International Bank Lending Channel of Monetary Policy

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The views expressed are those of the authors and do not necessarily represent those of the IMF or its policy, nor those of the Banco de España and the Eurosystem
Questions and contribution of the paper

• Monetary policy spillovers and global financial cycles: Rey (2013), Miranda-Agrippino and Rey (2015)

• What is the cross-border transmission channel of domestic monetary policy actions?

• Bank lending channel vs. portfolio rebalancing channel of monetary policy

• Does a recipient country’s choice of exchange rate regimes or capital controls affect the degree of spillovers?
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- Bank lending channel vs. portfolio rebalancing channel of monetary policy
- Does a recipient country’s choice of exchange rate regimes or capital controls affect the degree of spillovers?
- Provide a dynamic and flexible empirical framework in testing the spillover effect of domestic monetary policy in systemically important countries
- Offer a new set of empirical findings, which reconcile the contrasting findings in the recent literature
International bank lending channel of monetary policy

- Study the spillover effect of monetary policy in systemically important economies through cross-border bank lending
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  1. **Bank lending channel**: domestic tightening → higher funding costs → reduces cross-border lending

  2. **Portfolio re-balancing channel**: domestic tightening → reduces domestic net worth → makes domestic borrower riskier → increases cross-border lending
     Cerutti et al. (2017), Correa et al. (2017), Avdjiev et al. (2018)
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• Mixed empirical evidence in the literature: driven by systematic component of the monetary policy and a static framework
Why cross-border banking flows matter?

- While net flows are seen as a counterpart to the current account, a rapid expansion of gross asset/liability positions of bank balance sheets calls for deeper understanding of these flows (e.g., global banking glut by Shin, 2012)
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- While net flows are seen as a counterpart to the current account, a rapid expansion of gross asset/liability positions of bank balance sheets calls for deeper understanding of these flows (e.g., global banking glut by Shin, 2012)
  - Cross-border banking flows have important implications for economic and financial conditions in recipient countries (Borio and Disyatat, 2011; Cetorelli and Goldberg, 2011; Hahm et al., 2013)
  - Previous studies focus on their driving factors (Cetorelli and Goldberg, 2011; Popov and Udell, 2012; Cerutti et al., 2017; Correa et al., 2017; Avdjiev and Hale, 2018; Wang, 2018; Choi and Furceri, 2019)
  - Bilateral data structure allows for disentangling supply vs. demand factors: not available for other financial flows from BoP
What we do in the paper

1. Identification of **exogenous** monetary policy surprises:
   - U.S. economy: narrative approach by Romer and Romer (2004) and high-frequency identification with external instruments (Gertler and Karadi, 2015)
   - Other 8 AEs: use forecast errors from professional survey (Furceri et al., 2018)
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   Why local projections?

   - More in line with the literature on the domestic bank-lending channel literature (VARs)
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3. Explore **non-linearities** and implications of **Mundellian trilemma**:
   - Source country’s state dependency & sign of the shock
   - Regime based on global risk or uncertainty
   - Recipient’s country heterogeneity (trilemma)
Preview of baseline results

- An exogenous domestic monetary policy tightening (both in the U.S. and other AEs) decreases cross-border bank lending
  - Consistent with a bank lending channel of monetary policy
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  • Identification of exogenous shocks from endogenous policy response to economic conditions matters
  • Changes in the policy rate reflect macroeconomic conditions, resulting in misleading findings
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  • Identification of exogenous shocks from endogenous policy response to economic conditions matters
  • Changes in the policy rate reflect macroeconomic conditions, resulting in misleading findings

• The effect is robust even when controlling global financial risk (VIX) or liquidity risk (Libor-OIS spread)
  • Since we control for credit demand factor, we identify an independent source of the “global financial cycle”
Interesting nonlinearities

