A General Equilibrium Approach to Oil Markets and The Macroeconomy

Drago Bergholt[†]

PhD course
DRE7011 – Oil Markets and The Macroeconomy
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[†] E-mail Drago.Bergholt@Norges-Bank.no. The usual disclaimer applies.

Agenda

- Our aim for the rest of the day (planned learning outcomes)
  a) Review expected *general equilibrium forces at play* following oil shocks
  b) Overview of *recent theoretical advances* on oil markets and the macroeconomy
  c) Provide *foundation* for students who want to build/analyze their own macro models
- Reading list: See course plan

Topics we will cover (roadmap)

a) Macro effects of a windfall shock – a simple two-period model
b) Recent advances in business cycle theory – a fully-fledged DSGE
c) The oil-macro interaction – lessons from estimated models
d) Monetary policy implications – the case of oil exporters
e) Matlab code for a small model (if we have time)

The simplest possible resource economy model I

Two-period small open endowment economy, international trade only in bonds

- Lifetime utility

$$U = \ln C_1 + \beta \ln C_2$$

- Saving period 1

$$NFA_1 = Y + P_1^o O_1 - C_1$$

- Saving period 2

$$NFA_2 = (1 + r^*) NFA_1 + Y + P_2^o O_2 - C_2 = 0$$

- Lifetime budget constraint

$$C_1 + \frac{C_2}{1 + r^*} = Y + P_1^o O_1 + \frac{Y + P_2^o O_2}{1 + r^*}$$

The simplest possible resource economy model II

Optimal allocations (assuming $\beta(1+r^*)=1$)

$$C = Y + \frac{1}{1+\beta}\left(P_1^o O_1 + \beta P_2^o O_2\right)$$

$$CA_1 = \frac{\beta}{1+\beta}\left(P_1^o O_1 - P_2^o O_2\right)$$

$$CA_2 = -CA_1$$

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- The windfall is a *wealth shock*
- Higher lifetime income – *increased demand* for goods (cars, houses, smart phones) and services (hairdressing, eating out, traveling)
- Savings effects depend on the *timing* of shocks

Labor market implications

Suppose commodity extraction is endogenous and requires labor

$$\Pi_t^o = P_t^o O_t - W_t N_t = P_t^o N_t^\gamma - W_t N_t$$

$$U = \ln\left(C_1 - \frac{N_1^{1+\varphi}}{1+\varphi}\right) + \beta \ln\left(C_2 - \frac{N_2^{1+\varphi}}{1+\varphi}\right)$$

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Optimal allocations ($\Theta \equiv \frac{1+\varphi-\gamma}{1+\varphi}$)

$$C_1 = Y + \frac{1}{1+\beta}\gamma^{\frac{1}{\Theta}}\left[\left(\frac{\Theta}{\gamma} + \frac{1+\beta}{1+\varphi}\right) P_1^{o\,\frac{1}{\Theta}} + \beta\frac{\Theta}{\gamma} P_2^{o\,\frac{1}{\Theta}}\right]$$

$$N_t = (\gamma P_t^o)^{\frac{1}{1+\varphi-\gamma}}, \quad W_t = (\gamma P_t^o)^{\frac{\varphi}{1+\varphi-\gamma}}$$

$$CA_1 = \frac{\beta}{1+\beta}\gamma^{\frac{\gamma}{\Theta}}\Theta\left(P_1^{o\,\frac{1}{\Theta}} - P_2^{o\,\frac{1}{\Theta}}\right), \quad CA_2 = -CA_1$$

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- Rising real wages due to i) increased *factor demand* and ii) a *wealth effect* – wealthy people can afford leisure

Implications for capital markets

Suppose commodity extraction is endogenous and requires capital

$$\Pi_t^o = P_t^o O_t - I_t^o = P_t^o K_t^\gamma - I_t^o$$
$$K_{t+1} = K_t + I_t^o$$

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Optimal allocations ($\Upsilon \equiv \frac{\gamma\beta}{1-\beta}$)

$$C = Y + \frac{1}{1+\beta}\left[P_1^o O_1 + K_1 + \beta(1-\gamma)\Upsilon^{\frac{\gamma}{1-\gamma}} P_2^{o\,\frac{1}{1-\gamma}}\right]$$
$$I_1^o = (\Upsilon P_2^o)^{\frac{1}{1-\gamma}} - K_1$$
$$CA_1 = \frac{\beta}{1+\beta}\left[P_1^o O_1 + K_1 - (1+2\Upsilon)\Upsilon^{\frac{\gamma}{1-\gamma}} P_2^{o\,\frac{1}{1-\gamma}}\right], \quad CA_2 = -CA_1$$

Implications for capital markets

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- *Rising investment* due to higher capital demand
- Current oil price irrelevant – what matters is the entire *expected price path*

Summary from toy model

- The windfall is a wealth shock
  - *Higher consumption and factor demand* – economic activity rise
  - *Factor prices inflate*
- The lifetime income hypothesis at work
  - *Persistence* matters
    - Persistent (transitory) shocks lead to large (small) demand effects and small (large) current account effects
  - *Timing* matters
    - Current (future) shocks give rise to current account surpluses (deficits)

These are fairly robust predictions (should carry over to larger and more quantitative models)

DSGE models vs. VARs

- VARs
  a) Minimum set of restrictions needed – let the data speak
  b) Good forecasting power
  c) Natural benchmark for evaluation of DSGE models
- DSGEs
  a) Economic theory does all inference – rich structural stories
  b) Allows for identification of a large set of shocks
  c) Formal micro foundation – suitable for policy analysis and welfare evaluation
- Complementary tools in macroeconomic analysis (DSGE-VARs a formalization of this complementarity)

The DSGE approach to oil-macro – A review

Fairly new literature, almost entirely about net oil importers (US)

- *First generation:* Macro effects of exogenous oil price fluctuations in calibrated models of the US economy
  - Rotemberg and Woodford (1996), Finn (2000), Leduc and Sill (2004)
- *Second generation:* Estimated medium scale DSGE models with a partial equilibrium view on oil markets
  - Kormilitsina (2011), Bodenstein et al. (2011), Bodenstein and Guerrieri (2012)
- *Third generation:* Oil markets and macroeconomy jointly determined and estimated
  - Nakov and Pescatori (2010a,b), Peersman and Stevens (2013)

A theory of oil demand I

Households' utility structure

$$W_0 = \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \eta_t^T U_t \left(C_t - hC_{t-1}, L_t, OS_{t-1}, \eta_t^{OS} \right)$$

$$C_t = \left[\delta^{\frac{1}{\psi}} O_t^{C\,\frac{\psi-1}{\psi}} + (1-\delta)^{\frac{1}{\psi}} Y_t^{C\,\frac{\psi-1}{\psi}} \right]^{\frac{\psi}{\psi-1}}$$

$$OS_t = (1-\tau_O)\, OS_{t-1} + \left[1 - S_O \left(\frac{I_t^O}{I_{t-1}^O} \right) \right] I_t^O$$

$$S_O(1) = S_O'(1) = 0, \quad S_O''(1) > 0$$

Oil provides utility in two forms: As a flow (O_t^C) and as a convenience yield (OS_t). η_t^{OS} is a shock to the convenience yield – a type of oil specific demand shock.

A theory of oil demand II

Optimality conditions for households' oil demand

$$O_t^C: \quad O_t^C = \delta \left(\frac{P_t^o}{P_t} \right)^{-\psi} C_t$$

$$OS_t: \quad Q_t^O = \mathbb{E}_t \left\{ \frac{\Pi_{t+1}}{R_t} \left[\eta_{t+1}^T \eta_{t+1}^{OS} \frac{U_{OS,t+1}}{U_{C,t+1}} + Q_{t+1}^O (1 - \tau_O) \right] \right\}$$

$$I_t^O: \quad \frac{P_t^o}{P_t} = Q_t^O \left[1 - S_O \left(\frac{I_t^O}{I_{t-1}^O} \right) - S_O' \left(\frac{I_t^O}{I_{t-1}^O} \right) \frac{I_t^O}{I_{t-1}^O} \right] + \mathbb{E}_t \left\{ \frac{\Pi_{t+1}}{R_t} Q_{t+1}^O S_O' \left(\frac{I_{t+1}^O}{I_t^O} \right) \left(\frac{I_{t+1}^O}{I_t^O} \right)^2 \right\}$$

These are i) cost minimizing flow demand, ii) asset pricing equation for convenience yield, and iii) a no-arbitrage condition for oil storage

A theory of oil demand III

Oil in production

$$Y_t = \left[\eta^{\frac{1}{\alpha}} VA_t^{\frac{\alpha-1}{\alpha}} + (1-\eta)^{\frac{1}{\alpha}} O_t^{G\,\frac{\alpha-1}{\alpha}} \right]^{\frac{\alpha}{\alpha-1}} - \Phi$$

$$O_t^G = \frac{1-\eta}{\eta} \left(\frac{MC_t^c}{P_t^o} \right)^{\alpha} VA_t$$

$$MC_t = \left[\eta MC_t^{c\,1-\alpha} + (1-\eta) P_t^{o\,1-\alpha} \right]^{\frac{1}{1-\alpha}}$$

Global oil demand

$$\begin{aligned} \tilde{O}_t^* &= O_t^{d,RW} + O_t^{d,US} \\ &= O_t^{d,RW} + O_t^G + O_t^C + I_t^O \end{aligned}$$

A theory of oil supply I

Global, competitive oil retailer

$$\tilde{O}_t^* = \left(\int_0^1 O_t^{*,j \frac{1}{1+\eta_t^O}} dj \right)^{1+\eta_t^O}, \quad O_t^{*,j} = \left(\frac{P_t^{o,j}}{P_t^o} \right)^{-\frac{1+\eta_t^O}{\eta_t^O}} \tilde{O}_t^*$$

Monopolistic oil producer j rents an exploitable oil field D_{t-1}^j

$$O_t^{*,j} = \eta_t^{OC} u_t D_{t-1}^j$$

Drilling firm produces new exploitable fields DN_t using AK-technology

$$D_t = D_{t-1} + DN_t - O_t^*$$
$$DN_t = \eta_t^{OI} K_t^{S,*}$$

A theory of oil supply II

Log-linearized oil supply schedule

$$\hat{O}_t^* = \frac{1}{\vartheta}\left(\hat{p}_t^o - \hat{p}_t^y\right) + \hat{D}_{t-1} + \left(1 + \frac{1}{\vartheta}\right)\hat{\eta}_t^{OC} - \frac{1}{\vartheta}\hat{\eta}_t^O$$

