Interest rates during and after the crisis: Leaning against the wind, or not?

Lars E.O. Svensson

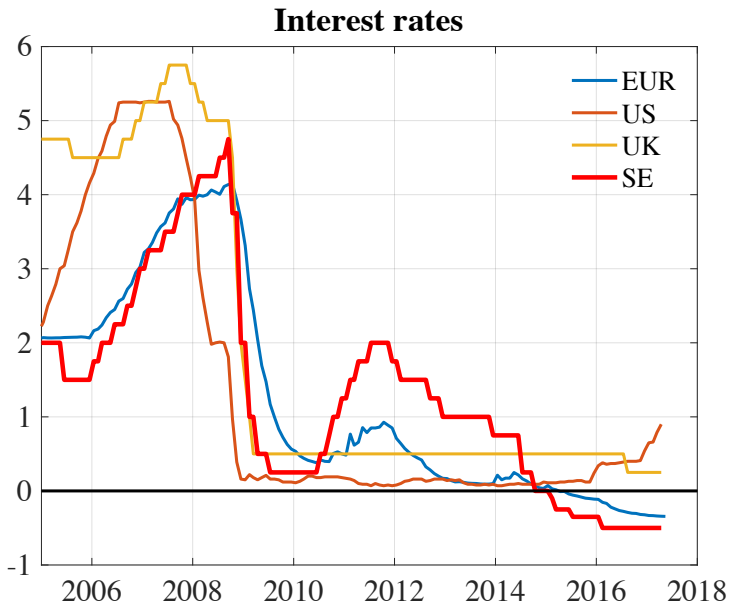
Stockholm School of Economics
www.larseosvensson.se

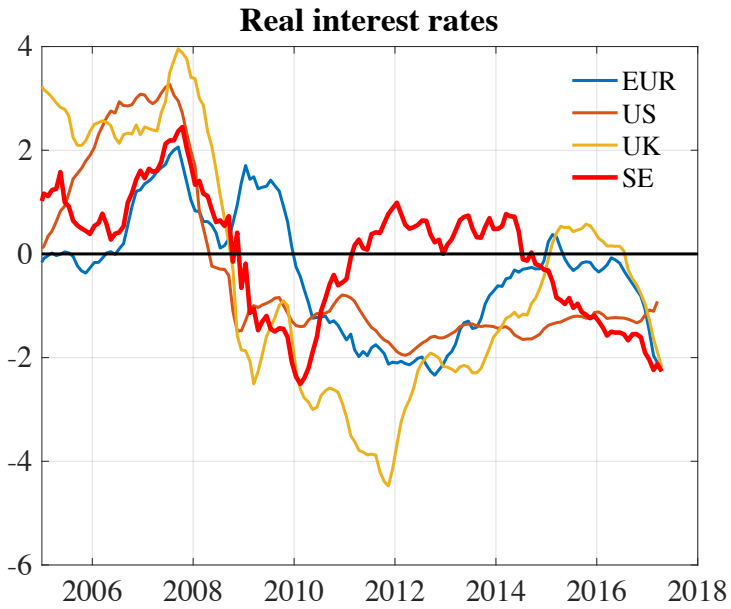
Workshop on "Interest rates after the financial crisis,"
Örebro University and Kommuninvest, Örebro, October 3–4, 2017

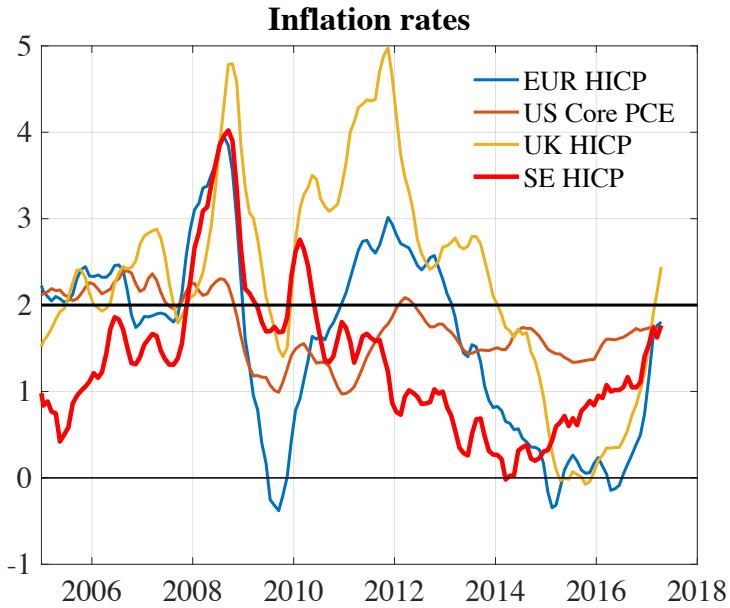
Outline

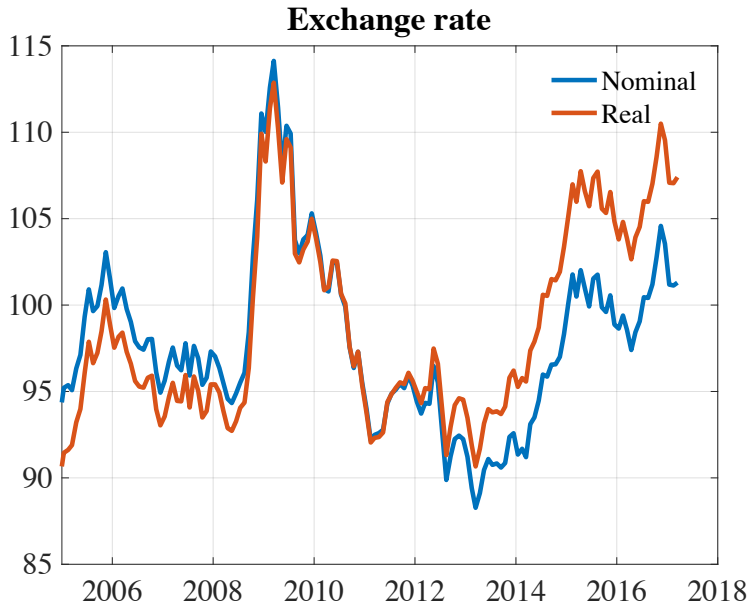
- Workshop: "Interest rates after the financial crisis"
- Interest rates during and after the crisis in Sweden
  - Shortly after the crisis: Leaning Against the Wind (LAW)
  - Later: LAW abandoned, expansionary monetary policy
- Was it worth it?
- Cost-benefit analysis of leaning against the wind (JME Oct 2017)