- Spillovers tend to be stronger in period of domestic expansions
  - Consistent with monetary policy asymmetry (Tenreyro and Thwaites, 2016; Alpanda and Zubairy, 2018)
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- Tends to be larger for lending toward EMEs (risky borrowers)
  - Consistent with an international risk-taking channel of monetary policy (Temesvary et al., 2017; Brauning and Ivashina, 2018; Iacoviello and Navarro, 2019)

- When considered alone, the floating regime can’t insulate a recipient country from spillovers
- When jointly considered with capital controls, exchange rate regime still matters
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Overview of the BIS LBS

- Residency (not nationality) principle consistent with the BoP statistics
  - Internationally active banks located in 46 reporting countries against counterparties (capturing 95 percent of all cross-border interbank business)
  - These banks also account for the bulk of the domestic banking system
  - Tracks well aggregate and banking flows in BoP
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• Useful for our analysis

  • Information about geographical breakdown of counterparties: control for demand-side factors
  • Information about currency composition of banks’ balance sheets: account for the valuation effect
Data construction

- Drop financial offshore centers (e.g., Hong Kong, Singapore...)
- Drop observations with the size of cross-border position less than $5 million
- Dependent variables in the upper and lower one percentile of the distribution are excluded from the sample
- BIS LBS only reports the exchange rate-adjusted flows: reconstruct the stock of the cross-border claims $L_{i,j,t}$ and liabilities $B_{i,j,t}$ by adding the exchange rate-adjusted flows to the initial stock
- Left with 9 reporting countries where exogenous monetary shocks are available and their 45 counterparties
- Interesting heterogeneity in the bilateral level
Data on monetary shocks

- Exogenous U.S. monetary policy shocks by Coibion (2012)
  - Extends the monetary policy shocks identified by Romer and Romer (2004) using a narrative approach
  - Take residuals from regressing the changes in the Fed’s target interest rate at FOMC on the Fed’s real-time forecasts of relevant macroeconomic variables
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\[
\Delta f_{fm} = \alpha + \beta f_{fbm} + \sum_{i=-1}^{2} \gamma_i F_m \Delta y_{m,i} + \sum_{i=-1}^{2} \lambda_i (F_m \Delta y_{m,i} - F_{m-1} \Delta y_{m,i}) \\
+ \sum_{i=-1}^{2} \phi_i F_m \pi_{m,i} + \sum_{i=-1}^{2} \theta_i (F_m \pi_{m,i} - F_{m-1} \pi_{m,i}) + \mu_i F_m u_{m0} + \epsilon_m
\]  

(1)
Data on monetary shocks

- Exogenous monetary policy shocks in other advanced economies
  - Construct exogenous monetary policy shocks at a quarterly frequency for 8 advanced economies following Auerbach and Gorodnichenko (2013)
  - Compute the unexpected changes in policy rates using the forecast errors of the policy rates provided by Consensus Economics
  - Take residuals from regressing the forecast errors of the policy rates on similarly-computed forecast errors of inflation and output growth

\[ \text{FE}_{i,t} = \alpha_i + \beta \text{FE}_{\Delta y_{i,t}} + \gamma \text{FE}_{\pi_{i,t}} + \sum_{j=0}^{4} \delta_j \Delta y_{i,t-j} + \sum_{j=0}^{4} \theta_j \pi_{i,t-j} + \epsilon_{i,t} \] (2)
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\[
FE_{i,t}^r = \alpha_i + \beta FE_{i,t}^{\Delta y} + \gamma FE_{i,t}^{\pi} + \sum_{j=0}^{4} \delta_j \Delta y_{i,t-j} + \sum_{j=0}^{4} \theta_j \pi_{i,t-j} + \epsilon_{i,t}
\] (2)
Unconventional monetary policy

• For robustness checks and future works, use high-frequency identification with external instruments (Gertler and Karadi, 2015)

Monetary policy shock series

• Short-term government yields at different maturities (policy indicator)
• Changes in Fed funds futures in a narrow window around FOMC announcements as an IV
• Choose combinations, which pass the weak instrument test: 2-yr government bond yield & surprises in 3-month ahead Fed futures
• Allow us to consider some effect of unconventional monetary policy during the ZLB period
Baseline specification

