

Uncertainty Shocks and the Cross-Border Funding of Banks: Unmasking Heterogeneity

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IEER Institute of Empirical
Economic Research

Journal of
**INTERNATIONAL
MONEY
and FINANCE**

Conference on

Financial Globalization and De-Globalization: Perspectives and Prospects

May 3-4, 2021

Organized by Global Research Unit, City University of Hong Kong, Dockson Chair, University of Southern California, Institute of Empirical Economic Research, Osnabrück University, and Journal of International Money and Finance

Motivation

Large body of research looking into different dimensions of international capital flows and their determinants

⇒ The subset focusing on international banking and uncertainty seems incomplete:

- BIS International Banking Statistics has a great deal of detail
- Comprehensive approach including and comparing alternative measures for uncertainty missing
- One size does *not* fit all. Great deal of heterogeneity masked by aggregate approaches.
 - Panel-data models
 - Country groupings: ADV/EMEs, financial/non-financial centres
 - Aggregate capital flow measures

Related research, 1/3

Driving factors of capital flows

- [Kleimeier et. al \(2013, JIMF\)](#): study \uparrow XB banking and the *prior* GFC: interbank and retail banking (vis-à-vis XB private customers);
- [Bruno and Shin \(2015, RES\)](#): global factors and bank flows; “double-decker” model of intl banking; leverage key channel for intl. transmission of financial conditions
- [Cerutti et al \(2015, JIMF\)](#): financial crisis and composition of XB lending; 1995-2012; syndicated loans 1/3 of total XB \uparrow during GFC
- [Cerutti et al \(2017, EP\)](#): global liquidity and XB bank flows; UNC shocks using VIX, US MP and US ER; US developments not relevant outside GFC period; European bank conditions (leverage, TED spread ,etc) matter too from 2000s
- [Choi \(2017 JMacro\)](#): time variability of UNC shocks using rolling VAR on US GDP; 1970-; UNC effect on 12 small OEcs GDP recently has increased
- [Correa et. al \(2018\)](#): effect of MP on XB bank flows using bilateral banking BIS data; MP in source country affect bank flows

Related research, 2/3

Global Financial Crisis

- [Cetorelli and Goldberg \(2011, IMFER\)](#): global banks at the centre of the intl transmission of shocks during GFC; focus negative liq shocks on ADV vs. EMEs; XB exposure to banking system key, instead of fin openness broadly defined
- [Milesi-Feretti and Tille \(2011, EP\)](#): great retrenchment in international capital flows; heterogeneity (across time, types of flows with banking most important, geography with EME showins shorter-lived ↓)
- [Broner et. al \(2013, JME\)](#): gross capital flows from foreign and domestic investor perspective; inflows and outflows positively correlated; during GFC retrenchment in both and all types of k flows
- [Lane and Milesi-Ferretti \(2017 IMFER\)](#): focus on overall IIP, halt in IFI?; mostly driven by other investment (banks)
- [McCauley et. al \(2019, JIMF\)](#): Nationality of banking systems matter, European banks contraction reverberated globally

Other

- [Ahmed and Zlate \(2014 JIMF\)](#): private capital flows to EME and role of international rate differentials; capital controls
- [Benhina and Cordonier \(2020\)](#): breaks down news from investor sentiment shocks to study international capital flows

Related research, 3/3

Country-specific uncertainty to explain K flows

- [Gauvin et. al \(2013\)](#): US policy uncertainty (EPU) \downarrow portfolio bond and equity flows to EMEs; more of this effect is transmitted after GFC; breaks in the relation EPU-flows 2007Q1 and 2010Q4
- [Gourio et. al \(2015\)](#): UNC (measured as aggregate stock market return volatility) and capital flows
- [Choi and Furceri \(2019, JIMF\)](#): BIS banking data (*bilateral*) to study the push/pull effects of uncertainty; Uncertainty shocks generate \downarrow in XB bank flows (inflows and outflows); \downarrow in XB borrowing $>$ \downarrow XB lending; Their UNC measure is realized volatility; when UNC \uparrow : \downarrow inflows and \downarrow outflows

