Spillover Effects of U.S. Monetary Policy and Policy Uncertainty on Chinese Economy

Steven Wei Ho, Ji Zhang, and Hao Zhou

PBC School of Finance
Tsinghua University
Background

- U.S. unconventional monetary policy
  - zero lower bound
  - LSAP
  - QEs
  - tapering
- impact on emerging market, especially China
- China is likely to pass U.S. as world’s leading economic power
Questions

- How do U.S. monetary policy and policy uncertainty shocks affect China, especially during and after the Great Recession?
  - What’s the transmission channel?
  - Which one is more important?
  - Is there any structural change in the past few years?
What Do We Do?

- Factor-Augmented VAR
- U.S. monetary policy
- U.S. policy uncertainty
- both before and at the ZLB
Main Results

- At the ZLB,
  - U.S. monetary policy shocks do have significant impact on Chinese monetary policy and real economy
  - U.S. policy uncertainty shocks are less important
- Comparing the cases before and at the ZLB,
  - Dynamics of Chinese macro variables are different under the same shocks
  - Relative importance of the two shocks changes
  - Indicate structural changes in both U.S. policy transmission and Chinese economy
FAVAR – Bernanke et al (2005, QJE)

\[
\begin{pmatrix}
F_t \\
Y_t
\end{pmatrix} = \Phi(L) \begin{pmatrix}
F_{t-1} \\
Y_{t-1}
\end{pmatrix} + \nu_t, \quad (1)
\]

\[
X_t = \Lambda^f F_t + \Lambda^y Y_t + e_t. \quad (2)
\]

- \( F_t \): factors \((T \times K)\),
- \( X_t \): macro variables \((T \times N, N > K)\),
- \( Y_t \): policy indicators.
Why FAVAR?

- Overcomes some shortcomings of structural VAR:
  - use more information
  - no arbitrary choice of a specific data series
  - impulse responses for all variables
Data

- 162 Chinese macroeconomic series (real activity variables, policy variables, price variables)
- U.S. policy rate: Wu-Xia shadow rate (Wu and Xia (2014))
- U.S. policy uncertainty: news-based measure (Baker, Bloom and Davis (2013))
Ajustment

- New Year effect (except policy variables) (Fernald et al (2013))
- Seasonal adjustment (US Census Bureau X13 Software)
- EM algorithm for missing values (Stock and Watson (2002, JEBS))
- Fast/slow moving variable (asset price vs. wages)
Estimation and Identification – Bernanke et al (2005, QJE)

- factors are constructed to be orthogonal to policy rate and uncertainty
  - \(pc_t\): principal components of all series, \(pc^s_t\): principal components for slow-moving series
  - run the regression:
    \[
    pc_t = b_{pc}pc^s_t + b_{pc}^Y Y_t + \eta^p_{pc}
    \]
- factors are constructed to be
  \[
  F_t = pc_t - \hat{b}^Y_{pc} Y_t
  \]
Estimation and Identification – Bernanke et al(2005, QJE)

