Effects of U.S. Quantitative Easing on Emerging Market Economies

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SEM Conference 2015  
July 24, 2015
Motivation

- With the short-term interest rate at the ZLB since late 2008, the Federal Reserve of the US engaged in quantitative easing (QE) policy
- Active empirical literature on the effects (if any) of QE but it largely focuses on domestic implications of QE
- Popular discussion on international spillovers, especially to emerging market (EM) countries
- This paper aims to study both domestic and international spillover effects of QE
  - “Fragile Five” countries (Brazil, India, Indonesia, South Africa, and Turkey) thought to be particularly vulnerable to the withdrawal of QE
Motivation

- Literature largely focuses on “announcement effects” of QE
  - Analyze effects around narrow 1/2-day windows following policy announcements
  - Advantages: easy to establish causality/exogeneity
  - Disadvantages: high-frequency financial variables only; dynamic effects?

- We employ a framework suitable for
  - Inferring both real and financial implications of US QE policies
  - Analyzing dynamic effects
Motivation

US variables

Notes:
1. Sep 2008 Lehman Brothers
5. Nov 2010, QE2
6. Sep 2011, MEP
7.–8. Sep, Dec 2012, QE3
9. May 2013, Taper scare
Motivation

Cumulative equity inflows of selected emerging market economies
Motivation

Exchange rates against USD of selected emerging market economies
What we do

- Identified Bayesian VAR with monthly US data
  - Balance sheet variable as a policy instrument
  - Macro variables: output and consumer prices
  - Financial variables: long-term Treasury yields and equity prices
  - Non-recursive short-run restrictions to identify a US QE shock
- Given the identified US QE shock, assess effects on emerging markets
  - Focus first on the “Fragile Five” countries and then extend to others
  - Macro variables: output, consumer prices, trade flows
  - Financial variables: exchange rates, bond yields, equity prices, capital flows
Related Literature

- Announcement effects
  - Gagnon et al (2010); Krishnamurthy and Vissing-Jorgensen (2011)

- VAR based identification
  - Gambacorta et al (2014); Baumeister and Benati (2011); Wright (2011)

- International effects of US QE policies
  - Neely (2010); Chen et al (2011); Glick and Leduc (2011); Bauer and Neely (2013)

- Effects on emerging markets/Fragile Five of taper scare
  - Eichengreen and Gupta (2013); Aizenman et al (2014)
Policy rule and QE shock

- We posit the Fed’s QE policy is well approximated by a linear policy rule
  - Analogous to the Taylor-type reaction function for conventional monetary policy
- The policy instrument is the securities held outright on the Fed’s balance sheet
  - It includes the holdings of Treasury securities, federal agency debt securities, and mortgage-backed securities.
  - Not composition of assets
  - An approach similar to Gambacorta et al (2014)
- The Fed observes/responds to current long-term Treasury yields
  - Other variables only with lags
- We isolate the non-systematic component of policy as a QE shock
Consider a structural VAR model for the US

\[ A_0 y_t = A_1 y_{t-1} + \cdots + A_l y_{t-l} + \varepsilon_t \]

Use non-recursive restrictions on \( A_0 \) for identification of the QE shock \( \varepsilon_{QE,t} \)

- Restrictions on short-run responses of the variables
- Sims and Zha (2006a,b) and Leeper, Sims, and Zha (1996)
US QE Shock Identification

- Restrictions on $A_0$ (similar to Sims and Zha 2006)

<table>
<thead>
<tr>
<th></th>
<th>Industrial production</th>
<th>PCE deflator</th>
<th>Securities held-outright</th>
<th>10-year Treasury yields</th>
<th>S&amp;P500 index</th>
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<td>$a_3$</td>
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- “X”: the corresponding coefficient of $A_0$ is not restricted
- Blanks: the corresponding coefficient of $A_0$ is restricted to zero
- “a”s: weakly restricted with the liquidity priors, $\text{Corr} (-a_1, a_2) = -0.8$ and $\text{Corr} (a_3, -a_4) = 0.8$
Spillover Effects of QE Shock

