a matrix form

$$\begin{bmatrix} y_t^* \\ y_t \\ z_t \end{bmatrix} = \begin{bmatrix} B_{y^*y^*} & \mathbf{0} & \mathbf{0} \\ \tilde{B}_{yy^*} & \tilde{B}_{yy} & \tilde{B}_{yz} \\ \mathbf{0} & B_{zy} & B_{zz} \end{bmatrix} \begin{bmatrix} y_{t-1}^* \\ y_{t-1} \\ z_{t-1} \end{bmatrix} + \begin{bmatrix} B_{y^*\varepsilon} & \mathbf{0} & \mathbf{0} \\ \tilde{B}_{y\varepsilon} & B_{y\xi} & \tilde{B}_{y\nu} \\ \mathbf{0} & \mathbf{0} & B_{z\nu} \end{bmatrix} \begin{bmatrix} \varepsilon_t \\ \xi_t \\ \nu_t \end{bmatrix}$$

2. SIP



$$\max \sum_{i=0}^{\infty} \beta^i (\theta_{t+i} \ln C_{t+i} - \gamma_{t+i} H_{t+i})$$

$$\ln \theta_t = (1 - \rho_\theta) \bar{\theta} + \rho_\theta \ln \theta_{t-1} + \varepsilon_t^\theta$$

$$\ln \gamma_t = (1 - \rho_\gamma) \bar{\gamma} + \rho_\gamma \ln \gamma_{t-1} + \varepsilon_t^\gamma$$

$$\begin{bmatrix} y_t \\ x_t \end{bmatrix} = \begin{bmatrix} B_{yy} & B_{yx} \\ \mathbf{0} & B_{xx} \end{bmatrix} \begin{bmatrix} y_{t-1} \\ x_{t-1} \end{bmatrix} + \begin{bmatrix} B_{y\varepsilon} & B_{y\eta} \\ \mathbf{0} & B_{x\eta} \end{bmatrix} \begin{bmatrix} \varepsilon_t \\ \eta_t \end{bmatrix}$$

$$x_t = \begin{bmatrix} \ln(\theta_t / \bar{\theta}) & \ln(\gamma_t / \bar{\gamma}) \end{bmatrix}$$

3. GME



$$f_t = B_{fs} s_t + B_{fu} u_t$$

$$s_t = B_{ss} s_{t-1} + B_{s\varepsilon} \varepsilon_t$$

$$u_t = B_{uu} u_{t-1} + B_{u\zeta} \zeta_t$$

$$\begin{bmatrix} y_t \\ u_t \end{bmatrix} = \begin{bmatrix} B_{yy} & B_{yu} \\ \mathbf{0} & B_{uu} \end{bmatrix} \begin{bmatrix} y_{t-1} \\ u_{t-1} \end{bmatrix} + \begin{bmatrix} B_{y\varepsilon} & B_{y\zeta} \\ \mathbf{0} & I \end{bmatrix} \begin{bmatrix} \varepsilon_t \\ \zeta_t \end{bmatrix}$$

The Approaches



1. CNC

$$\begin{bmatrix} y_t^* \\ y_t \\ z_t \end{bmatrix} = \begin{bmatrix} B_{y^*y^*} & \mathbf{0} & \mathbf{0} \\ \tilde{B}_{yy^*} & \tilde{B}_{yy} & \tilde{B}_{yz} \\ \mathbf{0} & B_{zy} & B_{zz} \end{bmatrix} \begin{bmatrix} y_{t-1}^* \\ y_{t-1} \\ z_{t-1} \end{bmatrix} + \begin{bmatrix} B_{y^*\varepsilon} & \mathbf{0} & \mathbf{0} \\ \tilde{B}_{y\varepsilon} & B_{y\xi} & \tilde{B}_{y\nu} \\ \mathbf{0} & \mathbf{0} & B_{z\nu} \end{bmatrix} \begin{bmatrix} \varepsilon_t \\ \xi_t \\ \nu_t \end{bmatrix}$$

2. SIP

$$\begin{bmatrix} y_t \\ x_t \end{bmatrix} = \begin{bmatrix} B_{yy} & B_{yx} \\ \mathbf{0} & B_{xx} \end{bmatrix} \begin{bmatrix} y_{t-1} \\ x_{t-1} \end{bmatrix} + \begin{bmatrix} B_{y\varepsilon} & B_{y\eta} \\ \mathbf{0} & B_{x\eta} \end{bmatrix} \begin{bmatrix} \varepsilon_t \\ \eta_t \end{bmatrix}$$