This paper

- 1 Studies the relation between uncertainty shocks and cross-border funding of banks through the lens of a **new dataset**
- 2 Jointly studies the impact of uncertainty measures based on volatility, newspapers, and professional forecast surveys - *our key data innovation*: <https://github.com/mpcurran/uncertaintybanking>
- 3 Presents a comprehensive assessment of how XB funding responds to: uncertainty type, funding sector, country and time period
- 4 Documents that the ↓ in cross-border bank funding can be large
- 5 Shows that dimension-specific response can be quite different ⇒ standard approaches mask relevant heterogeneities

Country Sample

Australia	Denmark	Italy	Spain
Austria	Finland	Japan	Sweden
Belgium	France	Netherlands	Switzerland
Brazil	Germany	Norway	Turkey
Canada	India	Portugal	UK
Chile	Ireland	Singapore	USA

- Sub-sample of BIS 24 reporters countries
 - We exclude small islands and offshore financial centres

Uncertainty Data

1. Implied volatility ([Black and Scholes, 1973](#); [Merton, 1973](#)) based on at-the-money call options on [national stock market indexes](#) (Bloomberg, OVM function); last value each quarter.
 - (i) One-month options (**IV1**). Coverage: **24/24**
 - (ii) Three-month options (**IV3**). Coverage: **24/24**
2. Realized volatility (**RV**): [national stock price indexes](#) (downloaded from Bloomberg). We convert nominal daily closing prices to real and purge global uncertainty proxy using VIX (standard approach). Coverage: **24/24**

Uncertainty Data

3. News-based includes two alternative indicators, frequency counts of 'uncertainty' and variants in quarterly Economic Intelligence Unit country reports; source: policyuncertainty.com
 - (i) Economic Policy Uncertainty (**EPU**) ([Baker et al., 2016](#)). Coverage: **16/24**
 - (ii) World Uncertainty Index (**WUI**). Coverage: **23/24**

4. Forecast-based uncertainty measures. Survey data on expectations used to construct uncertainty measures ([Bachmann et al., 2013](#); [Morikawa, 2016](#)) incomparable across countries. Bloomberg: historical quarterly real GDP growth forecasts by multiple forecasters.
 - (i) Forecast dispersion (**FD**): standard deviation of forecasts across forecasters. Coverage: **15/24**
 - (ii) Forecast error dispersion (error = realized real GDP growth – forecast). Coverage: **15/24**
 - (iii) Mean absolute forecast errors. Coverage: **12/24**

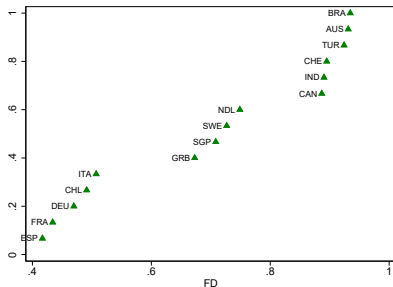
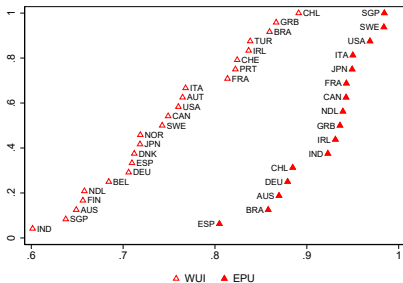
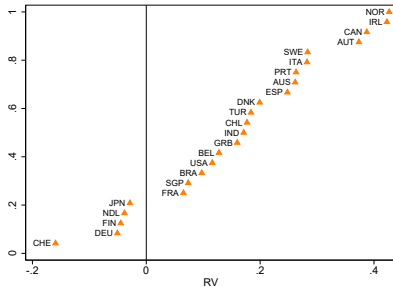
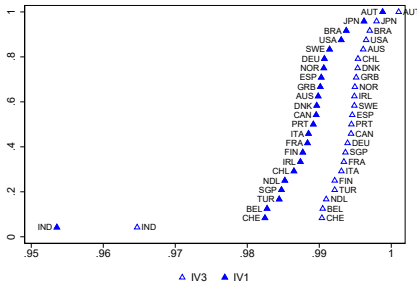
Why different uncertainty measures?