- Panel version of the estimation (Khwaja and Mian, 2008):

\[
y_{i,j,t+h} - y_{i,j,t-1} = \alpha_{i,j}^h + \alpha_{j,t}^h + \beta^h MPshock_{i,t} + \sum_{p=1}^{n} \gamma^h X_{i,j,t-p} + \epsilon_{i,j,t+h}
\]

where \(y_{i,j,t}\): is the log of cross-border lending from \(i\) to \(j\); \(MPshock_{i,t}\): exogenous monetary policy shock in \(i\); \(X_{i,j,t}\): a set of control variables including lags of the dependent variable and monetary policy shocks
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(3)

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- Mitigates reverse causality
- \( \alpha_{i,j}^h \) controls for any time-invariant characteristics between two countries
- \( \alpha_{j,t}^h \) controls for any macroeconomic shocks affecting recipient countries and maximizes sample coverage
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\]  

(3)

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- \(\alpha_{i,j}^h\) controls for any time-invariant characteristics between two countries
- \(\alpha_{j,t}^h\) controls for any macroeconomic shocks affecting recipient countries and maximizes sample coverage

- Exogenous monetary policy shocks + bilateral structure of banking data ⇒ clean identification immune to endogeneity issues
Baseline U.S. analysis

• Estimate the following equation using U.S. quarterly data (1990Q1-2012Q4)

\[ y_{j,t+h} - y_{j,t-1} = \alpha_j^h + \beta^h MP_{shock, t} + \sum_{p=1}^{n} \gamma^h X_{j,t-p} + \epsilon_{j,t+h} \]  \hspace{1cm} (4)

• Four lags of shocks and control variables (recipient country’s real GDP growth, the short-term interest rate, inflation, and the nominal exchange rate growth vis-à-vis the U.S.) are used

• HAC standard errors are clustered by time
## Baseline results

- Baseline estimation results from a dynamic framework

<table>
<thead>
<tr>
<th>Variable</th>
<th>h=0</th>
<th>h=1</th>
<th>h=2</th>
<th>h=3</th>
<th>h=4</th>
<th>h=5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(2.773)</td>
<td>(2.570)</td>
<td>(3.422)</td>
<td>(2.923)</td>
<td>(3.301)</td>
<td>(3.579)</td>
</tr>
<tr>
<td></td>
<td>(3.583)</td>
<td>(4.177)</td>
<td>(4.351)</td>
<td>(4.366)</td>
<td>(5.978)</td>
<td>(5.690)</td>
</tr>
<tr>
<td>GDP growth</td>
<td>0.712*</td>
<td>0.354</td>
<td>0.672</td>
<td>1.085</td>
<td>0.768</td>
<td>1.420</td>
</tr>
<tr>
<td></td>
<td>(0.411)</td>
<td>(0.618)</td>
<td>(0.684)</td>
<td>(0.835)</td>
<td>(0.832)</td>
<td>(0.954)</td>
</tr>
<tr>
<td>Interest rate</td>
<td>-0.053</td>
<td>-0.002</td>
<td>-0.189</td>
<td>0.139</td>
<td>-0.128</td>
<td>-0.125</td>
</tr>
<tr>
<td></td>
<td>(0.108)</td>
<td>(0.131)</td>
<td>(0.216)</td>
<td>(0.168)</td>
<td>(0.187)</td>
<td>(0.209)</td>
</tr>
<tr>
<td>Exchange rate</td>
<td>-0.217**</td>
<td>-0.369**</td>
<td>-0.456***</td>
<td>-0.695***</td>
<td>-0.435**</td>
<td>-0.366</td>
</tr>
<tr>
<td></td>
<td>(0.096)</td>
<td>(0.147)</td>
<td>(0.146)</td>
<td>(0.169)</td>
<td>(0.206)</td>
<td>(0.223)</td>
</tr>
<tr>
<td>Inflation rate</td>
<td>-0.473</td>
<td>0.317</td>
<td>0.850</td>
<td>1.252**</td>
<td>0.219</td>
<td>0.554</td>
</tr>
<tr>
<td></td>
<td>(0.447)</td>
<td>(0.514)</td>
<td>(0.741)</td>
<td>(0.619)</td>
<td>(0.653)</td>
<td>(0.809)</td>
</tr>
<tr>
<td>Obs</td>
<td>3,085</td>
<td>3,041</td>
<td>3,001</td>
<td>2,956</td>
<td>2,918</td>
<td>2,880</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.08</td>
<td>0.10</td>
<td>0.13</td>
<td>0.14</td>
<td>0.15</td>
<td>0.18</td>
</tr>
<tr>
<td>Recipient country-</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>fixed effect</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Baseline results