3. GME

$$\begin{bmatrix} y_t \\ u_t \end{bmatrix} = \begin{bmatrix} B_{yy} & B_{yu} \\ \mathbf{0} & B_{uu} \end{bmatrix} \begin{bmatrix} y_{t-1} \\ u_{t-1} \end{bmatrix} + \begin{bmatrix} B_{y\varepsilon} & B_{y\zeta} \\ \mathbf{0} & I \end{bmatrix} \begin{bmatrix} \varepsilon_t \\ \zeta_t \end{bmatrix}$$

Estimation



- UK data (source ONS, 1978Q1-2005Q1):
 - CVM measures of C , I (construct $Y=C+I$)
 - LFS measure of H , N

[C , I , Y , H all detrended by population]

Estimation



- β, δ, α calibrated
- Bayesian ML for other parameters:
 - CNC : productivity shock, non core coefficients, non core consumption and investment eq residuals (13)
 - SIP : productivity, preference, labour supply shocks (6)
 - GME : measurement errors and productivity shock (17)

Results



- Variance decomposition
- Contribution over history and the forecast
- Treatment of judgments

Results



- Variance decomposition

Table 1: variance contributions of technology shock (per cent)

	GME	SIP	CNC
Output	28.65	97.53	82.12
Consumption	10.40	98.63	83.40
Investment	72.15	76.73	44.63
Hours	7.75	31.67	89.10