- Implied volatility
 - **Pros:** forward looking; based on option prices
 - **Cons:** limited country coverage (we make a big contribution here); dependent on size/depth/liquidity of option markets
- Realized volatility
 - **Pros:** widely available and used
 - **Cons:** backward looking; dependent on size of financial markets
- Economic Policy Uncertainty (news-based)
 - **Pros:** broad measure; reflects current uncertainty and expectations of future uncertainty
 - **Cons:** low cross-country coverage; credibility of news sources and noise-to-signal ratios from the press; differences in international construction

Why different uncertainty measures?

- World Uncertainty Index (news-based)
 - **Pros:** greater country coverage than EPU; mixture of backward and forward looking components
 - **Cons:** based on frequency counts of the word 'uncertainty'
- Expert forecasts
 - **Pros:** complements measures above; focus on real GDP growth expectations
 - **Cons:** country coverage; we do a big contribution here too:
 - ① We went from zero quarterly forecasts that can be accessed to at least 16 countries (12 in our sample) with multiple forecasts per quarter for each country. (IMF do not distribute their WEO quarterly forecasts..)
 - ② Semi-annual forecasts are available, not quarterly

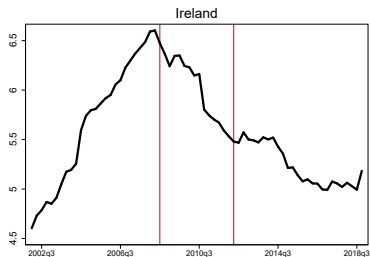
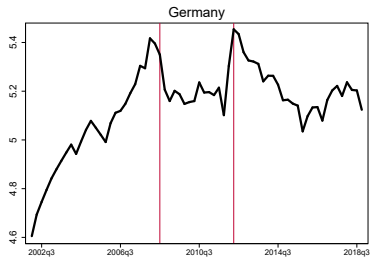
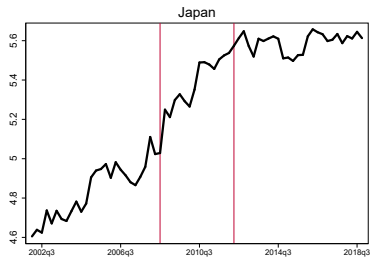
Data properties: Large variation in uncertainty persistence



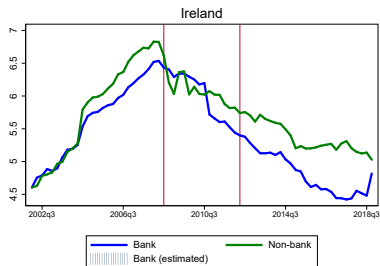
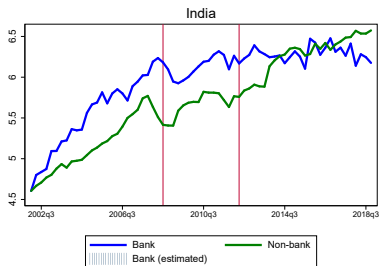
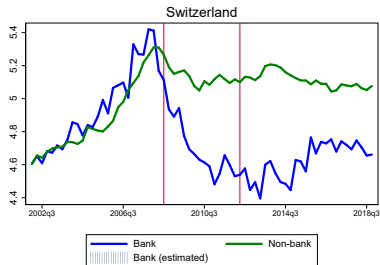
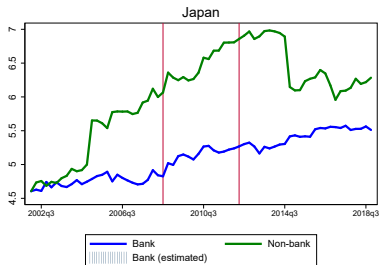
Banking Data

- International bank funding: cross-border liabilities (loans plus debt securities) from BIS Locational Banking Statistics
- Period/Frequency: 2001-2018/quarterly
- Counterparty: rest of the world, i.e. multilateral data
- Funding sectors: **All**, **Banks** and **Non-Banks**