- Effect of a 100 bp U.S. monetary policy shock from Coibion (2012)
Comparison with the literature

• Effect of a 100 bp increase in the federal funds rate
Comparison with the literature

- Replicate the same results from Correa et al. (2017) and Avdjiev et al. (2018): a significant increase in cross-border bank lending

Table 5. Results using a static framework

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>(I)</th>
<th>(II)</th>
<th>(III)</th>
<th>(IV)</th>
<th>(V)</th>
<th>(VI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The lagged Federal funds rate</td>
<td>0.707**</td>
<td></td>
<td></td>
<td>0.609**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.298)</td>
<td></td>
<td></td>
<td>(0.282)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Changes in the Federal funds rate</td>
<td>0.786</td>
<td></td>
<td></td>
<td></td>
<td>0.826</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.573)</td>
<td></td>
<td></td>
<td>(1.550)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monetary policy shock</td>
<td>-0.338</td>
<td></td>
<td></td>
<td></td>
<td>-0.309</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3.201)</td>
<td></td>
<td></td>
<td></td>
<td>(3.174)</td>
<td></td>
</tr>
</tbody>
</table>
Robustness checks

- Our findings are robust to
  - the inclusion of domestic control variables
  - different lag length selections
  - an alternative way of computing and clustering standard errors
  - controlling for bilateral imports and exports
  - excluding the GFC period
  - controlling for global financial risks measured by VIX
  - controlling for liquidity risks measured by LIBOR-OIS spread
Robustness checks

- Effect of a 100 bp U.S. monetary policy shock from Gertler and Karadi (2015)
Nonlinearities in the int’l bank lending channel

- Expansions vs. recessions

\[ y_{j,t+h} - y_{j,t-1} = F(z_t)(\alpha^{h}_{R,j} + \sum_{p=1}^{n}\gamma^{h}_{R}X_{j,t-p} + \beta^{h}_{R}MP_{shock_t}) \]

\[ +(1 - F(z_t))(\alpha^{h}_{E,j} + \sum_{p=1}^{n}\gamma^{h}_{E}X_{j,t-p} + \beta^{h}_{E}MP_{shock_t}) + \epsilon_{j,t+h} \]

(4)

with \[ F(z_t) = \frac{exp(-\theta z_t)}{1 + exp(-\theta z_t)} \text{ and } \theta > 0 \]

- \( z_t \): 5-quarter centered MA of real GDP growth; \( F(z_t) \): smooth transition function; \( \theta = 1.5 \)
Nonlinearities in the int’l bank lending channel

- Expansions vs. recessions
Nonlinearities in the int’l bank lending channel

- Expansions vs. recessions using FFR shocks
Nonlinearities in the int’l bank lending channel

• Low uncertainty vs. High uncertainty
Trilemma and int’l transmission of monetary policy

• Role of capital openness and the exchange rate regime of the recipient country:

\[
y_{j,t+h} - y_{j,t-1} = \alpha_j^h + \beta_1^h D_{j,t} MP_{shock,t} + \beta_2^h (1 - D_{j,t}) MP_{shock,t} \\
+ \sum_{p=1}^{n} \gamma^h X_{j,t-p} + \epsilon_{j,t+h}
\]