Riksbank LAW 2010–2013 1

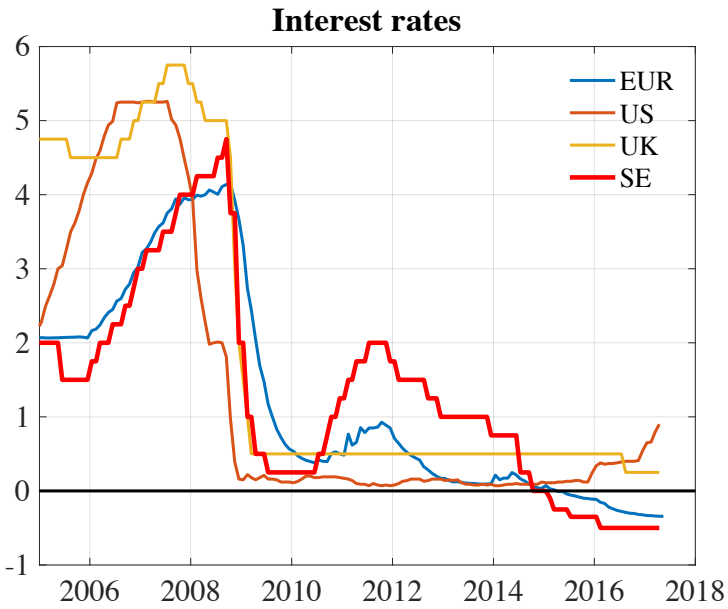


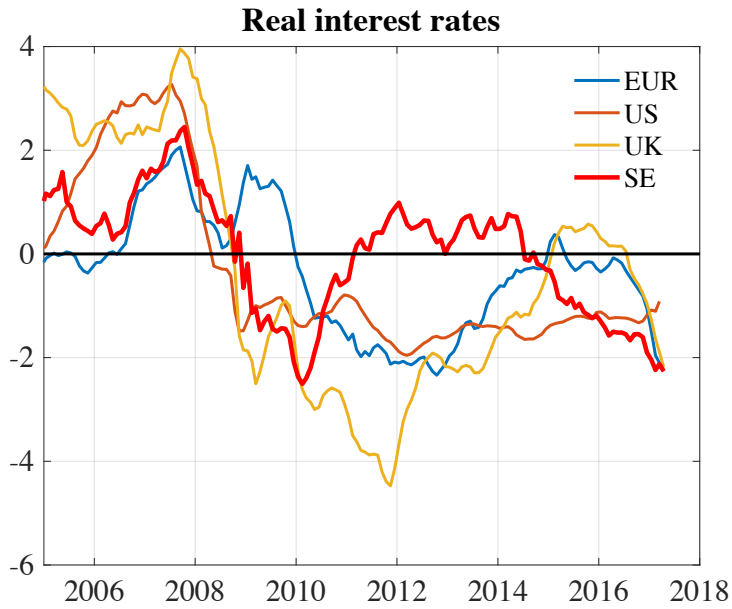


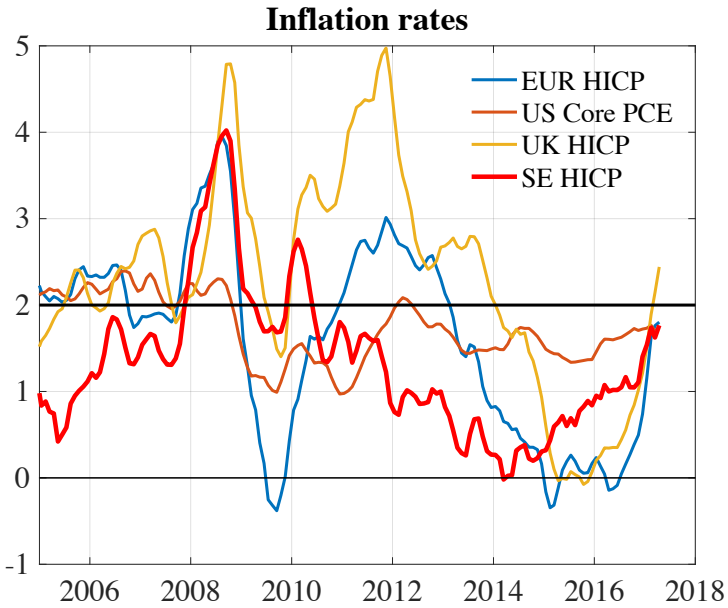


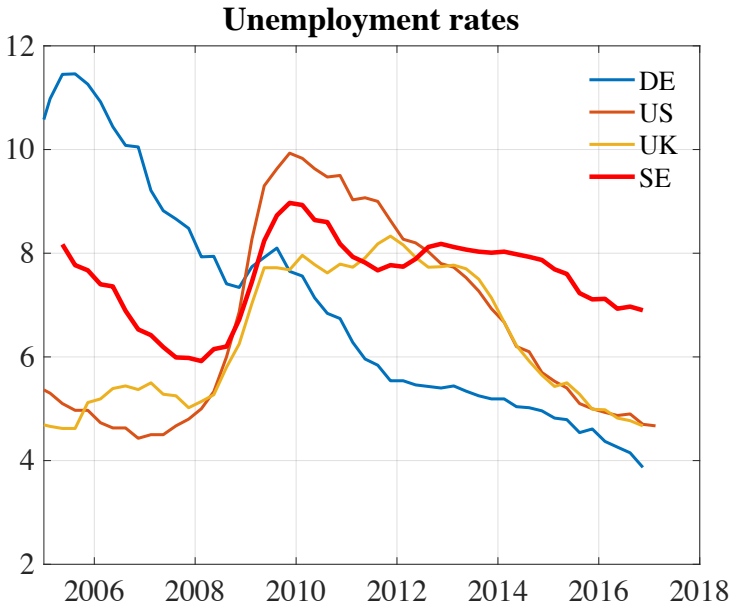


Riksbank LAW 2010–2013 2









Riksbank LAW 2010–2013 3

Ingves, "Stora risker med alltför låg ränta," SvD, Oct 18, 2012:

> *Dagens höga arbetslöshet är ett problem, men som riksbankschef kan jag inte bara agera kortsiktigt. Jag måste även ta ansvar för de långsiktiga konsekvenserna av dagens penningpolitik. Och det finns risker förknippade med en alltför låg ränta under en lång tid som inte går att bortse från. ... Om Riksbanken inte tar hänsyn till skuldsättningen hos hushåll och företag kan dessa konsekvenser bli mycket allvarliga.*

Riksbank Monetary Policy Report July 2017 (p. 13):

> *It is not likely that small increases in the repo rate would have any tangible effects on household indebtedness. A large increase in the repo rate could certainly slow down the buildup of debts but would also lead to higher unemployment, a much stronger krona and lower inflation. Other measures more specifically aimed at reducing the risks associated with household debt have less negative effects on the economy as a whole.*

Riksbank LAW 2010–2013 4

Ingves, "Large risks with too low interest rate," SvD, Oct 18, 2012:

> *Today's high unemployment is a problem, but as Governor I cannot only act short-sightedly. I must also take responsibility for the long-run consequences of today's monetary policy. And there are risks associated with too low an interest rate for a long period that cannot be neglected. ... If the Riksbank does not take into account the debt of households and firms, these consequences may become very serious.*

Riksbank Monetary Policy Report July 2017 (p. 13):

> *It is not likely that small increases in the repo rate would have any tangible effects on household indebtedness. A large increase in the repo rate could certainly slow down the buildup of debts but would also lead to higher unemployment, a much stronger krona and lower inflation. Other measures more specifically aimed at reducing the risks associated with household debt have less negative effects on the economy as a whole.*

Introduction 1

- Using monetary policy to deal with financial stability
- Leaning against the wind (LAW): Somewhat tighter policy than justified by standard inflation targeting
- Strongly promoted by BIS, practiced by Norges Bank
- Previously practiced (under strong dissents from Karolina Ekholm and me), but now abandoned by Riksbank
- Scepticism elsewhere (Bernanke, Draghi, Evans, Williams, Yellen, IMF 2015, FOMC 2016, Bank of Canada Review of Inflation Control Target 2016, Independent Review of BIS Research 2017, ...)

Introduction 2

- IMF 2015:
  "The question is whether monetary policy should be altered to contain financial stability risks. ...
  Based on our current knowledge, and in present circumstances, the answer is generally no."
- Williams 2015:
  "monetary policy is poorly suited for dealing with financial stability, even as a last resort."
- FOMC minutes, April 2016:
  "Most participants judged that the benefits of using monetary policy to address threats to financial stability would typically be outweighed by the costs ... ;
  some also noted that the benefits are highly uncertain."

Introduction 3

- Independent Review of BIS Research, January 2017:
  "so far the [BIS] argument for LAW seems to have cut relatively little ice with those actually responsible for setting monetary policy. In part, that is because of the lack of convincing evidence that the expected benefits outweigh the expected costs."
  "in some cases the research programme appeared somewhat one-eyed. [Of 9 projects on financial stability and monetary policy] the first and (to some extent) the fifth seem motivated primarily by a desire to overturn Svensson's (2016) conclusion on the inadvisability of LAW."
  "the research effort ... seems excessively focussed on building the case for LAW, rather than also investigating the scope for other policy actions to address financial stability risks."

Introduction 4

- LAW has costs in terms of a weaker economy (higher unemployment, lower inflation), but possible benefits in terms of a lower probability or smaller magnitude of a crisis
- Is LAW justified or not?
- Requires a cost-benefit analysis: Numbers!

Conclusions 1

- For existing empirical estimates, marginal cost of LAW much higher than marginal benefit
- This result is quite robust; overturning the result requires effects that are more than 5–40 standard errors larger than empirical benchmark estimates
- LAW increases not only *non-crisis* unemployment but also *crisis* unemployment; the latter is main component of the marginal cost
- Lower probability and smaller magnitude of a crisis are possible marginal benefits of LAW
- For empirical estimates and channels, effect of LAW on probability or magnitude of a crisis too small to make marginal benefit exceed marginal cost

Conclusions 2

The result is robust to:

- Monetary non-neutrality: A permanent policy-rate effect on real debt
- A smaller policy-rate effect on unemployment
- Larger policy-rate effects on probability and magnitude of crises: 5–40 std.e. larger effect just to get to break-even
- A credit boom and a higher probability of a crisis
- A larger crisis magnitude
- A longer crisis duration
- Last 3: Robust to less effective macroprudential policy! Costs actually increase more than benefits!

Conclusions 3

- Do not do any LAW without support from a thorough cost-benefit analysis
- At this stage of knowledge, the burden of proof should be on the proponents of LAW
- To achieve and maintain financial stability, as far as I can see, there is no choice but to use macroprudential policy; monetary policy simply cannot do it

What is new in my approach

- Simplicity, transparency, few assumptions
- Take into account that crisis loss is higher if economy initially weaker because of LAW
- Role of monetary neutrality and non-neutrality
- Consistent use of empirically supported estimates
- Robustness of results, in spite of stacking cards in favor of LAW
- Quarterly, quadratic loss function (different from Svensson 2014, 2015)

The framework 1

- $\mathrm{E}_1 \sum_{t=1}^{\infty} \delta^{t-1} L_t = \sum_{t=1}^{\infty} \delta^{t-1} \mathrm{E}_1 L_t$ intertemporal loss function
- $L_t = (\tilde{u}_t)^2$ indirect loss function (flexible IT, Phillips curve)
- $\tilde{u}_t \equiv u_t - u_t^*$ unemployment deviation
- u_t^* optimal unempl. rate for flexible IT with $p_t = 0$
- p_t probability of (financial) crisis in quarter t
- $\tilde{u}_t^{\mathrm{n}}$ *non-crisis* unemployment deviation; > 0 LAW; < 0 LWW
- $\Delta u_t > 0$ crisis unemployment increase (net of policy response)
- $\tilde{u}_t^{\mathrm{c}} \equiv \tilde{u}_t^{\mathrm{n}} + \Delta u_t$ *crisis* unemployment deviation
- LAW: $d\bar{i}_1 \equiv di_t > 0$ for $t = 1, .., 4$
- Examine $(d/d\bar{i}_1)\mathrm{E}_1 \sum_{t=1}^{\infty} \delta^{t-1} L_t = \sum_{t=1}^{\infty} \delta^{t-1} d\mathrm{E}_1 L_t / d\bar{i}_1 \gtrless 0$

