

An Open Economy DSGE Model Linking The Euro Area and the US Economy

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Workshop "Practical Issues in DSGE Modelling at Central Banks", Bank of Finland, June 5-7, 2006

WORK IN PROGRESS

PRELIMINARY RESULTS

COMMENTS WELCOME

1. INTRODUCTION

- This contribution extends our closed economy models for the EA & US to an integrated two-country model. The result is an estimated medium-sized model in the NOEM-tradition.
- Most academic research on NOEM has been theoretical, with a few exceptions on small scale models:
 - Ghironi (1999), Bergin (2004), Lubik & Schorfheide (2003-2005);
 - Justiniano et al. (2005), Rabanal et al (2005), etc.
- Central Banks have developed large-scale open and multi-country models based on the NOEM approach: GEM, SIGMA, models at Riksbank, BoF, BoC, NAWM, BdI.
- Advances in Bayesian estimation techniques make it feasible to estimate medium-sized NOEM models now:
 - see Adolfson et al. (2004-2005), Adjémian et al. (2004).

1. INTRODUCTION (continued)

- **Insights from an estimated two-country EA-US model:**
- empirical test of a consistent model for the Trade Balance and the Exchange Rate behaviour and their relation with the domestic variables and the monetary policy reaction:
 - based on the marginal likelihood for different model specifications;
 - based on the stylised facts for the main open economy variables.
- the focus of this empirical exercise is:
 - on the estimation of the elasticity of substitution between domestic and foreign goods;
 - on the restrictions implied by the UIRP condition for the exchange rate and the overall model dynamics.

1. INTRODUCTION (continued)

- **Insights from an estimated two-country EA-US model:**
- the estimated model allows to assess the role of various types of shocks in explaining the exchange rate volatility as well as trade balance variations:
 - contribution of domestic shocks;
 - contribution of spill-over effects between the two main economies;
 - contribution of ROW shocks: oil shocks, UIRP shocks, demand and price shocks.

1. INTRODUCTION (continued)

- **Overview of the presentation:**
- model specification
- estimation results & issues
- model validation
 - structural IR: mon.pol., productivity, oil, uirp
 - reproducing stylised facts
 - variance decomposition
 - historical decomposition

2. MODEL DESCRIPTION

- Euro Area and US are modelled symmetrically
- Each country block contains three types of agents:
 - households: consume, work, set wages, invest, allocate wealth
 - ➔ hh have only access to one-period foreign bonds and the exchange rate is determined by the UIRP condition.
 - firms: hire labour and capital, import oil and foreign goods, produce goods, set prices
 - ➔ domestic good, import distribution good and final good sector
 - central bank: sets short-term interest rate
- Rest of the World is introduced via exogenous shocks:
 - Oil price, ROW price shocks and ROW demand shocks

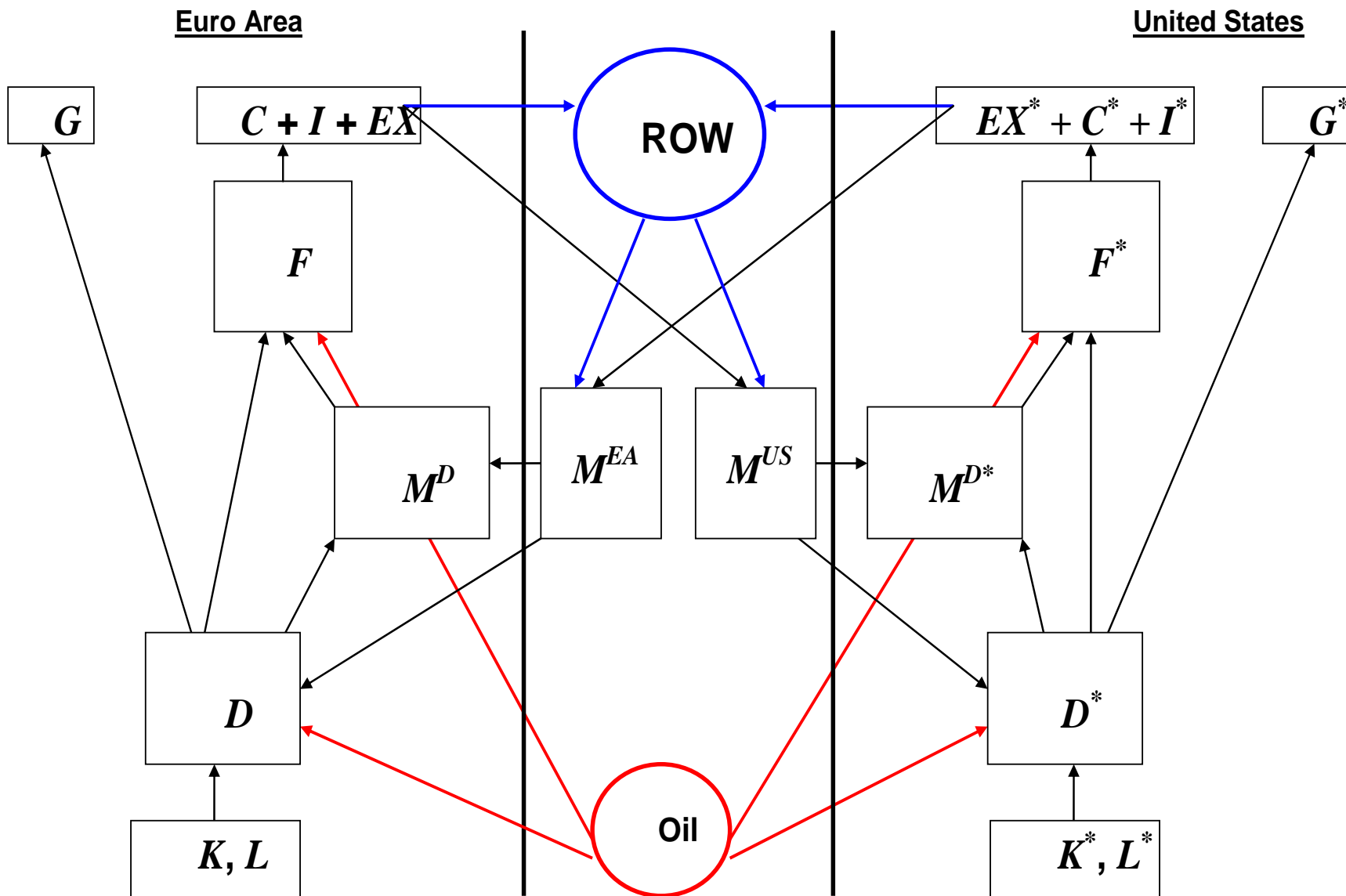
2. MODEL DESCRIPTION: household and firm sector

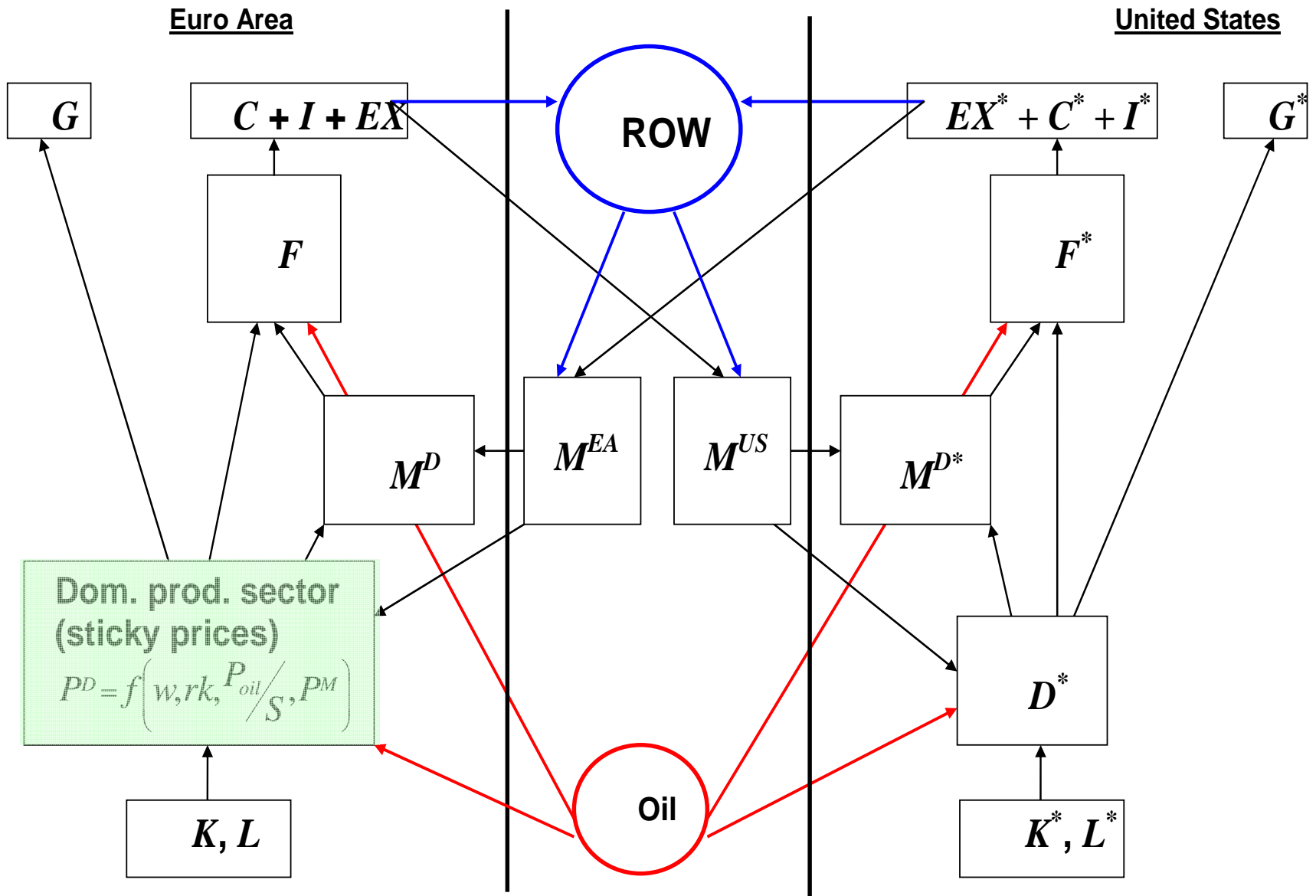
- Contains a relatively large number of real and nominal frictions (CEE 2005 – ACEL 2003 - S&W 2003)
 - Monopolistic competition in goods and labour markets with sticky nominal prices and wages;
 - Calvo pricing with partial indexation of prices and wages on lagged inflation;
 - Endogenous elasticity of demand (Eichenbaum & Fischer 2004);
 - Costs of adjustment in capital accumulation as a function of change in investment;
 - External habit formation;
 - Variable capital utilisation and fixed costs.