- Supply increasing in
  - Oil price spread above cost of utilization
  - Existing stock of exploitable fields
- Two supply shifters, i) TFP in oil sector and ii) mark-up in wholesale market for oil
- Key parameter is $\frac{1}{\vartheta}$, the oil supply elasticity
  - $\vartheta \equiv \frac{\vartheta''(1)}{\vartheta'(1)}$ measures how costly it is to adjust utilization of existing fields
  - $\vartheta \to \infty$ gives vertical supply in the short run

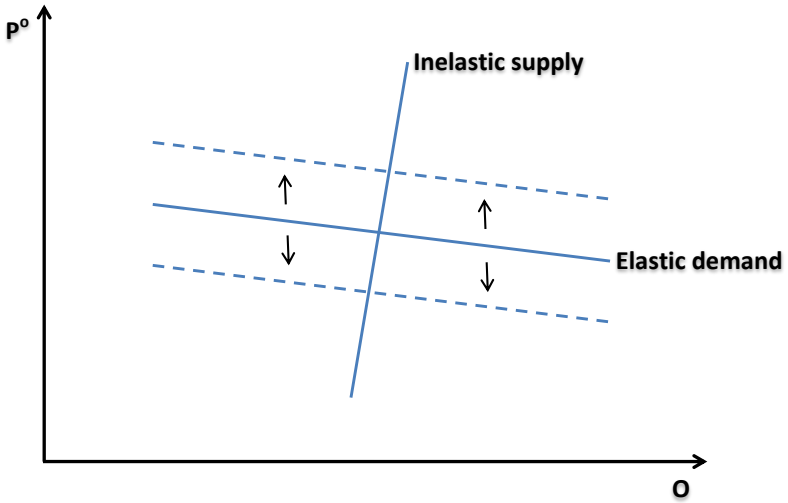
DSGE model with joint oil-macro determination

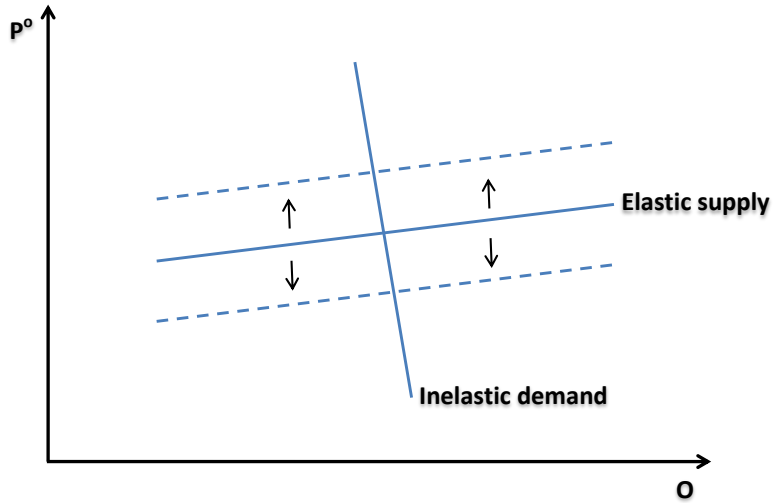
Peersman and Stevens (2013) extend the Smets and Wouters (2007) model with an oil block in order to *identify drivers of oil markets and the business cycle*.

- Large number of shocks
  - Oil inventory shock η_t^{OS}, oil mark-up shock η_t^{O}, oil TFP shock η_t^{OC}, oil field shock η_t^{OI}, RoW oil demand shock η_t^{RW}, plus all the standard DSGE shocks
- Fit the model to data (1986Q1-2008Q4) using Bayesian methods
  - US macro series plus 2 US and 4 international oil market series
- Estimate a number of key "oil" parameters
  - Substitution elasticity in consumption ψ and production α, oil supply elasticity $\frac{1}{\vartheta}$, curvature on storage costs S''_O

Elasticities matter

Some estimated "oil" parameters			
		Prior	Post.
S''_O	Oil inventory adj. cost	$G(0.5, 0.25)$	0.77 [0.32, 1.22]
ψ	Elasticity oil and core cons.	$G(0.5, 0.25)$	0.04 [0.02, 0.07]
α	Elasticity oil and val. added	$G(0.5, 0.25)$	0.04 [0.02, 0.06]
ϑ	Inverse oil supply elasticity	$N(15.0, 3.00)$	7.52 [4.58, 10.3]





Which shocks are important? FEVD

US GDP

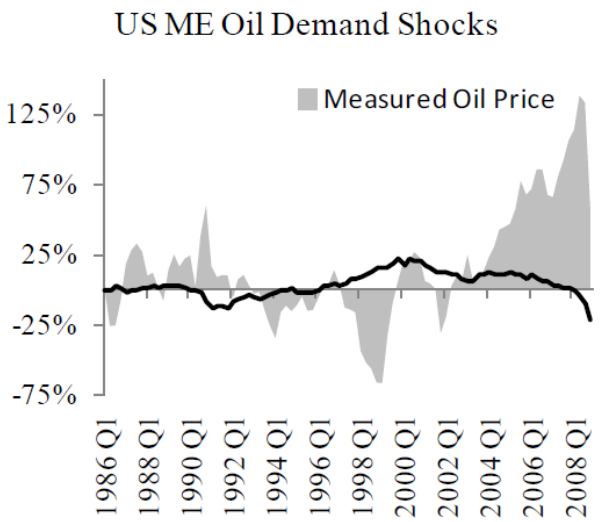
Horizon → / Shocks ↓	1Q	2Q	4Q	10Q	40Q
Time Preference	5.84	5.05	3.41	1.65	1.43
Inv.-spec. Tech.	16.78	20.58	24.72	26.44	20.27
Exog. Spend.	18.26	13.83	9.27	5.02	2.80
TFP	44.25	42.65	41.00	41.68	53.66
Mon. Pol.	10.14	10.73	10.23	7.58	4.57
Price Markup	2.74	4.10	6.44	10.17	10.97
Wage Markup	0.37	0.79	1.81	3.96	3.86
Oil Inventory	0.54	0.84	1.31	1.70	1.12
Oil Capacity	0.11	0.16	0.24	0.32	0.29
Oil Markup	0.43	0.64	0.83	0.71	0.40
Oil Investment	0.30	0.27	0.24	0.25	0.32
RoW Oil Dem	0.23	0.36	0.50	0.51	0.32

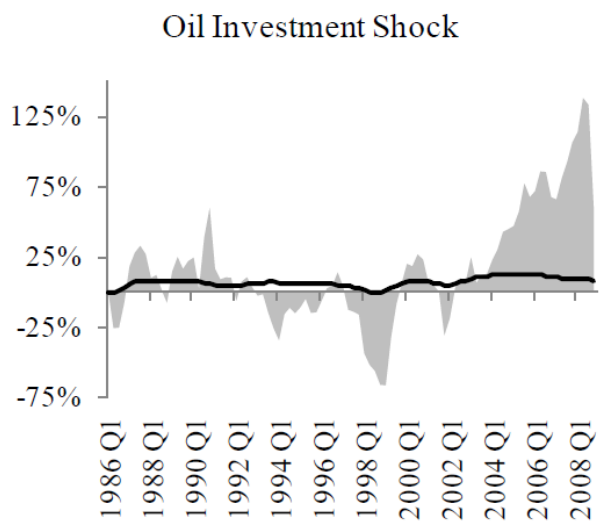
Real Oil Price

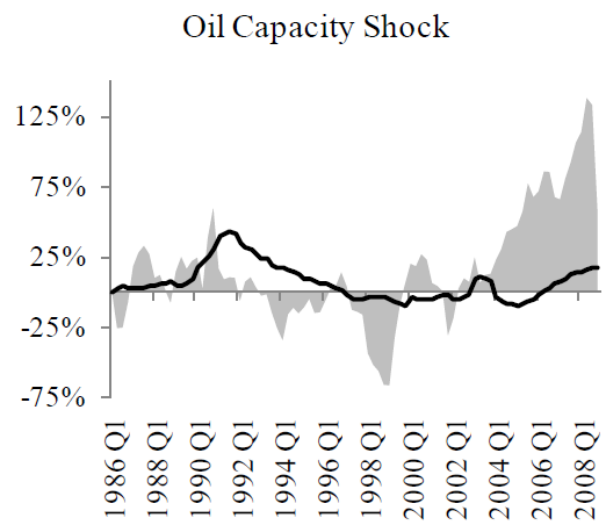
Horizon → / Shocks ↓	1Q	2Q	4Q	10Q	40Q
ME Oil Demand	2.37	3.04	4.12	6.14	8.70
Oil Inventory	9.92	13.51	18.54	23.25	22.08
Oil Capacity	3.99	4.19	4.55	5.35	6.50
Oil Markup	65.17	61.03	55.02	47.64	42.68
Oil Investment	0.02	0.06	0.24	1.15	4.78
RoW Oil Dem	18.54	18.17	17.52	16.47	15.26

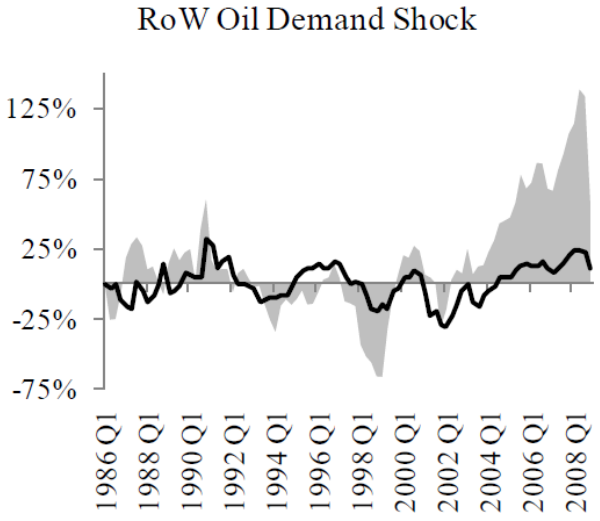
Source: Peersman and Stevens (2013)