- We feed the US QE shock $\varepsilon_{QE,t}$ into a country-specific VAR for EM countries to assess spillover effects

$$z_t = B_1 z_{t-1} + \cdots + B_p z_{t-p} + D_0 \varepsilon_{QE,t} + \cdots + D_q \varepsilon_{QE,t-q} + u_t$$

- Baseline 4 variables (IP, CPI, 3-month interest rates and USD exchange rate) and the US QE shock as an exogenous variable
- After baseline estimation, we add one additional variable at a time
  - Stock price index, long-term yields, cumulative equity flows
Estimation Details

- Data sources: FRED, IMF, Datastream, Bloomberg, EPFR
- Monthly data from January 2008 through June 2014
- We use the Bayesian approach
  - Prior distributions: Extend the Minnesota-type prior as in Sims and Zha (1998)
  - Posterior distribution characterized by the Gibbs sampler (US VAR) and by direct simulation (emerging market VARs)
- Because of concerns about the sample size, fix the lag order at 6 (US VAR) and at 3 (emerging market VARs)
IRFs of US variables to a unit QE shock

- **IP**
- **PCE deflator**
- **Securities**
- **10-year yields**
- **S&P500**

Median responses and 68% error bands are shown.

Periods after impact:
- 0 10 20

Percentage (annualized):
- -0.2
- -0.15
- -0.1
- -0.05
- 0
## US QE Shock

Variance decompositions of US variables

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<td>[.02,.36]</td>
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**Notes:** Mean and 16% and 84% quantiles.
US QE Shock

Shock series and growth in securities held outright
Spillover Effects of QE Shock
USD exchange rate: Fragile Five

![Brazil](image1)
![India](image2)
![Indonesia](image3)
![South Africa](image4)
![Turkey](image5)
Spillover Effects of QE Shock

Long-term interest rates: Fragile Five

[Graphs showing the percentage points of long-term interest rates for Brazil, India, Indonesia, South Africa, and Turkey over a period of 10 units of time.]
Spillover Effects of QE Shock

Stock price: Fragile Five

[Graphs showing stock price changes for Brazil, India, Indonesia, South Africa, and Turkey.]
Spillover Effects of QE Shock

Equity flows: Fragile Five

Brazil

India

Indonesia

South Africa

Turkey
Spillover Effects of QE Shock
Net exports (US): Fragile Five

Brazil

India

Indonesia

South Africa

Turkey
Spillover Effects of QE Shock
Output: Fragile Five

- Brazil
- India
- Indonesia
- South Africa
- Turkey
Spillover Effects of QE Shock

CPI: Fragile Five

Brazil

India

Indonesia

South Africa

Turkey
Spillover Effects of QE Shock

- Now consider other emerging market economies
- Were the “Fragile Five” different?
  - Qualitative or quantitative differences?
- Extended sample: Chile, Colombia, Malaysia, Mexico, Peru, South Korea, Taiwan, and Thailand
- Same specification as the VAR for the “Fragile Five”
Spillover Effects of QE Shock
USD exchange rate: Other countries

Chile
 COLombia
 Malaysia
 Mexico
 Peru
 South Korea
 Taiwan
 Thailand
Spillover Effects of QE Shock

Long-term interest rates: Other countries
Spillover Effects of QE Shock

Stock price: Other countries
Spillover Effects of QE Shock

Medians of the two groups

- Fragile Five appear to respond more
Panel VAR

- To get the average effect of the US QE shock with proper estimation uncertainties, a panel VAR with dynamic heterogeneities is estimated.

- Random coefficient approach to partially pool the cross-sectional information.

- Consider for EM country $i$,

$$z_{i,t} = B_{i,1}z_{i,t-1} + \cdots + B_{i,p}z_{i,t-p} + D_{i,0}\varepsilon_{QE,t} + \cdots + D_{i,q}\varepsilon_{QE,t-q} + u_{i,t}$$

with $u_{i,t} \sim N(0, \Sigma_i)$, where

$$B_{i,j} = \bar{B}_j + v_{B_{i,j}}$$

$$D_{i,k} = \bar{D}_k + v_{D_{i,k}}$$

with $v_{B_{i,j}} \sim N(0, \Omega_{B_{i,j}})$ and $v_{D_{i,k}} \sim N(0, \Omega_{D_{i,k}})$.