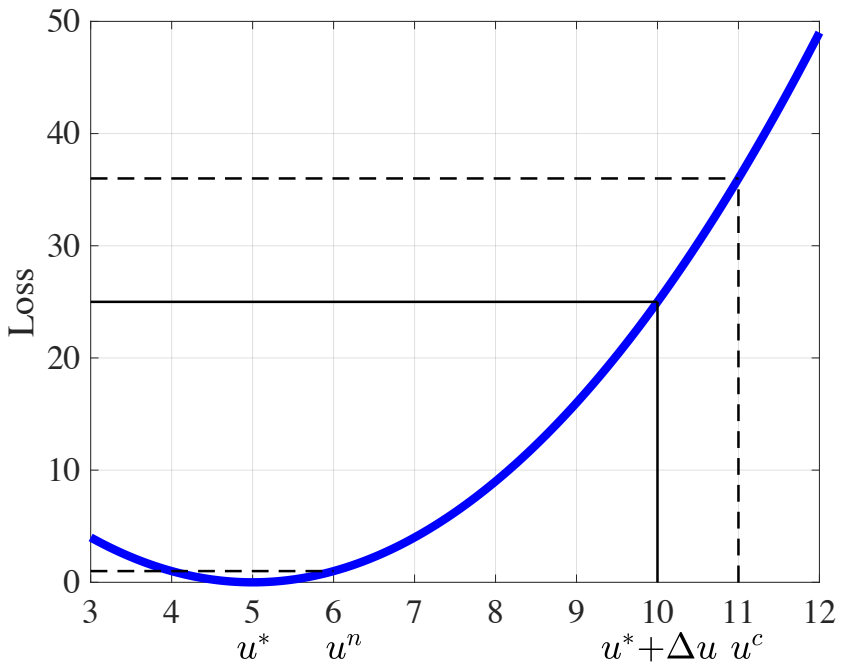
The framework 2

Expected quarter-t loss

$$\begin{aligned}
\mathrm{E}_1 L_t &= (1-p_t)\mathrm{E}_1 L_t^{\mathrm{n}} + p_t \mathrm{E}_1 L_t^{\mathrm{c}} \\
&= (1-p_t)\mathrm{E}_1 (\tilde{u}_t^{\mathrm{n}})^2 + p_t \mathrm{E}_1 (\tilde{u}_t^{\mathrm{n}} + \Delta u_t)^2 \\
&= \mathrm{E}_1 L_t^{\mathrm{n}} + p_t \left[\mathrm{E}_1 L_t^{\mathrm{c}} - \mathrm{E}_1 L_t^{\mathrm{n}}\right] \\
&= \mathrm{E}_1 (\tilde{u}_t^{\mathrm{n}})^2 + p_t [\mathrm{E}_1 (\tilde{u}_t^{\mathrm{n}} + \Delta u_t)^2 - \mathrm{E}_1 (\tilde{u}_t^{\mathrm{n}})^2] \\
&= \mathrm{E}_1 (\tilde{u}_t^{\mathrm{n}})^2 + p_t [\mathrm{E}_1 (\Delta u_t)^2 + 2\mathrm{E}_1 \Delta u_t \, \mathrm{E}_1 \tilde{u}_t^{\mathrm{n}}]
\end{aligned}$$

- LAW: $d\bar{i}_1 \equiv di_t > 0$ for $t = 1, .., 4$
- $\tilde{u}_t^{\mathrm{n}} \uparrow \Rightarrow L_t^{\mathrm{n}} \uparrow$ (1st cost of LAW, 2nd order)
- $\tilde{u}_t^{\mathrm{n}} \uparrow \Rightarrow L_t^{\mathrm{c}} \uparrow$ (2nd cost, 1st order, not in previous literature)
- $p_t \downarrow \Rightarrow p_t \left[\mathrm{E}_1 L_t^{\mathrm{c}} - \mathrm{E}_1 L_t^{\mathrm{n}}\right] \downarrow$ (Benefit from lower probability of crisis)
- $\Delta u_t \downarrow \Rightarrow L_t^{\mathrm{c}} \downarrow$ (Benefit from smaller magnitude of crisis)

The two costs of LAW



$$L_t = (u_t - u_t^*)^2 = (\tilde{u}_t)^2$$
$$L_t^{\mathrm{n}} = (u_t^{\mathrm{n}} - u_t^*)^2 = (\tilde{u}_t^{\mathrm{n}})^2$$
$$L_t^{\mathrm{c}} = (u_t^{\mathrm{c}} - u_t^*)^2 = (u_t^{\mathrm{n}} + \Delta u - u_t^*)^2 = (\tilde{u}_t^{\mathrm{c}})^2$$

- $u^{\mathrm{n}} : u^* \rightarrow u^n$ (1st cost)
- $u^{\mathrm{c}} : u^* + \Delta u \rightarrow u^n + \Delta u$ (2nd cost)
- $p_t \downarrow$ (1st benefit, lower probability)
- $\Delta u \downarrow$ (2nd benefit, lower magnitude)

Net Marginal Cost, Marginal Cost, Marginal Benefit 1

Expected quarter-t loss

$$\mathrm{E}_1 L_t = \mathrm{E}_1 (\tilde{u}_t^{\mathrm{n}})^2 + p_t [\mathrm{E}_1 (\Delta u)^2 + 2\mathrm{E}_1 \Delta u \mathrm{E}_1 \tilde{u}_t^{\mathrm{n}}]$$

Net Marginal Cost: $\mathrm{NMC}_t \equiv d\mathrm{E}_1 L_t / d\bar{i}_1$

$$= 2 \underbrace{[\mathrm{E}_1 \tilde{u}_t^{\mathrm{n}} + p_t \mathrm{E}_1 \Delta u]}_{\text{Exp. unempl. deviation}} \frac{d\mathrm{E}_1 u_t^{\mathrm{n}}}{d\bar{i}_1}$$

$$- \{\underbrace{[\mathrm{E}_1 (\Delta u)^2 + 2\mathrm{E}_1 \Delta u \mathrm{E}_1 \tilde{u}_t^{\mathrm{n}}]}_{\text{Crisis loss increase}} (-\frac{dp_t}{d\bar{i}_1}) + \{2p_t \underbrace{\mathrm{E}_1 (\tilde{u}_t^{\mathrm{n}} + \Delta u)}_{\text{Crisis unempl. dev'n}} (-\frac{d\mathrm{E}_1 \Delta u}{d\bar{i}_1})\}$$

$$\equiv \mathrm{MC}_t - \{\mathrm{MB}_t^p + \mathrm{MB}_t^{\Delta u}\} \equiv \mathrm{MC}_t - \mathrm{MB}_t$$

Exogenous crisis probability and magnitude: LWW!

What if crisis probability and magnitude are exogenous?

$$\frac{dp_t}{d\bar{i}_1} = \frac{d\mathrm{E}_1 \Delta u_t}{d\bar{i}_1} = 0 \text{ for } t \geq 1$$

$$\mathrm{MB}_t^p = \mathrm{MB}_t^{\Delta u} = 0$$

$$\mathrm{NMC}_t = \mathrm{MC}_t = 2\mathrm{E}_1 \tilde{u}_t \frac{d\mathrm{E}_1 u_t^{\mathrm{n}}}{d\bar{i}_1} = 2(\mathrm{E}_1 \tilde{u}_t^{\mathrm{n}} + p_t \mathrm{E}_1 \Delta u_t) \frac{d\mathrm{E}_1 u_t^{\mathrm{n}}}{d\bar{i}_1} = 0$$

$$\mathrm{E}_1 \tilde{u}_t^{\mathrm{n}} = -p_t \mathrm{E}_1 \Delta u_t \quad [= -0.06 \cdot 5 \text{ pp} = -0.30 \text{ pp}]$$

LWW, but too small to bother about.

