Seðlabanki Íslands

QMM
Nýtt ársfjórðungslegt þjóðhagslíkan Seðlabanka Íslands

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Málstofa í Seðlabanka Íslands
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Inngangur

- Meðganga
  - Verið í smíðum meira eða minna frá 2001
  - Mikill tími farið í uppbyggingu á ársfjórðungslegum gagnagrunni
- Fyrirmyndir
  - Meginfyrirmyndin er MTMM-líkan Englandsbanka
  - Fyrirmyndir einnig sóttar í BASMOD-líkan Riksbank, AQM-líkan Seðlabanka Austurríkis, MEP-líkan Seðlabanka Chíle og MM-líkan ástralska fjármálaráðuneytisins

Gagnagrunnur

- Fjöldi stærða: 147
  - Innri hegðunarstærðir: 28
    - Þar af metnar hegðunarjöfnur: 20
  - Tæknisambönd: 24
  - Skilgreiningar: 28
  - Bókhaldssambönd: 26
  - Ytri stærðir: 41
- Ársfjórðungsleg gögn
  - Frá 1970Q1: 60 raðir (40% af heild)
  - Frá 1980Q1 og fyrr: 93 raðir (63% af heild)
  - Frá 1990Q1 og fyrr: 145 raðir (99% af heild)
  - Frá 1994Q1 og fyrr: allur grunnur

Yfirlit yfir uppbyggingu QMM

Uppbygging QMM

- QMM er í meginatriðum tölfræðilega metið villuleiðréttingarlíkan (ECM)
  - Form, skýristærðir og eiginleikar einstaka jöfnu ráðast þó ekki eingöngu af tölfræðilegum eiginleikum heldur af samhengi við líkanið í heild og eiginleika þess
- QMM er tiltölulega einfalt eins-geira líkan af íslenska hagkerfinu
  - Mjög “aggregerað” en nægilega ítarlegt til að lýsa meginþáttum hagkerfisins
  - Nægilega einfalt til að hægt sé að halda utan um líkanið og gagnagrunn þess og að hafa yfirsýn yfir hagfræðilega skammtíma- og langtímaeiginleika líkansins
  - Á móti kemur að upplýsingar um ýmsa undirþætti tapast
  - Fyrir Seðlabankann skiptir hins vegar mestu máli að líkanið lýsi meginmiðlunarleiðum peningastefnunnar í samræmi við nútímaþekkingu og niðurstöður rannsókna

Einstakir hlutar QMM

- Fjármálakerfi
  - Vextir og eignaverð
    - Stýrivextir, langtímanafnvextir, verðtryggðir vextir og raunkostnaður fjármagns
    - Gengi: Nafngengisvísitala, US$ og raungengi
    - Hlutabréfaverð
  - Peningamagn og auður
    - Hreinn auður heimila: Fjármagnsauður, húsnæðisauður og skuldir
    - Peningaeftirspurn

Einstakir hlutar QMM

- Eftirspurn og framleiðsla
  - Einkaneysla
  - Samneysla
  - Fjárfesting
    - Atvinnuvegir, húsnæði, hið opinbera, fjármagnsstofnar og birgðabreytingar
  - Utanríkisviðskipti
    - Útflutningur utan stóriðju og sjávarafurða, stóriðja og sjávarafurðir
    - Innflutningur
    - Viðskiptajöfnuður og erlend staða
  - Framleiðslugeta og -spenna

Einstakir hlutar QMM

- Vinnumarkaður
  - Laun og launakostnaður á framleidda einingu
  - Atvinnuleysi og atvinnuþátttaka
  - Atvinna og framleiðni vinnuaflsins
- Verðhluti
  - Vísitala neysluverðs
  - Verðvísitölur ráðstöfunarhluta og landsframleiðslu
  - Byggingarvísitala og húsnæðisverð
  - Verðbólguvæntingar

Einstakir hlutar QMM

- Fjármál hins opinbera
  - Skatttekjur
    - Tekjuskattar heimila og fyrirtækja og útgjaldaskattar
  - Útgjöld
    - Niðurgreiðslur, styrkir og vaxtagreiðslur
  - Afkoma hins opinbera
- Ráðstöfunartekjur heimila
  - Atvinnutekjur, fjármagnstekjur og ráðstöfunartekjur

Lýsing á einstaka jöfnum QMM

Stýrivextir

- Taylor-regla

$$RS_t = \lambda_{rs} RS_{t-1} + (1 - \lambda_{rs}) \left[(\rho_{rs} + IT_t) + \beta_{rs} (INF_t - IT_t) + \phi_{rs} GAPAV_t \right]$$

RS	Short-term interest rate (4.1).
IT	Central Bank of Iceland 2.5% inflation target (exogenous).
INF	Four-quarter CPI inflation rate (7.15).
$GAPAV$	Annual average of output gap (5.44).

- Orphanides-regla

$$RS_t = \lambda_{rs} RS_{t-1} + (1 - \lambda_{rs}) \left[(\rho_{rs} + IT_t) + \beta_{rs} (INF_t - IT_t) + \phi_{rs} (\Delta_4 gdp_t - \Delta_4 gdpt_t) \right]$$

RS	Short-term interest rate (4.1).
IT	Central Bank of Iceland 2.5% inflation target (exogenous).
INF	Four-quarter CPI inflation rate (7.15).
GDP	GDP (5.39).
$GDPT$	Potential output (5.42).

ρ_{rs}	$= 3.0\%$
β_{rs}	$= 1.5$
ϕ_{rs}	$= 0.5$
λ_{rs}	$= 0.5$

Aðrir vextir

- Langtímanafnvextir

$$RL_t = \underset{(0.3)}{0.00029} + \underset{(12.9)}{0.861} RL_{t-1} + \underset{(4.1)}{0.665} RS_t + (1 - 0.861 - 0.665) RS_{t-1}$$

Adjusted R^2	0.866
Equation standard error	0.49%
Dynamic homogeneity (F-test)	5.32 [0.03]
LM test for serial correlation (F-test)	1.08 [0.31]
Normality test (χ^2-test)	9.16 [0.01]
White test for heteroscedasticity (F-test)	2.56 [0.04]
Sample period	1996:Q1-2004:Q4 ($T = 36$)

- Verðtryggðir langtímavextir

$$RLV_t = (RL_t - INFE_t) - PRISK_t$$

RLV	Long-term indexed interest rate (4.4).
RL	Long-term interest rate (4.3).
$INFE$	Inflation expectations (7.16).
$PRISK$	Inflation risk premium (exogenous).

Gengisvísitala

- UIP-samband

$$eer_t = feer_t - \log RD_t \qquad RD_t = \left(\frac{(1 + RS_t/4)}{(1 + WRS_t/4)(1 + RISK_t/4)} \right)$$

- PPP-villuleiðréttingarsamband

$$\Delta eer_t = \underset{(2.6)}{0.021} + \underset{(3.5)}{0.386} rex_{t-4}$$

- Gengisjafnan

$$eer_t = \omega_e(feer_t - \log RD_t) + (1 - \omega_e)(0.021 + eer_{t-1} + 0.386 rex_{t-4})$$

EER	Exchange rate index of foreign currency (4.6).
$FEER$	Expected exchange rate index (4.9).
RD	Short-term interest rate differential (4.11).
REX	Real exchange rate (4.15).