- estimate the observation equation by OLS (2 lags)
- estimate the transition equation by OLS
- identification is achieved through recursive assumption
## Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Full Name</th>
<th>$R^2$ before ZLB</th>
<th>$R^2$ at ZLB</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSEI</td>
<td>Shanghai Stock Exchange Composite Index</td>
<td>0.928</td>
<td>0.639</td>
</tr>
<tr>
<td>PE ratio (SSE All)</td>
<td>PE ratio (SSE All Stocks)</td>
<td>0.871</td>
<td>0.806</td>
</tr>
<tr>
<td>PE ratio (SSE A)</td>
<td>PE ratio (SSE A-Shares )</td>
<td>0.872</td>
<td>0.806</td>
</tr>
<tr>
<td>PE ratio (SSE Fin)</td>
<td>PE ratio (SSE Finence)</td>
<td>0.736</td>
<td>0.835</td>
</tr>
<tr>
<td>PE ratio (SSE RE)</td>
<td>PE ratio (SSE Real Estate)</td>
<td>0.860</td>
<td>0.807</td>
</tr>
<tr>
<td>PE ratio (SSE Const)</td>
<td>PE ratio (SSE Construction)</td>
<td>0.904</td>
<td>0.778</td>
</tr>
<tr>
<td>PE ratio (SSE Manu)</td>
<td>PE ratio (SSE Manufacturing)</td>
<td>0.902</td>
<td>0.694</td>
</tr>
<tr>
<td>Loan</td>
<td>The Total Amount of Loans</td>
<td>0.087</td>
<td>0.502</td>
</tr>
<tr>
<td>Loan Rate (1yr)</td>
<td>Nominal Loan Rate (1 Year)</td>
<td>0.943</td>
<td>0.882</td>
</tr>
<tr>
<td>HH DR (1yr)</td>
<td>Household Saving Deposit Rate (1 Year)</td>
<td>0.932</td>
<td>0.903</td>
</tr>
<tr>
<td>SHIBOR (1d)</td>
<td>SHIBOR (1 Day)</td>
<td>0.995</td>
<td>0.602</td>
</tr>
<tr>
<td>Bond Index (Inter Bank ST)</td>
<td>Inter-Bank Short Term Government Bond Index</td>
<td>0.921</td>
<td>0.604</td>
</tr>
<tr>
<td>FES (USD 1yr)</td>
<td>Foreign Exchange Swap (USD 1 Year)</td>
<td>0.995</td>
<td>0.142</td>
</tr>
<tr>
<td>CPI</td>
<td>CPI</td>
<td>0.769</td>
<td>0.740</td>
</tr>
<tr>
<td>InvestRE</td>
<td>Investment in Real Estate</td>
<td>0.948</td>
<td>0.921</td>
</tr>
<tr>
<td>NHS</td>
<td>New Housing Start</td>
<td>0.632</td>
<td>0.479</td>
</tr>
<tr>
<td>Comm Bldg Sales</td>
<td>Commodity Building Sales</td>
<td>0.533</td>
<td>0.279</td>
</tr>
<tr>
<td>PMI Manufacturing</td>
<td>Purchase Management Index (Manufacturing)</td>
<td>0.995</td>
<td>0.649</td>
</tr>
<tr>
<td>PMI new orders</td>
<td>Purchase Management Index (New Orders)</td>
<td>0.995</td>
<td>0.624</td>
</tr>
<tr>
<td>Auto Sales (DM)</td>
<td>Automobile Sales (Domestically Made)</td>
<td>0.467</td>
<td>0.527</td>
</tr>
<tr>
<td>Macro index</td>
<td>Macroeconomic Index</td>
<td>0.505</td>
<td>0.715</td>
</tr>
</tbody>
</table>
Outline

- after 2008M12 (ZLB is binding in the U.S.)
  - IRFs to U.S. monetary policy shock
  - IRFs to U.S. policy uncertainty shock
- before 2008M12 (ZLB is not binding in the U.S.)
  - IRFs to U.S. monetary policy shock
IRFs to USMP Shock at the ZLB

U.S. Monetary Policy Shock at ZLB

- Policy Rate
- USPU
- Loan
- Loan Rate (1yr)
- HH DR (1yr)
- SHIBOR (1d)
- Bond Index (Inter Bank ST)
- FES (USD 1yr)
- CPI
IRFs to USMP Shock at the ZLB

U.S. Monetary Policy Shock at ZLB

- Policy Rate
- USPU
- SSEI
- PE ratio (SSE All)
- PE ratio (SSE A)
- PE ratio (SSE Fin)
- PE ratio (SSE RE)
- PE ratio (SSE Const)
- PE ratio (SSE Manu)
IRFs to USMP Shock at the ZLB

U.S. Monetary Policy Shock at ZLB

- Policy Rate
- USPU
- InvestRE
- NHS
- Comm Bldg Sales
- PMI Manufacturing
- PMI new orders
- Auto Sales (DM)
- Macro index
Is It Interest Rate Channel?

