



The Global Banking Network in the Aftermath of the Crisis: Is There Evidence of De-globalization?

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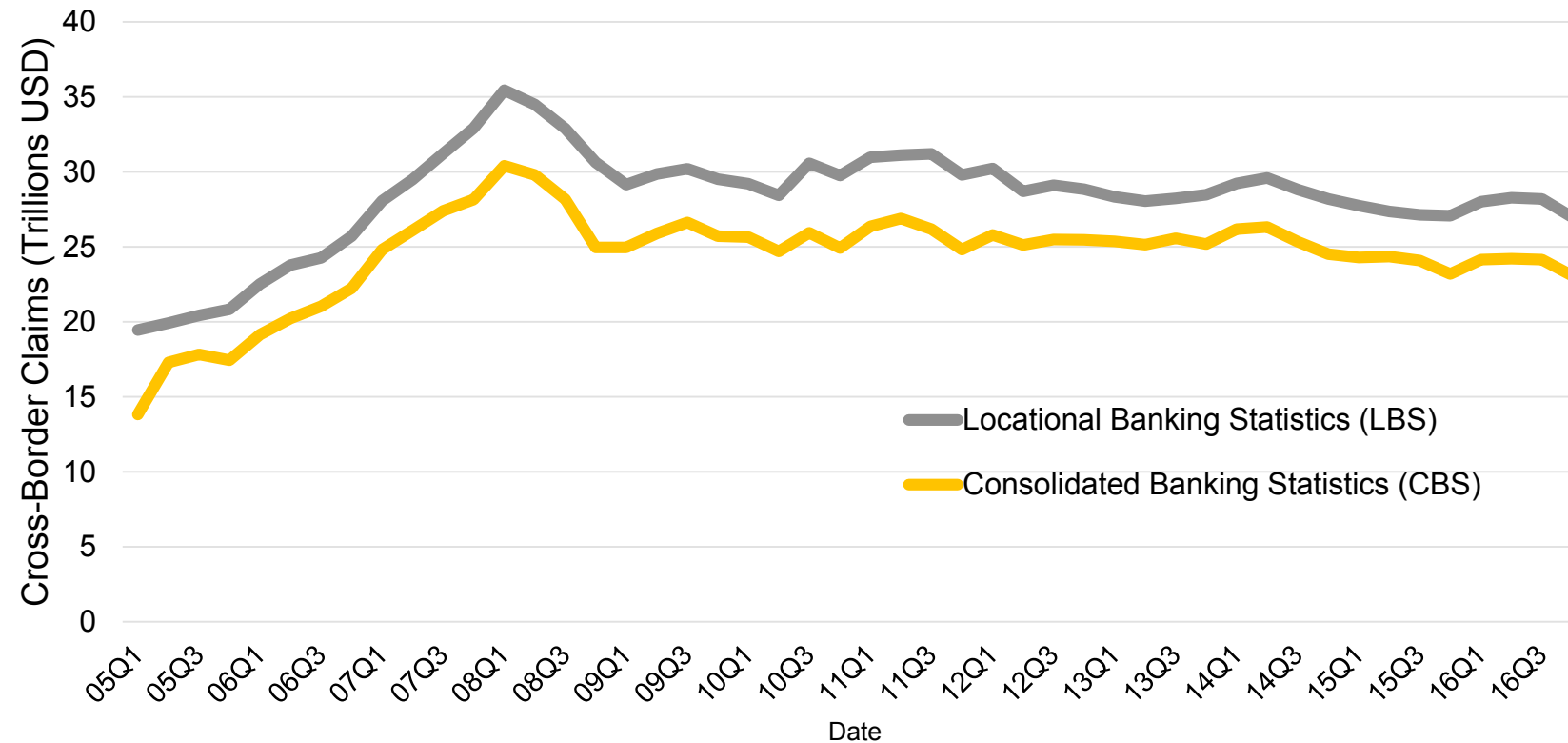
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Motivation

Sharp and persistent fall in global cross-border banking claims after the crisis

- Origin to financial “de-globalization” argument (Lund et al 2013; Forbes 2014; Mallaby 2016 and Forbes, Reinhart, and Wieladek 2017)



Aims of this Paper

Map the global banking network using aggregate data

- Tradeoffs between using BIS Locational (LBS) and Consolidated CBS

Analyze the evolution of the global financial network

- Careful selection of network tools and measures of node importance
- Particular focus on the aftermath of the crisis

Consider the reach of the financial de-globalization argument

- Uncover deeper structural transformation under the overall shrinkage

Preview of Main Findings

- De-globalization argument is overly simplified
- While connections within traditional lenders become sparser, many borrowers located at the periphery of the network are more connected
- There is evidence of “Regionalization”:
 - Periphery borrowers have more linkages with non-core, non-European lenders, in terms of both direct cross-border lending and affiliates’ flows
 - In line with Claessens and Van Horen (2015) and others, which find a more regional focus in the evolution of foreign affiliates since the crisis

Mapping the Global Banking Network

BIS Locational Banking Statistics (LBS)

- Follows residence based approach (data used in Minoiu and Reyes 2013) and offer longer historical time series

BIS Consolidated Banking Statistics (CBS)

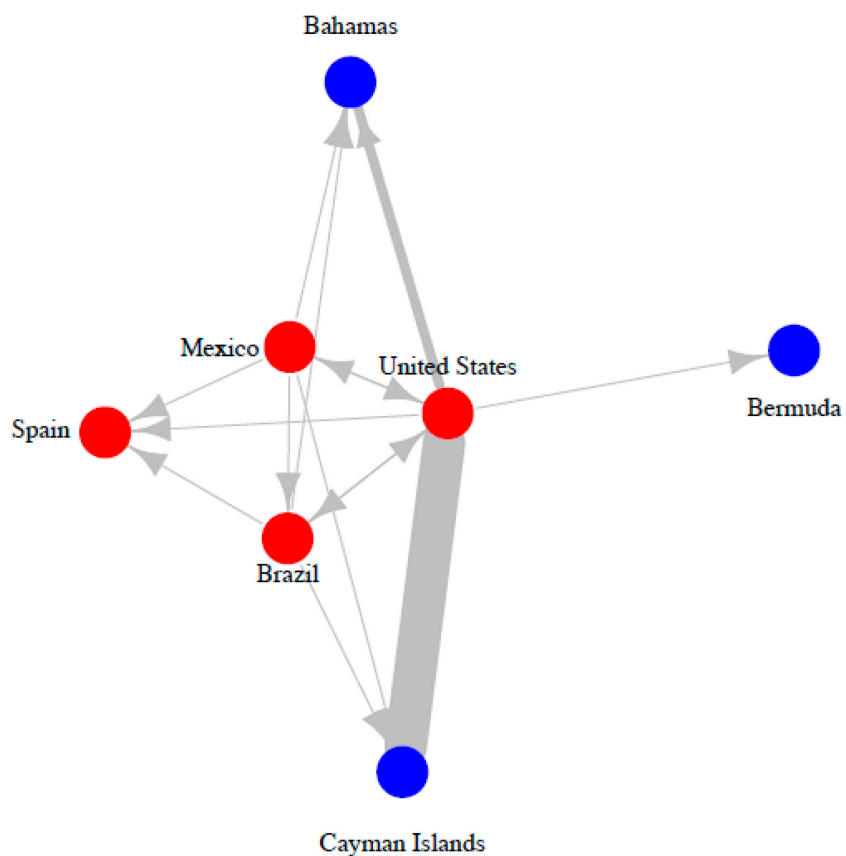
- Tracks the consolidated gross claims of each international banking group, aggregating following the nationality of the parent bank (data used in McCauley et al 2017)
- Cross-border and local affiliate components
- Adjusted following Cerutti (2015) by domestic deposit funding