$\omega_e = 0.75$

$feer_t = eer_{t-1}$

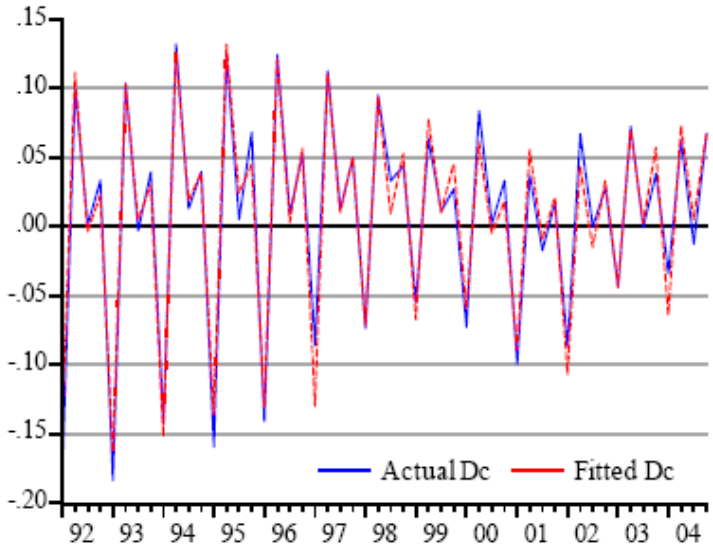
Einkaneysla – matsjafna

$$\begin{aligned}\Delta c_t &= \underset{(2.8)}{-0.038} - \underset{(3.1)}{0.050}Q1 - \underset{(2.5)}{0.040}Q2 - \underset{(4.0)}{0.059}Q3 + \underset{(3.0)}{0.054}D031 \\ &\quad + \underset{(6.5)}{0.615}\Delta c_{t-4} + \underset{(2.7)}{0.290}\Delta rhpi_t - \underset{(2.7)}{1.579}\Delta UR_t \\ &\quad - \underset{(2.9)}{0.134}[c - 0.794rhpi - 0.206(wel - pc) + 1.458RLV]_{t-1}\end{aligned}$$

Adjusted R^2	0.957
Equation standard error	1.63%
Long-run restrictions (F-test)	2.70 [0.11]
LM test for serial correlation (F-test)	0.08 [0.77]
Normality test (χ^2-test)	2.11 [0.35]
White test for heteroscedasticity (F-test)	2.10 [0.04]
Sample period	1992:Q1-2004:Q4 ($T = 52$)

C	Private consumption (5.2).
$RHPI$	Real household post-tax income (9.6).
WEL	Household sector wealth (4.17).
PC	Private consumption deflator (7.5).
RLV	Long-term indexed interest rate (4.4).
UR	Unemployment rate (6.5).
$Q1$-$Q3$	Centered seasonal dummies.
$D031$	Dummy variable: 1 2003:Q1 and zero elsewhere.

Einkaneysla – eiginleikar jöfnu



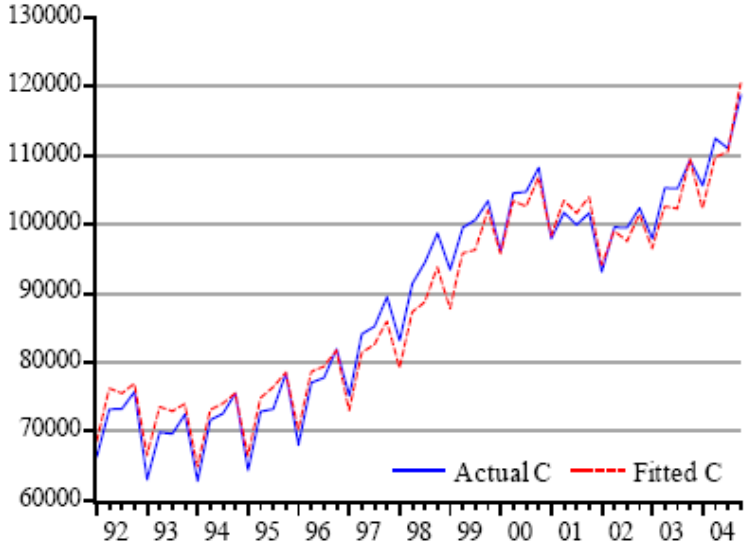


Table 5.1. Responses of c to a 1% increase in RHS variables

Quarters	$rhpi$	$wel - pc$	UR	RLV
Simultaneous	0.29	0.00	−1.58	0.00
Four quarters ahead	0.69	0.09	−1.86	−0.64
Eight quarters ahead	0.95	0.19	−1.30	−1.31
Long run	0.79	0.21	0.00	−1.46
50% of long-run effect	Overshoots	Overshoots	-	Overshoots
90% of long-run effect	Overshoots	Overshoots	-	Overshoots

Steady state solution:

$(c - rhpi) = const + 0.206(wel - pc - rhpi) - 1.458RLV$

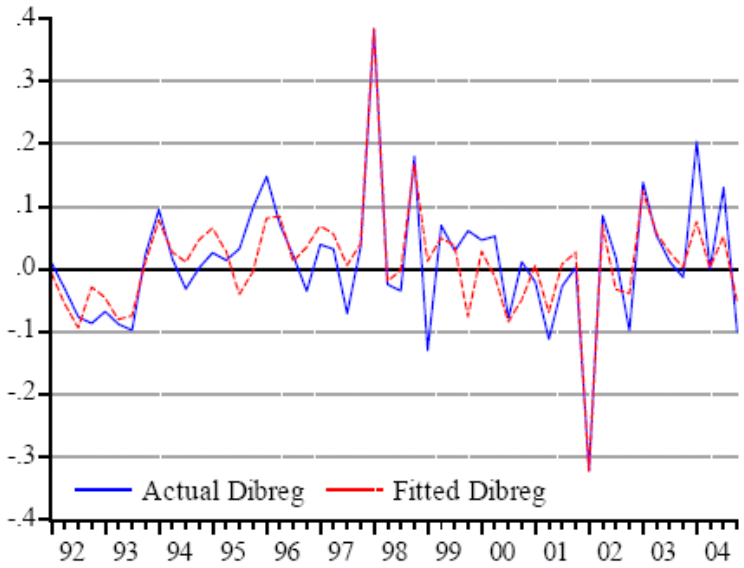
Atvinnuvegafjárfesting – matsjafna

$$
\begin{aligned}
\Delta ibreg_t \;=\; & \underset{(4.6)}{-1.910} - \underset{(3.6)}{0.103} D9395 + \underset{(3.6)}{0.235} D981 + \underset{(2.5)}{0.070} D9801 \\
& - \underset{(4.4)}{0.273} D021 + \underset{(1.9)}{0.044} Q1 + \underset{(2.9)}{0.072} Q2 + \underset{(2.3)}{0.068} Q3 \\
& + \underset{(2.5)}{0.211} \Delta ibreg_{t-3} + \underset{(3.1)}{0.727} \Delta gdp_{t-2} - \underset{(4.6)}{0.326} [ibreg - gdp + rcc]_{t-1}
\end{aligned}
$$

Adjusted R^2	0.697
Equation standard error	5.63%
Long-run restrictions (F-test)	2.78 [0.08]
LM test for serial correlation (F-test)	0.50 [0.48]
Normality test (χ^2-test)	5.14 [0.08]
White test for heteroscedasticity (F-test)	0.89 [0.11]
Sample period	1992:Q1-2004:Q4 ($T = 52$)

$IBREG$	Business investment excluding the aluminium sector (5.10).
GDP	GDP (5.39).
RCC	Real cost of capital (4.5).
$D9395$	Dummy variable: 1 1993:Q1-1995:Q4 and zero elsewhere.
$D981$	Dummy variable: 1 1998:Q1 and zero elsewhere.
$D9801$	Dummy variable: 1 1998:Q1-2001:Q4 and zero elsewhere.
$D021$	Dummy variable: 1 2002:Q1 and zero elsewhere.
$Q1$-$Q3$	Centered seasonal dummies.