(6)
Trilemma and int’l transmission of monetary policy

• Role of capital openness and the exchange rate regime of the recipient country:

\[ y_{j,t+h} - y_{j,t-1} = \alpha_j^h + \beta_1^h D_{j,t} MPshock_t + \beta_2^h (1 - D_{j,t}) MPshock_t + \sum_{p=1}^{n} \gamma^h X_{j,t-p} + \epsilon_{j,t+h} \]  

(6)

• Trilemma index developed by Aizenman et al. (2013): *de facto* measure of the exchange rate regime, *de jure* measure of capital account openness, monetary independence index

• Time-varying measure alleviates measurement errors in VAR studies
Trilemma and int’l transmission of monetary policy

- Peg vs. floating
Trilemma and int’l transmission of monetary policy

- Open vs. closed capital account
Trilemma and int’l transmission of monetary policy

• Independent vs. dependent monetary policy
Trilemma and int’l transmission of monetary policy

- If trilemma binds, need to consider them jointly: $2 \times 2$ regimes
Do the U.S. results still hold?

- Analyze international bank lending channel of monetary policy in other systemically important countries, including the U.K, Germany, and Japan
- Estimate equation (1) using exogenous monetary policy shocks in 8 OECD countries at a quarterly frequency (2001Q1-2012Q4)
- 348 source-recipient pairs
- HAC standard errors are clustered at the recipient-time level
- Most results from robustness checks and nonlinearity tests are similar to the U.S. analysis
Baseline results

- Effect of a monetary policy shock on cross-border bank lending from eight OECD countries
Conclusion

• Simple but strong evidence on international bank lending channel of monetary policy

• Reconcile a lack of empirical consensus

• Local projections allow for exploring interesting patterns in spillovers

• Implications on financial stability

• Contribution to the trilemma vs. dilemma debate
Why local projections?

• Flexible alternative to VAR, proposed by Jorda (2005) and advocated by Auerbach and Gorodnichencko (2012) and Ramey and Zubairy (2018), used in a large international panel setup by Choi et al. (2018) and Miyamoto et al. (2019)
  • No need to impose dynamic restrictions as in VARs
  • Accommodates state dependence easily

• Particularly suitable for our analysis
  • Shocks are already exogenous, no need to use restrictions in VARs
  • A large bilateral panel data with fixed effects
  • Minimum restrictions given potential heterogeneity across countries
  • Accounts for nonlinearity effects and interaction effects
  • Easy to handle correlation in error terms under a linear estimation

• Does not allow for full dynamic interaction among potential factors as in VARs
Appendix A. Additional Figures and Tables

Table A.1. Data availability on cross-border flows in the BIS International Banking Statistics

<table>
<thead>
<tr>
<th></th>
<th>Nationality of Lending Bank</th>
<th>Residence of Borrowers</th>
<th>Currency Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consolidated Banking Statistics</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Locational Banking Statistics by residence</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Locational Banking Statistics by nationality</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Locational Banking Statistics stage 1 data</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Note: This table is reproduced from Table 1 in Avdjiev and Takáts (2014). In addition to exchange rate fluctuations, the quarterly flows in the locational datasets are corrected for breaks in the reporting population. The BIS consolidated banking statistics group claims according to the nationality of banks (i.e., according to the location of banks’ headquarters), netting out inter-office positions. The BIS locational banking statistics define creditors and debtors according to their residence, consistently with national accounts and balance of payments principles. The Stage 1 enhanced data are the first consistent data set to provide all three dimensions at the same time, but the construction of comprehensive time series data is still in progress.
Comparison with BoP data

- Taken from Wang (2018)
Valuation matters
The size of cross-border banking to GDP