Impulse Responses of the Interest Rates at the ZLB

Treasury rate: 6 month

Treasury rate: 1 year

Treasury rate: 5 year

Treasury rate: 10 year

Treasury rate: 15 year

Treasury rate: 30 year
Is It “Hot Money”?
Possible Channel

- U.S. monetary policy shock does not affect Chinese economy through market determined interest rate channel
- Responses of Chinese policy and international capital inflow are important
- U.S. MP $\Rightarrow$ capital inflow / people’s expectations
  $\Rightarrow$ Chinese policy rates
  $\Downarrow$
  $\Rightarrow$ real economy
IRFs to USPU Shock at the ZLB

U.S. Policy Uncertainty Shock at ZLB

Policy Rate

USPU

Loan

Loan Rate (1yr)

HH DR (1yr)

SHIBOR (1d)

Bond Index (Inter Bank ST)

FES (USD 1yr)

CPI
IRFs to USPU Shock at the ZLB

U.S. Policy Uncertainty Shock at ZLB

- Policy Rate
- USPU
- SSEI
- PE ratio (SSE All)
- PE ratio (SSE A)
- PE ratio (SSE Fin)
- PE ratio (SSE RE)
- PE ratio (SSE Const)
- PE ratio (SSE Manu)
IRFs to USPU Shock at the ZLB

U.S. Policy Uncertainty Shock at ZLB

- Policy Rate
- USPU
- InvestRE
- NHS
- Comm Bldg Sales
- PMI Manufacturing
- PMI new orders
- Auto Sales (DM)
- Macro index
IRFs to USMP Shock before the ZLB

U.S. Monetary Policy Shock before ZLB

- Policy Rate
- USPU
- Loan
- Loan Rate (1yr)
- HH DR (1yr)
- SHIBOR (1d)
- Bond Index (Inter Bank ST)
- FES (USD 1yr)
- CPI
IRFs to USMP Shock before the ZLB

U.S. Monetary Policy Shock before ZLB

- Policy Rate
- USPU
- SSEI
- PE ratio (SSE All)
- PE ratio (SSE A)
- PE ratio (SSE Fin)
- PE ratio (SSE RE)
- PE ratio (SSE Const)
- PE ratio (SSE Manu)
IRFs to USMP Shock before the ZLB
Why Different at and before the ZLB?

- change in U.S. monetary policy transmission
  - responses of policy rate
- change in Chinese economy
  - bonds market
  - liberalization of the interest rates
  - managed floating exchange rate
USMP and US Interest Rates (Zhang(2014))
## Variance Decomposition