Atvinnuvegafjárfesting – eiginleikar jöfnu



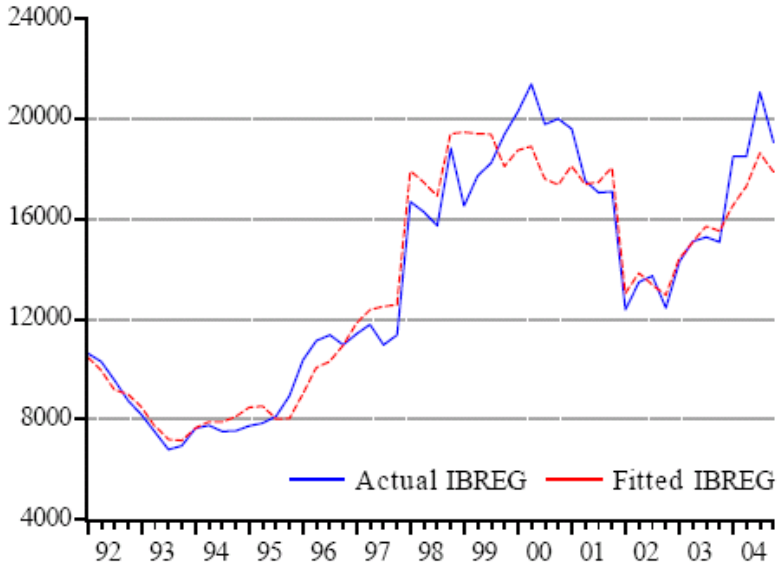


Table 5.2. Responses of *ibreg* to a 1% increase in RHS variables

Quarters	*gdp*	*rcc*
Simultaneous	0.00	0.00
Four quarters ahead	1.06	−0.72
Eight quarters ahead	1.02	−0.90
Long run	1.00	−1.00
50% of long-run effect	Overshoots	2Q
90% of long-run effect	Overshoots	8Q

Steady state solution:
$(ibreg - gdp) = const - rcc$

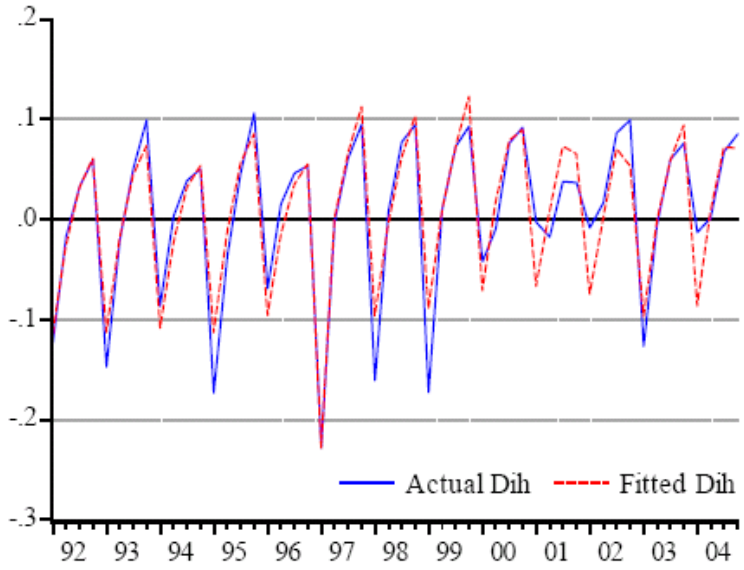
Húsnæðisfjárfesting – matsjafna

$$\begin{aligned}\Delta ih_t &= \underset{(3.7)}{-0.219} - \underset{(6.3)}{0.138}Q1 - \underset{(1.7)}{0.035}Q2 + \underset{(1.3)}{0.030}Q3 - \underset{(7.4)}{0.118}D971 \\ &\quad \underset{(2.6)}{-0.282}\Delta ih_{t-3} - \underset{(3.8)}{0.079}[(ih - gdp) - 1.395(ph - pih)]_{t-1}\end{aligned}$$

Adjusted R^2	0.852
Equation standard error	3.15%
Long-run restrictions (F-test)	10.4 [0.00]
LM test for serial correlation (F-test)	0.07 [0.80]
Normality test (χ^2-test)	2.74 [0.25]
White test for heteroscedasticity (F-test)	6.87 [0.00]
Sample period	1992:Q1-2004:Q4 ($T = 52$)

IH	Private sector housing investment (5.14).
GDP	GDP (5.39).
PH	House prices (7.12).
PIH	Housing investment deflator (7.8).
$Q1$-$Q3$	Centered seasonal dummies.
$D971$	Dummy variable: 1 1997:Q1 and zero elsewhere.

Húsnæðisfjárfesting – eiginleikar jöfnu



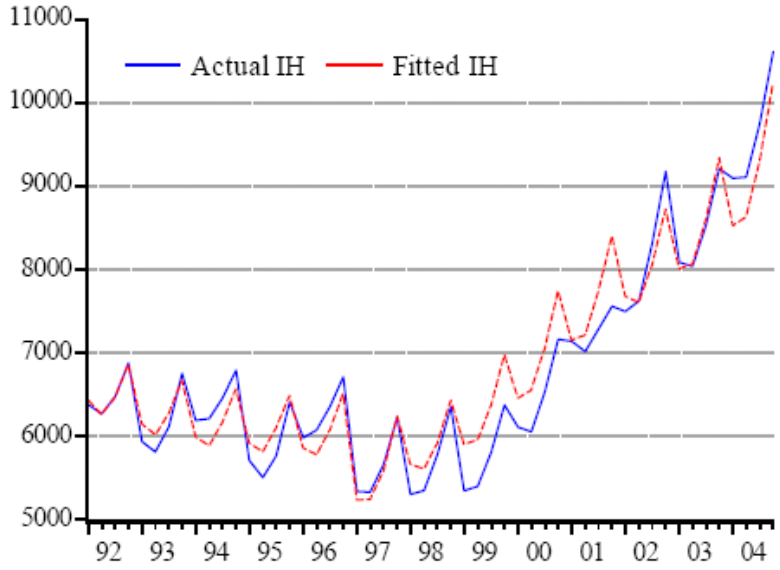


Table 5.3. Responses of ih to a 1% increase in RHS variables

Quarters	gdp	$ph - pih$
Simultaneous	0.00	0.00
Four quarters ahead	0.26	0.36
Eight quarters ahead	0.41	0.57
Long run	1.00	1.40
50% of long-run effect	11Q	11Q
90% of long-run effect	37Q	37Q

Steady state solution:
$(ih - gdp) = const + 1.395(ph - pih)$

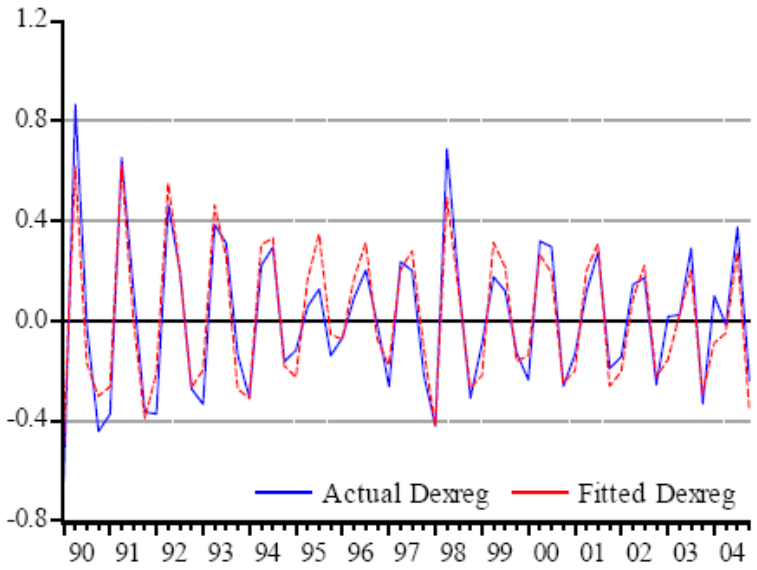
Almennur útflutningur – matsjafna

$$\begin{aligned}\Delta exreg_t &= \underset{(6.3)}{8.254} - \underset{(3.4)}{0.189}Q1 - \underset{(0.7)}{0.046}Q2 + \underset{(2.9)}{0.142}Q3 - \underset{(2.5)}{0.280}D981 \\ &\quad + \underset{(3.6)}{0.308}\Delta exreg_{t-4} - \underset{(6.3)}{0.813}[exreg - trade + 0.480rex]_{t-1}\end{aligned}$$

Adjusted R^2	0.847
Equation standard error	10.65%
Long-run restrictions (F-test)	5.66 [0.02]
LM test for serial correlation (F-test)	1.19 [0.28]
Normality test (χ^2-test)	1.18 [0.56]
White test for heteroscedasticity (F-test)	2.22 [0.04]
Sample period	1990:Q1-2004:Q4 ($T = 60$)

$EXREG$	Exports, excluding aluminium and marine goods (5.26).
$TRADE$	World trade (exogenous).
REX	Real exchange rate (4.15).
$Q1$-$Q3$	Centered seasonal dummies.
$D981$	Dummy variable: 1 1998:Q1 and zero elsewhere.