**Table 2.** Total cross-border claims and liabilities as a share of GDP

<table>
<thead>
<tr>
<th>Country</th>
<th>Total cross-border claims as a share of GDP</th>
<th>Total cross-border liabilities as a share of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>88.99</td>
<td>66.26</td>
</tr>
<tr>
<td>Germany</td>
<td>289.92</td>
<td>130.79</td>
</tr>
<tr>
<td>Italy</td>
<td>101.95</td>
<td>127.21</td>
</tr>
<tr>
<td>Japan</td>
<td>162.92</td>
<td>72.29</td>
</tr>
<tr>
<td>Netherlands</td>
<td>524.19</td>
<td>469.70</td>
</tr>
<tr>
<td>Spain</td>
<td>135.20</td>
<td>171.35</td>
</tr>
<tr>
<td>Sweden</td>
<td>278.91</td>
<td>169.49</td>
</tr>
<tr>
<td>U.K.</td>
<td>648.95</td>
<td>379.29</td>
</tr>
<tr>
<td>U.S.</td>
<td>63.55</td>
<td>49.65</td>
</tr>
</tbody>
</table>

Note: Total cross-border claims and liabilities as a share of the domestic GDP in 2010Q4 under locational banking statistics with the residency principle.
Countries in the final sample (*: EMDEs)

- Source countries: Canada, Germany, Italy, Japan, Netherlands, Spain, Sweden, United Kingdom, United States

Heterogeneity in bilateral data

- Exchange-rate adjusted US cross-border bank claims to individual countries

a) country A  
![Graph for country A](image)

b) country B  
![Graph for country B](image)

c) country C  
![Graph for country C](image)

d) country D  
![Graph for country D](image)

e) country E  
![Graph for country E](image)

f) country F  
![Graph for country F](image)
Identified monetary policy shocks

• Identified monetary policy shocks and changes in the FFR
Nonlinearities in the int’l bank lending channel

• Weight on the recession regime
Monetary policy shocks in other advanced economies

• Distribution of the shock

![Distribution of MP shocks from 9 countries](image-url)
Monetary policy shocks in other advanced economies

• Summary statistics

<table>
<thead>
<tr>
<th>Source country</th>
<th>Standard deviation</th>
<th>Correlation with U.S. MP shocks (Furceri et al., 2018)</th>
<th>Correlation with U.S. MP shocks (Coibion, 2012)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>0.215</td>
<td>0.592</td>
<td>0.441</td>
</tr>
<tr>
<td>Germany</td>
<td>0.169</td>
<td>0.120</td>
<td>0.098</td>
</tr>
<tr>
<td>Italy</td>
<td>0.238</td>
<td>0.076</td>
<td>-0.004</td>
</tr>
<tr>
<td>Japan</td>
<td>0.065</td>
<td>0.211</td>
<td>-0.101</td>
</tr>
<tr>
<td>Netherlands</td>
<td>0.192</td>
<td>0.181</td>
<td>0.069</td>
</tr>
<tr>
<td>Spain</td>
<td>0.198</td>
<td>0.011</td>
<td>-0.071</td>
</tr>
<tr>
<td>Sweden</td>
<td>0.184</td>
<td>0.107</td>
<td>-0.026</td>
</tr>
<tr>
<td>U.K.</td>
<td>0.231</td>
<td>0.160</td>
<td>-0.041</td>
</tr>
<tr>
<td>U.S.</td>
<td>0.341</td>
<td>1.000</td>
<td>0.619</td>
</tr>
</tbody>
</table>
Nonlinearities in the int’l bank lending channel

- Monetary tightening vs. easing

\[ y_{j,t+h} - y_{j,t-1} = \alpha_j^h + \beta_+^h D_t MP_{shock_t} + \beta_-^h (1 - D_t) MP_{shock_t} \]
\[ + \sum_{p=1}^{n} \gamma^h X_{j,t-p} + \epsilon_{j,t+h} \]  

(5)
Nonlinearities in the int’l bank lending channel

- Monetary tightening vs. easing
Nonlinearities in the int’l bank lending channel

- Tightening during expansions vs. easing during recessions
Int’l risk-taking channel of U.S. monetary policy

- Advanced vs. emerging market economies