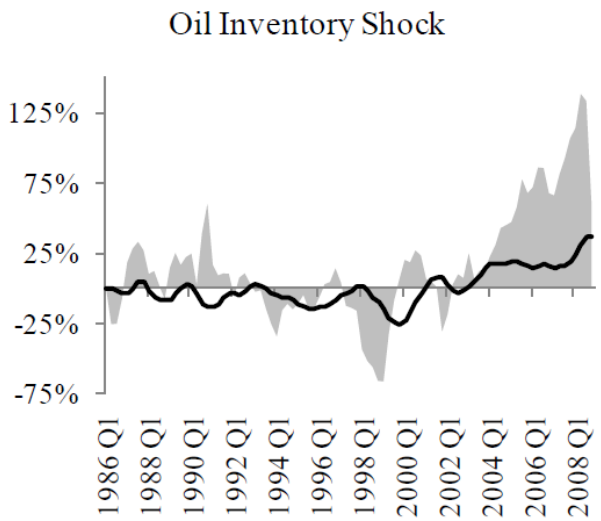
What drives the oil price? Historical decomposition

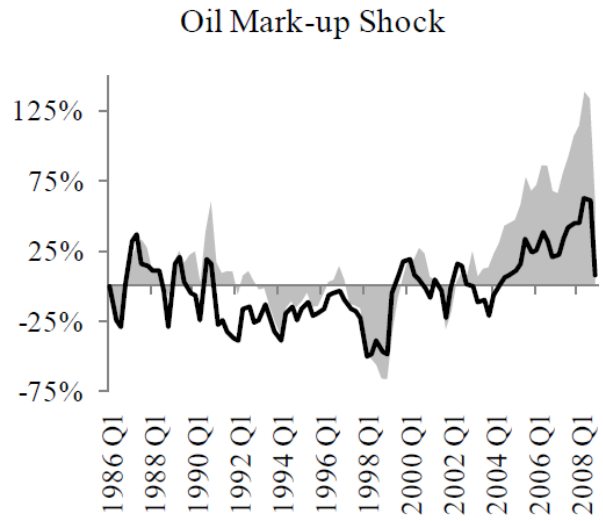






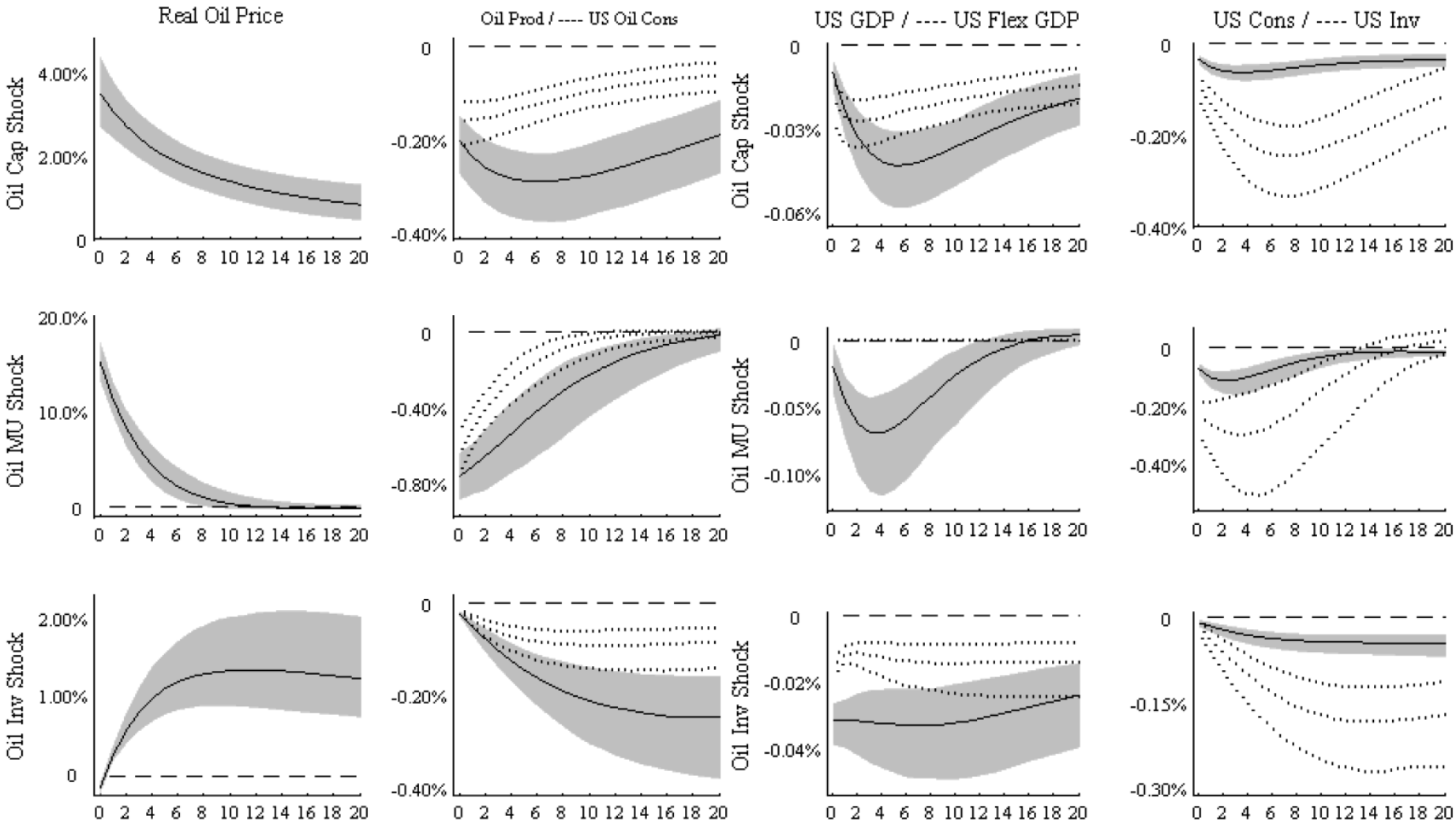






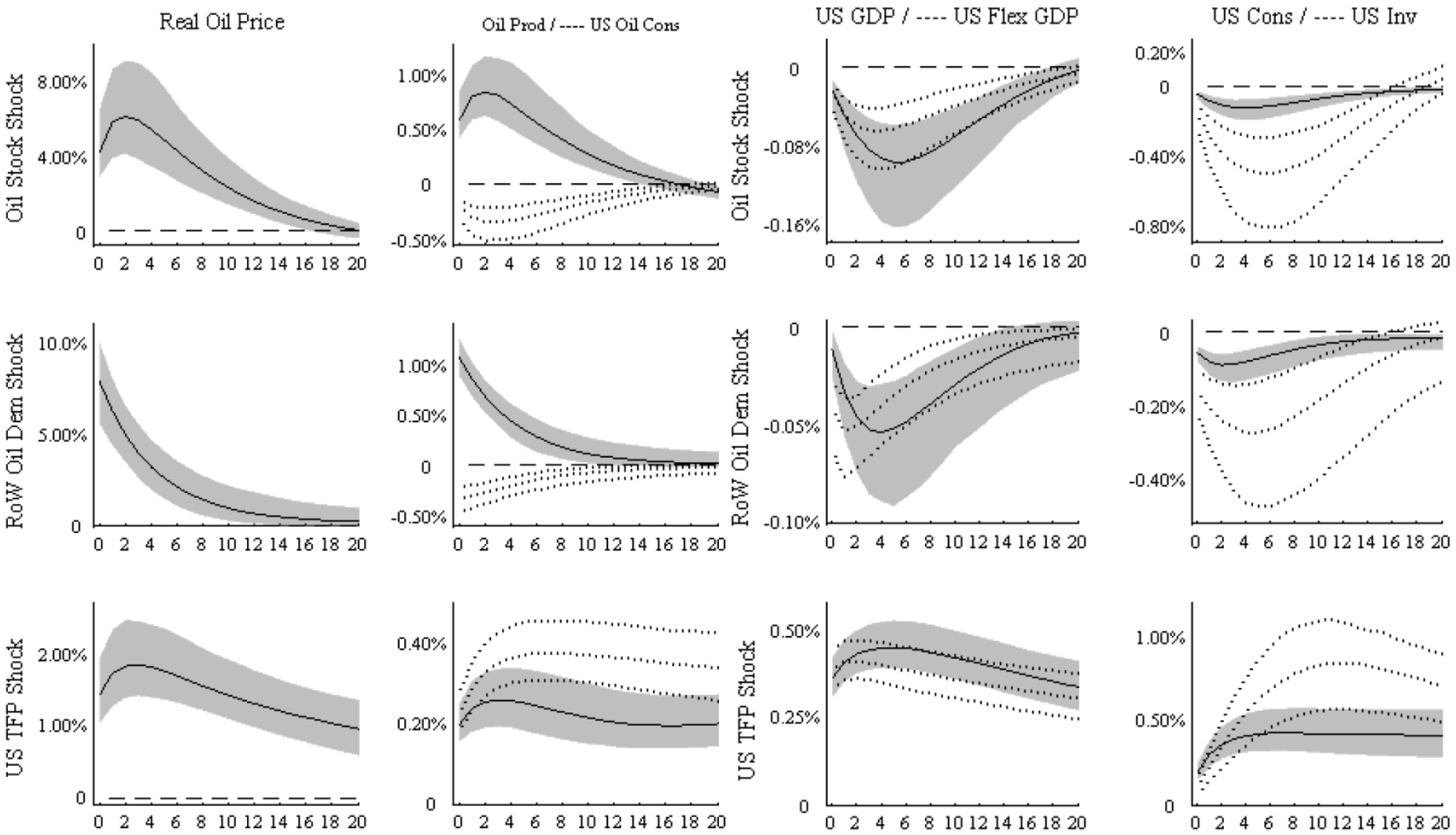
Source: Peersman and Stevens (2013)

Supply shocks in an estimated DSGE model



Source: Peersman and Stevens (2013)