Almennur útflutningur – eiginleikar jöfnu



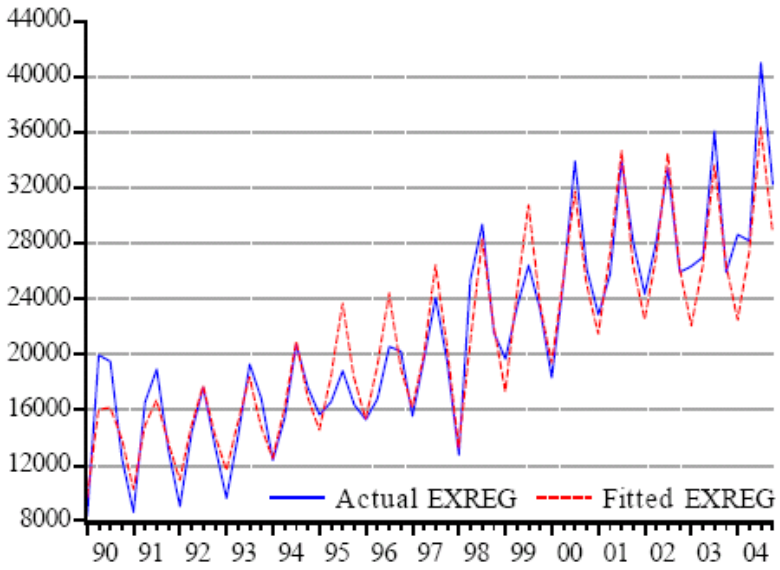


Table 5.4. Responses of *exreg* to a 1% increase in RHS variables

Quarters	*trade*	*rex*
Simultaneous	0.00	0.00
Four quarters ahead	1.00	−0.48
Eight quarters ahead	1.01	−0.48
Long run	1.00	−0.48
50% of long-run effect	Overshoots	Overshoots
90% of long-run effect	Overshoots	Overshoots

Steady state solution:
$(exreg - trade) = const - 0.480 rex$

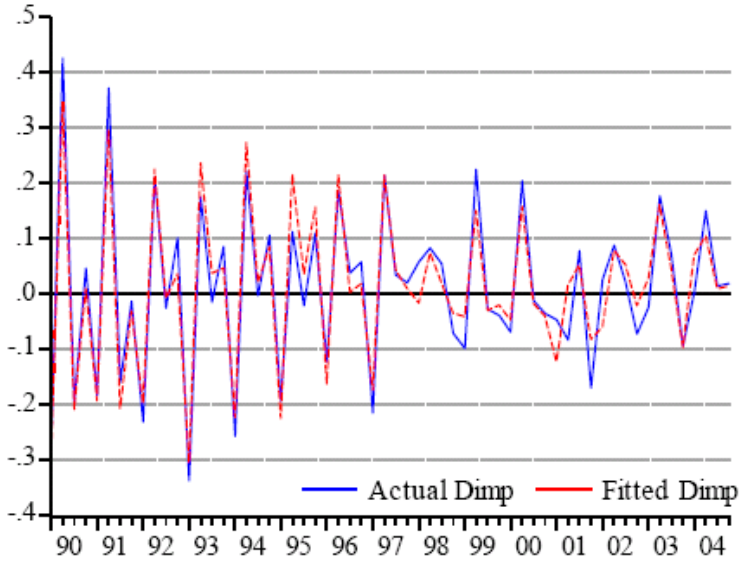
Innflutningur – matsjafna

$$
\begin{aligned}
\Delta imp_t \;=\; & \underset{(6.4)}{-0.824} + \underset{(0.9)}{0.029}Q1 + \underset{(1.1)}{0.023}Q2 + \underset{(2.1)}{0.040}Q3 \\
& + \underset{(6.0)}{1.332}\Delta dd_t + \underset{(1.9)}{0.419}\Delta dd_{t-4} \\
& - \underset{(6.4)}{0.841}[imp - dd + 0.336 rexm - 0.513 spec]_{t-1}
\end{aligned}
$$

Adjusted R^2	0.894
Equation standard error	4.89%
Long-run restrictions (F-test)	5.69 [0.02]
LM test for serial correlation (F-test)	0.18 [0.28]
Normality test (χ^2-test)	1.01 [0.60]
White test for heteroscedasticity (F-test)	1.60 [0.14]
Sample period	1990:Q1-2004:Q4 ($T = 60$)

IMP	Imports of goods and services (5.30).
DD	Domestic demand (5.23).
$REXM$	Importers' real exchange rate (4.14).
$SPEC$	Trade specialisation (5.32).
$Q1$-$Q3$	Centered seasonal dummies.

Innflutningur – eiginleikar jöfnu



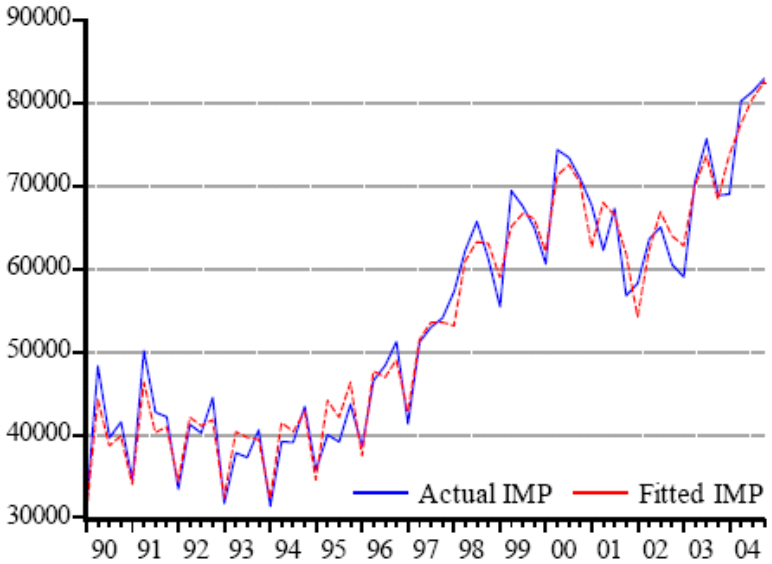


Table 5.5. Responses of *imp* to a 1% increase in RHS variables

Quarters		*dd*	*rexm*	*spec*
Simultaneous		1.33	0.00	0.00
Four quarters ahead		1.00	−0.34	0.43
Eight quarters ahead		1.00	−0.34	0.51
Long run		1.00	−0.34	0.51
50% of long-run effect	Overshoots		1Q	1Q
90% of long-run effect	Overshoots		2Q	2Q

Steady state solution:

$(imp - dd) = const - 0.336 rexm + 0.513 spec$

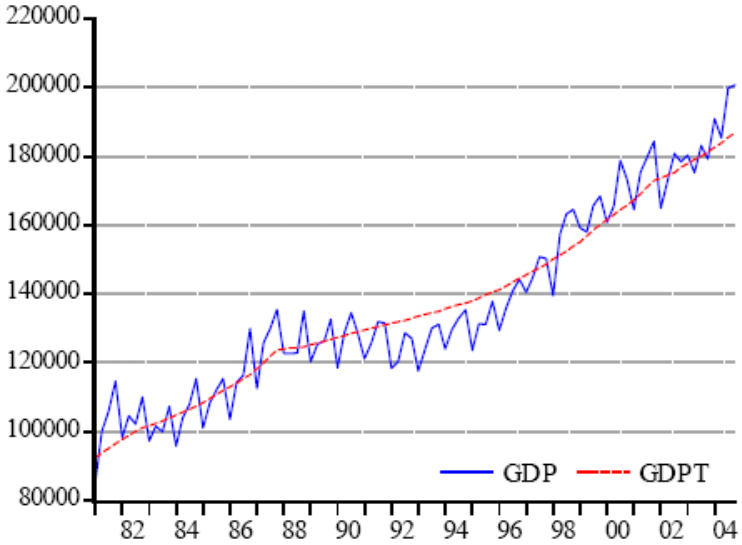
Framleiðslugeta og -spenna

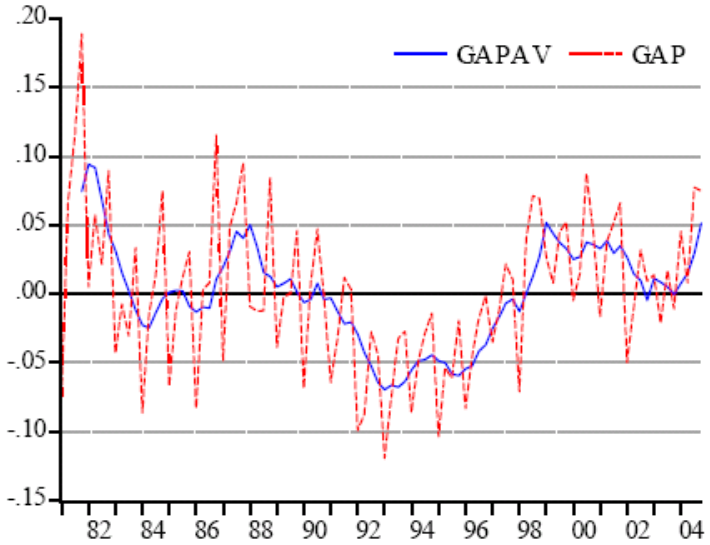
- Cobb-Douglas framleiðslufall

$$gdpt_t = \underset{(59.6)}{-1.172} + 0.64 \times \underset{(15.4)}{0.0049}T + 0.64empt_t + 0.36k_t$$

$$EMPT_t = PAT_t \times POWA_t \times (1 - NAIRU_t)$$

$GDPT$	Potential output (5.42).
$EMPT$	Trend employment (6.10).
K	Capital stock (5.18).
T	Linear time trend.
PAT	Trend participation rate (6.8).
$POWA$	Population at working age (16-64 years old) (exogenous).
$NAIRU$	Natural rate of unemployment (exogenous).





Launakostnaður – matsjafna

$$
\begin{aligned}
\Delta(ulct_t - pgdp_t) \;=\; & \underset{(5.9)}{-0.234} + \underset{(5.7)}{0.030}Q1 + \underset{(2.8)}{0.012}Q2 + \underset{(0.6)}{0.003}Q3 \\
& \underset{(3.2)}{-0.036}D971 - \underset{(7.8)}{0.930}\Delta(pgdp_t - cpi_t) \\
& \underset{(4.5)}{-1.002}(UR_t - NAIRU_t) + \underset{(2.1)}{0.367}(UR_{t-4} - NAIRU_{t-4}) \\
& \underset{(6.0)}{-0.442}[ulct - pgdp]_{t-1} + \underset{(5.9)}{0.0017}T
\end{aligned}
$$

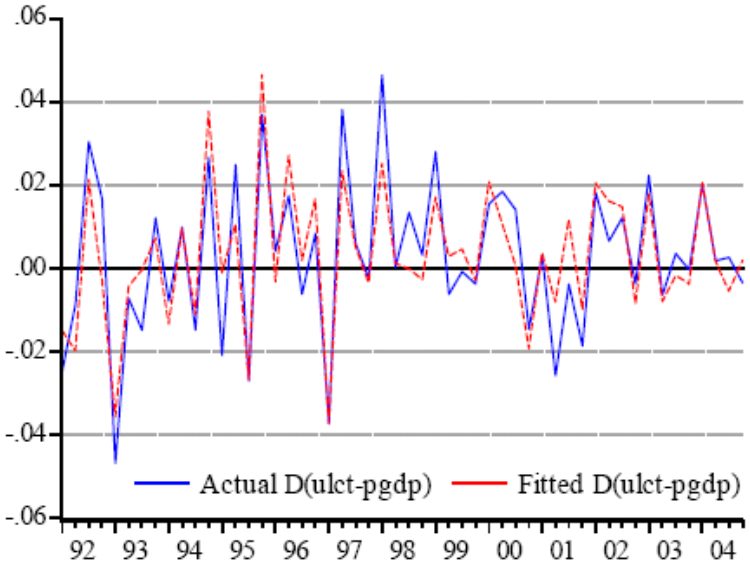
$$ULCT_t = \frac{W_t \times REM_t}{PRODT_t}$$

$$PRODT_t = \frac{GDPT_t}{EMPT_t}$$

Adjusted R^2	0.701
Equation standard error	1.03%
Long-run restrictions (F-test)	5.06 [0.01]
LM test for serial correlation (F-test)	1.21 [0.28]
Normality test (χ^2-test)	0.51 [0.77]
White test for heteroscedasticity (F-test)	0.98 [0.49]
Sample period	1992:Q1-2004:Q4 ($T = 52$)

W	Wages (6.2).
REM	Employers' wage-related cost (exogenous).
$PRODT$	Trend labour productivity (6.12).
$PGDP$	GDP price deflator (7.10).
CPI	Consumer price index (7.1).
UR	Unemployment rate (6.5).
$NAIRU$	Natural rate of unemployment (exogenous).
$D971$	Dummy variable: 1 1997:Q1 and zero elsewhere.
$Q1$-$Q3$	Centered seasonal dummies.
T	Linear time trend.

Launakostnaður – eiginleikar jöfnu



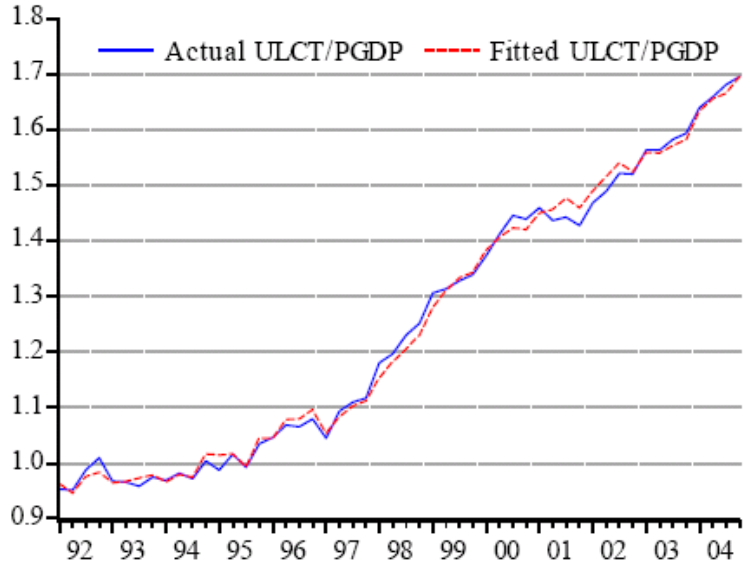


Table 6.1. Responses of w to a 1% increase in RHS variables

Quarters	rem	$prodt$	$pgdp$	cpi	$UR - NAIRU$
Simultaneous	−1.00	1.00	0.07	0.93	−1.00
Four quarters ahead	−1.00	1.00	0.91	0.09	−1.78
Eight quarters ahead	−1.00	1.00	0.99	0.01	−1.47
Long run	−1.00	1.00	1.00	0.00	−1.44
50% of long-run effect	0Q	0Q	2Q	-	Overshoots
90% of long-run effect	0Q	0Q	4Q	-	Overshoots

Steady state solution:

$(w + rem - prodt - pgdp) = const + 0.0039T$

Verðbólga – matsjafna

$$\Delta cpi_t = \underset{(11.7)}{0.741} INFE_t/4 + \underset{(1.9)}{0.059}\Delta pm_t + \underset{(2.5)}{0.080}\Delta pm_{t-1} + (1 - 0.741 - 0.059 - 0.080)\Delta ulct_{t-1} + \underset{(3.6)}{0.072} GAPAV_{t-1}$$

Adjusted R^2	0.548
Equation standard error	0.46%
Dynamic homogeneity (F-test)	0.18 [0.67]
LM test for serial correlation (F-test)	0.40 [0.53]
Normality test (χ^2-test)	3.39 [0.18]
White test for heteroscedasticity (F-test)	2.52 [0.02]
Sample period	1994:Q1-2004:Q4 ($T = 44$)

CPI	Consumer price index (7.1).
$INFE$	Inflation expectations (7.16).
$GAPAV$	Annual average of output gap (5.44).
PM	Import price deflator (7.2).
$ULCT$	Trend unit labour costs (6.4).