- Bayesian inference with the standard Normal-inverted Wishart prior plus the Minnesota-type prior.
Panel VAR

- Pooled estimates of the impulse responses (using $\bar{B}_j$'s and $\bar{D}_k$'s):
  Fragile five vs. Others

- IP
- CPI
- Exchange rates against USD
- Stock market indices
- Short-term interest rates
- Long-term interest rates
Extension and Robustness

- Extend the US VAR by including private sector interest rates and NEER
  - Corporate yields and mortgage rates decline while NEER depreciates in response to the US QE shock
- In the US VAR, qualitatively similar results when different maturities for the long-term Treasury yields and different measures of output are used
Summary of Domestic Effects of U.S. QE Shock

- Strong domestic effects on both real and financial variables
- The QE shock is estimated to
  - Increase IP and PCE Deflator
  - Lower long-term yields
  - Increase stock prices
Summary of Spillover Effects of U.S. QE Shock

- Relatively strong spillover effects on financial variables
  - Appreciation against USD
  - Reduction in long-term yields
  - Stock market boom

- Weak effects on macro variables
  - Some evidence on reduction of net exports to the US (Fragile Five)
  - No significant effect on IP or CPI

- Fragile Five countries appear to respond more strongly than others
Theoretical Channels

- Our results might be consistent with “reaching for yield” or “risk-taking” channel of the international monetary policy transmission
  - Borio and Zhu (2012), Bruno and Shin (2014)
- But weak effects on macro variables: need further investigation
- Why are the Fragile Five countries different from the other EM countries?
Future Work

- Control for anticipation of QE policy
- Spillovers to small-open developed countries (e.g. Canada, Australia, New Zealand, ...)?
- “Systematic” policy effect evaluation by counter-factual experiments
US QE Shock
Effects in terms of the size of intervention

- Baseline estimates suggest 40 billion dollars in securities purchased by the Fed reduces 10-year treasury yields by 10 bp on impact
- Comparison with “announcement effects” estimates is tricky as the measure of policy shock is different
- Krishnamurthy and Vissing-Jorgensen (2011)
  - Estimate effects on 10-year Treasury yields around QE 1 and QE 2 dates
- Our effects smaller than effects of QE 1 programs but similar to those of QE 2 programs
Extended US QE Shock Identification

- An extended 7-variable VAR with private sector yields and nominal effective (trade-weighted) exchange rate
  - Bank of America Merrill Lynch US corporate 10-15 year index
  - 30 year conventional mortgage rate

- Restrictions on $A_0$ for extended 7-variable VAR

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US QE Shock
Extended VAR 1

**IP**

- **Periods after impact:** 0, 10, 20
- **Percentage:** -0.2, 0.05, 0.1, 0.2, 0.25

**PCE deflator**

- **Periods after impact:** 0, 10, 20
- **Percentage:** 0, 0.05, 0.1, 0.15, 0.2

**Securities**

- **Periods after impact:** 0, 10, 20
- **Percentage:** -0.2, -0.15, -0.1, -0.05, 0

**10-year yields**

- **Periods after impact:** 0, 10, 20
- **Percentage:** -1, -0.8, -0.6, -0.4, -0.2, 0

**Mortgage 30-year Yield**

- **Periods after impact:** 0, 10, 20
- **Percentage:** -0.15, -0.1, -0.05, 0

**S&P500**

- **Periods after impact:** 0, 10, 20
- **Percentage:** -1, -0.8, -0.6, -0.4, -0.2, 0

**NEER**

- **Periods after impact:** 0, 10, 20
- **Percentage:** -0.2, -0.15, -0.1, -0.05, 0
US QE Shock
Extended VAR 2
Robustness

Recursive identification-1

- Inference on long-term yields different
Robustness

Recursive identification-2

- Inference on long-term yields different
Robustness
Alternative Treasury yields

- Treasury 1 year yield
- Treasury 3 year yield
- Treasury 5 year yield
- Treasury 20 year yield
Robustness

Alternative output measures

- Non Farm Payroll
- Real PCE
- Real PCE Durable
- Real PCE Nondurable