Demand shocks in an estimated DSGE model

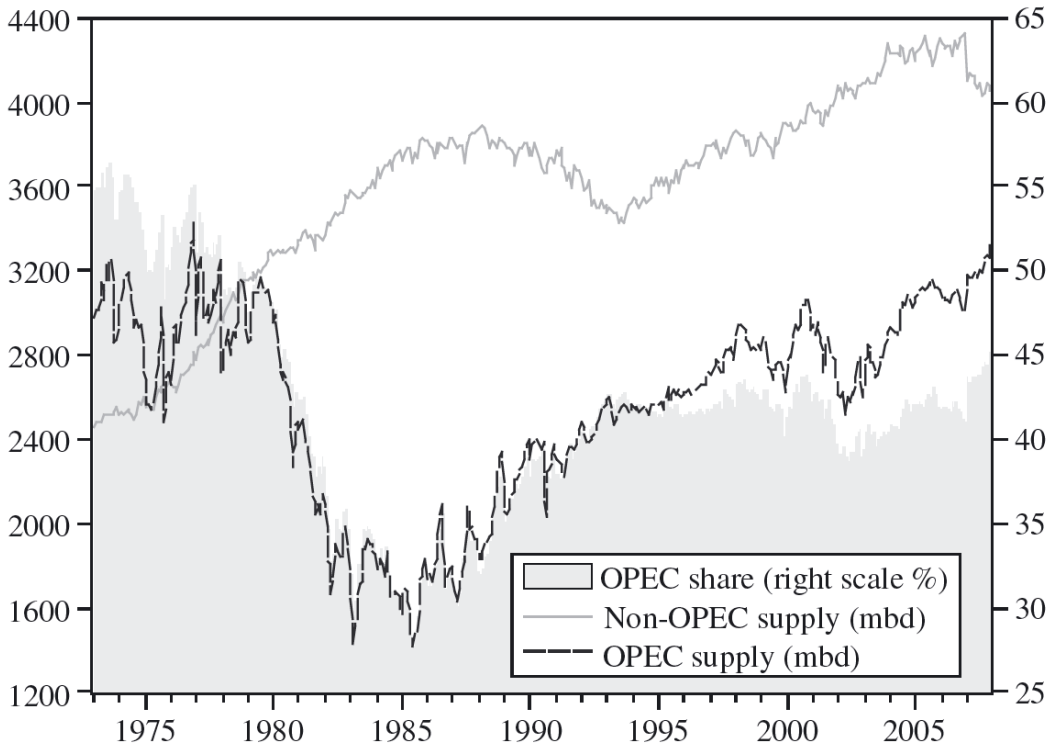


Source: Peersman and Stevens (2013)

Comparison with VAR literature

- Kilian (2009), Kilian and Murphy (2012, 2014)
  - Demand shocks key drivers of the oil price, supply shocks not important
  - Global demand shocks also important for the global business cycle
  - Assume low short run oil supply elasticity (≤ 0.025) compared with the demand elasticity (≤ 0.8)
- Baumeister and Peersman (2013a,b)
  - Estimate time varying elasticities, find that they have declined over time
  - Also oil supply shocks are important, both for oil prices and for global activity

A note on OPEC's market power



Source: Nakov and Pescatori (2010a)

"For lower-cost output to fall or stagnate, while higher-cost output rises, is like water flowing uphill. Some special explanation is needed"

Adelman (2002)

A cartel model I

DSGE model with oil and endogenous oil price. Three "economies":

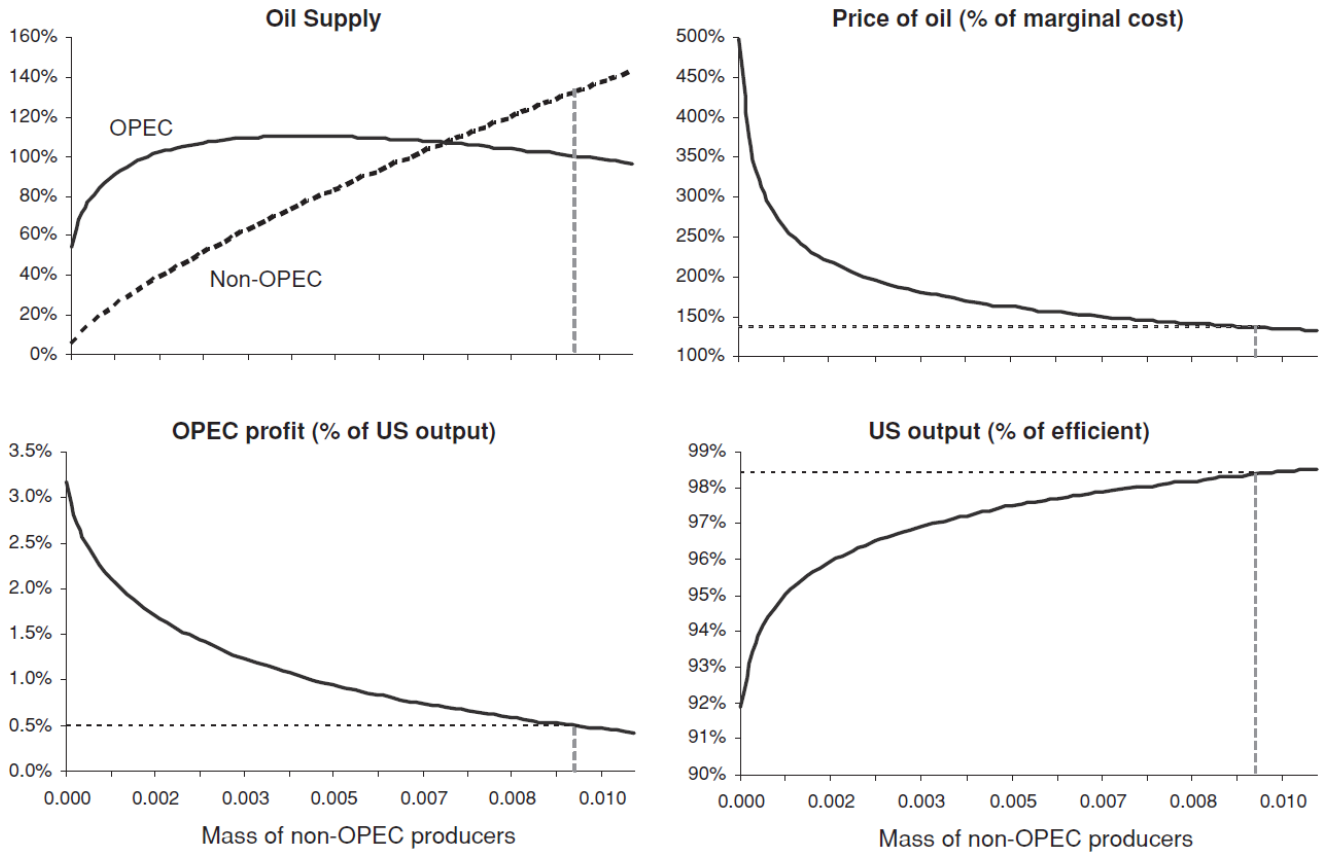
- Oil importer (US). Calvo-firms, output $Q_{it} = A_t L_{it}^{s_l} K_{it}^{s_k} O_{it}^{s_o}$ and BC $C_t = Y_t = Q_t - p_{ot} O_{dt}$.
- Dominant oil exporter (OPEC), output $O_t = Z_t \tilde{l}_t$ and BC $\tilde{C}_t = p_{ot} O_t - \tilde{l}_t$.
- Competitive fringe of oil exporters (non-OPEC), output $X_{it} = \xi_i Z_t \hat{l}_{it}$ and BC $\hat{C}_t = p_{ot} X_t - \hat{l}_t$.

Some aggregate relations:

$$X_t = \left[\int_0^{\Omega_t} X_{it} di \right] = p_{ot} Z_t \Omega_t$$

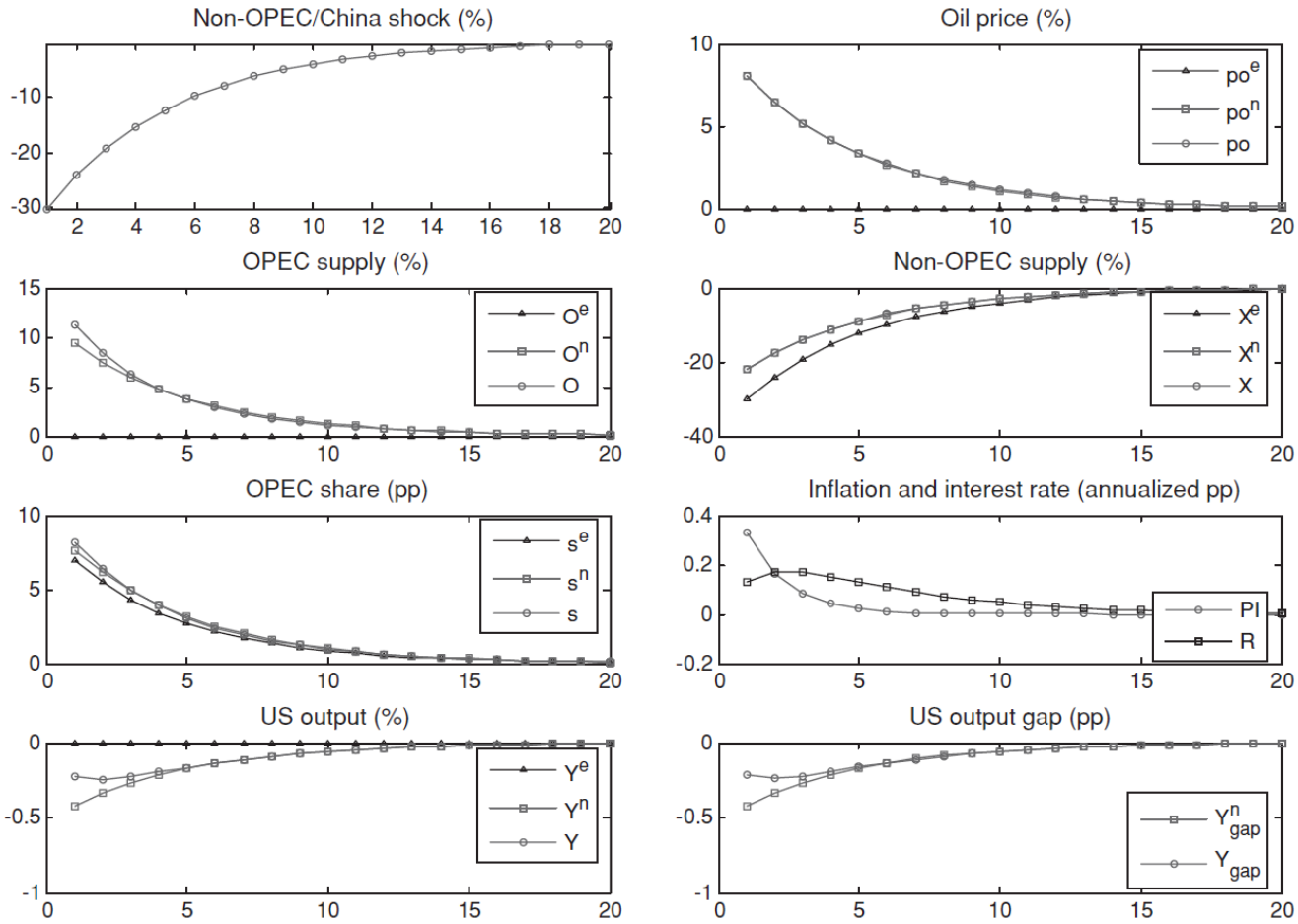
$$O_{dt} = \int_0^1 O_{it} di = O_t + X_t$$