Results

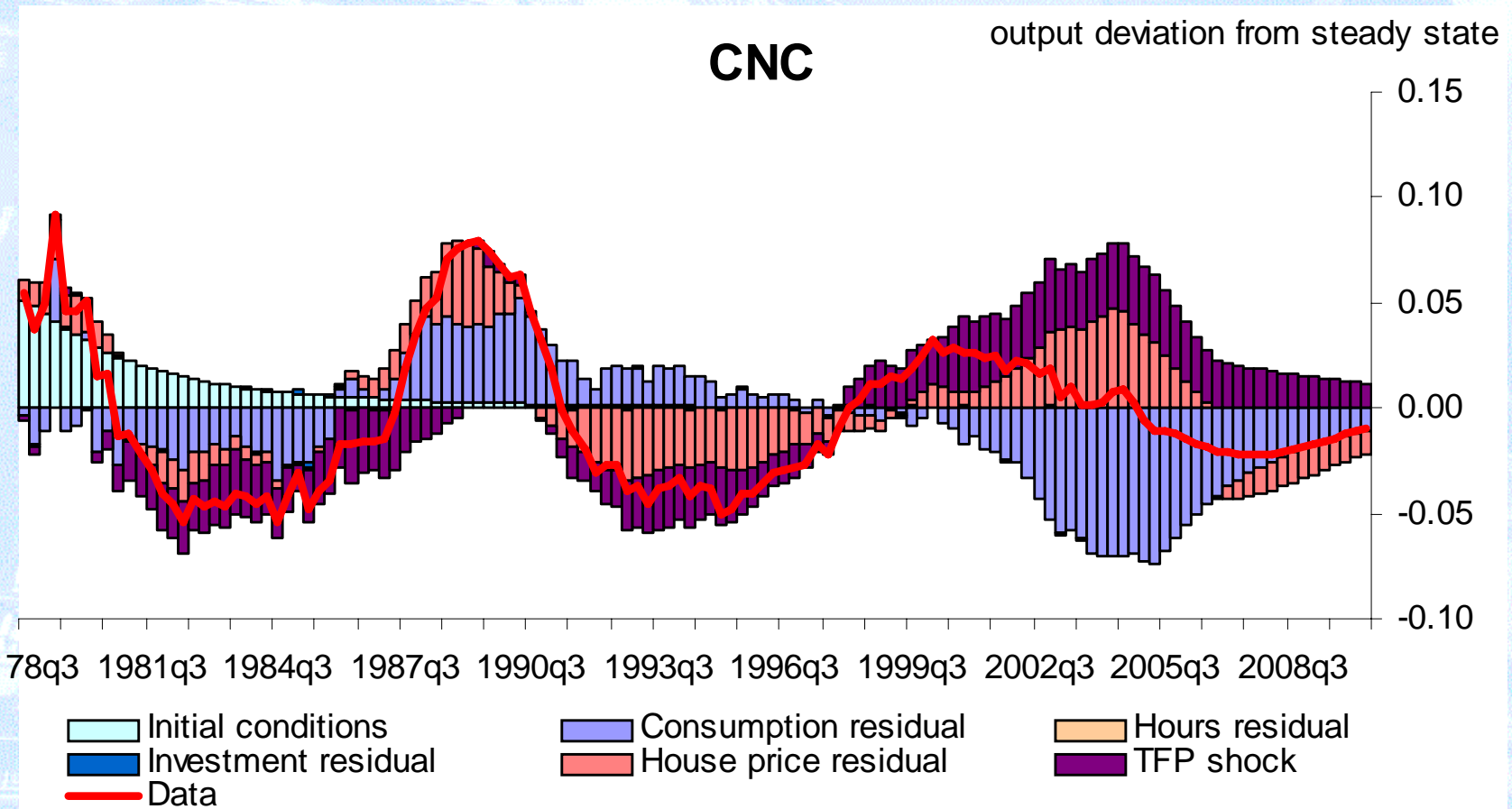


- Contribution over history and the forecast

Results



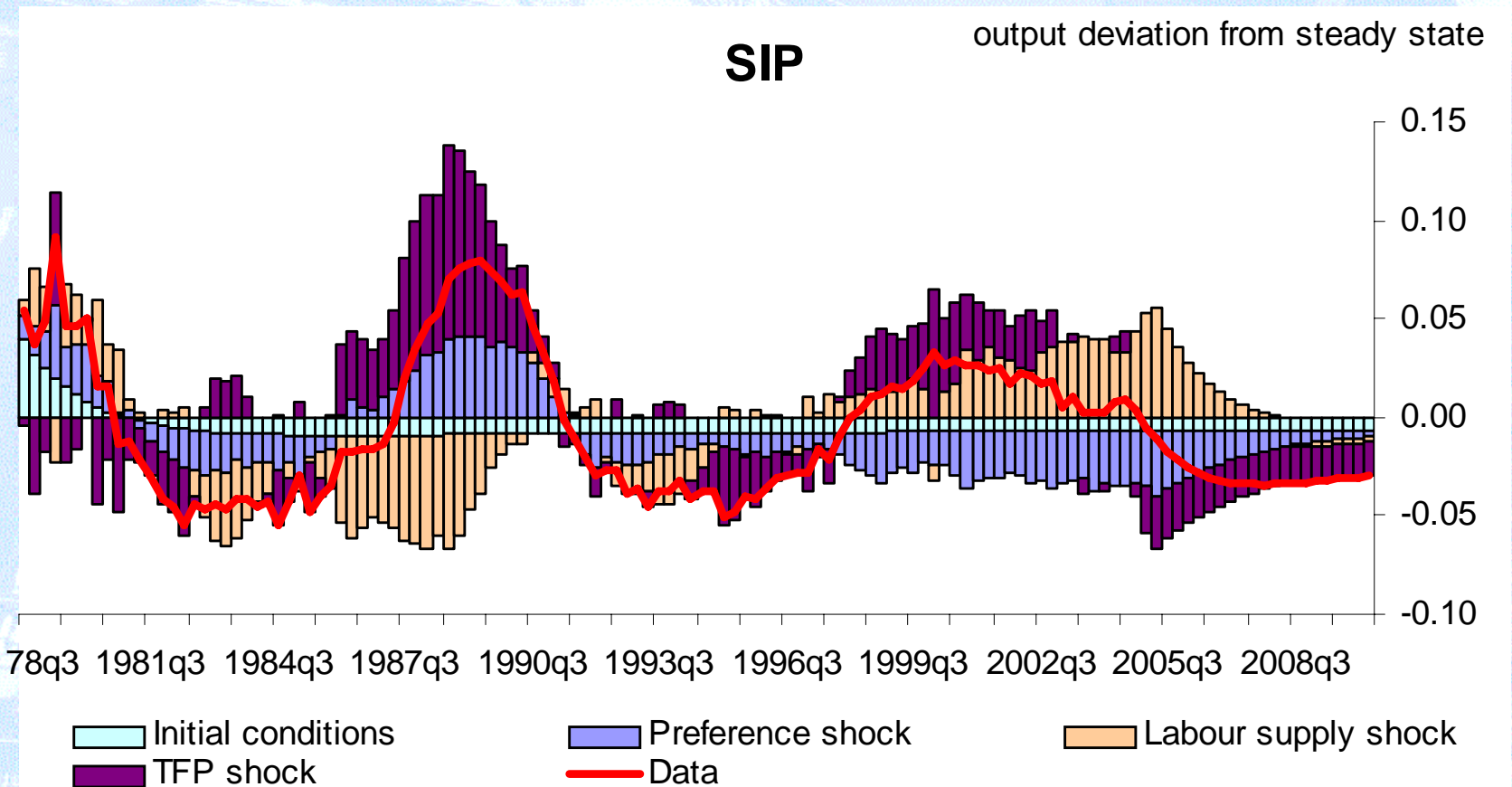
- Contribution over history and the forecast