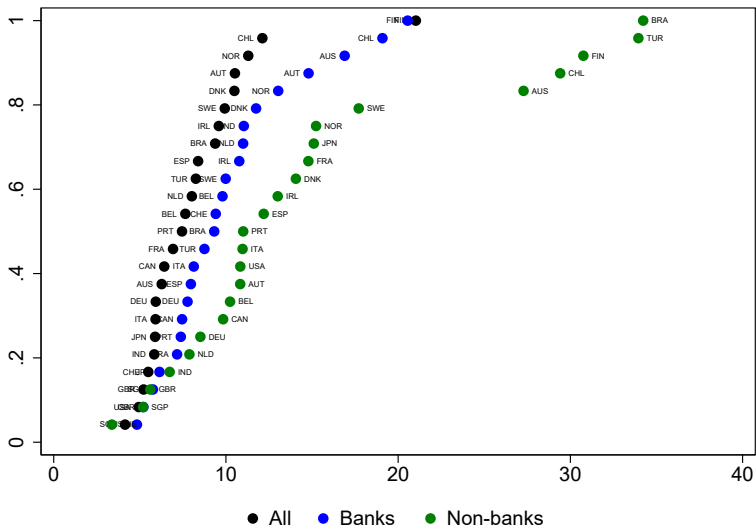
Data properties: Heterogeneous trends



Data properties: Sectoral breakdown show different dynamics



Data properties: Volatility quite different across funding sector



Empirical Approach

We estimate simple dynamic models following three strategies:

- 1 Panel-data model with country FE (the industry standard)
- 2 Mean-group estimator which accounts for slope-heterogeneity and fixes potential bias in dynamic panel framework
- 3 Country-specific regressions
 - Sample: 24-12 countries depending on UNC data
 - Period: 2003Q1 – 2018Q4

Empirical specifications

Baseline

$$\ln(L_{i,t}) = \alpha_i + \beta \ln(UNC_{i,t}) + \rho \ln(L_{i,t-1}) + \epsilon_{i,t} \quad (1)$$

Add controls as robustness

$$\ln(L_{i,t}) = \alpha_i + \beta \ln(UNC_{i,t}) + \gamma X_{i,t-1} + \rho \ln(L_{i,t-1}) + \epsilon_{i,t} \quad (2)$$

Conditioning factors / Macro controls

$X_{i,t-1}$ is a vector of conditioning factors lagged one quarter including:

- Real GDP growth (IMF IFS)
- Stock market growth (BBG)
- Inflation rates (BBG)
- Monetary policy rates (BBG/BIS/websites)
- Exchange rate of depreciation rate (IMF IFS)
- Credit growth (BIS)
- International debt to GDP (BIS)

Bivariate Regression Models – full period

Panel A: Panel Regressions

	All	Banks	Non-Banks	Obs./Countries
Implied Volatility (3M)	-2.40*** (0.80)	-2.66** (1.05)	-4.10*** (1.12)	1512 24
Implied Volatility (1M)	-1.53** (0.74)	-1.72* (0.96)	-2.81*** (0.92)	1512 24
Realized Volatility	-1.88** (0.89)	-2.15* (1.12)	-3.01** (1.91)	1512 24
EPU	-2.47*** (0.72)	-2.87*** (0.87)	-0.41 (1.91)	1008 16
WUI	-0.48* (0.24)	-0.53* (0.30)	-0.69* (0.36)	1386 22
Forecast Dispersion	0.04 (0.30)	0.31 (0.29)	-0.98 (0.65)	899 15

Bivariate Regression Models – full period

Panel B: Mean-Group Regressions

	All	Banks	Non-Banks	Obs./Countries
Implied Volatility (3M)	-2.57*** (0.96)	-2.93** (1.16)	-3.96*** (1.10)	1512 24
Implied Volatility (1M)	-1.51* (0.79)	-1.92* (1.00)	-2.20** (0.96)	1512 24
Realized Volatility	-2.07** (1.01)	-2.64** (1.16)	-2.65** (1.86)	1512 24
EPU	-1.90* (1.00)	-1.65 (1.25)	-0.81 (1.86)	1008 16
WUI	-0.47* (0.26)	-0.53 (0.34)	-0.78** (0.33)	1386 22
Forecast Dispersion	-0.36 (0.36)	0.49 (0.39)	-3.89* (2.08)	899 15