A cartel model II



Source: Nakov and Pescatori (2010a)

A cartel model III



Source: Nakov and Pescatori (2010a)

A cartel model IV

Variance Decomposition, 1970–83, 1984–2007

	US shocks			Oil shocks	
	Real		Nom.		
	$\hat{a}$	$\hat{b}$	$\hat{r}$	$\hat{z}$	$\hat{\omega}$
(*a*)					
Inflation	2.74	33.3	15.7	12.2	36.0
GDP growth	69.1	1.10	4.99	22.7	2.13
Interest rate	8.70	69.3	4.44	0.27	17.3
Real oil price	0.05	0.00	0.04	87.1	12.8
(*b*)					
Inflation	0.80	37.4	41.5	1.18	19.0
GDP growth	77.8	0.42	2.13	17.5	2.14
Interest rate	3.30	87.4	1.10	1.08	7.11
Real oil price	0.02	0.00	0.01	87.7	12.3

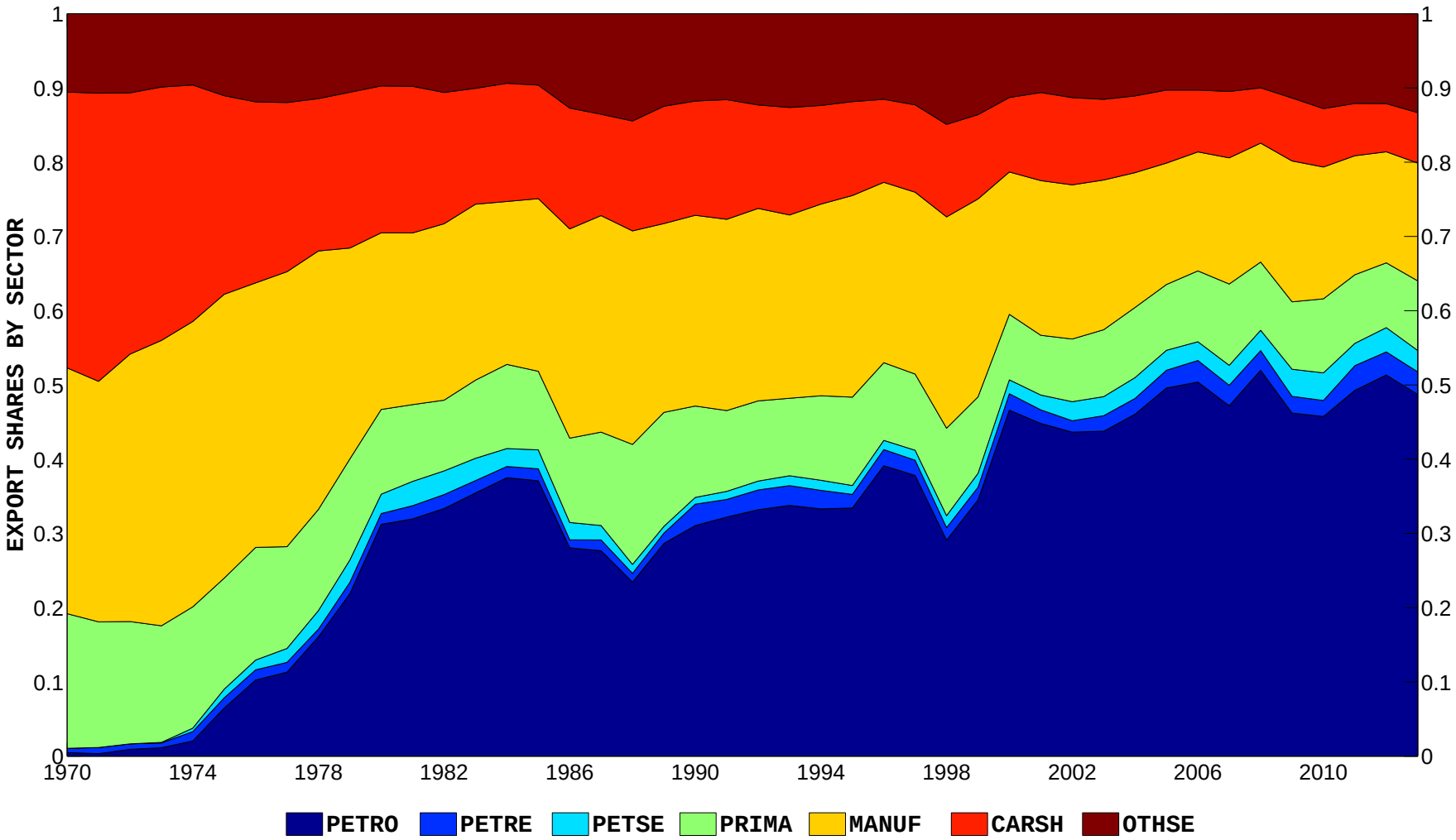
Source: Nakov and Pescatori (2010b)

Estimated model: Supply shocks explain virtually all oil price movements and one fifth of US GDP

So what can we learn from the DSGE literature?

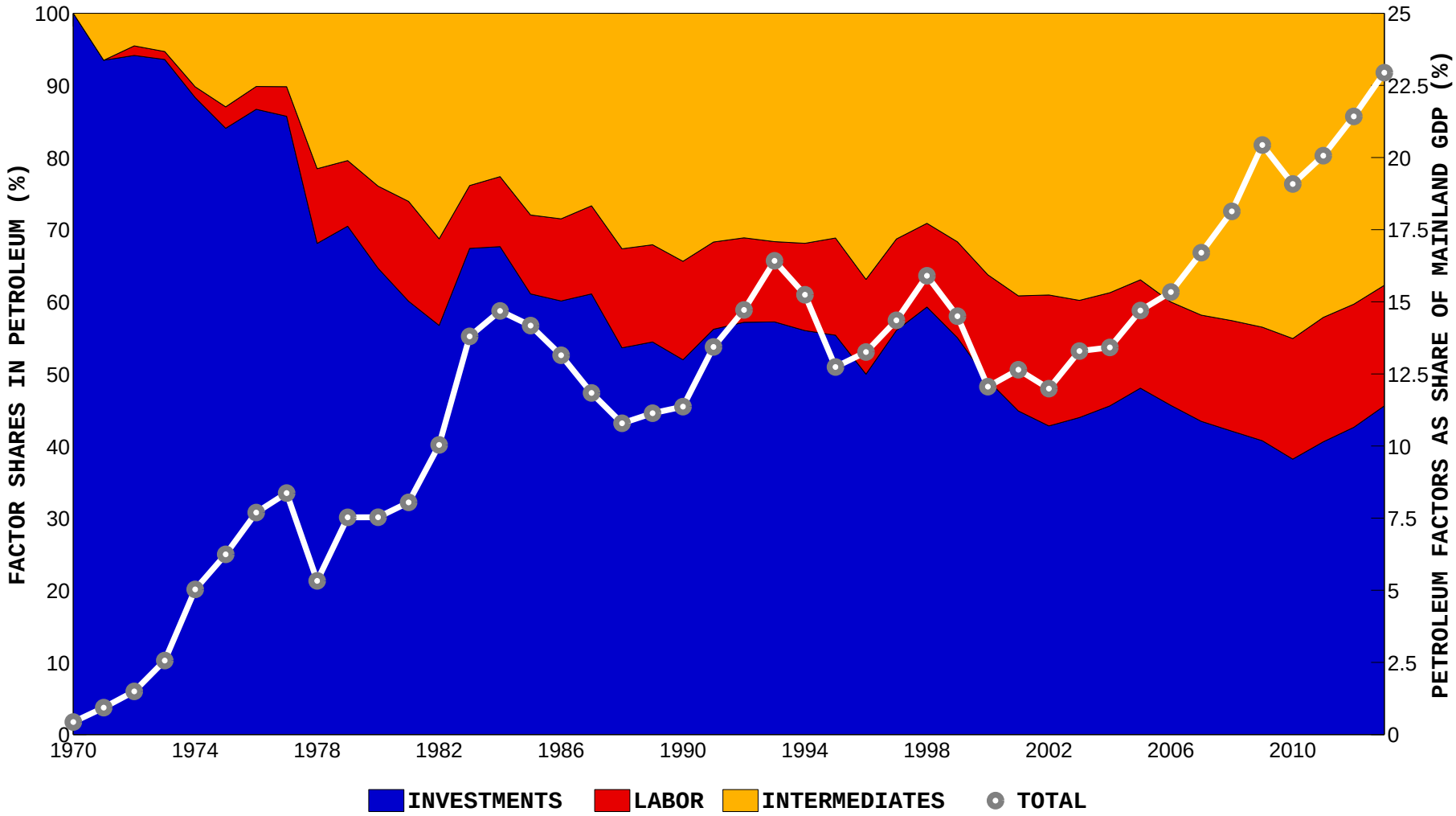
- Macro models deliver an *oil price disconnect*
  - Limited transmission from "conventional" business cycle shocks to the oil price
  - Limited transmission from oil market shocks to the macroeconomy
  - Oil prices notoriously hard to predict (similar to exchange rate literature)
- Elasticities matter – slope of supply *relative to* demand
  - Supply elasticities too low and demand elasticities too high in some VARs?
- Identification in empirical oil-macro models (VARs) might be restrictive
  - *Size* restrictions (on elasticities) determine supply vs. demand
  - *Sign* restrictions used (in oil-macro VARs) prone to misspecification