Verðbólga – eiginleikar jöfnu

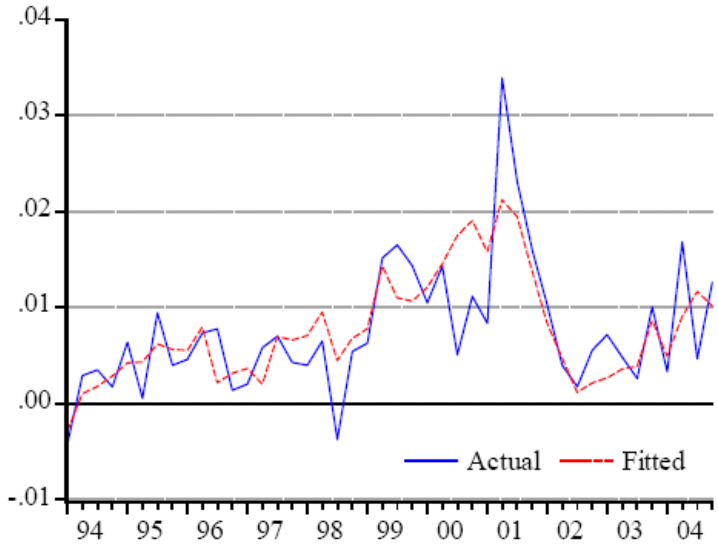


Table 7.1(b). Responses of Δcpi to a 1% increase in RHS variables

Jointly with $INFE$ equation (7.17)

Quarters	$IT/4$	Δpm	$\Delta ulct$	$GAPAV$
Simultaneous	0.30	0.06	0.00	0.00
Four quarters ahead	0.52	0.24	0.21	0.12
Eight quarters ahead	0.53	0.25	0.22	0.13
Long run	0.53	0.25	0.22	0.13
50% of long-run effect	0Q	1Q	1Q	1Q
90% of long-run effect	2Q	3Q	3Q	3Q

Steady state solution:
$\Delta cpi = 0.534IT/4 + 0.250\Delta pm + 0.216\Delta ulct$

Húsnæðisverð – matsjafna

$$\begin{aligned}\Delta(ph_t - cpi_t) &= \underset{(3.5)}{0.283} - \underset{(5.4)}{0.096}D894 + \underset{(4.4)}{0.044}D04 \\ &+ \underset{(1.8)}{0.165}\Delta(ph_{t-2} - cpi_{t-2}) + \underset{(2.5)}{0.113}\Delta ly_{t-4} - \underset{(2.8)}{1.482}\Delta RLV_t \\ &- \underset{(3.4)}{0.133}[(ph - cpi) + 0.870(kh - ly) + 2.230RLV]_{t-2}\end{aligned}$$

Adjusted R^2	0.530
Equation standard error	1.72%
Long-run restrictions (F-test)	1.05 [0.36]
LM test for serial correlation (F-test)	0.17 [0.68]
Normality test (χ^2-test)	1.41 [0.49]
White test for heteroscedasticity (F-test)	0.81 [0.62]
Sample period	1989:Q1-2004:Q4 ($T = 64$)

PH	House prices (7.12).
CPI	Consumer price index (7.1).
KH	Private sector housing stock (5.20).
LY	Real post-tax labour income (9.7)
RLV	Long-term indexed interest rate (4.4).
$D894$	Dummy variable: 1 1989:Q4 and zero elsewhere.
$D04$	Dummy variable: 1 2004:Q1-2004:Q4 and zero elsewhere.

Húsnæðisverð – eiginleikar jöfnu

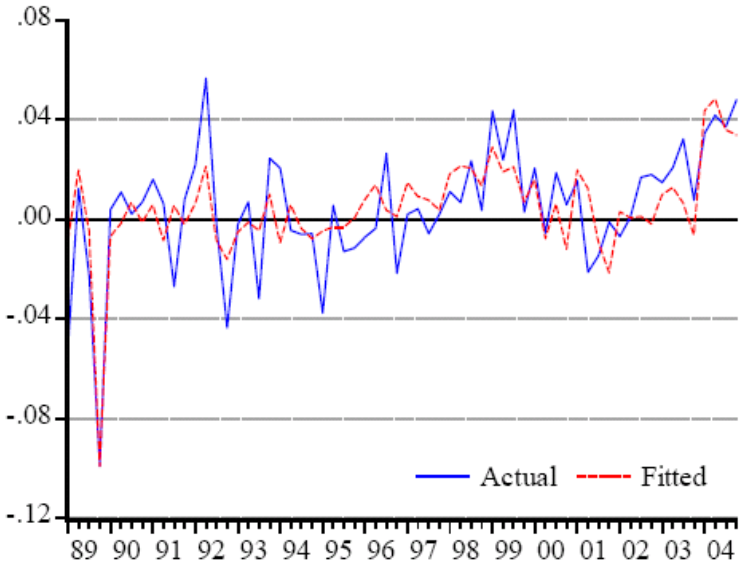


Table 7.5. Responses of $ph - cpi$ to a 1% increase in RHS variables

Quarters	kh	ly	RLV
Simultaneous	0.00	0.00	−1.48
Four quarters ahead	−0.35	0.46	−2.04
Eight quarters ahead	−0.67	0.76	−2.18
Long run	−0.87	0.87	−2.23
50% of long-run effect	5Q	4Q	0Q
90% of long-run effect	11Q	9Q	4Q

Steady state solution:

$(ph - cpi) = const - 0.870(kh - ly) - 2.230RLV$

Nokkrar aðrar verðjöfnur

- Verðvísitala samneyslu

$$\Delta pg_t = \underset{(2.5)}{0.006}Q1 - \underset{(5.8)}{0.014}Q2 - \underset{(2.0)}{0.004}Q3 + \underset{(6.2)}{0.028}D012 + \underset{(4.9)}{0.351}\Delta pg_{t-1} + \underset{(8.3)}{0.451}\Delta ulct_t + (1 - 0.351 - 0.451)\Delta cpi_t$$

- Verðvísitala fjárfestingar

$$\Delta pi_t = \underset{(0.2)}{0.001}Q1 - \underset{(3.3)}{0.012}Q2 - \underset{(4.4)}{0.016}Q3 + \underset{(13.9)}{0.660}\Delta bc_t + (1 - 0.660)\Delta pm_t$$

- Verðvísitala innflutnings

$$\Delta pm_t = \underset{(6.6)}{0.636}\Delta(wpx_t + eer_t) + \underset{(2.0)}{0.123}\Delta(wpx_{t-1} + eer_{t-1}) + \underset{(1.3)}{0.069}\Delta(pcom_t + eus_t) + \underset{(2.8)}{0.159}\Delta ulct_{t-2} + (1 - 0.636 - 0.123 - 0.069 - 0.159)\Delta(poil_{t-1} + eus_{t-1})$$

- Verðvístala útflutnings

$$\Delta pxreg_t = \underset{(1.8)}{0.126}\Delta cpi_{t-2} + \underset{(15.1)}{0.754}\Delta(wcpi_t + eer_t) + (1 - 0.126 - 0.754)\Delta(wcpi_{t-2} + eer_{t-2}) + \underset{(9.6)}{0.089}D971 - \underset{(5.9)}{0.055}D981$$