$$U_{ij}^{adjusted} = CB_{ij} + LC_{ij} \times [1 - \min(DLR_{ij}, 1)]$$

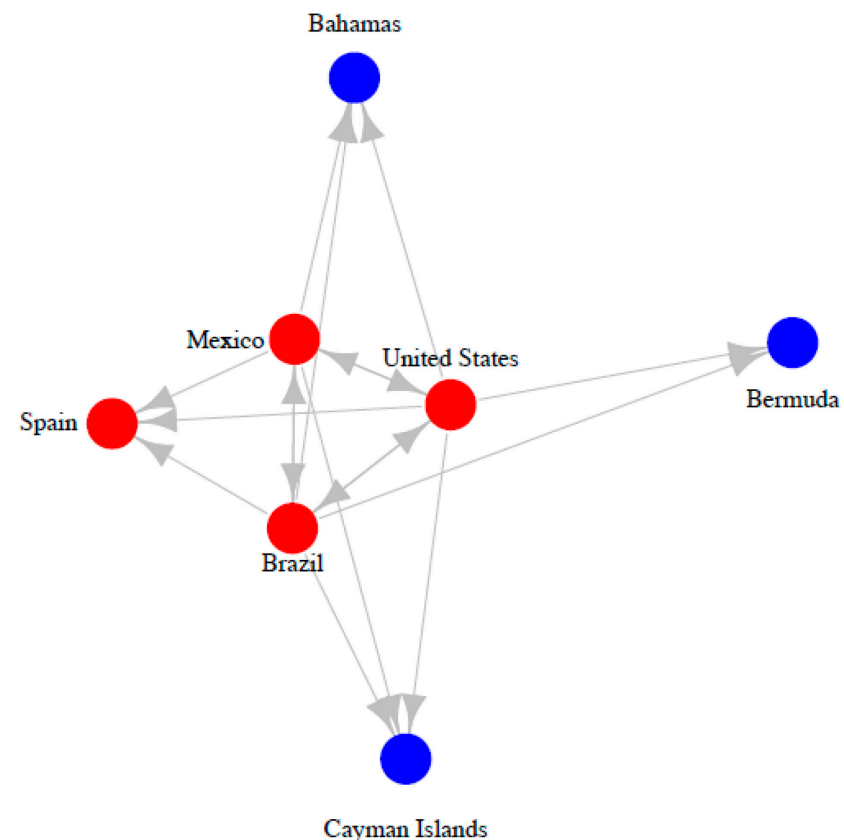
- Avoid overestimation of links through affiliates
- Avoid double counting due to intra-bank positions

Mapping the Global Banking Network

LBS vs CBS: CBS avoids double counting (intra-bank positions) and better mapping of offshore centers



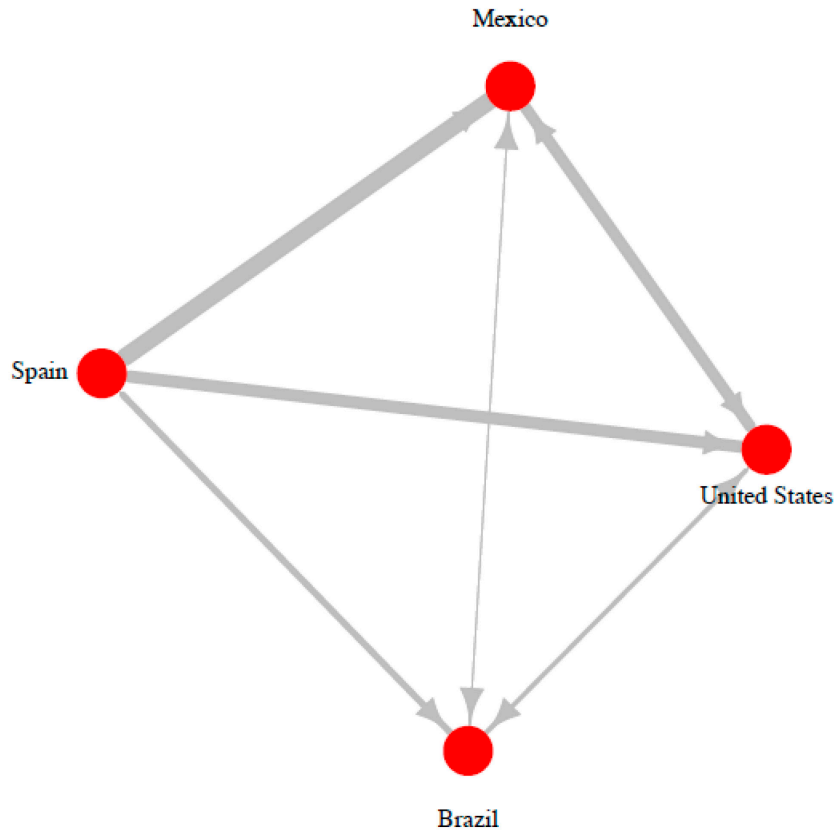
LBS: Offshore positions are large.



