Global impact of US and euro area unconventional monetary policies: a comparison

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Outline

- **US and euro area unconventional monetary policies (UMPs)**
  - Measured through shadow rates
- **Impact** of US and euro area UMP measures
  - Real and financial sectors
  - Global VAR model
    - Methodology and data
  - Compare global effects of US and euro area QE
    - Impulse responses: domestic & spillover effects
    - Advanced, emerging Asia, Latin America, emerging Europe and other emerging economies
Measuring UMP with shadow rates

- **ZLB & UMPs**
  - Policy rate no longer main policy instrument

- **Shadow rates à la Black (1995)**
  - Based on a model of the term structure

- **Shadow rates**: Lombardi & Zhu (2014)
  - Based on a dynamic factor model (Bańbura & Modugno 2012) on several monetary indicators
  - Approach extended to a shadow EONIA rate
How do we do it?

- Construct a large data matrix of variables related to (conventional and unconventional) monetary policy
  - Term structure
  - Monetary aggregates
  - Balance sheet items
- Model this as a function of few dynamic factors
- Treat the policy rate as missing after it hit the ZLB and use the factors to reconstruct it
  - This is done using the EM algorithm
The dynamic factor model

- Let \( \{X_t, \ t = 1, ..., T\} \) be an \( N \)-dimensional data matrix
- Factor representation:
  \[
  X_t = \Lambda F_t + e_t
  \]
- Factor dynamics:
  \[
  F_t = \sum_{i=1}^{p} A_i F_{t-i} + u_t
  \]
- Factors are unobservable
  - State-space representation
  - ML estimation via the Kalman filter
EM algorithm

- X may have missing entries in the $i$-th column:
  - Replace them with their expectations based on the observed series!

1. Start with a guess $X_{i,t}$
2. Compute the factors $F_t$
3. Replace the guess with $E(X_{i,t} \mid F_t)$
4. Iterate until convergence

- We treat the FFR (and short-term rates) as missing as soon as they hit the ZLB
Actual and shadow interest rates

Fed funds rate\(^2\)

EONIA\(^3\)

1 Dashed lines represent confidence bands.  
2 The grey areas indicate the periods of implementation of LSAP1, LSAP2, and LSAP3.  
3 The grey areas indicate the periods of LTRO1 (November 2008–June 2009) and LTRO2 (December 2011–February 2012) and Targeted LTRO (September 2014–16 December 2015). Vertical lines indicate the start of CBPP1 (July 2009), SMP (May 2010) and OMT (September 2012), respectively.

Sources: Krippner (2013); Lombardi and Zhu (2014); Wu and Xia (2013); Datastream.
Global vector error correction model (GVECM)

- **Country-specific VARX**
  \[ x_{it} = a_{i0} + a_{i1} \cdot t + \sum_{s=1}^{p_i} \Phi_{is} x_{i,t-s} + \sum_{s=0}^{q_i} \Lambda_{is} x^*_i t-s + \sum_{s=0}^{r_i} \Psi_{is} d_{t-s} + u_{it} \]
  - Time-varying weighting for foreign variables
    - Based on trade and capital flows
  - Country-by-country estimation

- **Aggregation in global system**
  \[ Gx_t = a_{i0} + a_{i1} \cdot t + \sum_{s=1}^{p} \Phi_s x_{t-s} + \sum_{s=0}^{r} \Psi_s d_{t-s} + u_t \]
  - G matrix based on time-varying weights
Specification of GVECM model

- Variables of interest
  - Real GDP, inflation, monetary policy indicator, equity prices
  - FX pressure index: e.g. Eichengreen, Ross and Wyplosz (1995)
  - BIS series of total credit to private, nonfinancial sector
  - Global variables: oil price and VIX (endogenous to US block)

- Monthly data for 24 economies
  - Advanced: US, Euro area (EA), Japan, Sweden, Switzerland, UK
  - Emerging Asia: China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, Singapore, Thailand
  - Latin America: Argentina, Brazil, Chile, Mexico
  - Emerging Europe: Czech Republic, Poland, Russia
  - Other emerging economies: Saudi Arabia, South Africa

- Robustness check
  - Analysis based on Wu-Xia (2015) shadow rates
Identification with sign restrictions

- Based on Eickmeier and Ng (2012)
  - Though we do not enforce orthogonality of shocks across different countries

- Expansionary monetary policy shock
  - Shadow interest rate $\leq 0$, for six months
  - Inflation $\geq 0$, for six months
  - Real GDP growth $\geq 0$, for six months

- Shocks to shadow rates scaled to -25 basis points
Impulse responses: domestic effects

Reductions in US & EA shadow policy rates (25 basis points)

The estimates correspond to a sample period beginning in October 2008 and ending in June 2014. The solid lines represent the median estimates while the dashed lines represent the upper or lower bounds. The shocks to the US and euro area monetary policy correspond to a 25-basis-points reduction in the Lombardi-Zhu (2014) shadow federal funds rate and Chen-Lombardi-Zhu (2015) shadow Eonia rates, respectively.  