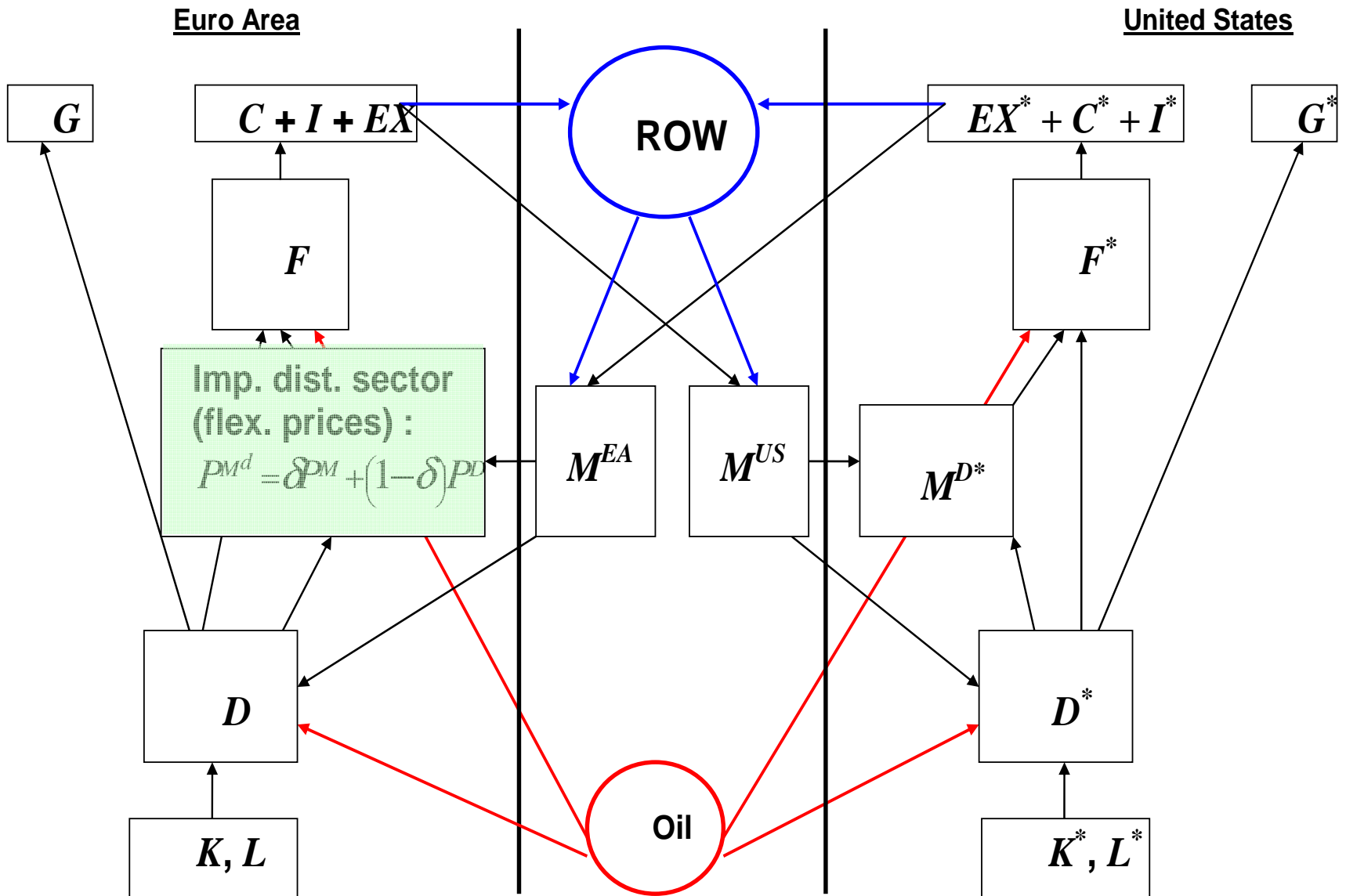
2. MODEL DESCRIPTION: detailed firm sector

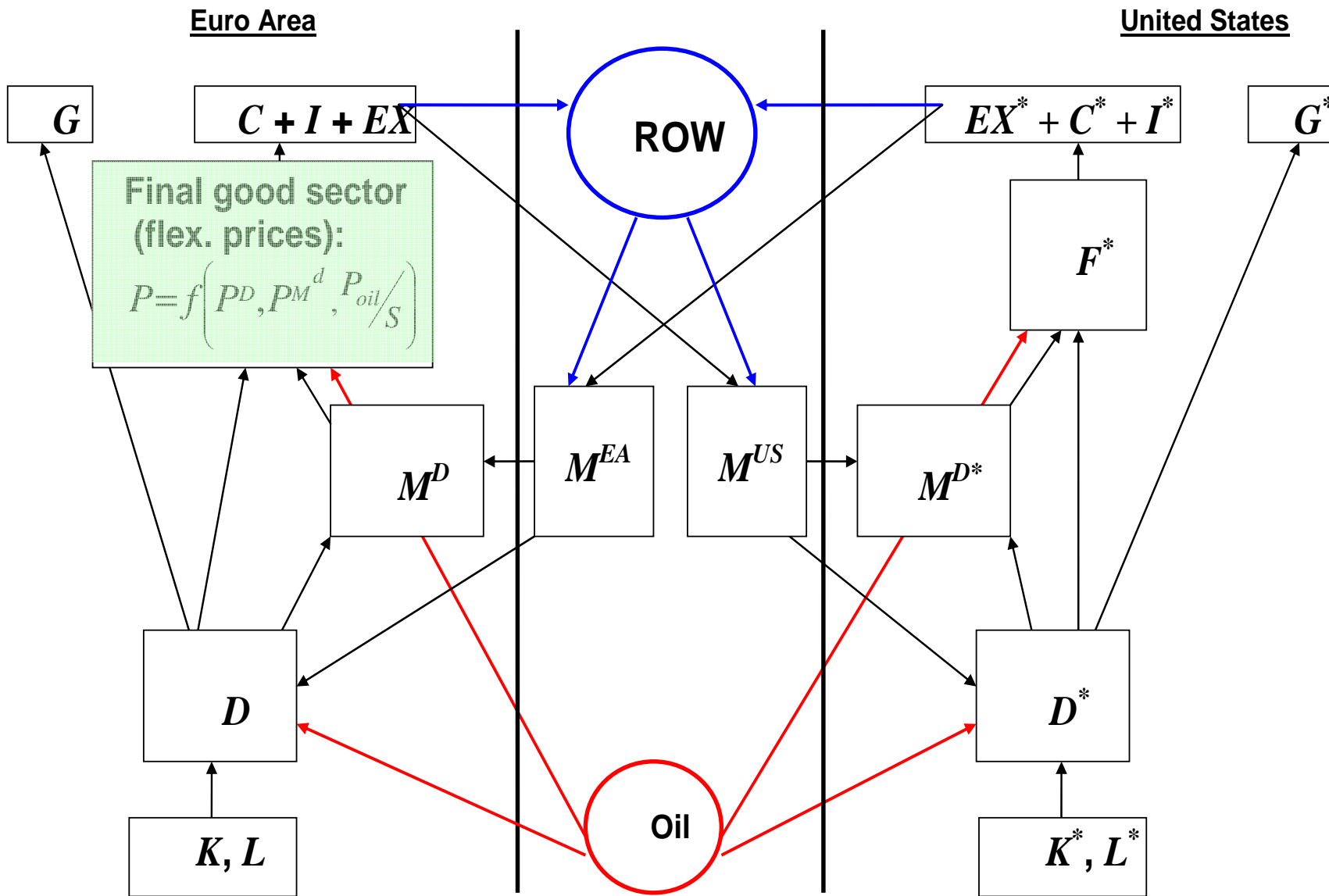
- Domestic intermediate good production sector:
 - sells to domestic final good producers and to the import distribution sector with sticky price;
- Imported intermediate good distribution sector:
 - combines foreign intermediate goods with domestic services and sells to the final good sectors at flexible price.
- Final good production sector:
 - combines domestic and imported goods with adjustment cost;
- Foreign trade sector:
 - determines sticky import price: pass-through is imperfect in short run but complete in the long run (Smets & Wouters 2002);
 - imported goods and oil are used as inputs both in the intermediate good production sector and in the final good sector.