Net Marginal Cost, Marginal Cost, Marginal Benefit 2

$$\mathrm{E}_1 \tilde{u}_t^{\mathrm{n}} \equiv \mathrm{E}_1 (u_t^{\mathrm{n}} - u_t^*) \begin{cases} > 0 & \text{LAW} \\ = 0 & \text{No leaning (NL)} \\ < 0 & \text{LWW} \end{cases}$$

Examine NMC_t for $\mathrm{E}_1 \tilde{u}_t^{\mathrm{n}} = 0$ (NL):

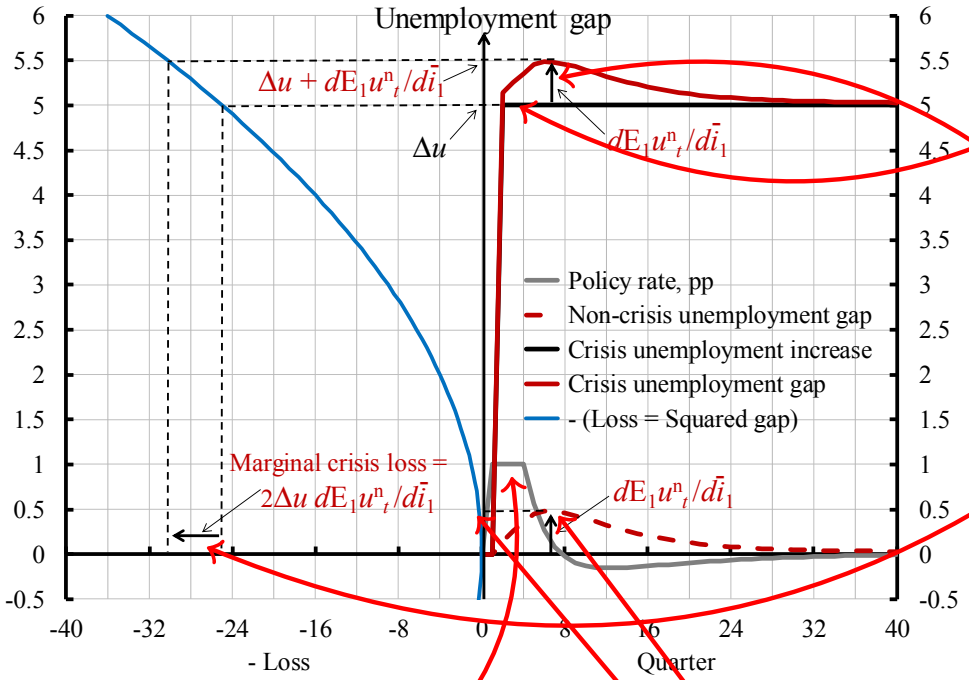
$$\begin{aligned} \mathrm{NMC}_t &= \mathrm{MC}_t - \mathrm{MB}_t \equiv \mathrm{MC}_t - \{\mathrm{MB}_t^p + \mathrm{MB}_t^{\Delta u}\} \\ &= 2p_t \mathrm{E}_1 \Delta u \frac{d\mathrm{E}_1 u_t^{\mathrm{n}}}{d\bar{i}_1} - \{\mathrm{E}_1 (\Delta u)^2 (-\frac{dp_t}{d\bar{i}_1}) + 2p_t \mathrm{E}_1 \Delta u (-\frac{d\mathrm{E}_1 \Delta u}{d\bar{i}_1})\} \end{aligned}$$

Examine

$$\sum_{t=1}^{\infty} [\delta^{t-1}] \mathrm{NMC}_t \begin{cases} > 0 & \Rightarrow \text{LWW} \\ = 0 & \Rightarrow \text{No leaning} \\ < 0 & \Rightarrow \text{LAW} \end{cases}$$

Understanding the marginal cost of LAW

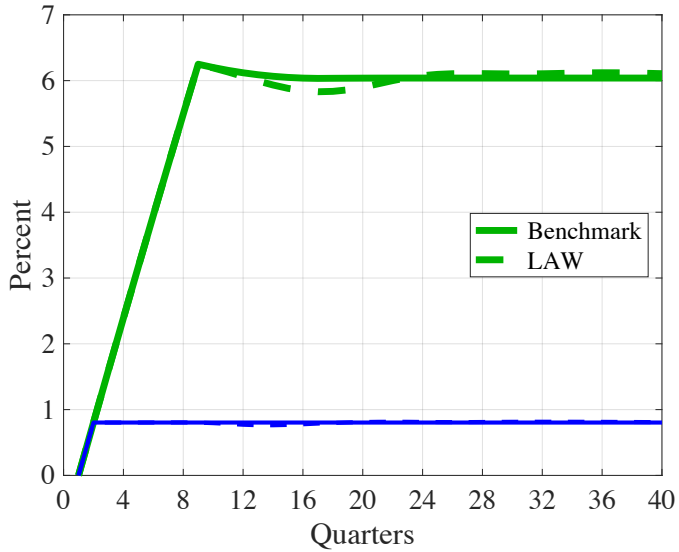
Loss = (Unemployment deviation)^2



- Policy-rate effect on non-crisis unemployment, $dE_1 u^n_t / d\bar{i}_1$
- Marginal *non-crisis* loss = 0, a 2nd-order loss (at zero u deviation)

- Crisis unemployment increase (net of policy response), Δu
- Effect on *crisis* unemployment, $dE_1 u^n_t / d\bar{i}_1$
- Marginal crisis loss = $2\Delta u \frac{dE_1 u^n_t}{d\bar{i}_1}$, a 1st-order loss
- Probability of crisis in quarter t, p_t
- Marginal cost = $2 p_t \Delta u \frac{dE_1 u^n_t}{d\bar{i}_1}$
- Crisis loss is higher with a higher non-crisis unemployment deviation due to LAW

The probability of a crisis, p_t



- Benchmark probability of crisis start in qtr t: $q_t = 0.8\%$, solid line (probability 3.2%/yr, 1 crisis on average every 33 years)
- Benchmark crisis duration: $n = 8$ quarters
- Benchmark probability of crisis in qtr t (Markov process): Approximation $p_t \approx \sum_{\tau=0}^{n-1} q_t$, solid line
- Dashed lines: Effect of LAW, $dq_t/d\bar{i}_1$, $dp_t/d\bar{i}_1$ (small)

Policy-rate effect on the probability of a crisis 1

- Schularick and Taylor (2012): Probability of crisis start in qtr t, q_t, related to real debt growth (14 countries, 1870–2008)
- Main logit equation, adapted to quarterly data

$$q_t = \frac{1}{4}\frac{\exp(X_t)}{1+\exp(X_t)}$$

$$X_t = [-3.89] - \underset{(2.110)}{0.398}\, g_{t-4} + \underset{(2.631)}{7.138^{***}}\, g_{t-8}$$

$$+ \underset{(2.948)}{0.888}\, g_{t-12} + \underset{(1.378)}{0.203}\, g_{t-16} + \underset{(1.640)}{1.867}\, g_{t-20}$$