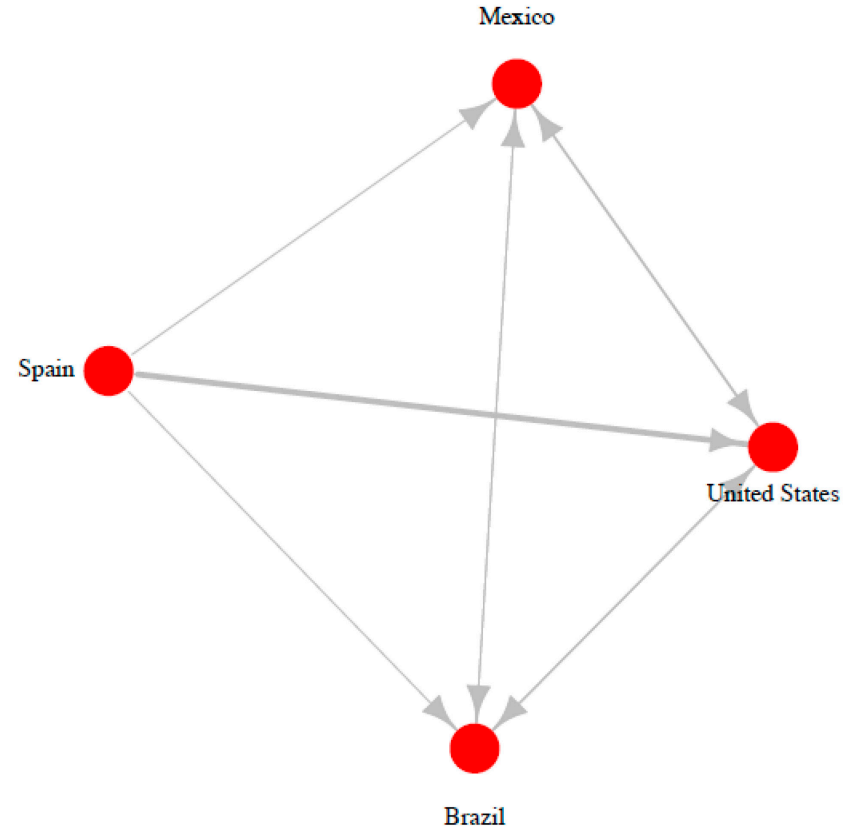
CBS and Adjusted CBS: Offshore centers get smaller role in networks.

Mapping the Global Banking Network

Adjusted CBS avoids CBS overestimation of links through affiliates



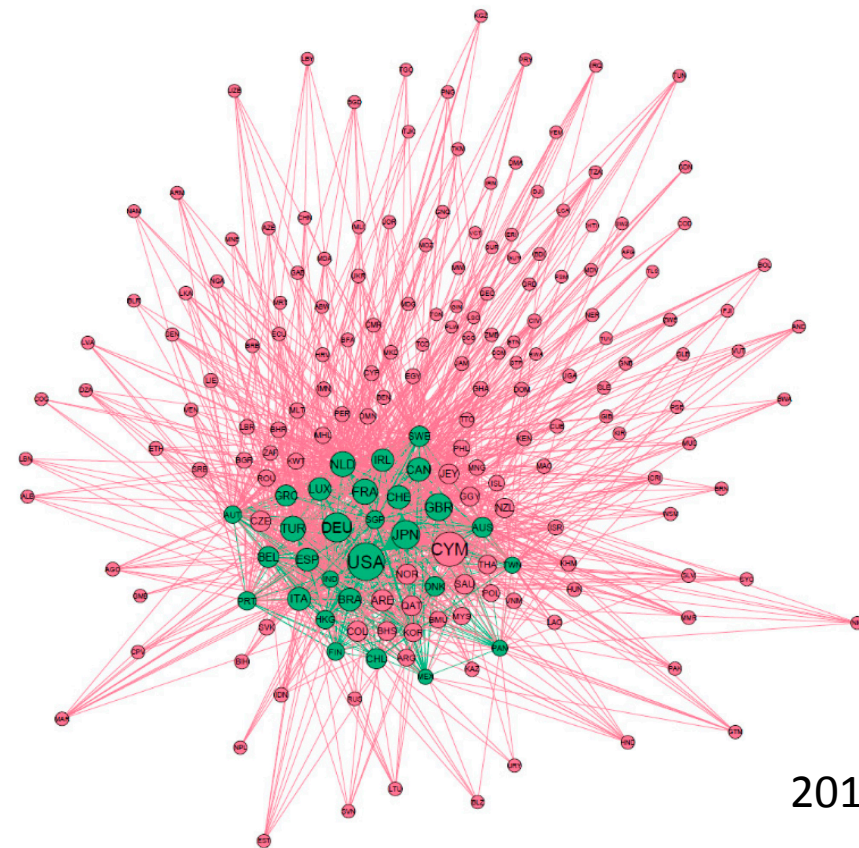
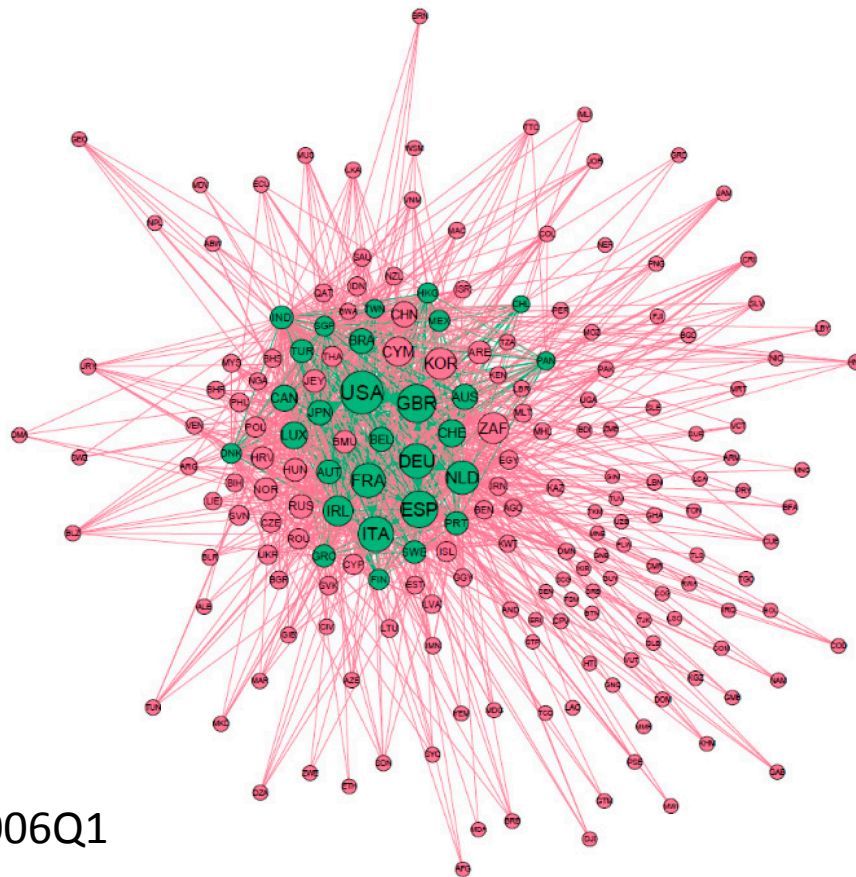
CBS: Claims include local claims funded domestically.



Adjusted CBS: Local claims are scaled down by bank-level balance-sheet data.