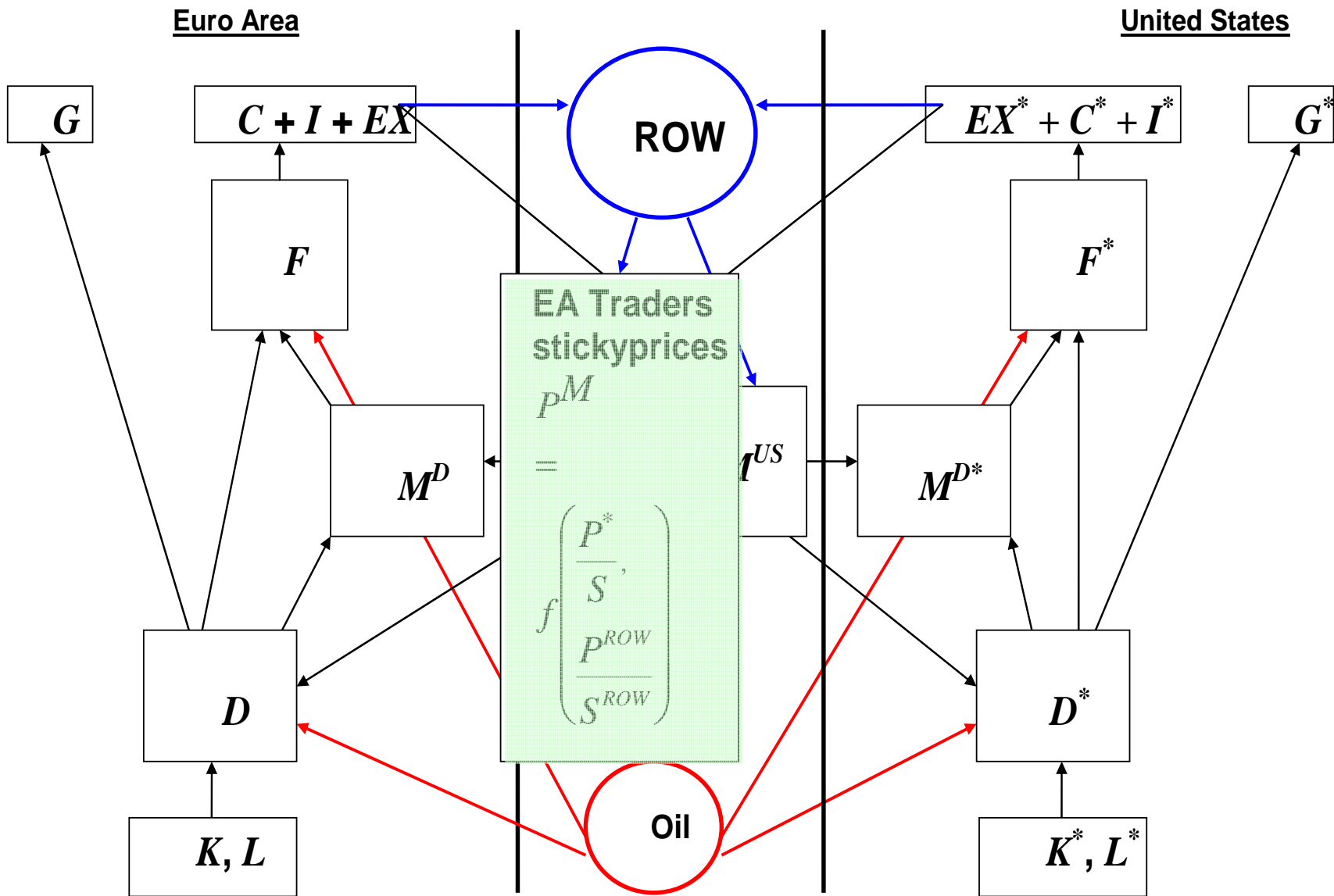
2. MODEL DESCRIPTION: detailed firm sector











2. MODEL DESCRIPTION: shocks

- supply: TFP and investment specific technology shocks;
- demand: intertemporal risk premium and government spending shocks;
- monetary policy: interest rate shocks;
- mark-up shocks: wages and producer prices (ARMA(1,1)), consumer prices (i.i.d. measurement error);
- ROW shocks: demand and price;

- oil price shocks;
- UIRP shocks;
- zero covariance between all shocks is assumed.

3. DESCRIPTION OF THE DATA

- 1974Q1-2004Q4 data for euro area and US (Smets & Wouters 2005)

- 10 country specific series:
 - growth rate in real GDP, consumption, investment, wages and employment (hours);
 - inflation in GDP, consumption and import deflator;
 - nominal short term interest rate;
 - real trade balance;

- 2 global series:
 - EUR/USD exchange rate depreciation and oil price inflation.

4. ESTIMATION RESULTS: 3 model versions

- model with a high and with a low substitution elasticity:
 - ➔ around a critical value of this parameter (~ 1.5) the exchange rate is extremely volatile and the model has an very low marginal likelihood (see discussion for IR of productivity shock below).
- model without UIRP and exogenous AR(1) process for exchange rate:
 - ➔ empirical test of the restrictions imposed by UIRP on the overall model dynamics and the systematic response of the exchange rate.

Marginal likelihood for the three model versions

Model with high elasticity of substitution	- 2358.99
Model with low elasticity of substitution	- 2355.27
Model without UIRP	- 2313.03

4. ESTIMATION RESULTS: parameter estimates

- parameter related to the domestic economy block are very similar to the estimates obtained in the closed economy models for all three model versions;
- the exception is the calvo price parameter due to the introduction of the endogenous demand elasticity (following Eichenbaum and Fischer 2004);
- stochastic structure will become clear when looking at the variance decomposition;
- parameters related to the open economy block are most interesting: both structural and behavioural parameters are estimated.

4. ESTIMATION RESULTS: closed economy block

Prior and posterior distribution: domestic economy parameters - HIGH elast.

	Prior Distribution			Posterior distribution			
	distr.	mean	stdev	Euro Area		US	
				mode	90% interval	mode	90% interval
inv. adj. cost	norm	4	1.5	8.07	6.20 / 9.54	4.39	3.00 / 6.06
sigma cons. util.	norm	1.5	0.375	0.84	0.77 / 0.98	0.94	0.78 / 2.03
sigma labor util.	norm	2	0.75	2.36	1.34 / 3.33	2.72	1.64 / 3.54
habit	beta	0.7	0.1	0.74	0.68 / 0.79	0.72	0.57 / 0.77
wage mark-up	norm	0.5	0.15	0.49	0.28 / 0.71	0.41	0.02 / 0.71
Calvo wage	beta	0.75	0.05	0.77	0.71 / 0.83	0.83	0.77 / 0.88
index. wage	beta	0.5	0.15	0.32	0.15 / 0.47	0.34	0.17 / 0.59
Calvo price	beta	0.66	0.05	0.74	0.68 / 0.79	0.70	0.63 / 0.74
index. price	beta	0.5	0.15	0.21	0.09 / 0.31	0.28	0.14 / 0.46
cap. util. adj. cost	norm	0.2	0.075	0.19	0.10 / 0.32	0.23	0.15 / 0.37
fixed cost	norm	1.25	0.125	1.35	1.22 / 1.52	1.46	1.36 / 1.58
Calvo employ.	beta	0.5	0.15	0.77	0.73 / 0.80		
Taylor rule EA							
r inflation	norm	1.5	0.25	1.62	1.31 / 1.94	1.50	1.21 / 1.74
r lagged int. rate	beta	0.75	0.1	0.88	0.84 / 0.92	0.87	0.83 / 0.90
r output gap	norm	0.125	0.05	0.08	0.04 / 0.13	0.12	0.06 / 0.18
r d(out. gap)	norm	0.125	0.05	0.19	0.15 / 0.25	0.21	0.17 / 0.26

4. ESTIMATION RESULTS: parameter estimates

- parameter related to the domestic economy block are very similar to the estimates obtained in the closed economy models for all three model versions;
- the exception is the calvo price parameter due to the introduction of the endogenous demand elasticity (following Eichenbaum and Fischer 2004);
- stochastic structure will become clear when looking at the variance decomposition;
- parameters related to the open economy block are most interesting: both structural and behavioural parameters are estimated.

4. ESTIMATION RESULTS: open economy block (1)

Prior and posterior distribution: open economy parameters - HIGH elast.

	Prior Distribution			Posterior distribution			
	distr.	mean	stdev	euro area		US	
				mode	90% interval	mode	90% interval
<i>structural parameters</i>							
imp. goods in D	norm	0.06	0.01	0.06	0.04 / 0.07	0.06	0.05 / 0.07
imp. goods in F	norm	0.06	0.01	0.07	0.06 / 0.08	0.05	0.04 / 0.06
oil in D	norm	0.006	0.001	0.006	0.004 / 0.007	0.006	0.005 / 0.007
oil in F	norm	0.006	0.001	0.007	0.005 / 0.008	0.007	0.006 / 0.009
delta	beta	0.7	0.1	0.86	0.77 / 0.93	0.73	0.58 / 0.86
beta m	beta	0.4	0.1	0.53	0.42 / 0.65	0.55	0.42 / 0.67
beta x	beta	0.4	0.1	0.36	0.26 / 0.50	0.25	0.16 / 0.33