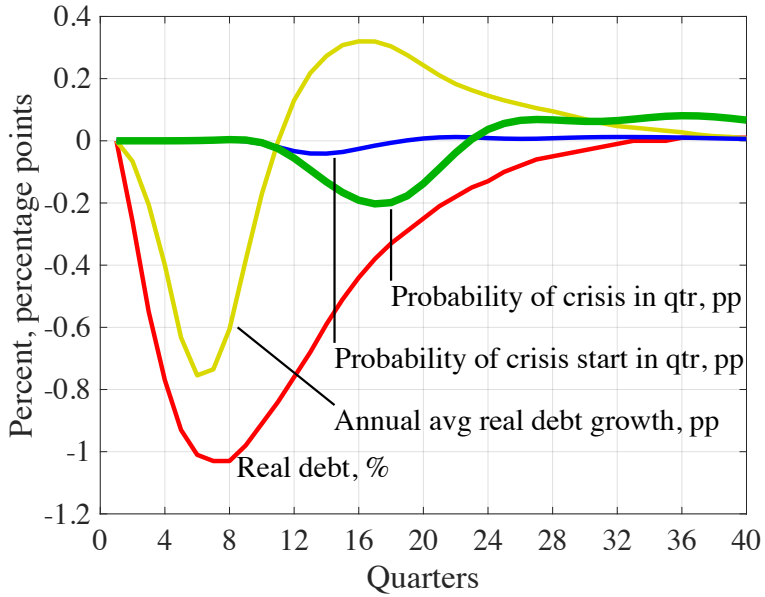
$$g_t \equiv \log(\textstyle\sum_{\tau=0}^{3} d_{t-\tau}/4) - \log(\sum_{\tau=0}^{3} d_{t-4-\tau}/4)$$

d_t real debt, g_t annual growth rate of average annual debt

- Main determinant is 2-year lag of annual credit growth, *not* cumulative 5-year growth as in some papers (coefficients different)

Policy-rate effect on probability of a crisis 2

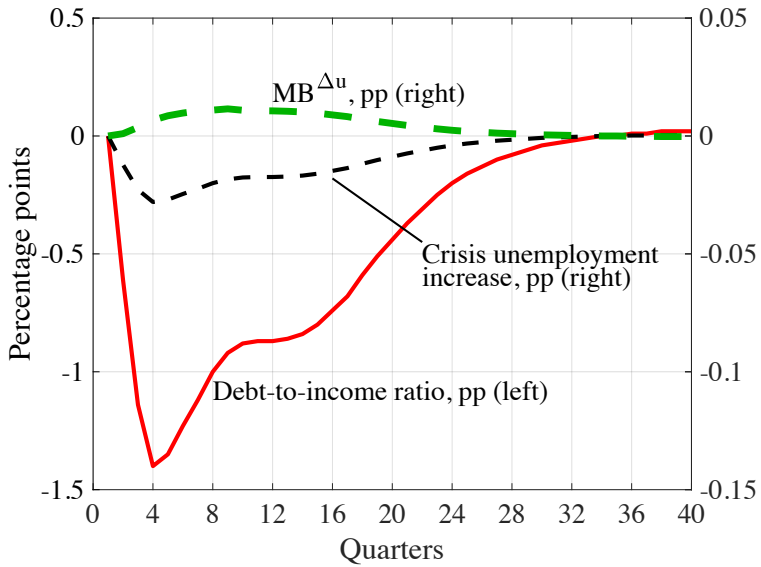
- Policy-rate effect on real debt, $\frac{d(d_t)}{d\bar{i}_1}$, $t \geq 1$, example and benchmark: Riksbank estimate (not statistically significant)



- Determines effects on
  average annual real debt growth, $\frac{dg_t}{d\bar{i}_1}$,
  probability of a crisis start, $\frac{dq_t}{d\bar{i}_1}$, and
  probability of a crisis, $\frac{dp_t}{d\bar{i}_1} = \sum_{\tau=0}^{n-1} \frac{dq_t}{d\bar{i}_1}$

Effect of LAW on the magnitude of a crisis 1

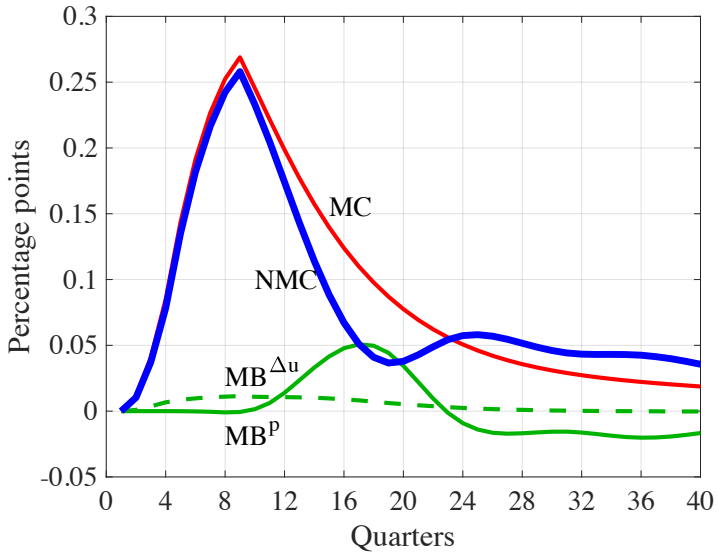
- Flodén (2014) OECD: 1 pp higher DTI implies 0.02 pp larger unemployment increase 2007-2012
- Riksbank estimate of policy-rate effect on DTI (too large)
- Implies maximum fall in Δu 0.03 pp in qtr 4 (dashed black line)

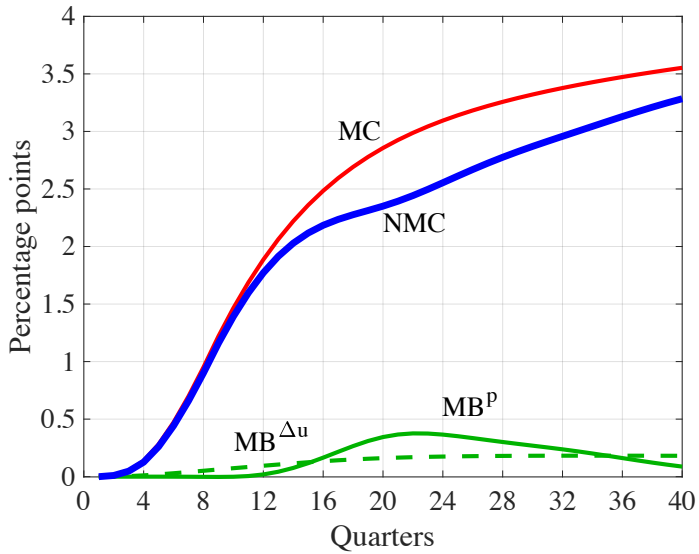


- Jorda, Schularick, Taylor (2013) implies 1 pp higher credit/GDP implies 0.04 pp higher unemployment increase (double Flodén's)