A rise in foreign exchange pressure index represents stronger appreciation pressure.

Source: Authors’ calculations based on an estimated Global Vector Error Correction model.

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Source: Authors’ calculations based on an estimated Global Vector Error Correction model.
Impulse responses: trans-Atlantic effects

*Reductions in US & EA shadow policy rates (25 basis points)*

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Source: Authors’ calculations based on an estimated Global Vector Error Correction model.
Distribution of cumulative impulse responses

Reductions in US & EA shadow policy rates (25 basis points)

- Greater dispersion in responses to US shock (output, credit, equity price, MP, FX)
- Larger median responses to US shock
- Median responses of opposite signs (equity price, FX pressure) to US, EA shocks
Impulse responses to US & EA policy shocks

- Domestic and trans-Atlantic effects
  - Larger & more persistent in US
  - Help restore credit flows in both economies
  - UMPs also work through equity prices in US, not EA
  - US UMPs tend to have far larger impact on EA

- Generally expansionary spillovers from UMPs
  - Positive on output growth and inflation
  - Effects typically much smaller and less sustained for EA easing, responses also less dispersed
  - Impact (size & sign) varies across economies and over time
  - Often greater & more diverse spillovers than domestic effects
Impulse responses: China
Reductions in US & EA shadow policy rates (25 basis points)

The estimates correspond to a sample period beginning in October 2008 and ending in June 2014. The solid lines represent the median estimates while the dashed lines represent the upper or lower bounds. The shocks to the US and euro area monetary policy correspond to a 25-basis-points reduction in the Lombardi-Zhu (2014) shadow federal funds rate and Chen-Lombardi-Zhu (2014) shadow Eonia rates, respectively.

2 A rise in foreign exchange pressure index represents stronger appreciation pressure.

Source: Authors’ calculations based on an estimated Global Vector Error Correction model.
Impulse responses: Brazil

Reductions in US & EA shadow policy rates (25 basis points)

The estimates correspond to a sample period beginning in October 2008 and ending in June 2014. The solid lines represent the median estimates while the dashed lines represent the upper or lower bounds. The shocks to the US and euro area monetary policy correspond to a 25-basis-points reduction in the Lombardi-Zhu (2014) shadow federal funds rate and and Chen-Lombardi-Zhu (2014) shadow Eonia rates, respectively. A rise in foreign exchange pressure index represents stronger appreciation pressure.

Source: Authors’ calculations based on an estimated Global Vector Error Correction model.
Transmissions of US & EA policy shocks differ

- Foreign exchange pressure
  - US easing generates BRL and RMB appreciation pressure
  - Opposite for EA
- Equity price inflation
  - Effects different: US shock more supportive
- Credit growth
  - Upon US stimulus, credit growth slows a bit in China, but accelerates in Brazil a few months after
  - No credit response to EA easing in Brazil

- Results robust to the use of Wu-Xia (2015) rates
Conclusion

- **Effects** from US & EA easing
  - Effective domestically, more so in US
  - Large variations in spillovers, signs may differ
  - US easing has larger and more persistent spillovers
  - But we do not differentiate across UMP measures

- **Cross-border effects and policy responses**
  - Cross-border effects may depend partly on how each economy reacts to the US and EA policy shocks
    - Evidence of diverse responses in emerging economies in terms of exchange rates, credit and monetary policy
  - Cross-border transmission of US and EA UMPs tend to operate differently, with typically weaker transmission for EA policies
Thank you!
“On December 16, 2008, the Federal Open Market Committee (FOMC), in an effort to fight what was shaping up to be the worst recession since 1937-38, reduced the federal funds rate to nearly zero. From then on, with all its conventional ammunition spent, the Federal Reserve was squarely in the brave new world of quantitative easing ... 

Roughly speaking, quantitative easing refers to changes in the composition and/or size of a central bank’s balance sheet that are designed to ease liquidity and/or credit conditions.