4. ESTIMATION RESULTS: open economy block (2)

Prior and posterior distribution: open economy parameters - 3 models

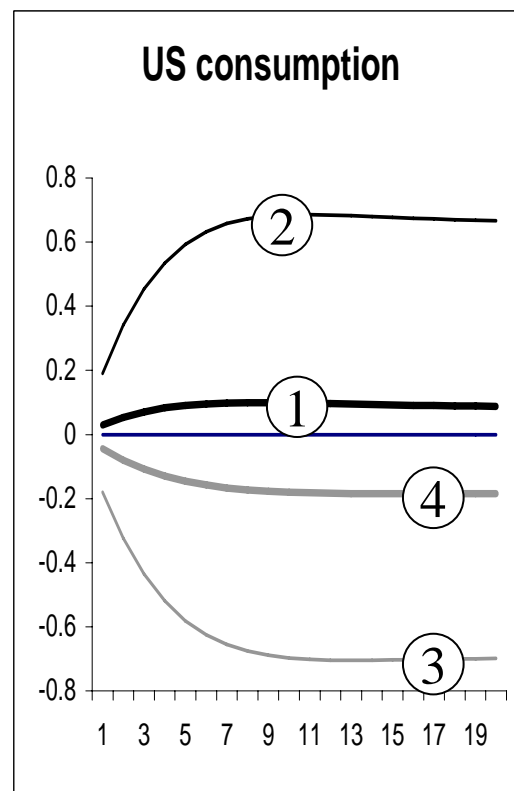
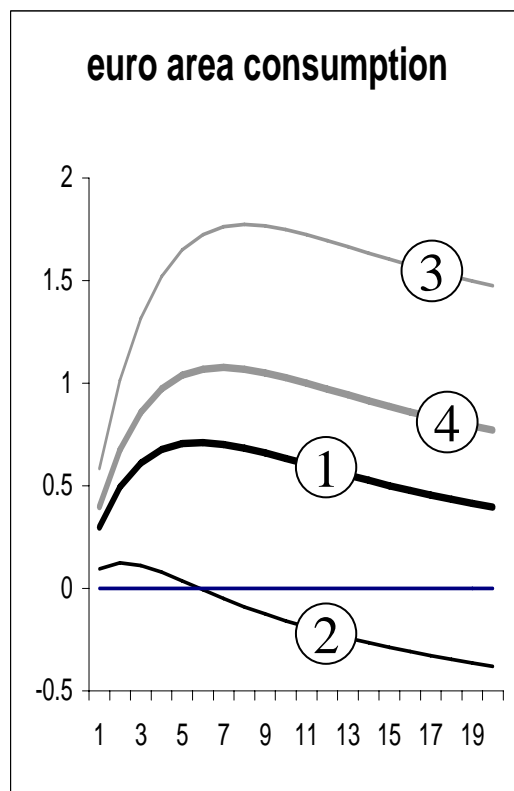
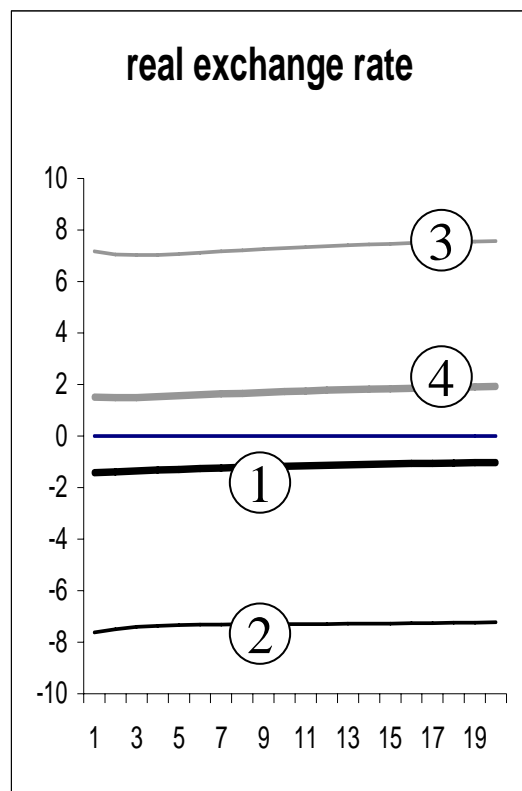
Prior Distribution				Posterior distribution			
				euro area		US	
distr.	mean	stdev		mode	90% interval	mode	90% interval
HIGH ELASTICITY							
<i>trade parameters</i>							
subst. elast.	norm	1.5	0.5	3.01	2.59 / 3.57	1.74	1.23 / 2.37
adj. cost.	norm	4	1	4.23	2.63 / 5.66	4.19	2.83 / 5.91
Calvo imp. price	beta	0.75	0.05	0.61	0.54 / 0.67	0.66	0.58 / 0.72
Index imp. price	beta	0.5	0.15	0.18	0.07 / 0.30	0.09	0.04 / 0.19
LOW ELASTICITY							
<i>trade parameters</i>							
subst. elast.	norm	1.5	0.5	1.08	0.53 / 1.74	1.26	0.36 / 1.74
adj. cost.	norm	4	1	3.89	2.09 / 5.65	4.22	2.49 / 5.59
Calvo imp. price	beta	0.75	0.05	0.64	0.58 / 0.70	0.68	0.59 / 0.75
Index imp. price	beta	0.5	0.15	0.17	0.08 / 0.30	0.10	0.04 / 0.19
NO UIRP							
<i>trade parameters</i>							
subst. elast.	norm	1.5	0.5	1.97	1.27 / 2.28	1.16	0.45 / 1.75
adj. cost.	norm	4	1	4.04	2.34 / 5.74	4.06	2.72 / 5.67
Calvo imp. price	beta	0.75	0.05	0.68	0.58 / 0.73	0.70	0.61 / 0.77
Index imp. price	beta	0.5	0.15	0.17	0.08 / 0.31	0.09	0.04 / 0.21

5. MODEL VALIDATION

- structural impulse response:
 - TFP productivity shocks: example of a supply shock to illustrate the importance of the elasticity substitution;
 - monetary policy interest rate shock and the transmission mechanism of monetary policy;
 - UIRP shocks;
 - OIL shocks.
- stylised facts: variances and correlations between main open economy macroeconomic series
- variance decomposition
- historical decomposition

5. MODEL VALIDATION: IRF TFP shock

- IRF of the RER and consumption to a TFP shock in the EA for different values of the elasticity of substitution



① 3.01

②

1.60

③

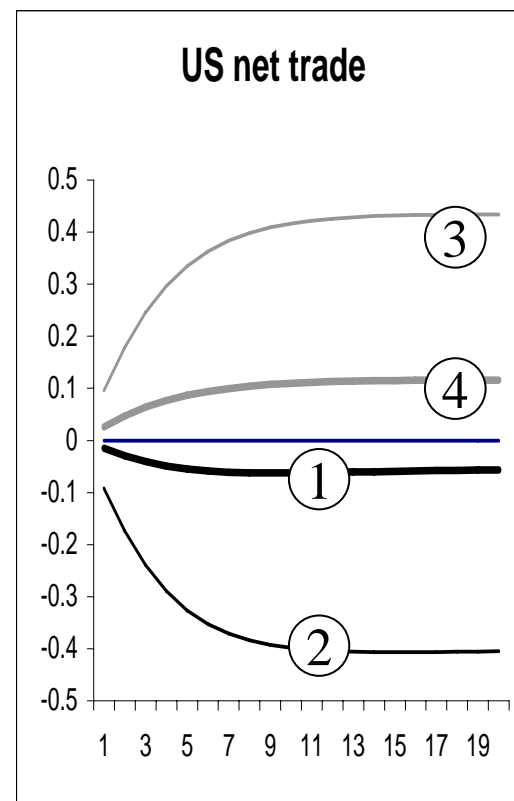
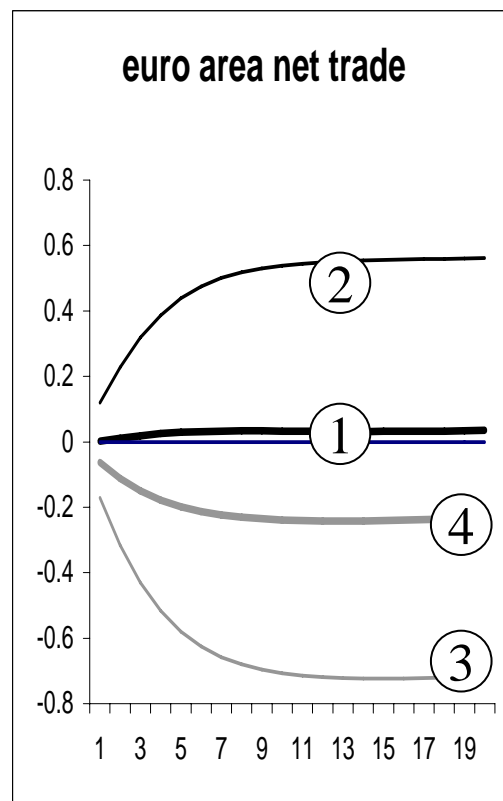
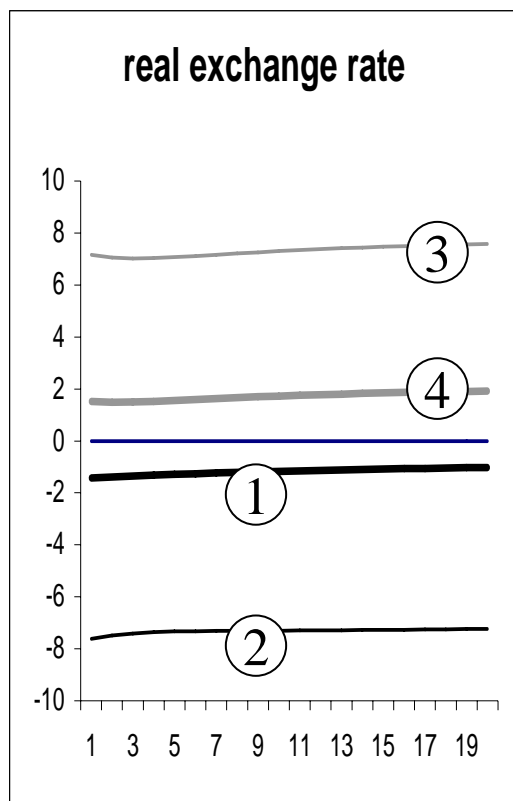
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④

0.80

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- IRF of the RER and consumption to a TFP shock in the EA for different values of the elasticity of substitution



① 3.01

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1.60

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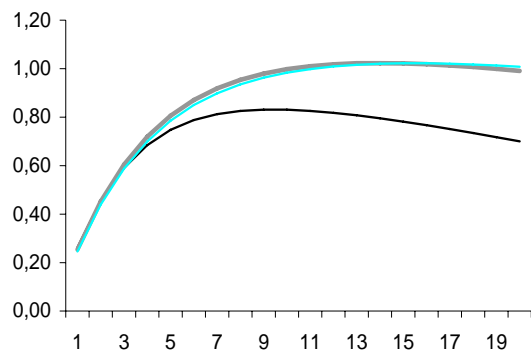
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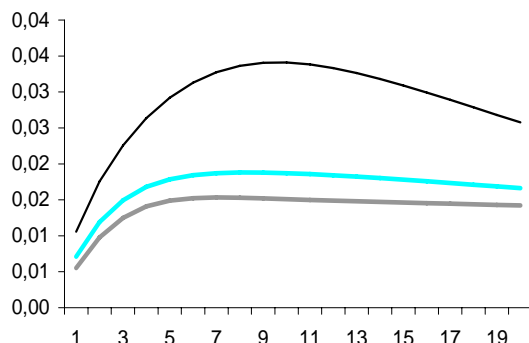
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5. MODEL VALIDATION: IRF TFP shock