Benchmark MC, MB and NMC

- $\mathrm{MC}_t = 2p_t \Delta u \frac{d\mathrm{E}_1 u_t^{\mathrm{n}}}{d\bar{i}_1}$; $\mathrm{MB}_t = \mathrm{MB}_t^p + \mathrm{MB}_t^{\Delta u}$
- $\mathrm{MB}_t^p = (\Delta u)^2(-\frac{dp_t}{d\bar{i}_1})$; $\mathrm{MB}_t^{\Delta u} = 2p_t \Delta u(-\frac{d\Delta u_t}{d\bar{i}_1})$
- $\mathrm{NMC}_t = \mathrm{MC}_t - \mathrm{MB}_t$





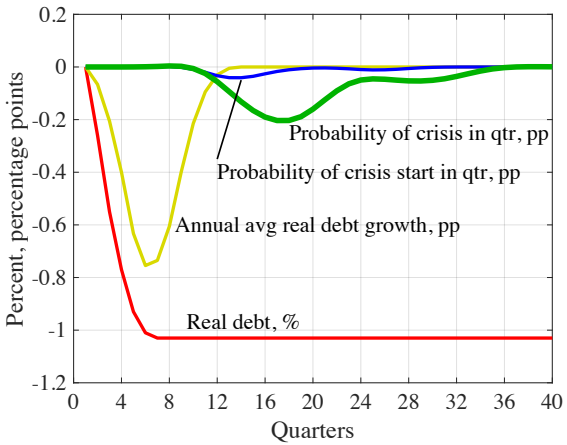
- Marginal cost exceeds marginal benefit by substantial margin
- $\sum_{t=1}^{40} \mathrm{NMC}_t > 0 \Rightarrow$ LWW!
  (but small, $\mathrm{E}_1 \tilde{u}_t^n = p_t \Delta u = 30$ bp if $p_t, \Delta u$ exogenous)
- Cumulative marginal benefits: $\sum_{t=1}^{40} \mathrm{MB}_t^p \approx 0$
- MC exceeds MB also if MC, MB beyond qtr 23 disregarded

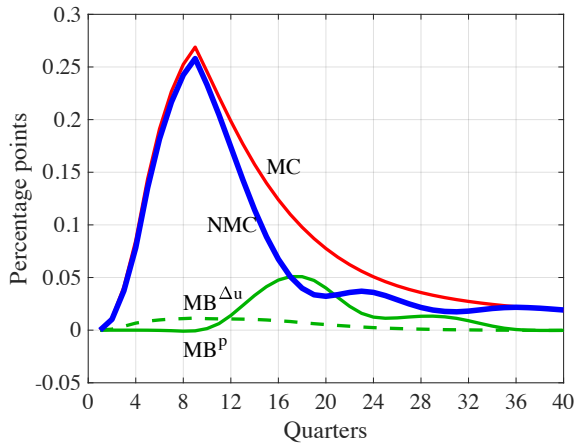
Robustness tests

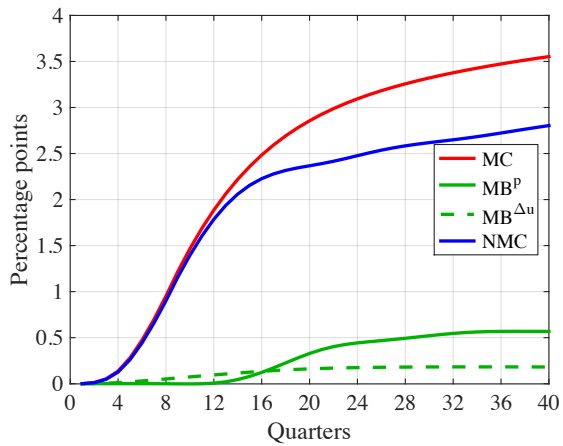
- Monetary neutrality: Permanent effect on real debt
- Smaller policy-rate effect on unemployment
- Less effective macroprudential policy
  - Credit boom and higher crisis probability
  - Larger crisis magnitude
  - Longer crisis duration
- Policy-rate effects on probability and magnitude of crisis for break-even: 5–40 standard errors larger
- Debt to GDP instead of real debt; 5-year moving averages
- Break-even ($\sum$ MC = $\sum$ MB) requires effects that are 5–40 standard errors larger than empirical benchmark estimates

Monetary non-neutrality: Permanent effect on real debt

- Assume that real debt stays at its lowest deviation from baseline
- Negative cumulative effect on crisis probabilities
- $\mathrm{MC}_t = 2p_t \Delta u \frac{d\mathrm{E}_1 u_t^{\mathrm{n}}}{d\bar{i}_1}$,
- $\mathrm{MB}_t^p = (\Delta u)^2(-\frac{dp_t}{d\bar{i}_1})$; $\mathrm{MB}_t^{\Delta u} = 2p_t \Delta u(-\frac{d\Delta u_t}{d\bar{i}_1})$