Alan Blinder (2010)
# Federal Reserve large-scale asset purchases

<table>
<thead>
<tr>
<th></th>
<th>Announcement</th>
<th>Termination</th>
<th>Assets purchased</th>
<th>Amount¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSAP1</td>
<td>November 2008</td>
<td>March 2009</td>
<td>Agency mortgage-backed securities (MBS) and agency debt</td>
<td>$600 billion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>March 2010</td>
<td>Agency securities</td>
<td>$850 billion</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Longer-term US Treasury securities</td>
<td>$300 billion</td>
</tr>
<tr>
<td>LSAP2</td>
<td>November 2010</td>
<td>June 2011</td>
<td>Longer-term US Treasury securities</td>
<td>$600 billion</td>
</tr>
<tr>
<td>Maturity extension programme (MEP)</td>
<td>September 2011</td>
<td></td>
<td>US Treasury securities with remaining maturities of six to 30 years</td>
<td>$400 billion</td>
</tr>
<tr>
<td></td>
<td>June 2012</td>
<td>December 2012</td>
<td>US Treasury securities with remaining maturities of six to 30 years</td>
<td></td>
</tr>
<tr>
<td>LSAP3</td>
<td>September 2012</td>
<td>October 2014</td>
<td>Agency MBS</td>
<td>$40 billion per month²</td>
</tr>
<tr>
<td></td>
<td>December 2012</td>
<td>October 2014</td>
<td>Longer-term US Treasury securities</td>
<td>$45 billion per month²</td>
</tr>
</tbody>
</table>

¹ Initially announced amount of asset purchases for each programme or programme expansion. In US dollar. ² The purchases were open-ended when they were announced. The Federal Reserve started to taper the asset purchases in January 2014, and eventually halted the purchases altogether in October 2014.
## ECB main non-standard measures

<table>
<thead>
<tr>
<th>Programme</th>
<th>Start</th>
<th>Termination</th>
<th>Details</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTRO1</td>
<td>October 2008</td>
<td>March 2009</td>
<td>Enhanced longer-term refinancing operations, three- and six-month; fixed-rate full allotment</td>
<td>EUR 300 billion</td>
</tr>
<tr>
<td>CBPP1</td>
<td>June 2009</td>
<td>December 2009</td>
<td>12-month fixed-rate full-allotment</td>
<td>442 billion</td>
</tr>
<tr>
<td>SMP</td>
<td>May 2010</td>
<td>September 2012</td>
<td>Securities markets programme, sterilised</td>
<td>&gt;200 billion</td>
</tr>
<tr>
<td>CBPP2</td>
<td>November 2011</td>
<td>October 2012</td>
<td>Covered bond purchase programme</td>
<td>16.4 billion</td>
</tr>
<tr>
<td>LTRO2</td>
<td>Oct &amp; Dec 2011 Dec 2011; Feb 2012</td>
<td></td>
<td>12- &amp; 13-month LTROs; Three-year fixed-rate full-allotment</td>
<td>529 billion</td>
</tr>
<tr>
<td>OMT</td>
<td>September 2012</td>
<td></td>
<td>Outright monetary transactions, government bonds of one to three years</td>
<td>Open-ended²</td>
</tr>
<tr>
<td>TLTRO</td>
<td>September 2014</td>
<td>June 2016</td>
<td>Targeted longer-term refinancing operations</td>
<td></td>
</tr>
<tr>
<td>EAPP</td>
<td>September 2014</td>
<td>September 2016</td>
<td>Expanded asset purchase programme</td>
<td>60 billion per month²</td>
</tr>
<tr>
<td>CBPP3</td>
<td>October 2014</td>
<td>At least 2 years</td>
<td>Covered bond purchase programme</td>
<td>131.14 billion</td>
</tr>
<tr>
<td>ABSPP</td>
<td>November 2014</td>
<td>At least 2 years</td>
<td>Longer-term US Treasury securities</td>
<td>14.58 billion</td>
</tr>
<tr>
<td>PSPP</td>
<td>March 2015</td>
<td>September 2016</td>
<td>Public sector purchase programme</td>
<td>393.64 billion</td>
</tr>
</tbody>
</table>
Cumulative impulse responses over one year

Reductions in US & EA shadow policy rates (25 basis points)

Real GDP growth

CPI inflation

AR = Argentina; BR = Brazil; CH = Switzerland; CL = Chile; CN = China; CZ = Czech Republic; GB = United Kingdom; HK = Hong Kong; ID = Indonesia; IN = India; JP = Japan; KR = Korea; MX = Mexico; MY = Malaysia; PH = Philippines; PL = Poland; RU = Russia; SA = Saudi Arabia; SE = Sweden; SG = Singapore; TH = Thailand; US = United States; XM = Euro Area; ZA = South Africa.

Adv = Advanced economies; EME Asia = Emerging economies in Asia; LA = Latin America; EME Europe = Emerging economies in Europe.

1 The US and euro area monetary policy shocks are a 25 basis-point reduction in the US shadow federal funds rate and euro area shadow EONIA rate, respectively.
Cumulative impulse responses over one year

Reductions in US & EA shadow policy rates (25 basis points)

Equity price inflation

Foreign exchange pressure

Response to US policy shock
Response to euro area policy shock
Cumulative impulse responses over one year

Reductions in US & EA shadow policy rates (25 basis points)

Monetary policy indicators

Credit to private sector

Response to US policy shock  
Response to euro area policy shock