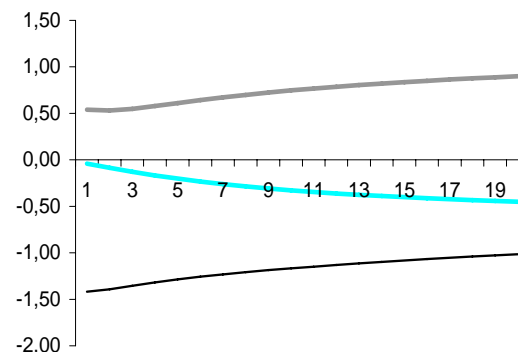
Y1



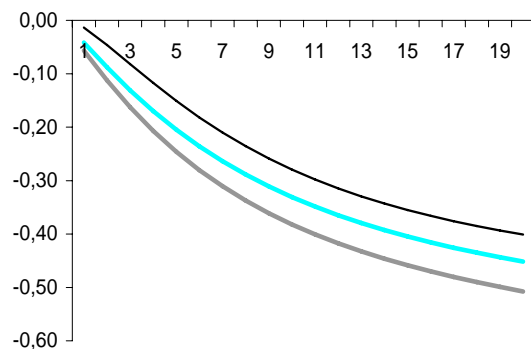
Y2



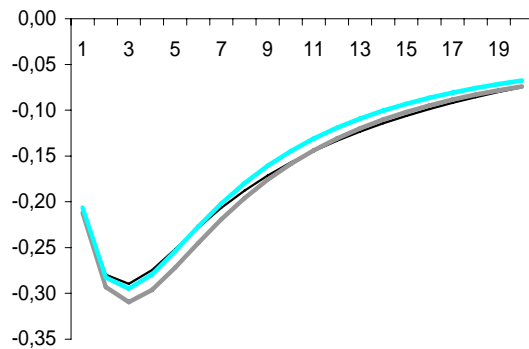
REAL EXCHANGE RATE



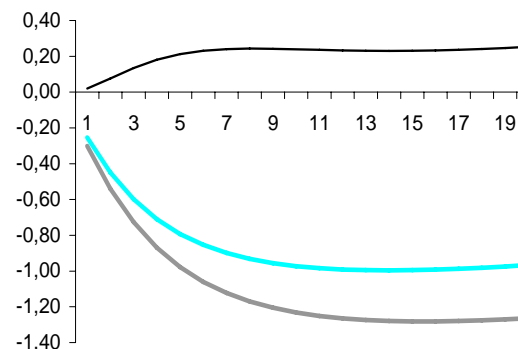
CPI 1



NOM. INTEREST RATE 1



NET TRADE 1



LEGEND black = high subst. elast. grey = low subst. elast. blue = no UIRP

5. IMPULSE-RESPONSE : MONETARY POLICY SHOCK

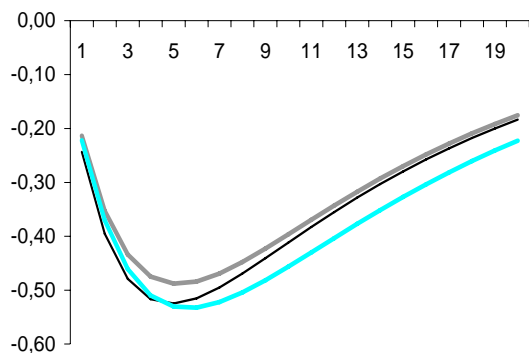
- transmission mechanism of a monetary policy shock in an open economy

- additional exchange rate mechanism:
 - impact on net trade through substitution effect: adj. costs
 - wealth effect on consumption
 - pass-through effect on inflation: PCP and sticky prices

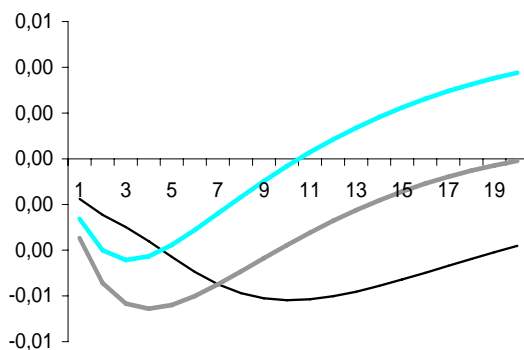
- spillover effects remain small and depend on elasticity of substitution

5. MODEL VALIDATION: IRF Monetary Policy shock

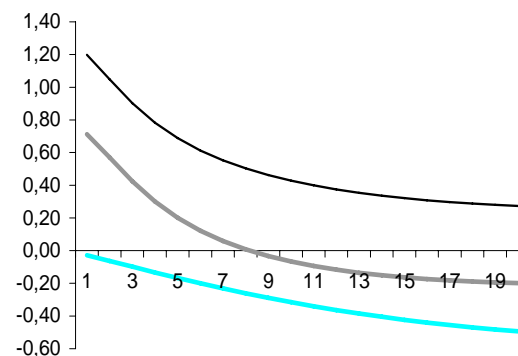
Y1



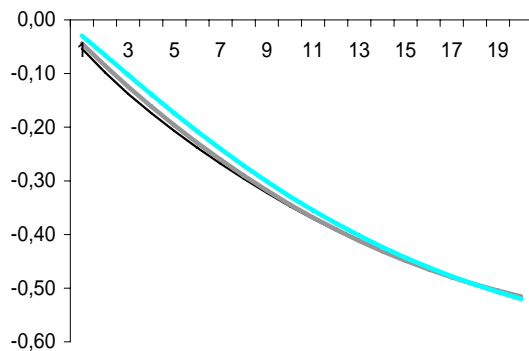
Y2



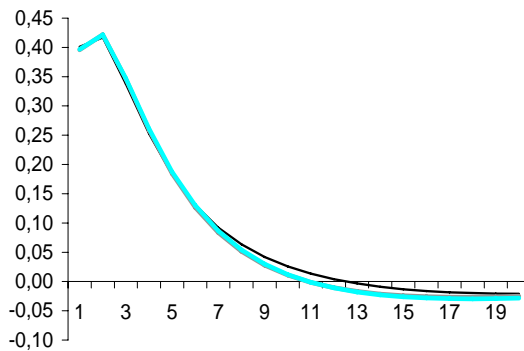
REAL EXCHANGE RATE



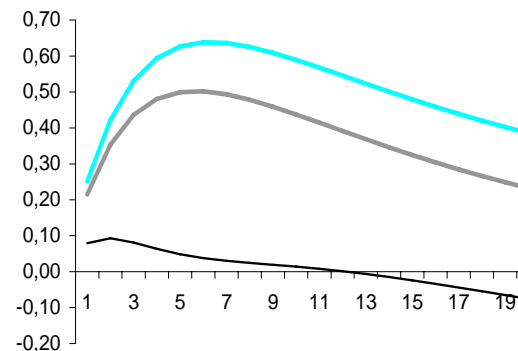
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NOM. INTEREST RATE 1



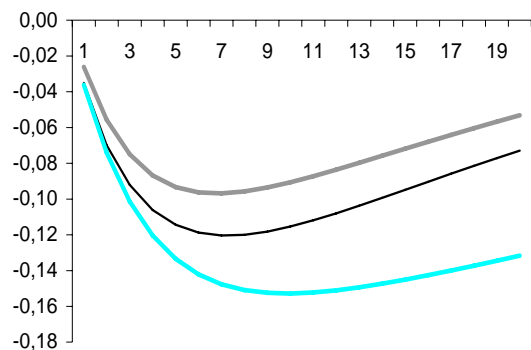
NET TRADE 1



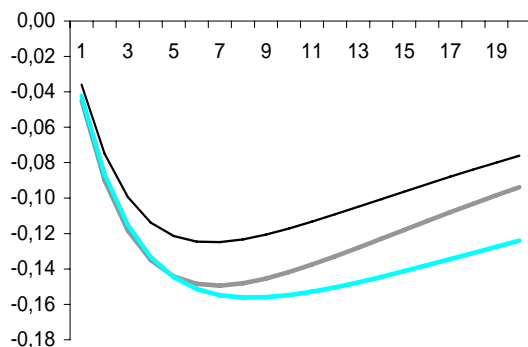
LEGEND black = high subst. elast grey = low subst. elast. blue = no UIRP

5. MODEL VALIDATION: IRF OIL shock

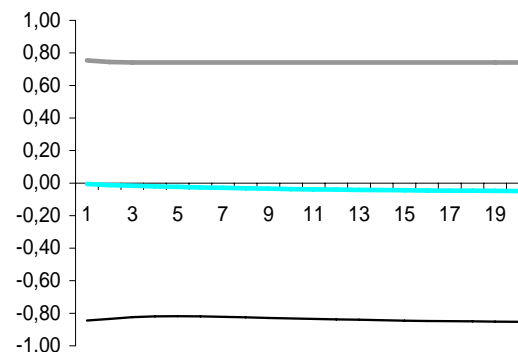
Y1



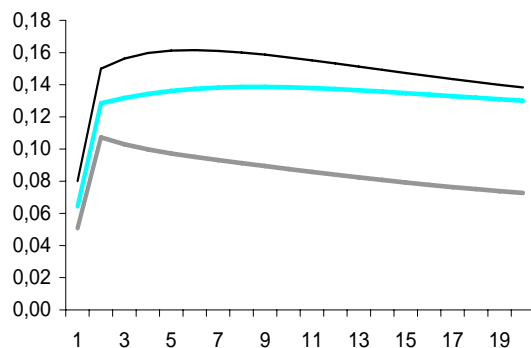
Y2



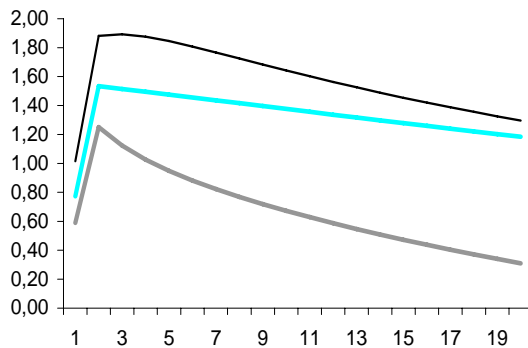
REAL EXCHANGE RATE



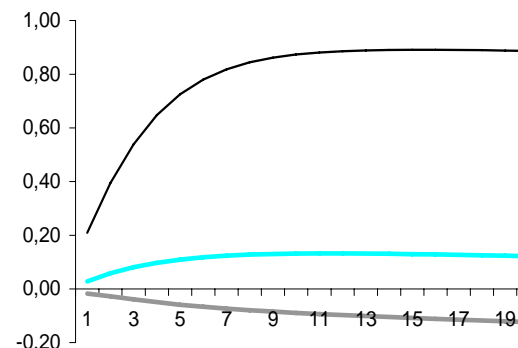
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IMPORT PRICE 1