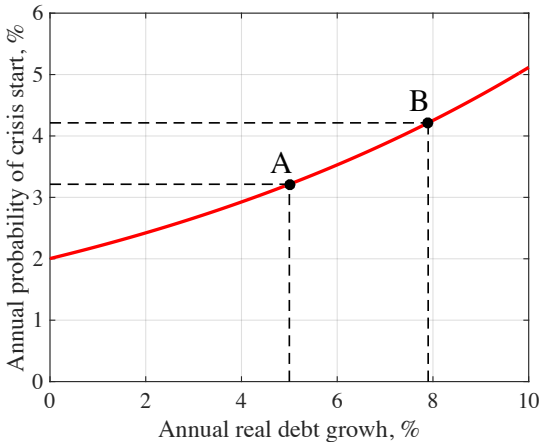


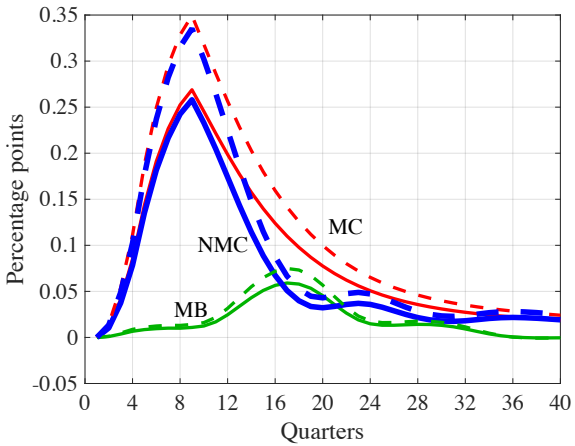


- Marginal cost still exceeds marginal benefit

Credit boom and higher probability of crisis start

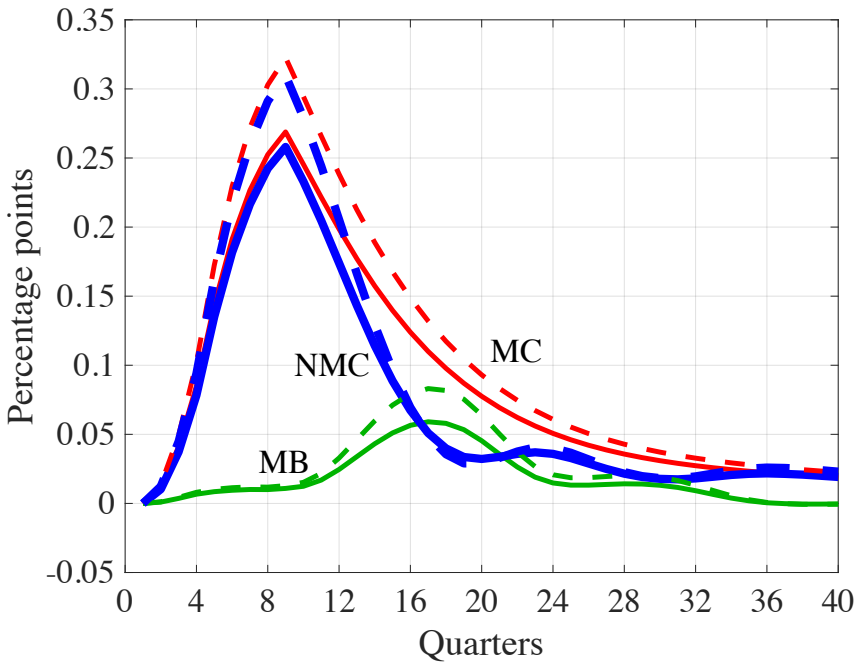
- Credit boom: Increase in annual real debt growth from 5% to 7.9%
- Increase in annual probability $4q$ from 3.21% to 4.21%
- dq/dg increases $\Rightarrow \left|dq_t/d\bar{i}_1\right|, \left|dp_t/d\bar{i}_1\right|$ increase
- $\mathrm{MC}_t = 2p_t\Delta u\frac{d\mathrm{E}_1 u_t^{\mathrm{n}}}{d\bar{i}_1}$; $\mathrm{MB}_t^p = (\Delta u)^2(-\frac{dp_t}{d\bar{i}_1})$; $\mathrm{MB}_t^{\Delta u} = 2p_t\Delta u(-\frac{d\Delta u_t}{d\bar{i}_1})$
- Increase in annual probability $4q$ from 3.21% to 4.21% (dashed)





A larger crisis increase in the unemployment rate

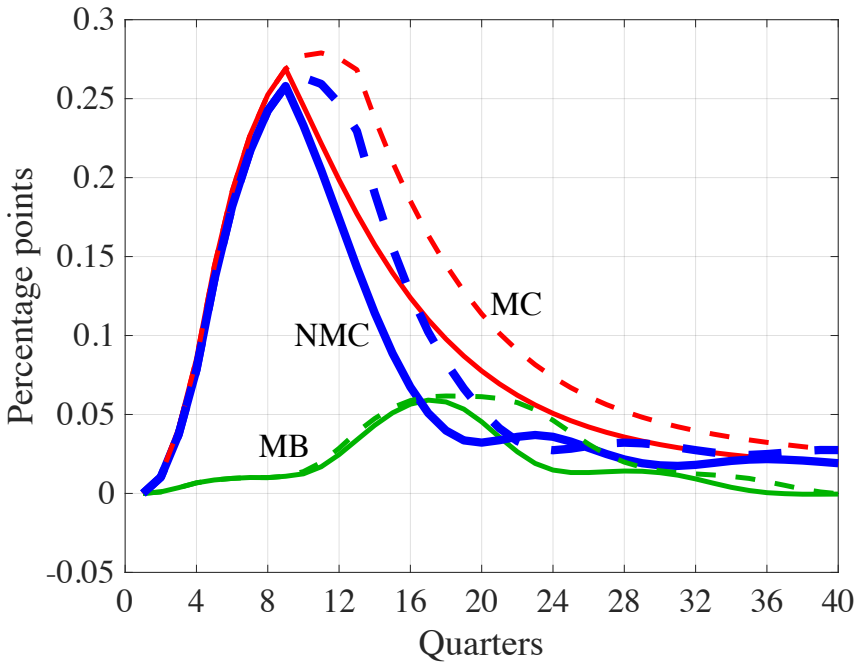
- Larger Δu, from 5 to 6 percentage points (dashed)
- $\mathrm{MC}_t = 2p_t\Delta u\frac{d\mathrm{E}_1 u_t^{\mathrm{n}}}{d\bar{i}_1}$; $\mathrm{MB}_t^p = (\Delta u)^2(-\frac{dp_t}{d\bar{i}_1})$; $\mathrm{MB}_t^{\Delta u} = 2p_t\Delta u(-\frac{d\Delta u_t}{d\bar{i}_1})$



- Break-even requires $\Delta u = 32$ pp

A longer crisis duration

- Increase in n from 8 to 12 quarters; $p_t \approx \sum_{\tau}^{n-1} q_{t-\tau}$ (dashed)
- $\mathrm{MC}_t = 2p_t \Delta u \frac{d\mathrm{E}_1 u_t^{\mathrm{n}}}{d i_1}$; $\mathrm{MB}_t^p = (\Delta u)^2(-\frac{dp_t}{di_1})$; $\mathrm{MB}_t^{\Delta u} = 2p_t \Delta u(-\frac{d\Delta u_t}{di_1})$



Summary conclusions

- Based on current estimates and knowledge, the cost of LAW is much larger than than the benefit
- Do not do any LAW without support from a thorough cost-benefit analysis
- At this stage of knowledge, the burden of proof should be on the advocates of LAW
- To achieve and maintain financial stability, as far as I can see, there is no choice but to use macroprudential policy; monetary policy simply cannot do it

Bank-capital effect on probability of crises

- Dagher, Dell'Ariccia, Laeven, Ratnovski, Tong (2016, "Benefits and Costs of Bank Capital," IMF SDN/16/04)
- 20% bank capital relative to RWA might have avoided 80% of historical banking crises in OECD since 1970 (DDLRT(2016, fig. 7)
- Dramatic effect on probability of crises with enough bank capital: Shift from solid lines to thick dashed lines