Norway – A resource rich economy



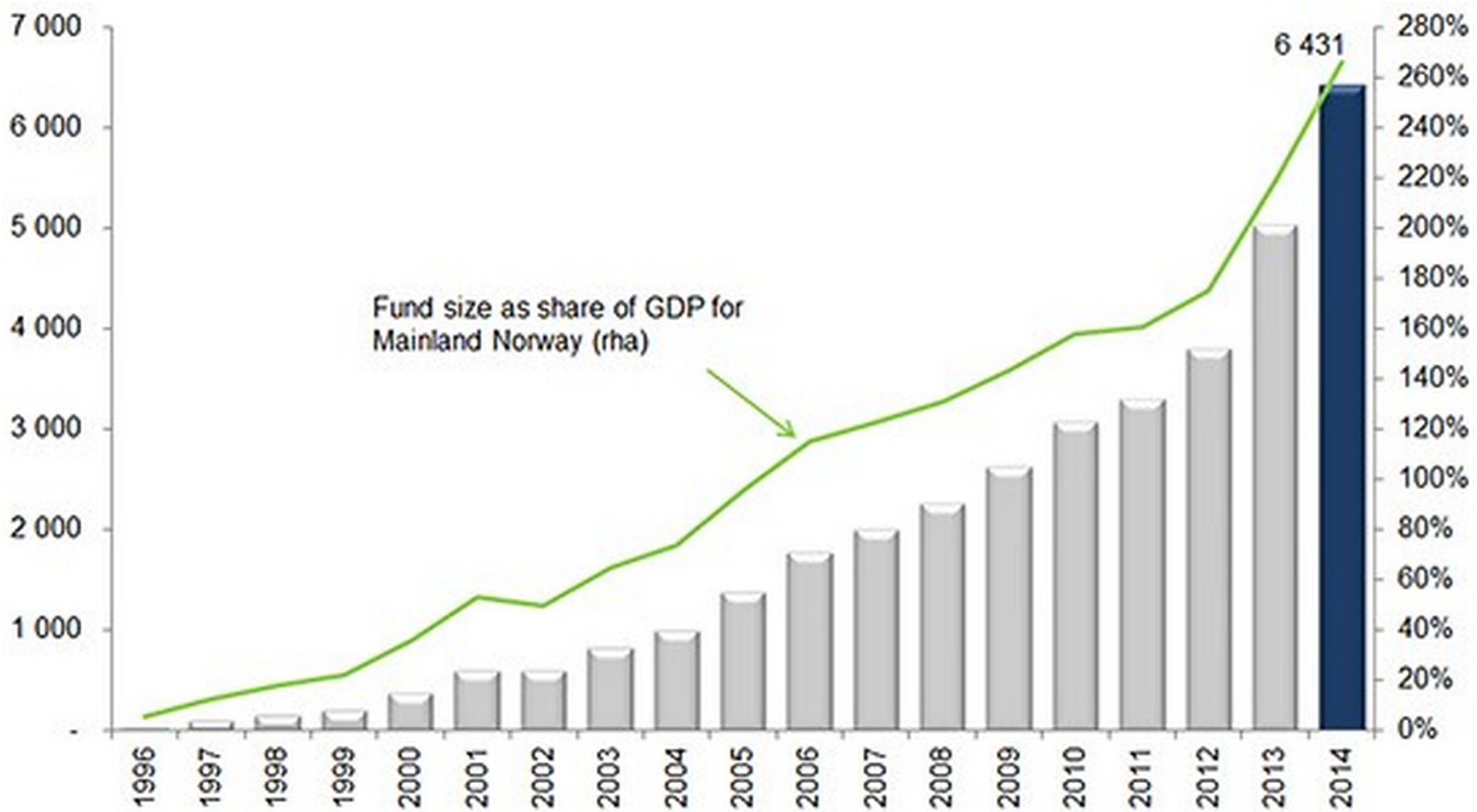
Source: Statistics Norway and own calculations

Norway – A resource rich economy



Source: Statistics Norway and own calculations

Government Pension Fund Global



Source: Norges Bank, Thomson Reuters Datastream and the Ministry of Finance

What if...

"Norges Bank's conduct of monetary policy is geared towards low and stable inflation. Our framework has still not been tested against a large and persistent negative oil price shock. I believe the real test of our framework will come when the present boom in the petroleum industry – at some point – is reversed."

Øystein Olsen, Governor of Norges Bank, 19 November 2012

Business cycle policy in resource economies

A literature still in its infancy

- Optimal monetary policy
  - Catão and Chang (2013), Benkhodja (2014), Bergholt (2014), Ferrero and Seneca (2015)
- Optimal fiscal policy
  - Pieschacon (2012)
- Optimal monetary and fiscal policy
  - Hevia and Nicolini (2013)

The role of monetary policy – A review

- Prices in the simple RBC world are equated with nominal marginal costs ($P_t = MC_t$), or

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This is efficient (optimal)

The role of monetary policy – A review

- Prices in the simple RBC world are equated with nominal marginal costs ($P_t = MC_t$), or

$$RMC_t = RMC = 1$$

  This is efficient (optimal)
- Sources of sub-optimality in the basic New Keynesian model
  - Time varying economy-wide markup (markup denoted by Ψ)

$$RMC_t = \Psi_t^{-1}$$

  - Cross-sectional price dispersion

$$Y_t = X_t \Delta_t$$

    Y_t is aggregate production (a production function), X_t is aggregate demand, and $\Delta_t = \int_0^1 \left(\frac{P_{j,t}}{P_t}\right)^{-\epsilon} dj \geq 1$ is a "tax" on output

The role of monetary policy – A review

- The simple NK model provides motivation for price stability as "good" monetary policy
  - *Strict* inflation targeting optimal or near optimal in the simple model
- Caveats
  - Trade-off between price stability and other concerns when additional frictions are introduced (Clarida et al., 1999; Erceg et al., 2000; Aoki, 2001; Amato and Laubach, 2004)
  - Terms of trade externality in open economies (Faia and Monacelli, 2008; De Paoli, 2009)
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But what about monetary policy in resource rich economies?

Standard way to model oil in small macro models

Simple production technology with decreasing returns to scale

$$O_t = A_{O,t} M_{O,t}^{\eta}$$

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Optimal oil sector behavior

$$\frac{P_{M,t}}{P_{O,t}} = \eta A_{O,t} M_{O,t}^{\eta-1}$$

M_t is resources supplied by non-oil agents (labor, materials etc.)

Hevia and Nicolini (2013)

- Galí and Monacelli (2005) extended with a resource sector
- Strict producer price (PPI) stability always optimal if complemented by a set of time varying taxes
- Assume that commodities are used as input in production:

$$MC_t = \frac{1}{A_t} P_{x,t}^{\eta} W_t^{1-\eta}$$

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- PPI stability implies (using the law of one (commodity) price)

$$MC = \frac{1}{A_t} \left(\mathcal{S}_t P_{x,t}^*\right)^{\eta} \left(\mathcal{S}_t P_{x,t}^* MPL_{x,t}\right)^{1-\eta}$$

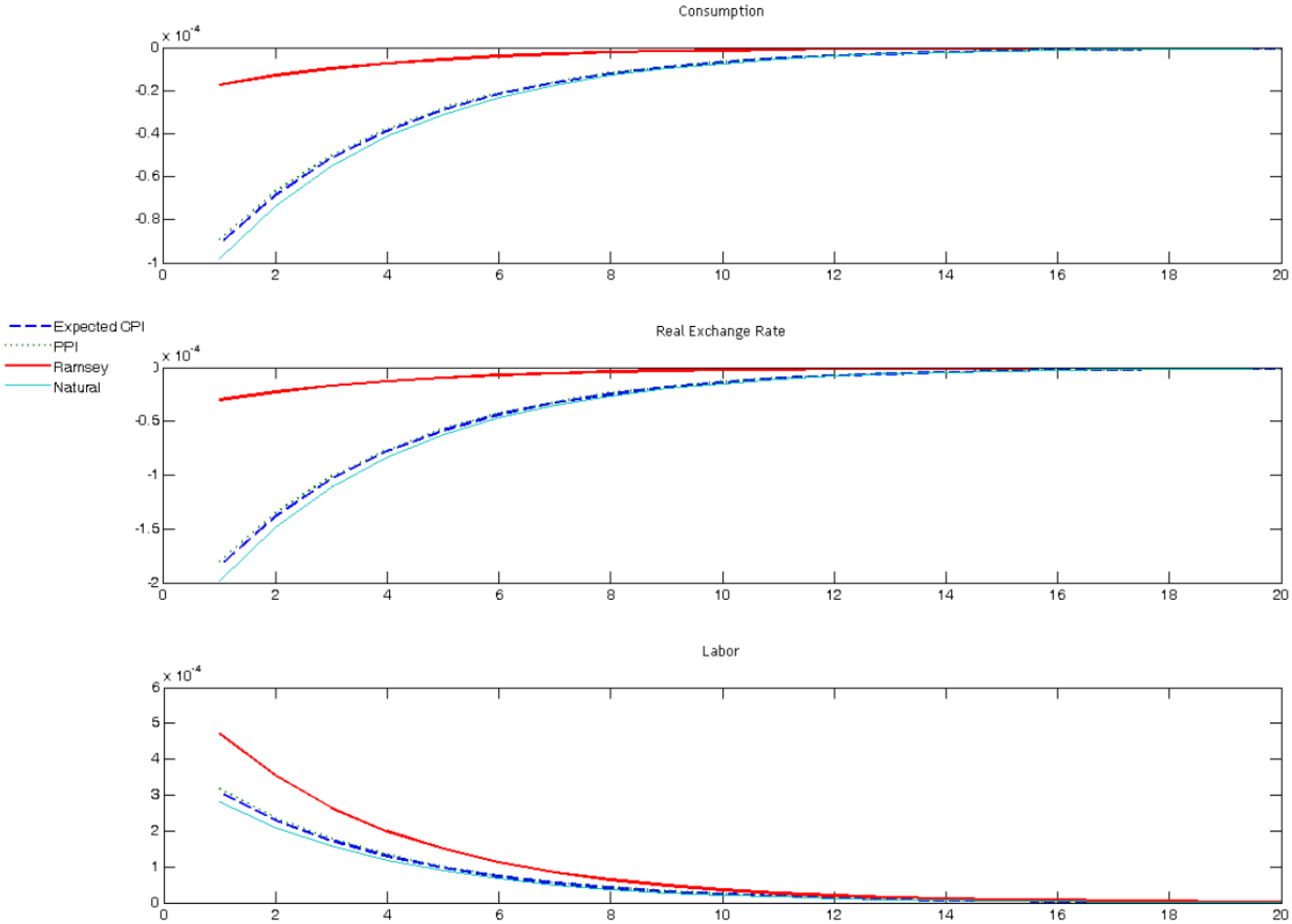
$$\Rightarrow \mathcal{S}_t = \frac{A_t}{P_{x,t}^* MPL_{x,t}^{1-\eta}} MC$$

- Use exchange rate to stabilize markup.