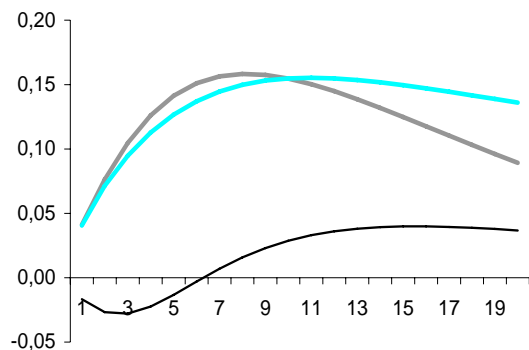
NET TRADE 1



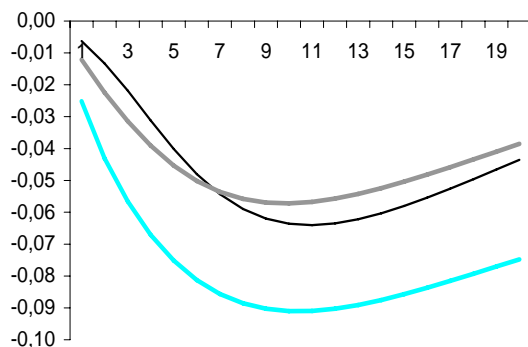
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5. MODEL VALIDATION: IRF UIRP shock

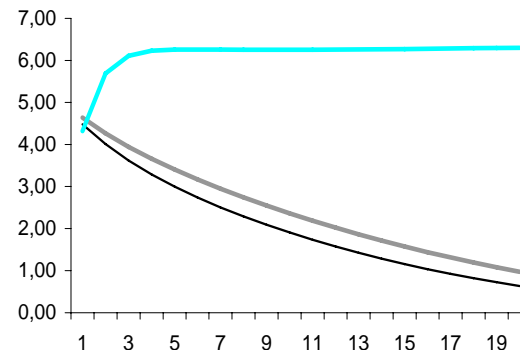
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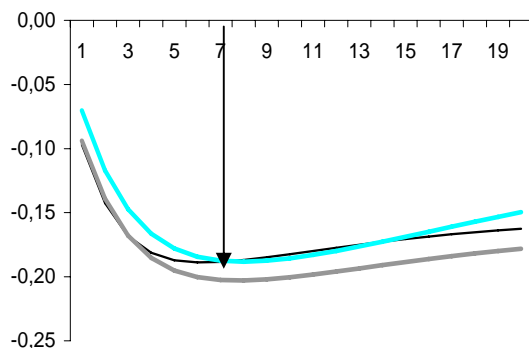
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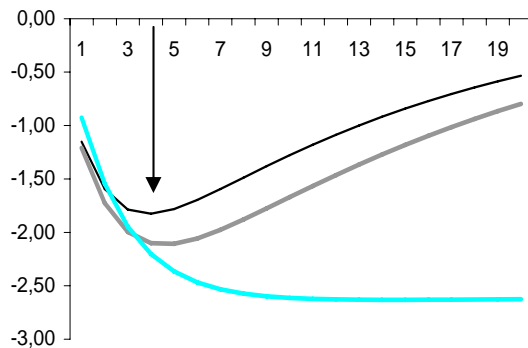
REAL EXCHANGE RATE



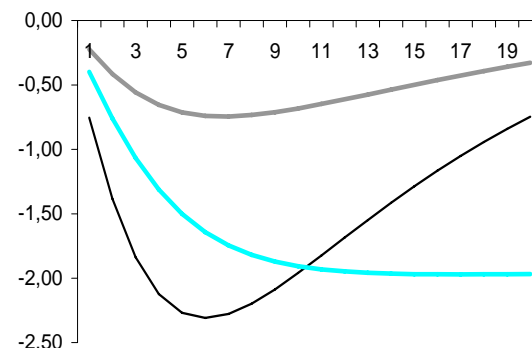
CPI 1



IMPORT PRICE 1



NET TRADE 1



LEGEND black = high subst. elast

grey = low subst. elast.

blue = no UIRP

6. STYLISTED FACTS

	DATA		HIGH SUBST.		LOW SUBST.		WITHOUT UIRP	
	US	EA	US	EA	US	EA	US	EA
st.dev.								
GDP	1.55	1.03	1.67	1.53	1.68	1.47	1.66	1.50
Consumption	1.19	0.92	1.74	1.69	1.70	1.75	1.69	1.78
Investment	5.20	2.54	6.00	4.14	6.10	3.89	5.91	3.94
Employment	1.32	0.72	1.19	0.55	1.21	0.51	1.19	0.52
Net Trade	0.40	0.48	0.46	0.64	0.42	0.52	0.43	0.56
Real Ex. Rate		7.84		7.36		7.25		7.50
Rel. Cons. Price		0.93		1.26		1.25		1.30
autocorrelation								
GDP	0.87	0.87	0.87	0.89	0.87	0.88	0.87	0.88
Consumption	0.86	0.86	0.88	0.90	0.88	0.90	0.88	0.90
Investment	0.92	0.88	0.93	0.92	0.93	0.91	0.93	0.92
Employment	0.89	0.97	0.82	0.94	0.83	0.94	0.83	0.94
Net Trade	0.86	0.86	0.85	0.85	0.84	0.84	0.85	0.85
Real Ex. Rate		0.86		0.70		0.71		0.84
Rel. Cons. Price		0.93		0.94		0.94		0.94

6. STYLISTED FACTS (continued)

	DATA		HIGH SUBST.		LOW SUBST.		WITHOUT UIRP	
	US	EA	US	EA	US	EA	US	EA
Cross Correlation over Countries								
GDP	0.42		0.05		0.00		0.05	
Consumption	0.33		-0.04		-0.08		-0.07	
Investment	0.34		-0.08		-0.12		0.01	
Employment	0.06		0.02		0.00		0.03	
Cross Correlation within Countries								
GDP-NT	-0.47	-0.35	-0.42	0.01	-0.50	-0.30	-0.44	-0.28
Cons. - NT	-0.61	-0.61	-0.52	-0.35	-0.59	-0.54	-0.58	-0.55
Invest. - NT	-0.48	-0.52	-0.51	-0.33	-0.54	-0.49	-0.48	-0.47
GDP - RER	0.06	0.10	-0.10	-0.10	-0.22	0.10	0.02	0.00
Cons. - RER	0.04	0.30	-0.16	0.00	-0.23	0.19	-0.11	0.13
Invest. - RER	0.08	0.21	-0.09	0.05	-0.20	0.18	0.04	0.00
NT - RER	0.24	-0.53	0.30	-0.29	0.29	-0.37	0.23	-0.30
Rel. Cons. - RER		0.18		0.11		0.29		0.16
Rel. GDP - RER		0.01		0.01		0.23		-0.02

6. STYLISED FACTS (continued)

Table 5: Correlation between the innovations over the two economies

	US => EA	contemporaneous	EA => US
prodty	-0.06	0.07	-0.06
risk prem.	0.19	0.10	0.03
gov. Spend.	-0.01	0.04	-0.15
mon.pol	0.10	0.29	0.01
p markup	0.06	0.02	0.07
inv.spec.techn.	0.01	0.00	0.05
ROW demand	-0.03	-0.08	0.12
pc shock	0.14	0.05	-0.01
ROW price	0.04	0.23	0.13
w markup	-0.01	0.11	0.08

Critical value for 124 observations 0.176 (for i.i.d series)

7. VARIANCE DECOMPOSITION: model with HIGH subst.

		Nominal Exchange Rate	
Horizon		4q.	10 y.
euro area shocks		0.124	0.254
of which	supply	0.067	0.051
	demand	0.006	0.022
	mark-up	0.006	0.120
	mon.pol.	0.046	0.061
US shocks		0.071	0.184
of which	supply	0.008	0.006
	demand	0.038	0.025
	mark-up	0.005	0.136
	mon.pol.	0.019	0.017
open econ. shocks		0.805	0.562
of which	UIRP	0.606	0.266
	Oil price	0.029	0.062
	ROW demand	0.018	0.032
	ROW price	0.152	0.202

7. VARIANCE DECOMPOSITION: model with HIGH subst.

Horizon	Trade Balance Euro Area		Trade Balance US	
	4q.	10 y.	4 q.	10 y.
domestic shocks	0.089	0.078	0.220	0.094
of which				
supply	0.005	0.020	0.017	0.026
demand	0.066	0.026	0.190	0.060
mark-up	0.016	0.029	0.001	0.003
mon.pol	0.001	0.003	0.012	0.005
spill-over	0.067	0.035	0.039	0.087
open econ. shocks	0.844	0.888	0.741	0.819
of which				
UIRP	0.376	0.272	0.195	0.123
Oil price	0.035	0.135	0.008	0.042
ROW demand	0.261	0.081	0.465	0.564
ROW price	0.171	0.400	0.073	0.089