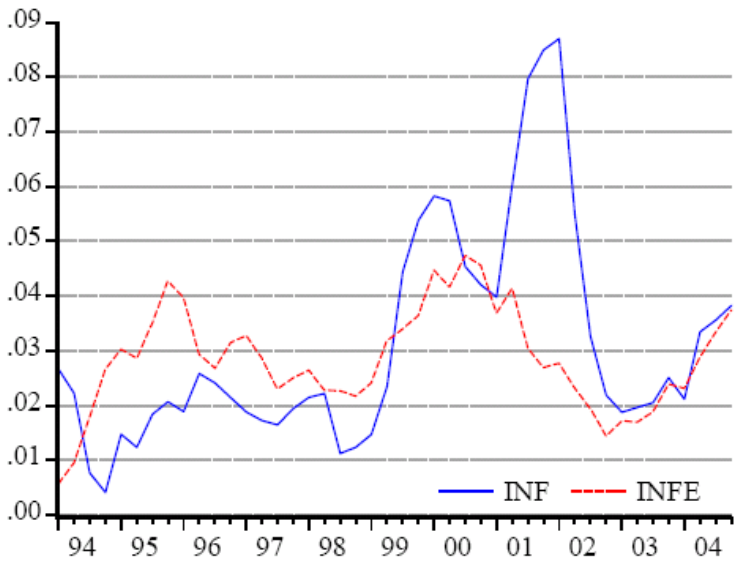
- Byggingarvísitala

$$\Delta bc_t = \underset{(3.9)}{0.303}\Delta bc_{t-1} + \underset{(5.2)}{0.472}\Delta cpi_t + (1 - 0.303 - 0.472)\Delta ulct_t + \underset{(4.0)}{0.025}D021$$

Verðbólguvæntingar

- Sögulegar mælingar

$$INFE_t = (RL_t - RLV_t) - PRISK_t$$



- Spá- og hermunarjafna

$$INFE_t = \omega_{pe} INF_{t-1} + (1 - \omega_{pe}) IT_t$$

$$\omega_{pe} = 0.6$$

- Þegar búið er að þróa langtímaeiginleika QMM munu væntingar vera framsýnar (rational expectations)

Eiginleikar QMM

Sögulegur samanburður

- Kvik hermun fyrir tímabilið 1995-2005
  - Ytri stærðir gefnar
  - Stýrivextir gefnir
- Nær að líkja ágætlega eftir sögulegri þróun en missir af gengissveiflu

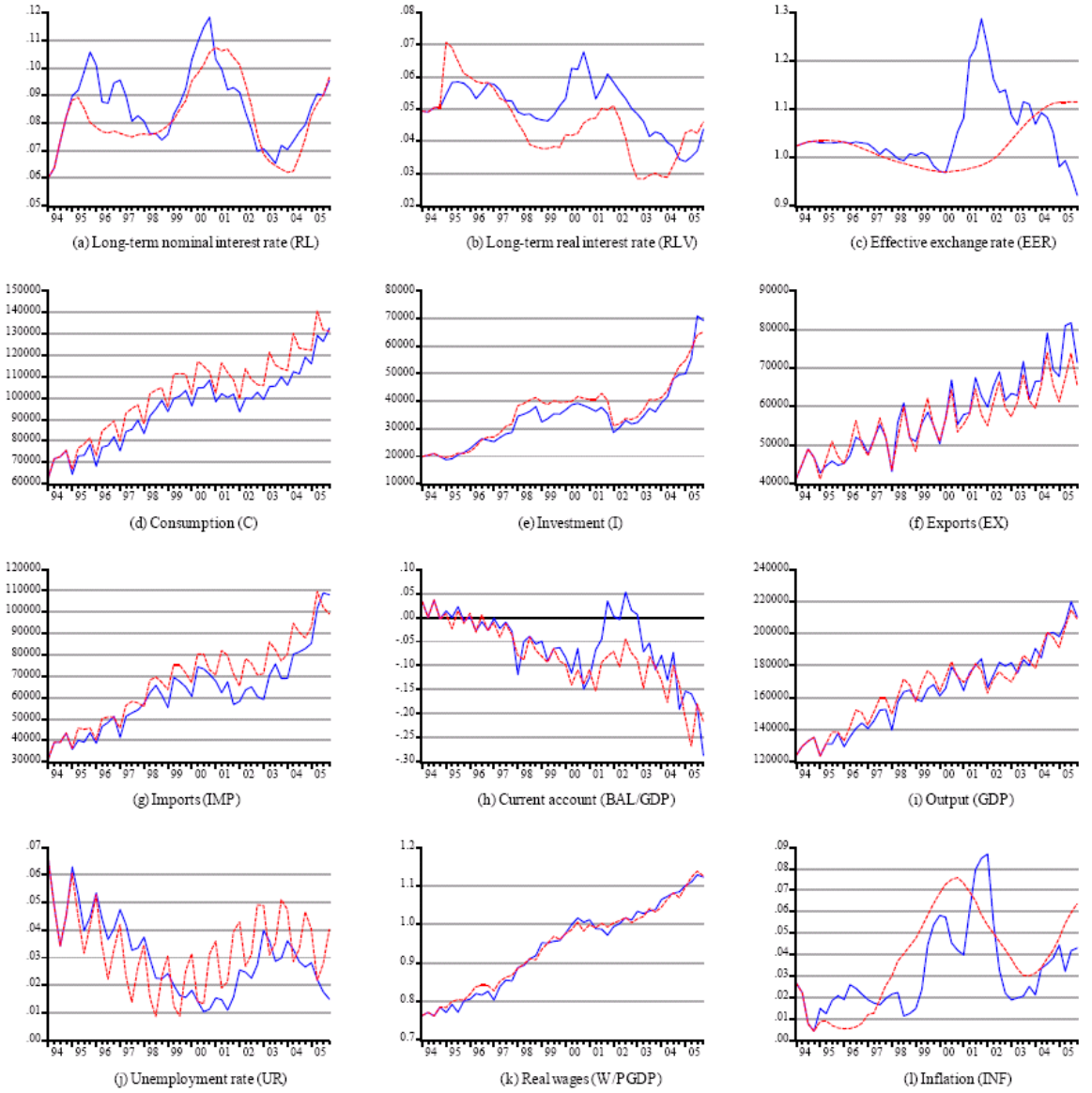


Figure 10.1. Comparison of actual (solid line) and simulated (broken line) data 1994-2005

Sögulegur samanburður

- Tekin út árstíðarsveifla og einblínt á hagsveiflutíðni
  - 6-32 ársfjórðungar; talin vera hefðbundin hagsveifla
- Hagsveifluhegðun í takti við alþjóðlegar niðurstöður
- QMM tekst að líkja eftir meginhegðun íslensku hagsveiflunnar
- Fylgni raunverulegrar og metinnar hagsveiflu ágæt

Table 10.3. Correlations between cyclical components of actual and simulated data

Series	Correlation	Series	Correlation	Series	Correlation
GDP	0.58	BAL/GDP	0.95	PH	0.84
C	0.90	EMP	0.67	INF	0.28
G	1.00	UR	0.65	RS	1.00
I	0.92	PA	0.52	RLV	0.57
IBUS	0.84	PRODT	0.87	M3	0.75
IH	0.57	W	0.89	EQP	-0.13
II/GDP	-0.18	W/PGDP	0.72	WEL	0.81
EX	0.47	CPI	0.52	REX	-0.26
IMP	0.83	PGDP	0.73	WGDP	1.00