Mapping the Global Banking Network

- Construction: use 4Q difference in total bilateral exposure (flows)
 - Connected if the difference is positive (increase exposure) $A_{ijt} = \max(\Delta_4 U_{ijt}^{adjusted}, 0)$
 - Core-periphery structure (29 reporting and over 160 non-reporting)



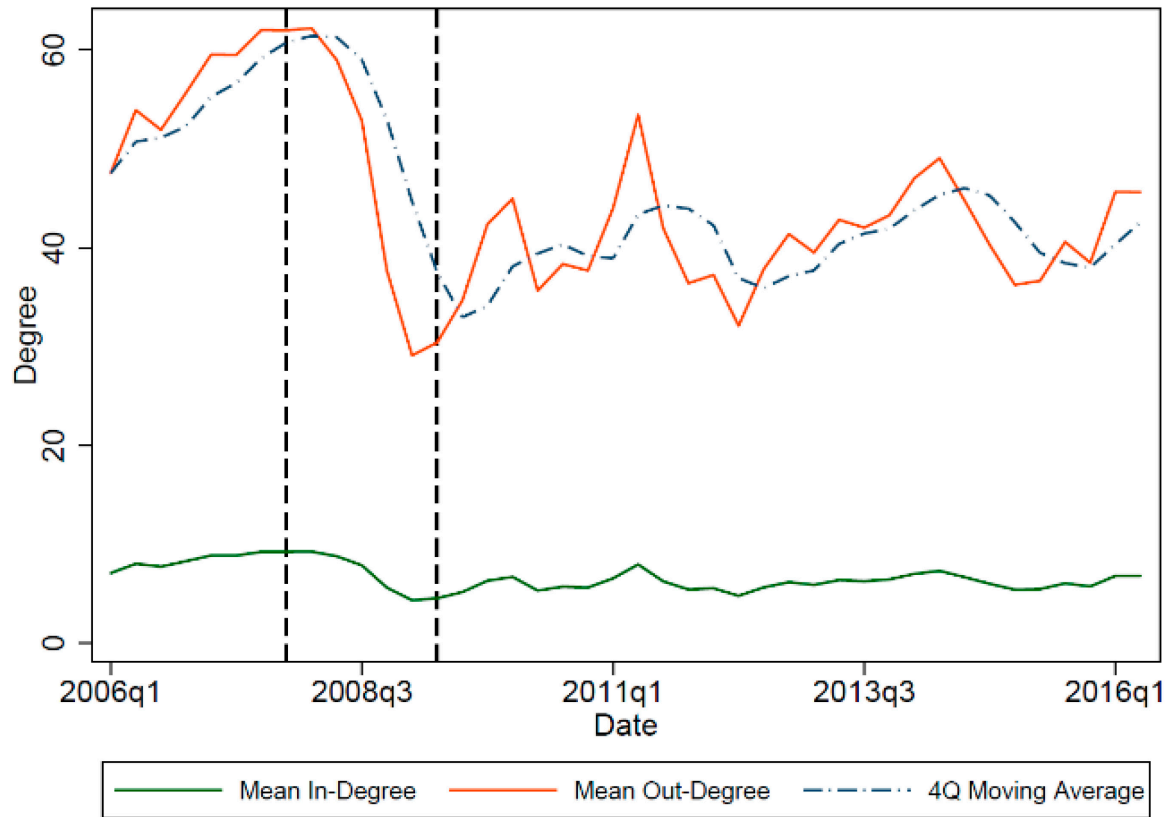
Network Analysis: Using the Right Tools

Network Metrics

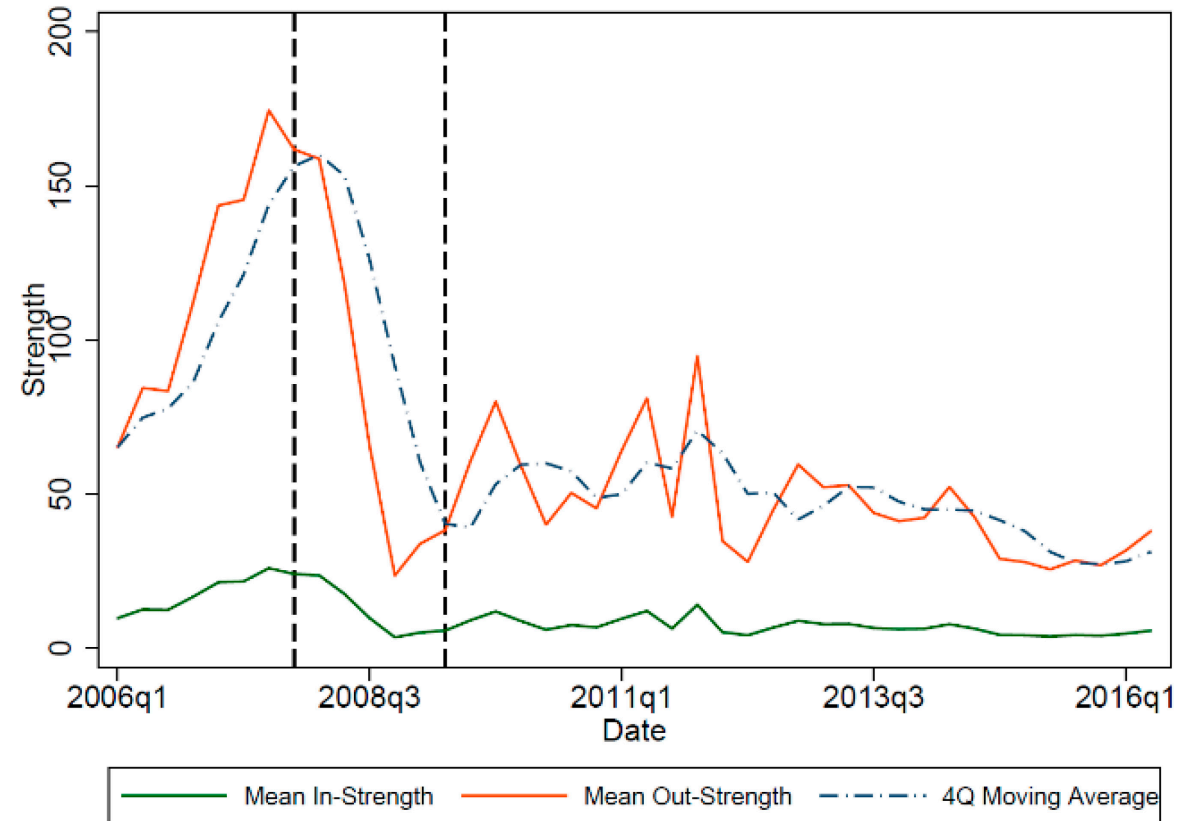
- (In/Out)-Degree: number of links
- (In/Out)-Strength: total weight of links (total flows)
- (In/Out)-Concentration: Hirschman-Herfindahl Index
- Katz-Bonacich Centrality: structural importance
 - High score if connected to other high-score nodes
 - In literature: risk measure (Acemoglu et al 2015; Denbee et al 2016)
- Authority-Hub: lender-borrower dependence
 - Transform network weight into shares and calculate the measure
 - High hub score: principal creditor for many borrowers
 - High authority score: heavily dependent on important hubs for funding, less diversification
 - Ideal for clearly defined country groups (reporting and non-reporting)