7. VARIANCE DECOMPOSITION: model with HIGH subst.

Horizon	Output Euro Area		Output US	
	4q.	10 y.	4 q.	10 y.
domestic shocks	0.955	0.982	0.976	0.959
of wich				
supply	0.381	0.549	0.147	0.398
demand	0.347	0.099	0.673	0.354
mark-up	0.017	0.237	0.012	0.101
mon.pol.	0.211	0.097	0.143	0.106
spill-over	0.001	0.000	0.000	0.001
open econ. shocks	0.044	0.017	0.024	0.039
of which				
UIRP	0.001	0.001	0.001	0.003
Oil price	0.008	0.007	0.008	0.012
ROW demand	0.033	0.006	0.015	0.014
ROW price	0.002	0.003	0.001	0.010

7. VARIANCE DECOMPOSITION: model with HIGH subst.

Horizon	CPI infl. Euro Area		CPI infl. US	
	4q.	10 y.	4 q.	10 y.
domestic shocks	0.817	0.902	0.812	0.859
of which supply	0.027	0.028	0.020	0.022
demand	0.015	0.018	0.015	0.028
mark-up	0.727	0.813	0.762	0.790
mon. pol.	0.048	0.044	0.015	0.019
spill-over	0.008	0.004	0.006	0.004
open econ. shocks	0.175	0.093	0.182	0.137
of which UIRP	0.068	0.033	0.022	0.013
Oil price	0.062	0.031	0.049	0.030
ROW demand	0.001	0.001	0.001	0.001
ROW price	0.044	0.029	0.111	0.093

8. HISTORICAL DECOMPOSITION: output EA

Historical Decomp. of output in the EA in the model with HIGH subst. elast.: average growth rate and relative contribution

Subperiod	Observed growth	Contribution of Euro area shocks								Contribution of US Shocks	Contribution of foreign shocks			
		prodty	inv	riskp	gov	monpol	p	pc	w		nt_ea	pm_eas	oil	uirp
74:1-75:1	-1.04	0.13	-0.17	-0.33	-0.57	0.53	-0.16	0.02	-0.25	-0.04	0.07	-0.06	-0.10	0.00
75:1-79:4	0.21	0.15	-0.03	0.16	0.06	0.01	0.11	0.02	-0.25	0.01	-0.01	-0.01	-0.02	0.00
79:4-82:4	-0.71	0.16	0.02	0.01	-0.12	-0.50	-0.07	0.00	-0.17	-0.02	-0.06	-0.02	0.02	0.03
82:4-90:1	0.13	-0.04	0.04	0.04	0.06	-0.11	0.06	0.00	0.01	0.01	-0.01	0.01	0.04	-0.01
90:1-93:2	-0.33	0.12	-0.14	-0.17	-0.06	-0.28	-0.04	0.00	0.06	-0.01	0.08	0.01	0.01	0.01
93:2-00:1	0.11	-0.20	0.04	-0.10	0.00	0.26	-0.07	-0.02	0.17	0.00	-0.02	0.01	0.01	0.00
00:1-03:1	-0.33	-0.38	-0.09	-0.09	0.00	0.15	-0.06	0.00	0.25	-0.01	-0.01	0.02	-0.02	-0.03
03:1-04:4	-0.09	-0.49	0.06	-0.08	0.06	0.18	-0.07	0.00	0.22	0.02	-0.08	0.00	-0.03	-0.01

(recessions in bold)

8. HISTORICAL DECOMPOSITION: output US

Historical Decomp. of output in the US in the model with a HIGH subst. elast.: average growth rate and relative contribution

Subperiod	Observed growth	Contribution of US Shocks								Contribution of EA Shocks	Contribution of foreign shocks			
		prodty	inv	riskp	gov	monpol	p	pc	w		nt_ea	pm_eas	oil	uirp
74:1-75:1	-1.51	-0.05	0.04	-0.66	-0.13	0.01	-0.20	0.05	-0.11	-0.01	0.00	-0.05	-0.11	-0.01
75:1-79:4	0.14	-0.07	0.15	0.22	-0.03	0.05	0.00	0.02	-0.14	0.01	0.00	0.00	-0.02	-0.01
79:4-82:4	-0.84	-0.10	0.06	-0.14	-0.04	-0.57	-0.03	-0.01	-0.08	-0.01	0.00	0.00	0.01	0.01
82:4-90:1	0.32	-0.06	-0.10	0.10	0.04	0.17	0.02	-0.03	0.11	0.00	0.00	0.01	0.03	0.00
90:1-93:2	-0.27	0.13	-0.09	-0.41	-0.04	0.06	-0.01	-0.04	0.08	0.00	0.00	0.01	0.01	-0.01
93:2-00:1	0.22	-0.02	-0.04	0.16	-0.01	0.02	0.00	-0.01	0.09	0.00	0.00	0.01	0.01	0.01
00:1-03:1	-0.41	0.23	-0.10	-0.43	0.06	-0.08	0.04	0.00	-0.07	-0.01	0.00	0.02	-0.01	0.04
03:1-04:4	0.39	0.44	0.14	0.06	-0.04	-0.01	-0.05	0.00	-0.04	-0.01	0.00	-0.02	-0.04	-0.02

(recessions in bold)

8. HISTORICAL DECOMPOSITION: EURO-USD

Historical Decomposition of exchange rate fluctuations

HIGH substitution elasticity

Subperiod	Observed change	Contribution of Euro area shocks							
		prodty	inv	riskp	gov	monpol	p	pc	w
74:1-80:1	20.19	-5.07	0.85	0.84	-0.33	-14.21	0.62	-0.14	-16.30
80:1-85:1	-75.06	-3.82	0.36	-7.43	-0.01	6.83	-0.29	3.36	-20.11
85:1-88:1	58.99	4.47	-0.59	-0.23	0.29	2.53	1.81	-1.30	-11.54
98:4-01:2	-29.87	4.61	0.09	1.82	-0.04	-3.73	-0.38	0.32	-0.18
01:2-04:4	39.68	5.30	0.51	1.07	0.19	-5.55	-2.08	0.35	3.15
		Contribution of US Shocks							
		prodty	inv	riskp	gov	monpol	p	pc	w
74:1-80:1	20.19	-0.59	1.53	-1.06	0.96	-1.53	1.40	-4.71	18.06
80:1-85:1	-75.06	0.63	3.37	5.96	-0.77	-4.55	0.00	-4.18	14.63
85:1-88:1	58.99	-0.22	1.85	2.93	0.07	0.27	-2.17	-1.84	2.85
98:4-01:2	-29.87	1.78	-0.19	5.92	0.14	-0.14	-1.46	1.86	-2.67
01:2-04:4	39.68	2.28	-1.76	1.78	-0.34	-0.43	-0.07	3.24	-2.61
		Contribution of foreign shocks							
		nt_ea	nt_us	pm_ea	pm_us	oil	uirp		
74:1-80:1	20.19	4.66	-0.24	5.01	-3.80	-8.30	27.70		
80:1-85:1	-75.06	-3.99	-0.08	-12.29	0.82	-2.86	-58.52		
85:1-88:1	58.99	-1.53	-0.26	4.38	1.07	1.83	49.32		
98:4-01:2	-29.87	0.02	-0.35	-10.50	-1.44	-4.07	-26.32		
01:2-04:4	39.68	-1.23	-0.59	5.53	4.34	-2.50	21.89		

8. HISTORICAL DECOMPOSITION: EURO-USD

Historical Decomposition of exchange rate fluctuations

LOW substitution elasticity

Subperiod	Observed change	Contribution of Euro area shocks								
		prodty	inv	riskp	gov	monpol	p	pc	w	
74:1-80:1	20.19	5.46	-1.19	2.75	-0.59	-4.43	0.51	2.36	-32.22	
80:1-85:1	-75.06	5.15	1.34	-5.28	-0.21	1.84	-0.64	0.82	-27.91	
85:1-88:1	58.99	-0.16	-0.15	-0.41	0.43	1.78	3.80	0.93	-12.33	
98:4-01:2	-29.87	-5.45	-0.77	2.39	-0.08	-1.62	-0.25	-0.19	3.76	
01:2-04:4	39.68	-7.77	-0.12	-1.01	0.30	-2.66	-2.75	-0.24	8.09	
		Contribution of US Shocks								
		prodty	inv	riskp	gov	monpol	p	pc	w	
74:1-80:1	20.19	-0.28	-0.78	-3.59	0.74	-1.57	1.62	-5.23	19.76	
80:1-85:1	-75.06	1.22	1.70	5.03	-0.63	-1.37	0.12	-3.85	15.84	
85:1-88:1	58.99	0.35	2.50	1.72	0.15	0.49	-2.49	-1.28	3.74	
98:4-01:2	-29.87	1.43	0.68	5.72	0.00	0.04	-1.37	2.09	-2.09	
01:2-04:4	39.68	0.45	-2.49	1.84	-0.30	-0.32	0.07	3.21	-2.12	
		Contribution of foreign shocks								
		nt_ea	nt_us	pm_ea	pm_us	oil	uirp			
74:1-80:1	20.19	-9.11	0.12	6.18	7.82	7.44	17.34			
80:1-85:1	-75.06	-7.86	0.10	-10.41	4.68	2.08	-63.85			
85:1-88:1	58.99	3.93	0.01	5.77	3.70	-2.01	43.69			
98:4-01:2	-29.87	-4.52	0.40	-10.11	0.83	3.66	-29.28			
01:2-04:4	39.68	-0.98	0.35	3.77	0.59	2.12	32.79			

8. HISTORICAL DECOMPOSITION: EU US Trade Balance

Historical Decomposition of the net trade balance
(net trade balance expressed as a % of GDP)