Results



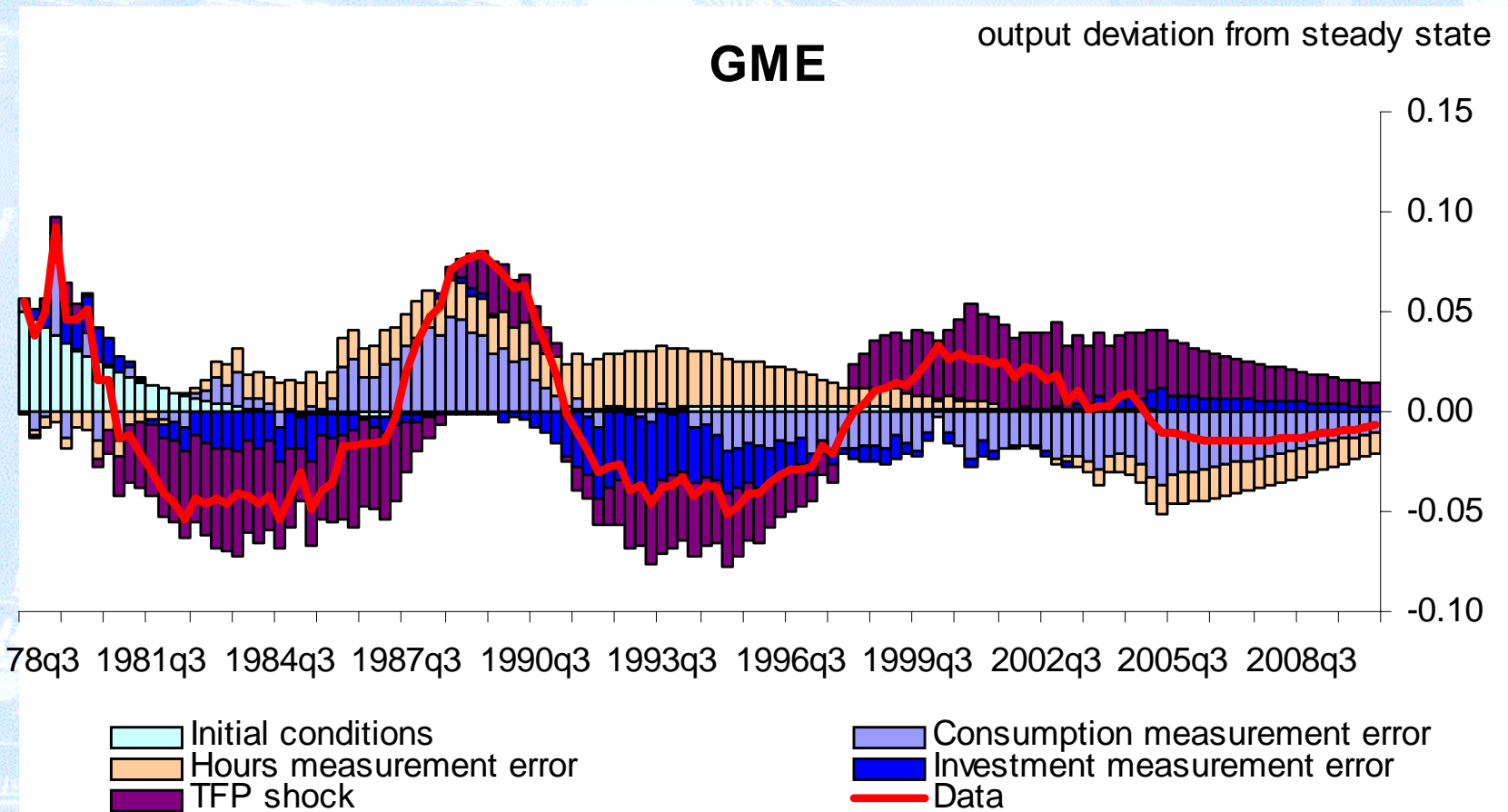
- Contribution over history and the forecast



Results



- Contribution over history and the forecast



Results



- Treatment of judgments

Methods differ for:

- 'levers' to explain the past
- ways of implementing forecast 'judgements'
- treatment of expectations

Conclusions and way forward



- Choice of method for taking DSGE models to data needs to rely on specific criteria in policy institutions
- 'Best' approach: hybrid (SIP with z variables in shock processes)?