Miðlun peningastefnunnar í QMM

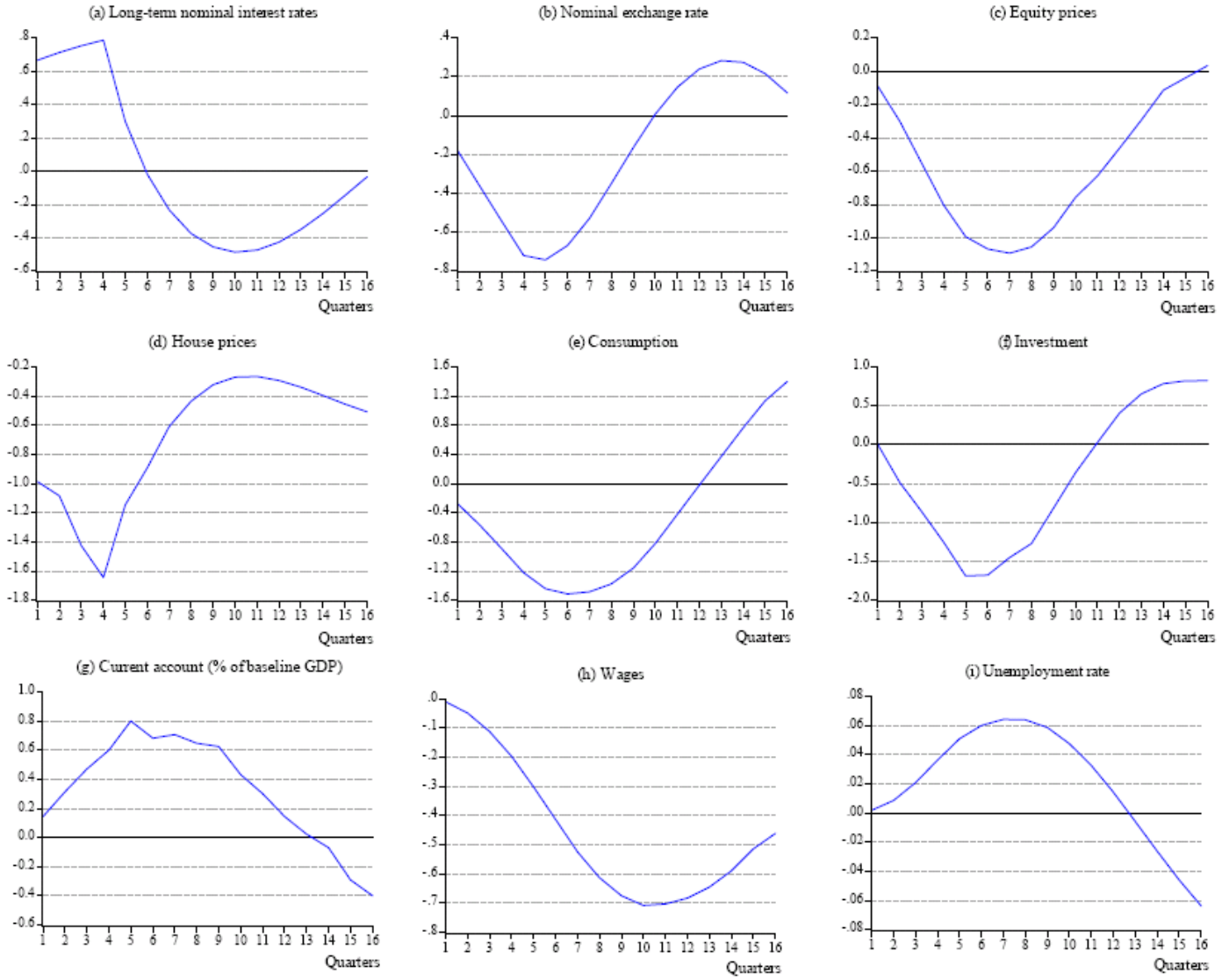


Figure 3.3. Responses of key variables to a monetary policy shock (deviations from baseline)

Miðlun peningastefnunnar í QMM

- Miðlunartafir og stærð áhrifa í takti við fyrri innlendar rannsóknir og niðurstöður alþjóðlegra rannsókna

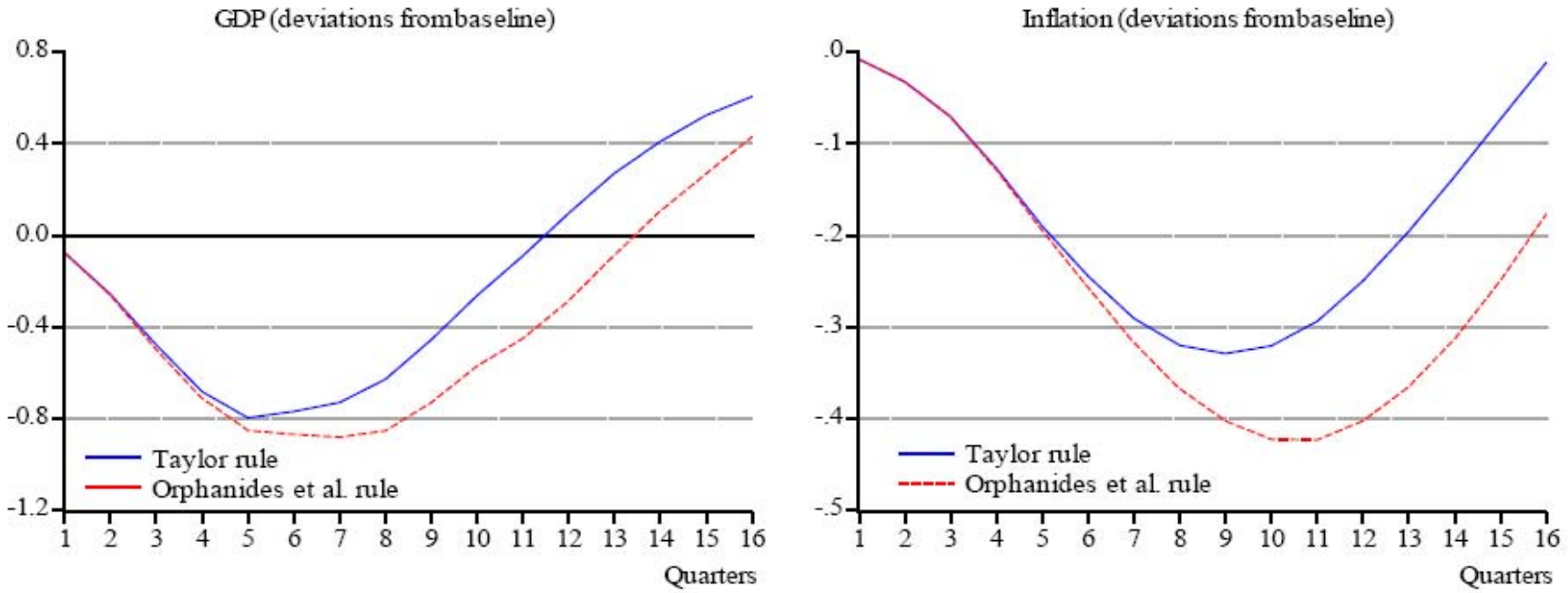


Figure 3.2. Response to 1 percentage point rise in monetary policy rate for one year

Frekari vinna við QMM og nýtt jafnvægislíkan

Langtímaeiginleikar QMM

- QMM er ekki leitt út frá vel skilgreindum hámörkunarvandamálum grunneininga hagkerfisins
  - Ekki er sjálfkrafa tryggt að líkanið leiti í stöðugt langtímajafnvægi til langs tíma
- Til langs tíma þurfa
  - Nafnstærðir að vaxa allar um sama hlutfallið: Verðbólgumarkmiðið
  - Raunstærðir vaxa allar um sama hlutfallið (balanced growth) sem er jafnt summu leitnivaxtar mannafla og framleiðni
  - Til langs tíma er ekkert samband á milli nafn- og raunstærða líkansins: Peningastefnan er hlutlaus til langs tíma
- Skilyrði 1 og 3 eru þegar uppfyllt í QMM en til að tryggja skilyrði 2 þarf að setja viðbótarskilyrði á fasta, útgjaldahlutföll og hlutfallsleg verð
- Verið að vinna við þetta
  - Núverandi líkan hentar hins vegar vel við spágerð og skammtímahermanir

Annmarkar QMM

- Skortir vel skilgreinda hámörkunareiginleika
- Vantar að skilgreina betur framsýna hegðun
- Vantar að skilgreina betur flæðis- og stofnsambönd
- Tölfræðilega metið líkan og getur því verið viðkvæmt fyrir breytingum í hegðunarsamböndum
  - Sértaklega ef kerfisbreytingar hafa orðið í hagkerfinu – samanber breytingu á stjórn peningamála
- Viðkvæmt fyrir gagnrýni Lucasar og því þarf að fara varlega í hagstjórnartilraunir

Nýtt jafnvægislíkan

- Verið að þróa lítið „einfalt” heildarjafnvægislíkan (DSGE) sem tekur á þessum vandamálum
  - Byggt á líkani sem er þróað af IMF (Hunt, 2006) og á sambærilegum líkönum sem notuð eru í ýmsum seðlabönkum
- Er hins vegar lítið og því vantar sundurliðun og upplýsingar um margar hagstærðir
  - Nýja líkanið verður því notað samhliða QMM
- Með þessum 2 líkönum ætti bankinn að vera vel í sveit settur við spágerð og hagstjórnartilraunir