Catão and Chang (2013)

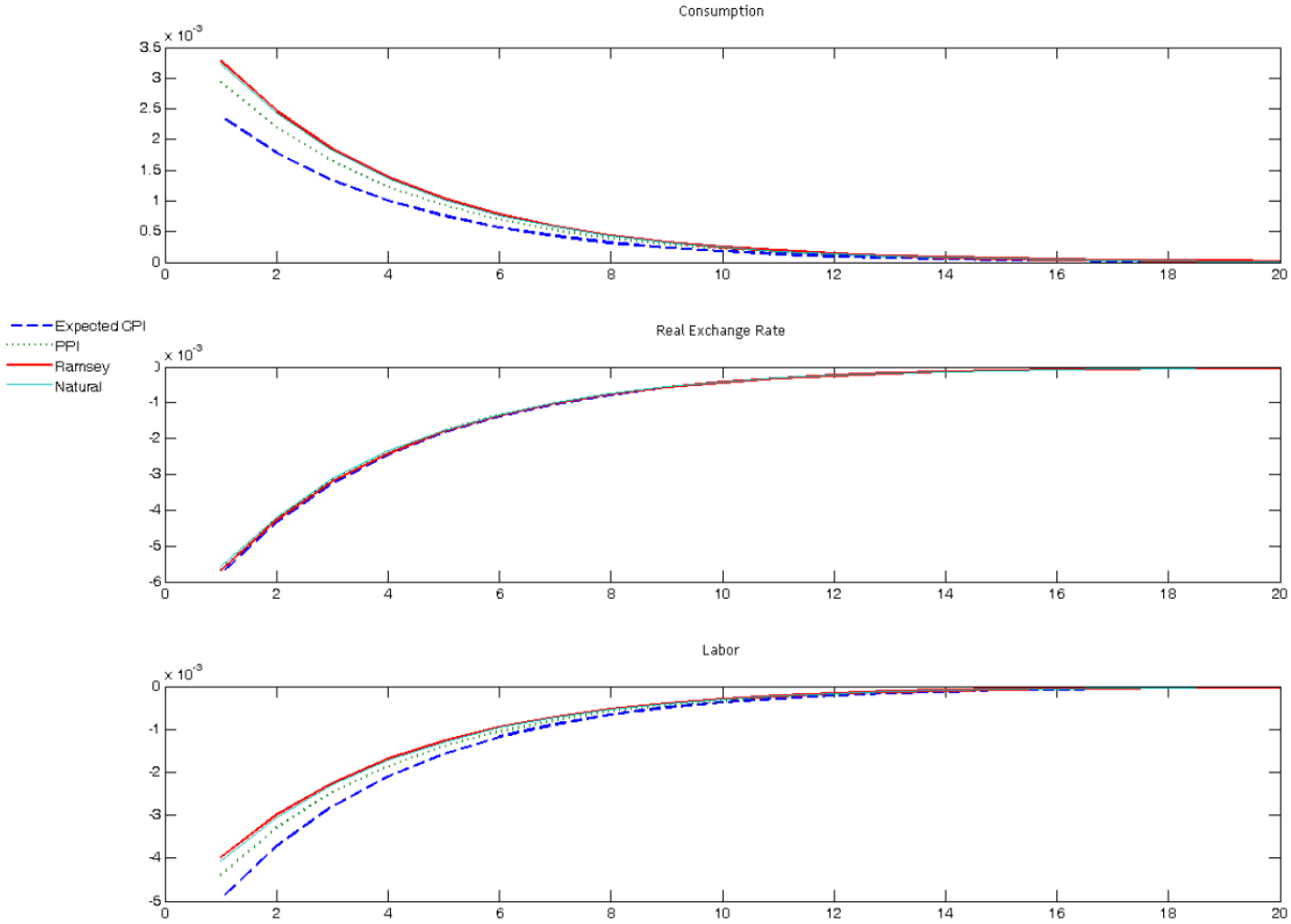
- Model similar to Hevia and Nicolini (2013), but compare risk sharing with financial autarky
- PPI targeting or CPI targeting if perfect risk sharing, PPI targeting or export price targeting if financial autarky
- Monetary policy must trade off the gains from higher consumption against the costs of more work when the exchange rate depreciates

Risk sharing versus financial autarky



Source: Catão and Chang (2013). Responses to a positive commodity price shock under risk sharing and autarky.

Risk sharing versus financial autarky



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Lessons so far

- Most insights from Galí and Monacelli (2005) carry over to a setting with oil exports (Hevia and Nicolini, 2013)
- But "good" monetary policy also depends on how the economy is structured
  - Access to capital markets, financial policy regime, integration between commodity sector and rest of economy, etc.
  - Parallel to optimal policy analysis in oil *importing* countries (Bodenstein et al., 2012)

Limitation in existing studies: Oil sector delivers input to non-oil producers in export economy, rather than the other way around

Ramsey optimal monetary policy

- Expected lifetime utility of HH member h

$$\mathcal{W}_t(h) = \mathbb{E}_t \sum_{s=t}^{\infty} \beta^{s-t} U\left(C_s(h), L_s(h)\right)$$

Aggregate expected lifetime utility is $\mathcal{W}_t \equiv \mathbb{E}_t \int_0^1 \mathcal{W}_{j,t}(h)\, dh$

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- Goal: Maximize expected lifetime utility of domestic HH's subject to their behavior (FOC's) and resource constraints:

$$(\mathbb{P}) \qquad \max \mathcal{W}_t \quad \text{subject to} \quad \mathbb{E}_t F\left(\mathcal{Y}_{t+1}, \mathcal{Y}_t, \mathcal{Y}_{t-1}, e_t\right) = 0$$

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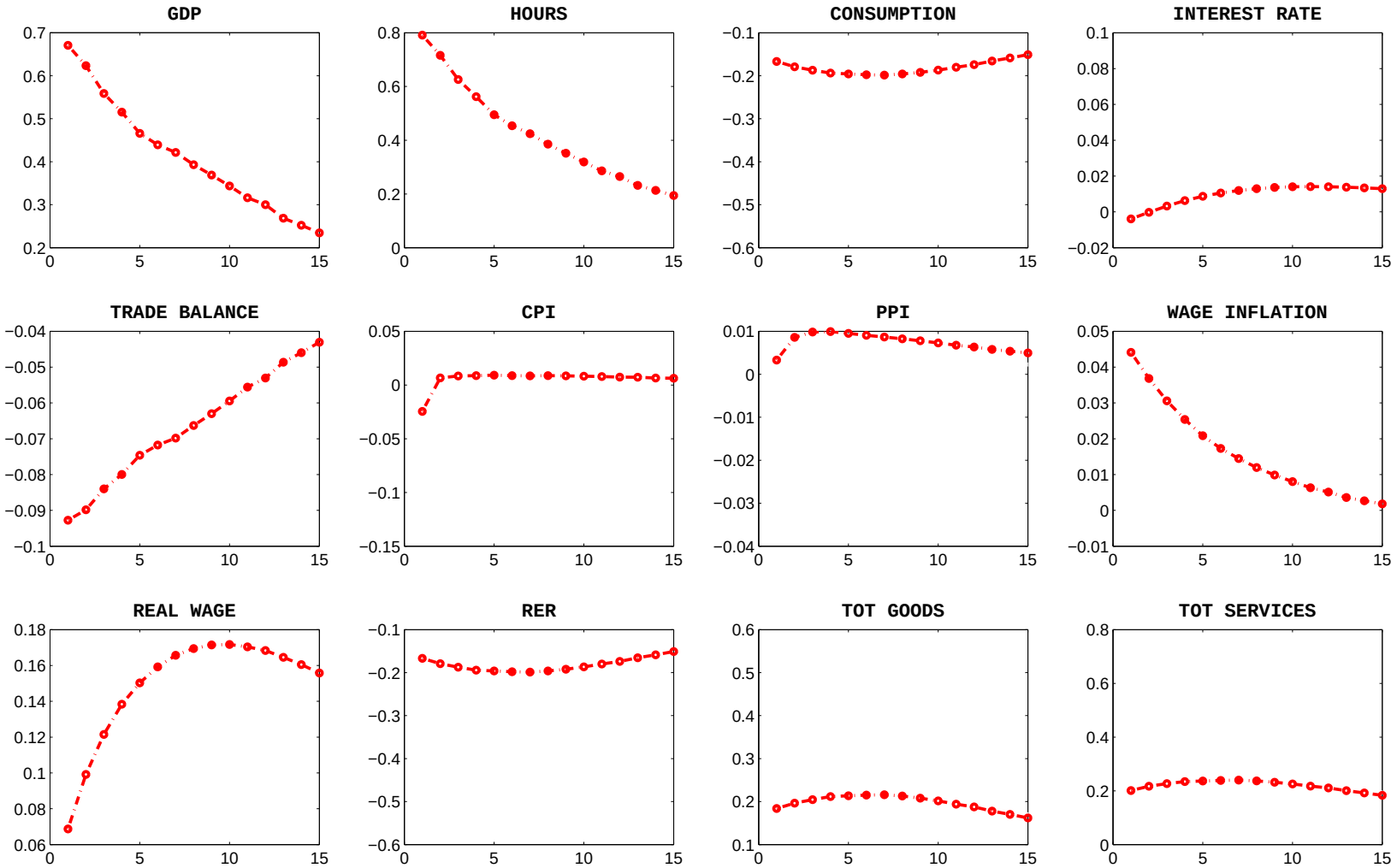
- Remarks:
  1. $\mathbb{E}_t F\left(\mathcal{Y}_{t+1}, \mathcal{Y}_t, \mathcal{Y}_{t-1}, e_t\right) = 0$ is the DSGE model (core).
  2. The instrument used to solve $(\mathbb{P})$ is R_t, the nominal interest rate.
  3. The solution to $(\mathbb{P})$ is known as Ramsey optimal (monetary) policy.