Bivariate Regression Models

- Local uncertainty is associated with less borrowing from abroad
- Sizable effects: a 1% \uparrow in IV3 can \downarrow XB borrowing by up to 4.1%
- The magnitude of the funding response to UNC is heterogeneous: 1% \uparrow IV or RV will produce \downarrow XB funding by between 1.5% – 4.1%
- News-based UNC shocks \downarrow XB funding too. Different quantitative results by counterparty sectors panel and MG models
 - Strongest effect EPU index in panel model: 2.9% contraction

These effects are big

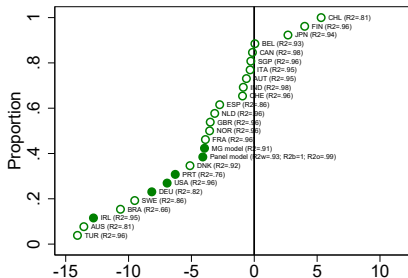
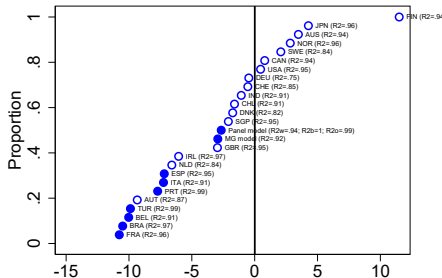
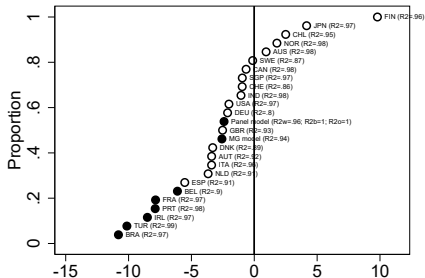
Example for IV

- A one percent (*one standard deviation*) \uparrow in IV1: at least a \$12 (\$573) billion \downarrow in **aggregate funding** and a \$5 (\$227) billion decline in **Non-bank** funding
- A one percent (*one standard deviation*) \uparrow in IV3: is associated with up to a \$21 (\$830) billion \downarrow in **aggregate funding** and a \$9 (\$385) billion \downarrow in **Non-bank** funding

Notes

- Implied volatilities have standard deviations of 42.2% and 46.3%, and one percent rises or even one standard deviation rises in volatility are likely from inspecting histograms and time-series
- The average aggregate funding is \$820 billion and the average non-bank funding is \$223 billion.

Baseline model: Three-month implied volatility (IV3)



Comparing UNC measures

Panel A: Panel Regressions (fixed sample)

	All	Banks	Non-Banks	Countries
Implied Volatility (3M)	-2.27** (0.76)	-2.79** (1.15)	-3.87** (1.51)	735 12
Implied Volatility (1M)	-1.61** (0.65)	-1.88 (1.05)	-2.60* (1.32)	735 12
Realized Volatility	-2.37*** (0.73)	-2.64** (1.05)	-3.55** (2.45)	735 12
EPU	-2.35*** (0.58)	-2.40** (1.00)	0.77 (2.45)	735 12
WUI	-0.20 (0.23)	-0.15 (0.36)	-0.82 (0.61)	735 12
Forecast Dispersion	0.19 (0.31)	0.45 (0.31)	-0.86 (0.75)	735 12

Countries: Australia; Brazil; Canada; Chile; France; Germany; India; Italy; Netherlands; Singapore; Spain; Sweden

Comparing UNC measures

- **All Sectors**: strongest effect (-2.37 Panel, -2.73 MG)
- **Banks**: IV3 is the greatest in Panel (-2.79) and RV in MG (-3.61)
- **Non-banks**: IV3 is the greatest in Panel (-3.87) and in MG (-3.9)

- EPU comes up as strong in **All Sectors** and **Banks**
 - Strong impact on funding from **Banks** in panel model only
- WUI no effects
- FD big variation with some positive coefficients (**Banks** in MG)

Time Variation

Global Financial Crisis

We estimate the model below to account for **GFC break**

$$\ln(L_{i,t}) = \alpha_i + \beta \ln(UNC_{i,t}) + \psi \ln(UNC_{i,t}) * GFC_t + \delta GFC_t + \gamma X_{i,t-1} + \rho \ln(L_{i,t-1}) + \epsilon_{i,t} \quad (3)$$