<table>
<thead>
<tr>
<th>Variables</th>
<th>Variance Decomposition Ratio (MP/PU) before ZLB</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1m</td>
<td>2m</td>
<td>6m</td>
<td>12m</td>
<td>1m</td>
<td>2m</td>
<td>6m</td>
<td>12m</td>
<td>1m</td>
<td>2m</td>
<td>6m</td>
<td>12m</td>
</tr>
<tr>
<td>SSEI</td>
<td>0.087</td>
<td>0.129</td>
<td>0.032</td>
<td>89.780</td>
<td>0.462</td>
<td>0.354</td>
<td>9.251</td>
<td>58.813</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PE ratio (SSE All)</td>
<td>0.000</td>
<td>0.003</td>
<td>0.029</td>
<td>9.973</td>
<td>0.042</td>
<td>88018</td>
<td>20.859</td>
<td>249.379</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PE ratio (SSE A)</td>
<td>0.000</td>
<td>0.003</td>
<td>0.033</td>
<td>10.914</td>
<td>0.046</td>
<td>70479</td>
<td>20.749</td>
<td>253.409</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PE ratio (SSE Fin)</td>
<td>0.016</td>
<td>0.000</td>
<td>0.055</td>
<td>164.872</td>
<td>5.991</td>
<td>11.672</td>
<td>108.486</td>
<td>209.800</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PE ratio (SSE RE)</td>
<td>0.000</td>
<td>0.017</td>
<td>0.001</td>
<td>4.114</td>
<td>1.539</td>
<td>4.477</td>
<td>88.145</td>
<td>68.655</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PE ratio (SSE Const)</td>
<td>0.005</td>
<td>0.047</td>
<td>0.000</td>
<td>35.081</td>
<td>0.891</td>
<td>4.278</td>
<td>994.457</td>
<td>30.264</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PE ratio (SSE Manu)</td>
<td>0.007</td>
<td>0.057</td>
<td>0.016</td>
<td>0.217</td>
<td>0.593</td>
<td>2.551</td>
<td>1.281</td>
<td>254288</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loan</td>
<td>0.000</td>
<td>12.958</td>
<td>0.977</td>
<td>0.434</td>
<td>83.851</td>
<td>286.516</td>
<td>5.670</td>
<td>6.229</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loan Rate (1yr)</td>
<td>0.095</td>
<td>0.021</td>
<td>0.057</td>
<td>1.007</td>
<td>0.070</td>
<td>0.158</td>
<td>8.091</td>
<td>33.931</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HH DR (1yr)</td>
<td>0.207</td>
<td>0.136</td>
<td>0.115</td>
<td>3.210</td>
<td>0.029</td>
<td>0.265</td>
<td>9.104</td>
<td>41.260</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHIBOR (1d)</td>
<td>0.010</td>
<td>0.003</td>
<td>0.005</td>
<td>0.238</td>
<td>1.343</td>
<td>0.482</td>
<td>6.980</td>
<td>0.653</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bond Index</td>
<td>0.532</td>
<td>15.728</td>
<td>58.577</td>
<td>122.821</td>
<td>5.789</td>
<td>1307.944</td>
<td>2.522</td>
<td>67.232</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FES (USD 1yr)</td>
<td>0.010</td>
<td>0.003</td>
<td>0.005</td>
<td>0.238</td>
<td>1.342</td>
<td>0.477</td>
<td>7.000</td>
<td>0.649</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CPI</td>
<td>0.003</td>
<td>1.994</td>
<td>10.303</td>
<td>0.485</td>
<td>0.098</td>
<td>0.513</td>
<td>241.168</td>
<td>12.285</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>InvestRE</td>
<td>0.171</td>
<td>0.402</td>
<td>1.488</td>
<td>11.697</td>
<td>652.787</td>
<td>57.601</td>
<td>15.390</td>
<td>51.016</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NHS</td>
<td>0.184</td>
<td>0.524</td>
<td>2.181</td>
<td>56.772</td>
<td>4.615</td>
<td>3.149</td>
<td>60.259</td>
<td>62.506</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comm Bldg Sales</td>
<td>0.169</td>
<td>0.261</td>
<td>0.204</td>
<td>0.821</td>
<td>290.534</td>
<td>5.371</td>
<td>985.425</td>
<td>71.211</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PMI Manufacturing</td>
<td>0.010</td>
<td>0.003</td>
<td>0.005</td>
<td>0.238</td>
<td>1.346</td>
<td>0.486</td>
<td>7.071</td>
<td>0.645</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PMI new orders</td>
<td>0.010</td>
<td>0.003</td>
<td>0.005</td>
<td>0.238</td>
<td>1.347</td>
<td>0.490</td>
<td>7.062</td>
<td>0.647</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auto Sales (DM)</td>
<td>0.761</td>
<td>0.066</td>
<td>1.601</td>
<td>0.402</td>
<td>6.584</td>
<td>46721.652</td>
<td>143.343</td>
<td>9.218</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Macro index</td>
<td>81.930</td>
<td>0.001</td>
<td>0.018</td>
<td>0.033</td>
<td>1.442</td>
<td>311.628</td>
<td>2.459</td>
<td>340.906</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
At the ZLB,

- U.S. monetary policy shocks do have significant impact on Chinese real economy
- The impact transmits not through market interest rate channel
- Possible transmission mechanism: hot money and people’s expectations
  \[\Rightarrow\text{Chinese policy rates}\]
  \[\downarrow\]
  \[\Rightarrow\text{real economy}\]
- U.S. policy uncertainty shocks are less important

Comparing the cases before and at the ZLB,

- Dynamics of Chinese macro variables are different under the same shocks
- Relative importance of the two shocks changes
- Indicate structural changes in both U.S. policy transmission and Chinese economy
THANK YOU!