Results from Network Analysis: Global Indicators

Overall shrinkage of the global banking network:



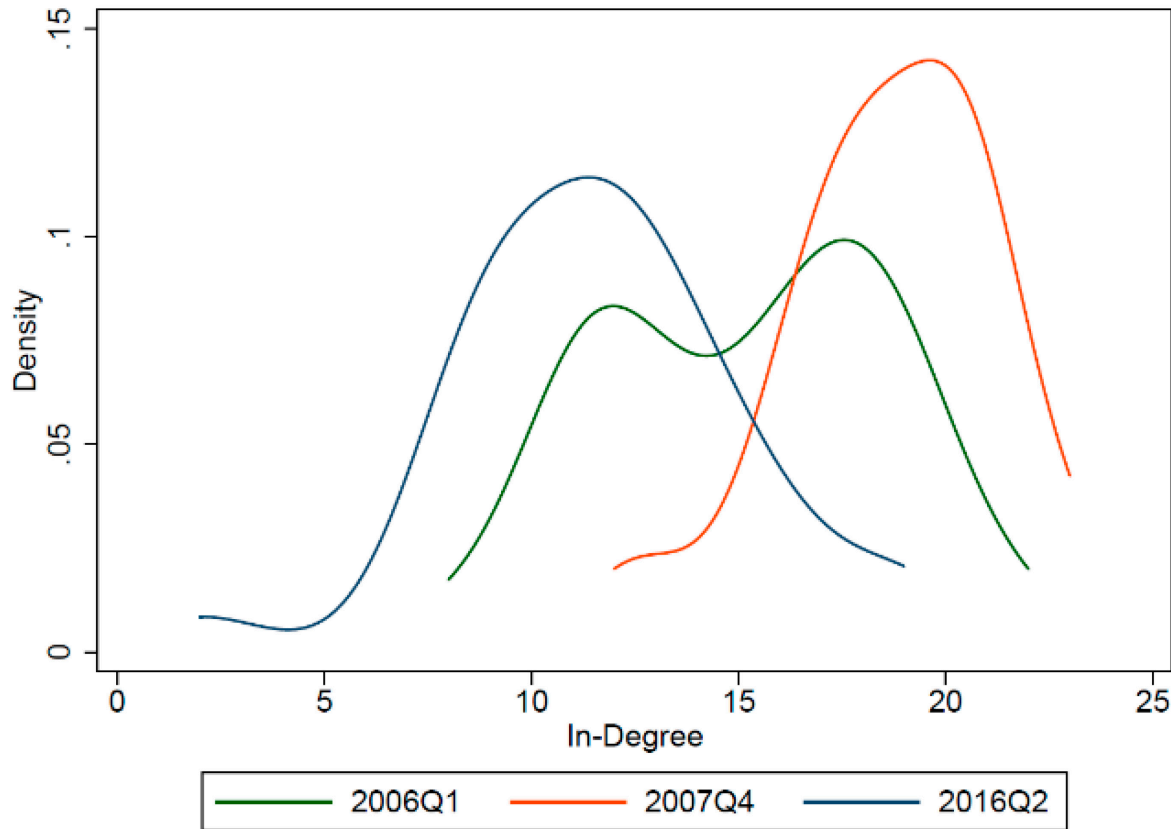
In-Degree



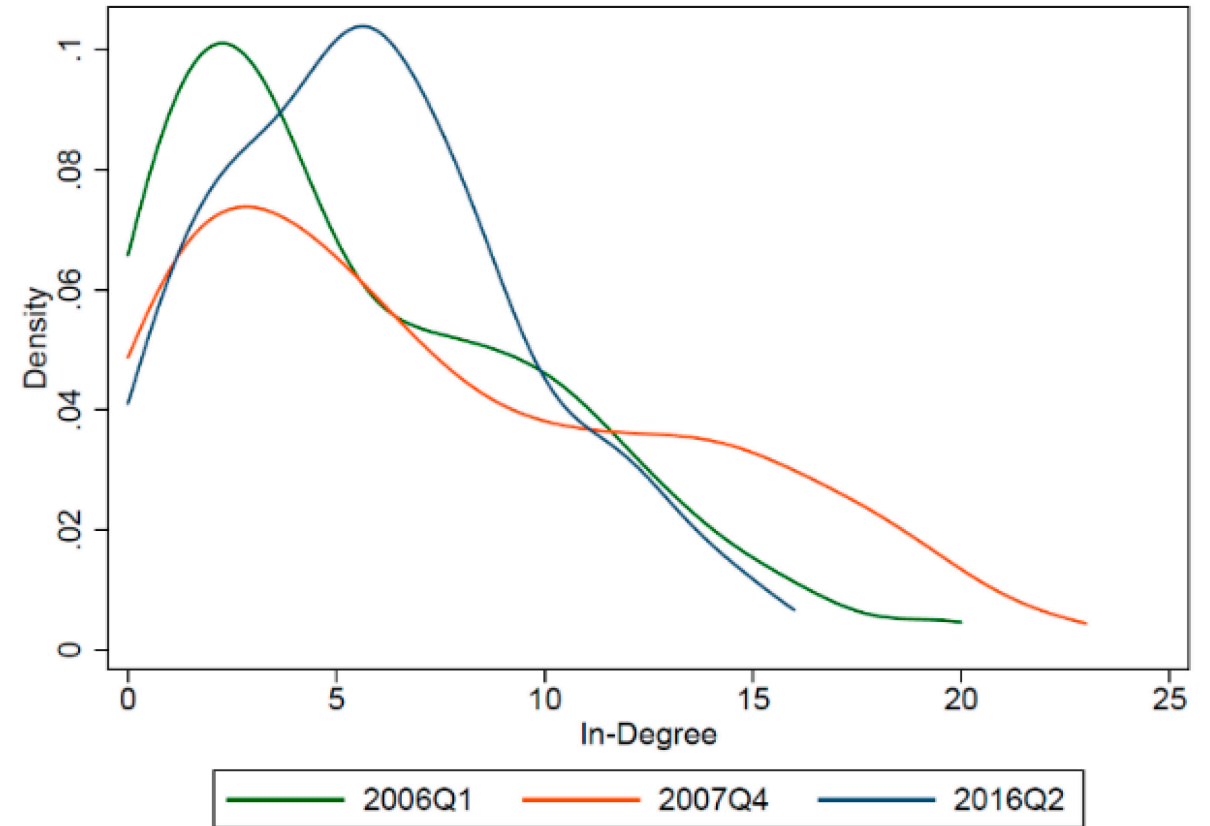
In-Strength

Results from Network Analysis: Global Indicators

Heterogeneity in post-crisis evolution:



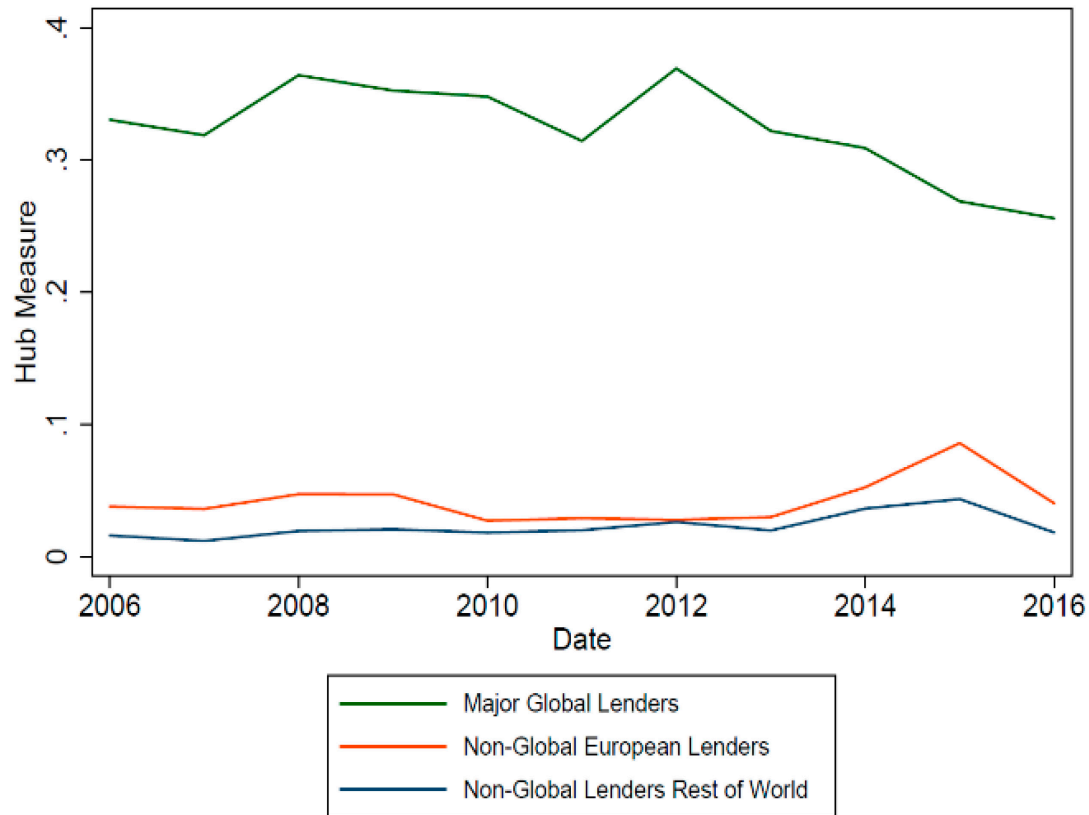
Reporting Countries



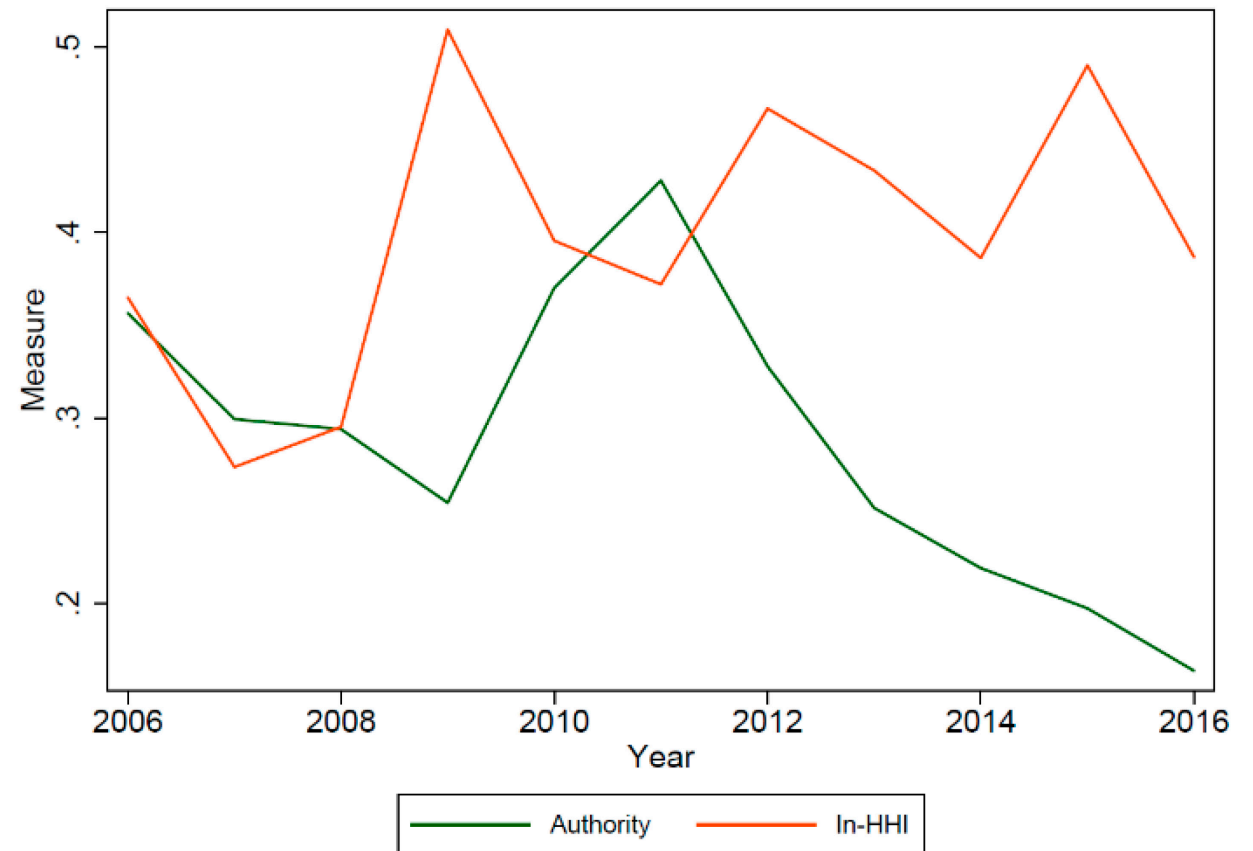
Non-Reporting Countries

Results from Network Analysis: Measures of Node Importance

Non-reporting EMs decrease dependence on core, global lenders after the crisis:



Hub Measure: Reporting Countries



Authority and In-HHI: Non-Reporting EMs

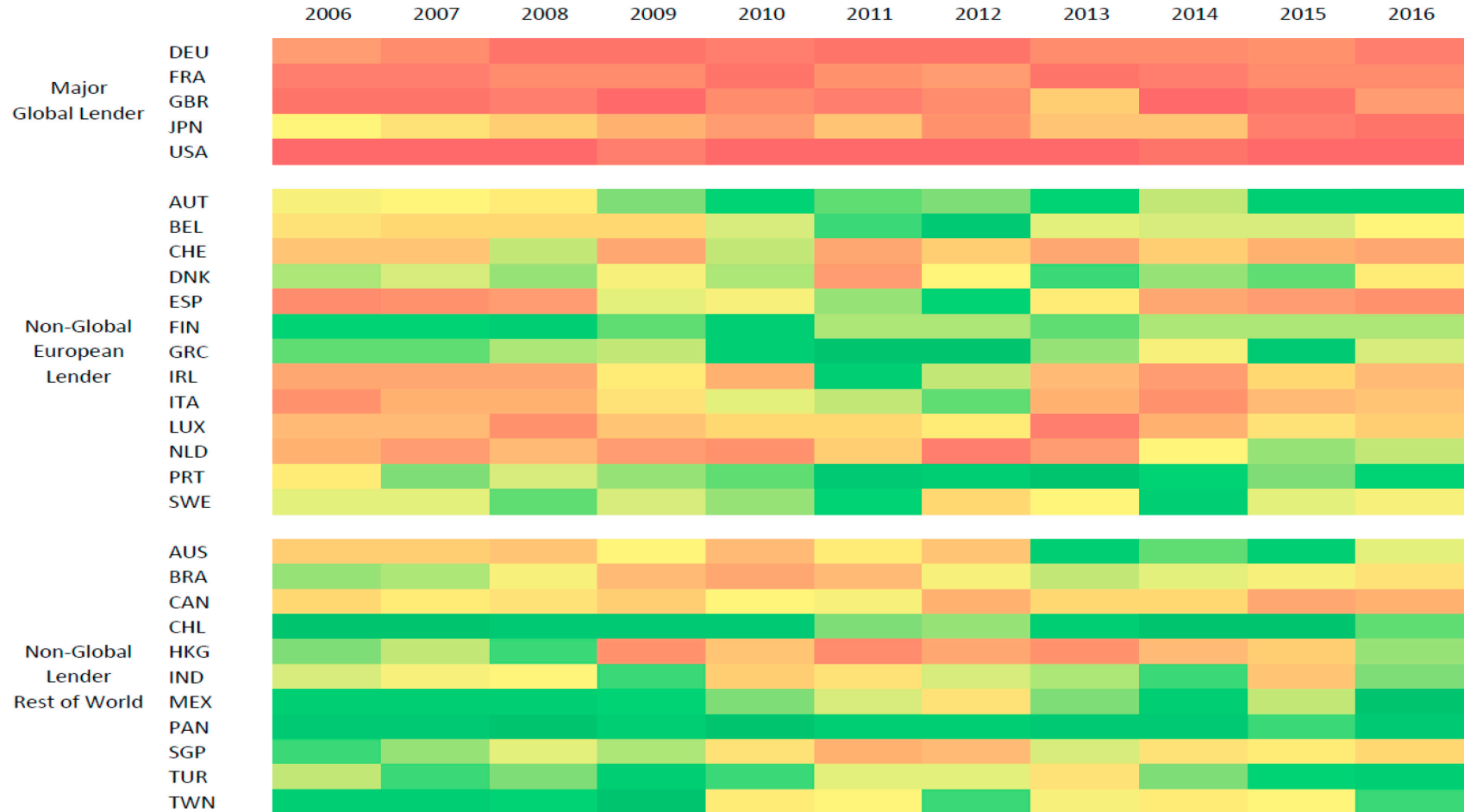
Results from Network Analysis: Measures of Node Importance

Non-global, rest of world lenders enjoy a rise in status, with the retreat of European lenders:

Rank Heatmap:

Katz-Bonacich
Centrality

Cross-Border
Flows



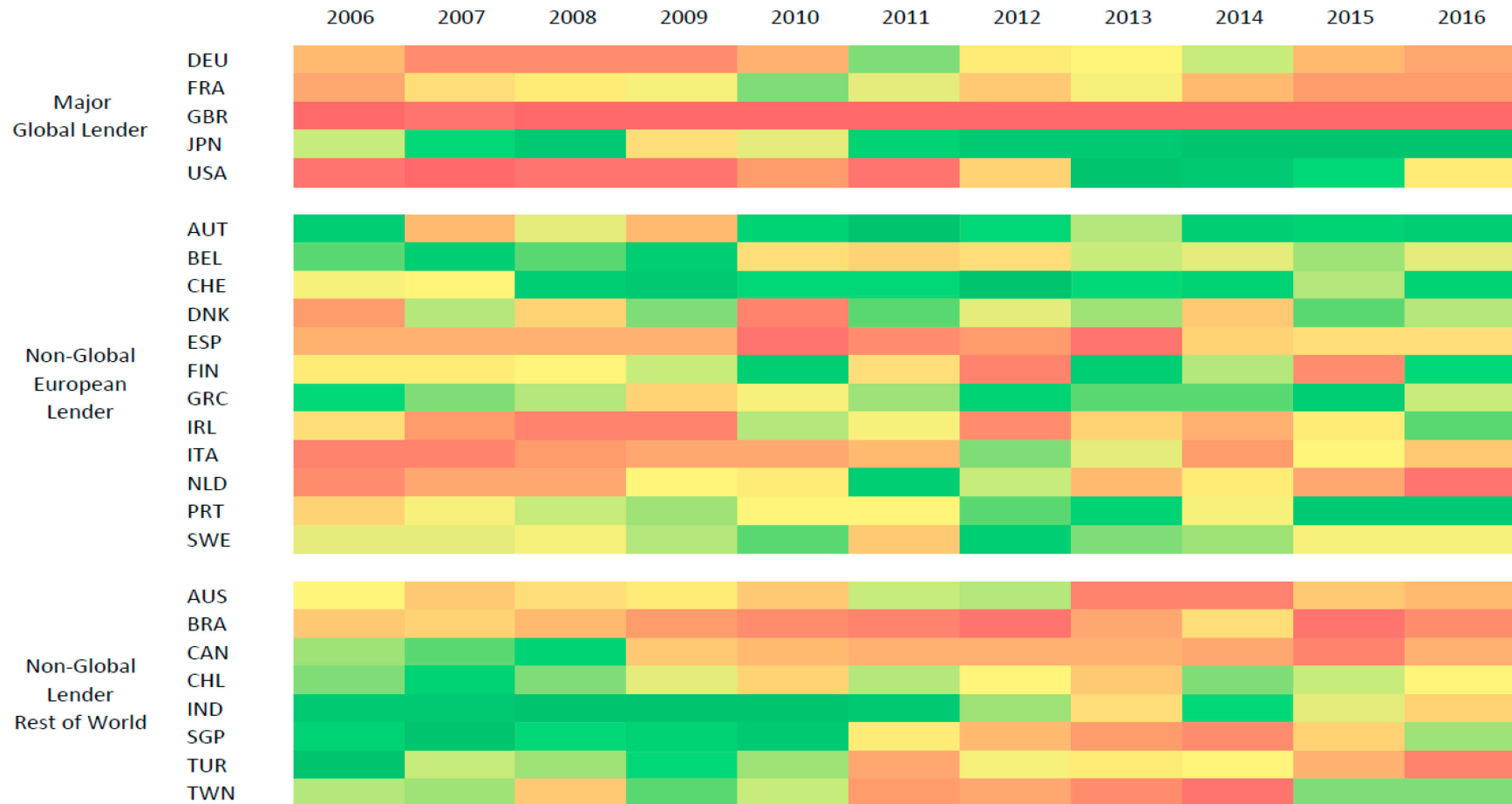
Results from Network Analysis: Measures of Node Importance