Crisis: period from Lehman Brothers collapse to “Whatever it takes” speech by Draghi: 2008Q3 – 2012Q2

Time Variation

Global Financial Crisis, Bivariate Models 1/2

	All	IV3 Banks	NBanks	All	IV1 Banks	NBanks	All	RV Banks	NBanks
UNC	-0.46 (0.70)	-0.54 (0.85)	-1.86 (1.46)	0.36 (0.66)	0.36 (0.79)	-0.43 (1.18)	1.09 (0.90)	1.13 (1.05)	0.55 (1.94)
GFC	16.30*** (3.79)	17.99*** (4.37)	24.15** (10.41)	15.72*** (2.82)	17.60*** (3.76)	23.88*** (7.23)	22.89*** (4.28)	25.96*** (5.20)	33.53*** (10.44)
UxGFC	-5.52*** (1.20)	-6.10*** (1.37)	-7.82** (3.30)	-5.53*** (0.92)	-6.19*** (1.22)	-8.05*** (2.28)	-7.35*** (1.29)	-8.32*** (1.58)	-10.42*** (3.25)
Obs.	1,512	1,512	1,512	1,512	1,512	1,512	1,512	1,512	1,512
R^2	0.96	0.94	0.93	0.96	0.94	0.93	0.96	0.94	0.93
Coun.	24	24	24	24	24	24	24	24	24

Time Variation

Global Financial Crisis, Bivariate Models 2/2

	All	EPU Banks	NBanks	All	WUI Banks	NBanks	All	FD Banks	NBanks
UNC	-1.81** (0.73)	-2.33** (0.84)	0.59 (2.40)	-0.81** (0.29)	-0.94** (0.35)	-0.97 (0.59)	0.19 (0.36)	0.46 (0.28)	-0.44 (0.67)
GFC	13.73** (5.48)	13.15* (6.51)	13.56 (22.48)	-3.30* (1.62)	-4.06** (1.87)	-2.96 (2.39)	-1.07 (1.16)	-1.15 (1.24)	0.07 (2.24)
GFCxUNC	-3.06** (1.11)	-2.89** (1.31)	-3.25 (4.55)	0.71 (0.45)	0.94* (0.53)	0.56 (0.88)	-0.22 (0.40)	-0.20 (0.49)	-1.30 (0.82)
Obs.	1,008	1,008	1,008	1,386	1,386	1,386	899	899	899
R^2	0.96	0.94	0.89	0.96	0.94	0.93	0.95	0.92	0.90
Coun.	16	16	16	22	22	22	15	15	15

Time Variation

Global Financial Crisis

- Inclusion of crisis dummy and its interaction with UNC takes most of the direct UNC impact on XB funding for volatility-based measures (IV3, IV1, RV)
- EPU impacts cross-border funding also during tranquil times for funding from **Banks** but not from **Non-Banks**. The effect is large enough to emerge in the aggregate of **All** sectors
- WUI uncertainty shocks impact XB funding from **Banks** in tranquil times only
- FD show no relation with XB funding / GFC crisis

Contributions

- Data. Freely available at:
<https://github.com/mpcurran/uncertaintybanking>
- Ground work for further research:
 - In-depth assessment of statistical and time-series properties for different UNC measures and cross-border funding of banks data
 - Unmask heterogeneity in the relation between uncertainty shocks and cross-border funding across: uncertainty proxies, sectoral funding sources, banking systems (countries) and time

Conclusions

One size does not fit all

- Heterogeneity across banking systems, e.g. Spain \neq Italy; Singapore \neq Ireland; Australia \neq Japan
- Bank/Non-Banks split relevant:
 - Banks more responsive to news-based UNC shocks; Non-Banks to volatility-based
- Time variation relevant too:
 - Volatility-based UNC relevant during the GFC
 - EPU shocks relevant after the crisis as well. We document that news-based uncertainty has increased over time.
- FD insignificant; disconnect between GDP forecasts and global banking? Not enough data points?
- Other dimensions of BIS data: intra-group; non-financial corporations; deposits vs. debt; currency of denomination; etc

Thank you for your attention!

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