Bergholt (2014)



Note: IRFs under Taylor (red) and Ramsey (blue). Taylor rule: $\frac{R_t}{R} = \left(\frac{R_{t-1}}{R}\right)^{\rho r}\left[\left(\frac{\Pi_t}{\Pi}\right)^{\rho \pi}\left(\frac{GDP_t}{GDP_{t-1}}\right)^{\rho y}\right]^{1-\rho r}$.

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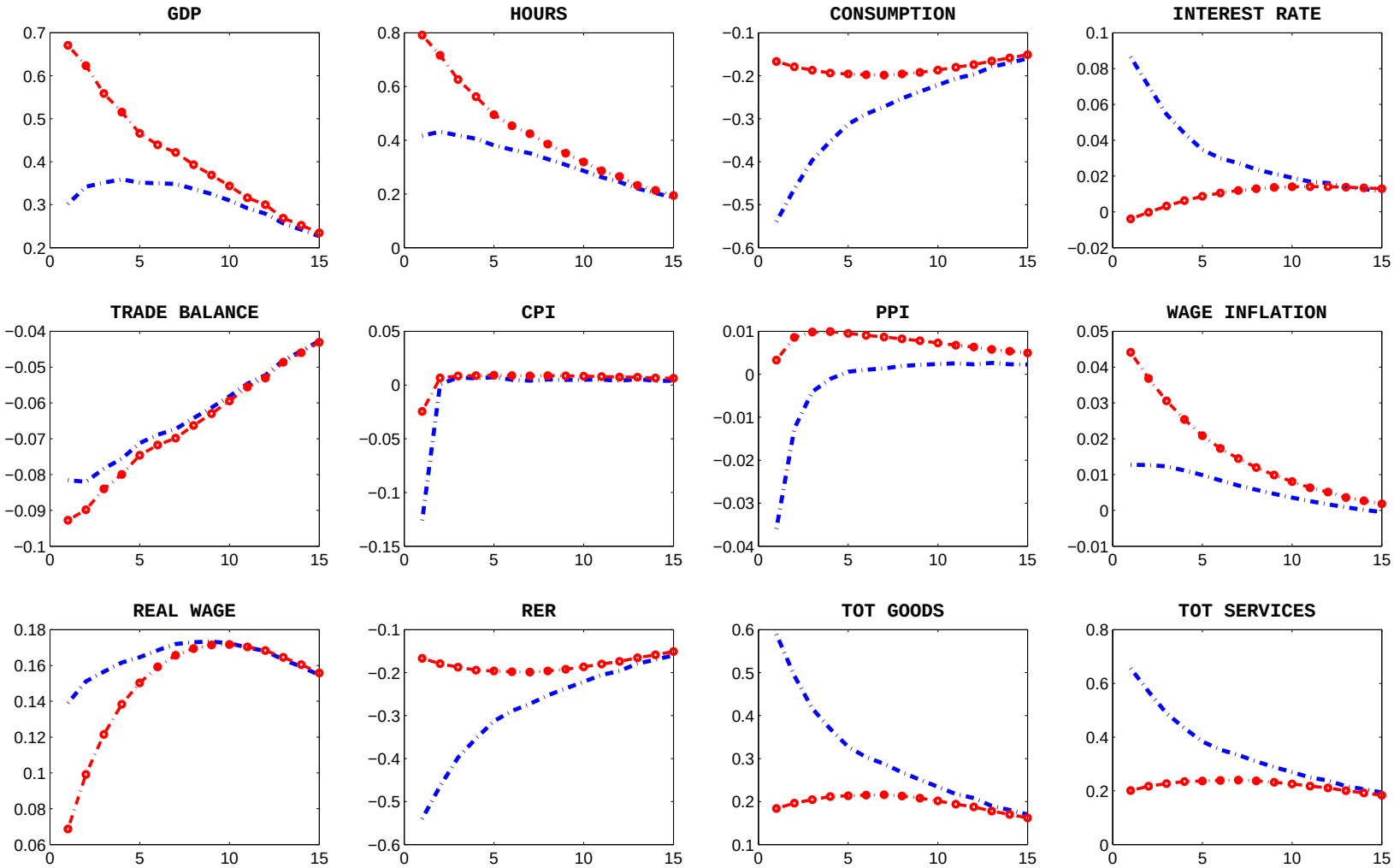

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Optimal policy features

- Observation: Higher oil prices $\Rightarrow$ resources *should* be reallocated towards the oil sector.

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Optimal policy features

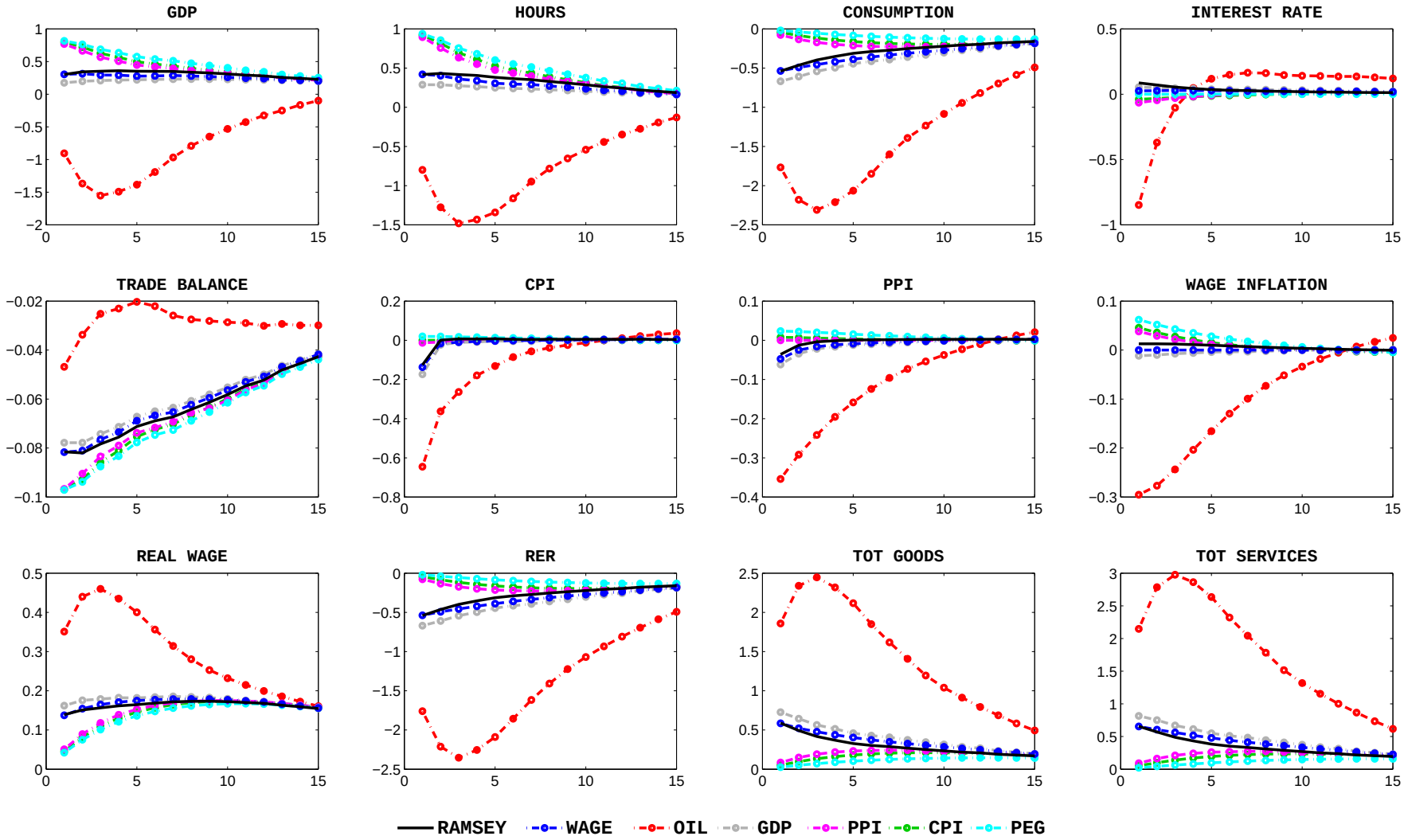
- Observation: Higher oil prices $\Rightarrow$ resources *should* be reallocated towards the oil sector.
- However, wage and price stickiness ...
  - ... prevent sufficient reallocation.
  - ... create cross-sectional wage and price dispersion across otherwise identical workers and firms.
- Ramsey optimal policy is an aggressive increase in (short and long) interest rates
  - $\Rightarrow$ higher real interest rates and appreciation of the RER (see UIP)
  - $\Rightarrow$ price deflation and less non-oil demand
  - $\Rightarrow$ CPI deflation helps to align MRS with real wages, i.e. $(1+\epsilon_w)\,\chi_N C_t L_{j,t}^{\varphi} = \Omega_{j,t}$
  - $\Rightarrow$ PPI deflation allows cheap input to the supply chain
  - $\Rightarrow$ alignment of real wage with the MRS limits the wage dispersion across workers.

Frankel (2003, 2008, 2011)

Proposes to peg the domestic currency value of the export price (PEP) because it stabilizes the terms of trade

- Objection 1: Excessive exchange rate volatility (Lars E. O . Svensson)
  - Suppose the world oil price doubles (e.g. from 50$ to 100$)
  - PEP implies a 50% NOK appreciation (e.g. I44 from 100 to 50), an extremely contractionary policy
- Objection 2: Interest rate channel not strong enough (Bergholt, 2014)
  - PEP imposes excessive volatility on the non-oil economy, causing large welfare losses elsewhere

Macro responses under strict targeting rules



Some issues

- Is commodity price exogeneity a valid restriction for net exporters?
- What about fiscal policy and foreign asset accumulation?
- What about the long run?
- The role of speculation?

Summary

Review of what we have covered

- Volatile commodity prices a potentially important source of macroeconomic fluctuations in resource economies
- A toy model
- DSGE models and their predictions regarding the oil-macro relationship
- The “oil price disconnect”
- Monetary policy among commodity exporters

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