HIGH substitution elasticity

Subperiod	Observed change	Contribution of Euro area shocks							
		prodty	inv	riskp	gov	monpol	p	pc	w
74:1-80:1	0.27	-0.34	-0.01	0.13	0.00	-0.30	-0.08	-0.09	0.59
80:1-85:1	-1.72	-0.44	0.07	-0.34	0.01	0.15	0.01	0.07	0.23
85:1-88:1	0.27	0.00	-0.02	0.00	0.00	0.05	-0.09	-0.04	-0.02
98:4-01:2	-1.48	0.30	-0.02	0.16	0.00	-0.10	-0.01	0.00	-0.16
01:2-04:4	-1.76	0.31	0.02	-0.12	0.00	-0.08	0.08	0.00	-0.22
		Contribution of US Shocks							
		prodty	inv	riskp	gov	monpol	p	pc	w
74:1-80:1	0.27	0.13	-0.36	-0.32	0.07	-0.03	0.08	-0.03	0.23
80:1-85:1	-1.72	0.08	0.05	0.14	-0.07	0.36	-0.03	0.01	0.07
85:1-88:1	0.27	0.04	0.40	0.21	0.02	-0.33	-0.07	0.02	-0.14
98:4-01:2	-1.48	-0.04	0.17	0.25	0.02	-0.06	-0.11	0.00	0.02
01:2-04:4	-1.76	-0.37	-0.12	0.63	-0.01	0.05	0.01	0.00	0.07
		Contribution of foreign shocks							
		nt_ea	nt_us	pm_ea	pm_us	oil	uirp		
74:1-80:1	0.27	0.36	-0.57	-0.28	0.22	-0.74	1.08		
80:1-85:1	-1.72	-0.20	0.27	0.69	-0.04	-0.38	-2.41		
85:1-88:1	0.27	-0.14	-0.96	0.00	-0.53	0.02	1.85		
98:4-01:2	-1.48	-0.08	-1.20	0.44	0.07	-0.13	-1.01		
01:2-04:4	-1.76	-0.02	-1.70	-0.25	-0.48	-0.10	0.49		

8. HISTORICAL DECOMPOSITION: EU US Trade Balance

Historical Decomposition of the net trade balance
(net trade balance expressed as a % of GDP)

LOW substitution elasticity

Subperiod	Observed change	Contribution of Euro area shocks							
		prodty	inv	riskp	gov	monpol	p	pc	w
74:1-80:1	0.27	0.27	-0.14	0.19	0.00	0.25	0.04	0.06	-0.42
80:1-85:1	-1.72	0.26	0.12	-0.20	0.00	-0.30	-0.02	-0.06	-0.20
85:1-88:1	0.27	-0.10	0.03	-0.01	0.00	-0.08	0.07	0.04	-0.01
98:4-01:2	-1.48	-0.41	-0.05	0.15	0.00	0.21	0.01	-0.01	0.12
01:2-04:4	-1.76	-0.43	-0.06	-0.16	0.00	0.10	-0.04	0.00	0.15
		Contribution of US Shocks							
		prodty	inv	riskp	gov	monpol	p	pc	w
74:1-80:1	0.27	0.20	-0.42	-0.41	0.05	-0.05	0.12	-0.07	0.39
80:1-85:1	-1.72	0.13	-0.04	0.07	-0.06	0.52	-0.05	0.05	0.06
85:1-88:1	0.27	0.10	0.39	0.09	0.03	-0.38	-0.09	0.06	-0.18
98:4-01:2	-1.48	-0.04	0.17	0.20	0.01	-0.11	-0.13	0.01	0.06
01:2-04:4	-1.76	-0.61	-0.16	0.61	0.01	0.10	0.03	-0.01	0.07
		Contribution of foreign shocks							
		nt_ea	nt_us	pm_ea	pm_us	oil	uirp		
74:1-80:1	0.27	-0.34	-0.60	-0.09	0.73	0.40	0.20		
80:1-85:1	-1.72	-0.23	-0.54	0.47	-0.06	0.06	-1.63		
85:1-88:1	0.27	0.01	-0.29	-0.01	-0.07	-0.10	0.76		
98:4-01:2	-1.48	-0.03	-1.43	0.24	-0.03	0.12	-0.55		
01:2-04:4	-1.76	-0.13	-1.52	-0.17	-0.25	0.06	0.64		

Conclusions

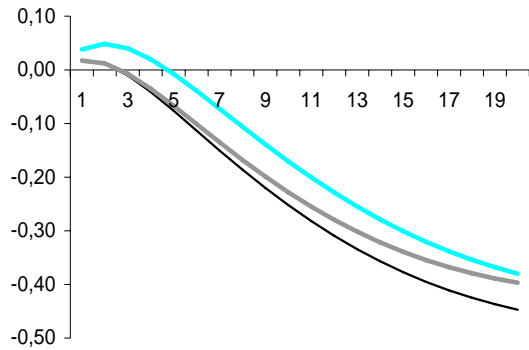
- Work in progress...
- Multiple applications/extensions with the model are possible

- The success in explaining exchange rate and trade balance developments is very modest: UIRP restrictions are rejected
 - Introduce risk premium or imperfect information & learning
 - Relation between productivity & markup shocks and exchange rate depends on elast. of subst => product innovation & firm entry

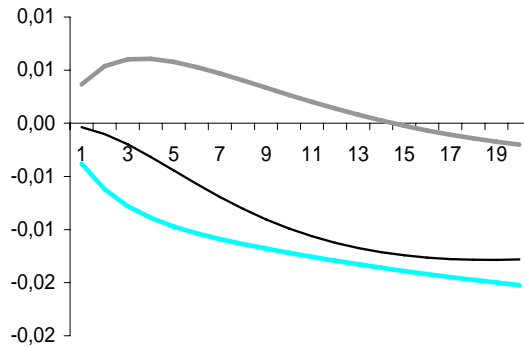
- Wealth effects of terms of trade are probably overestimated:
 - Introduce imperfect long run pass-through

- Spillover effects are minor: co-movement is unexplained:
 - Use positive prior on correlation between country shocks;
 - Introduce more risk sharing to reflect capital market integration.

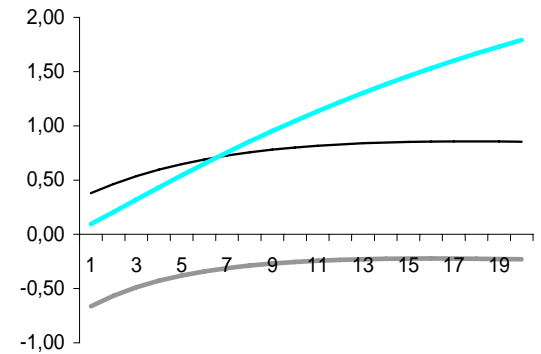
Y1



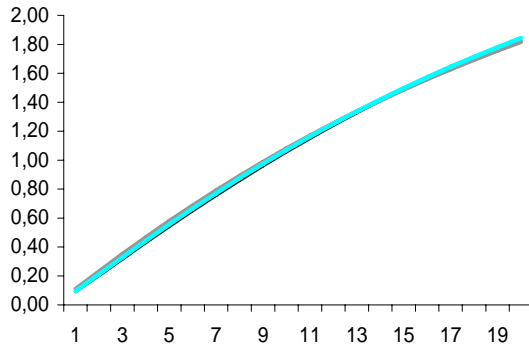
Y2



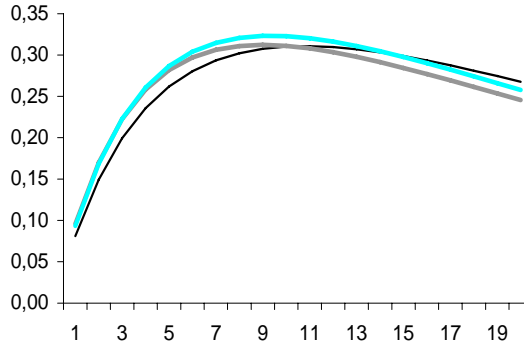
REAL EXCHANGE RATE



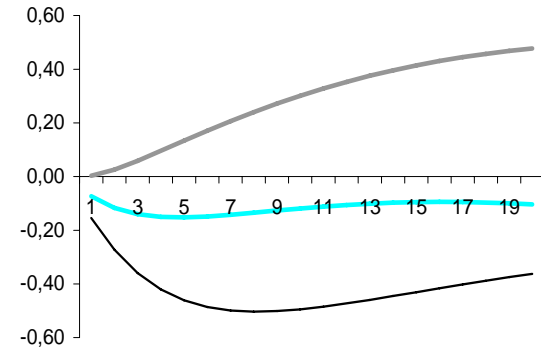
CPI 1



NOM. INTEREST RATE 1



NET TRADE 1



LEGEND black = high subst. elast grey = low subst. elast. blue = no UIRP

5. IMPULSE-RESPONSE: UIRP SHOCK

- important to explain real exchange rate variation (Lindé et al., 2004)
- deterioration of the TOT, negative wealth effect and rise of interest rate.
- => negative effect on domestic demand dominates the positive substitution effect initially and then it reverse: typical J-curve for the CA
- gradual pass-through of ER shocks in prices
- with monetary policy reaction on CPI inflation, the monetary policy can reduce the inflationary pressure of UIRP shocks on import and consumption prices: import price inflation is compensated by decline in domestic inflation.
- => argument for monetary policy to react on CPI inflation.

5. IMPULSE-RESPONSE: OIL PRICE SHOCK

- impact on GDP is around 0.15% the first two years for a 1σ shock (with $\sigma = 17\%$)
- domestic demand declines because of the negative wealth effects for oil importing economies together with monetary policy reaction
- complex pass-through: both immediate through consumption and gradual through domestic good production
- euro depreciates and CA reacts negatively. Real Trade Balance reacts slightly positive (see Jimenez-Rodriguez and Sanchez, 2004)
- If the monetary policy reacts on producer price inflation instead of consumption inflation, the real interest rate is lower and the domestic demand and output are less affected, but at the cost of higher and more persistent inflation.

8. HISTORICAL DECOMPOSITION since 1998

- output and inflation mainly determined by domestic shocks, spillover and row shocks have minor effects:
 - oil price fluctuations in 1998-99 had 0.5% effect on output in US and EA
 - UIRP shocks had minor effects on output (larger effect on the composition)

- trade balance are influenced by both domestic, foreign and row shocks. But overall, the UIRP shocks has been main determinant over the last five years: its influence works only gradually over time

- UIRP dominant shock behind USD-EUR exchange rate fluctuations