Trend driven by both cross-border and local affiliate flows:

Rank Heatmap:

Katz-Bonacich
Centrality

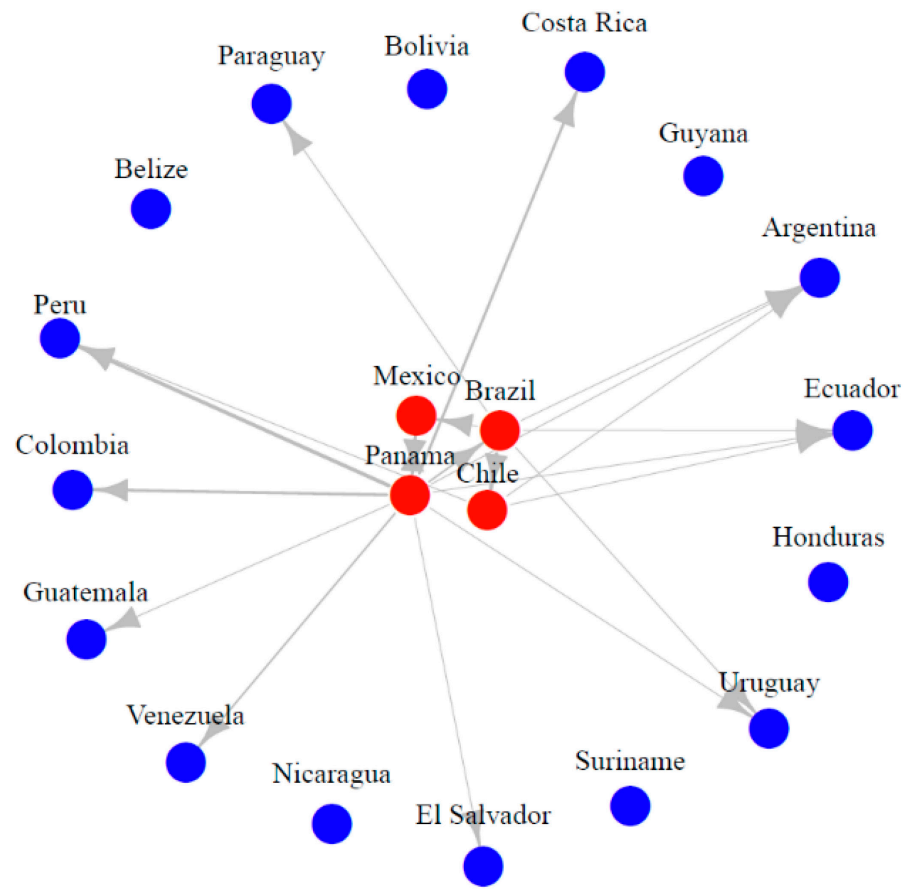
Adjusted Local
Affiliate Flows



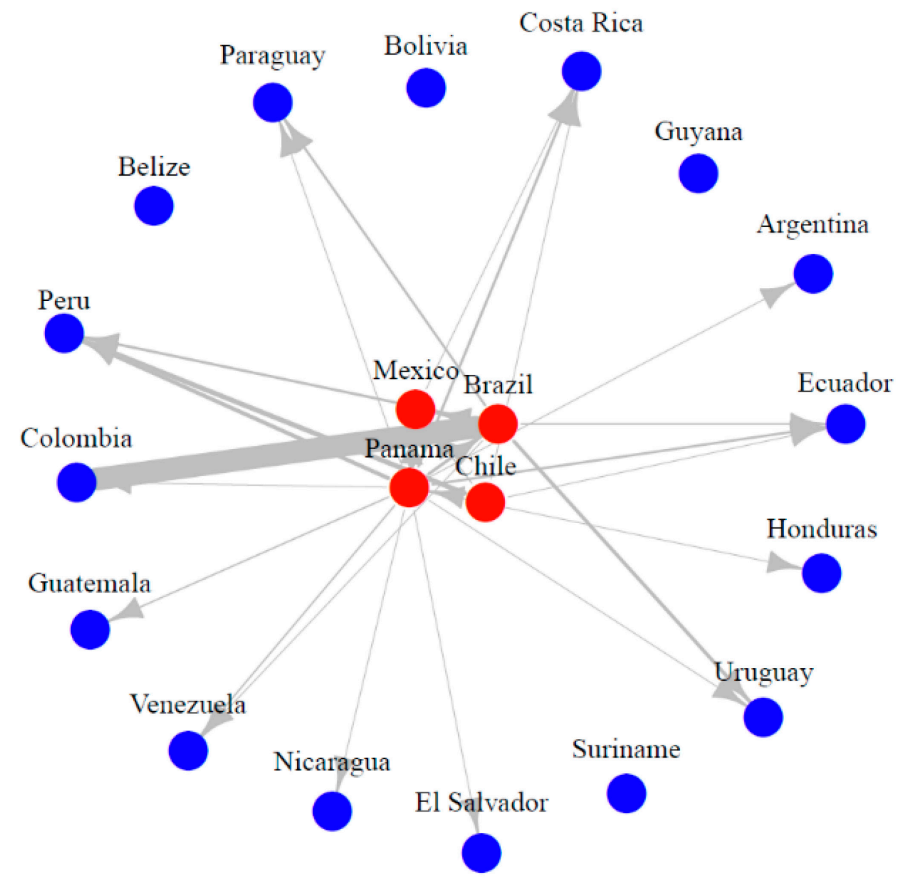
Towards a Regionalization Process?

- Previous evidence provides early hints of regionalization of network

The case of Latin America: (arrows indicate a year-over-year increase of exposure)



Cross-Border Flows: 2007Q4

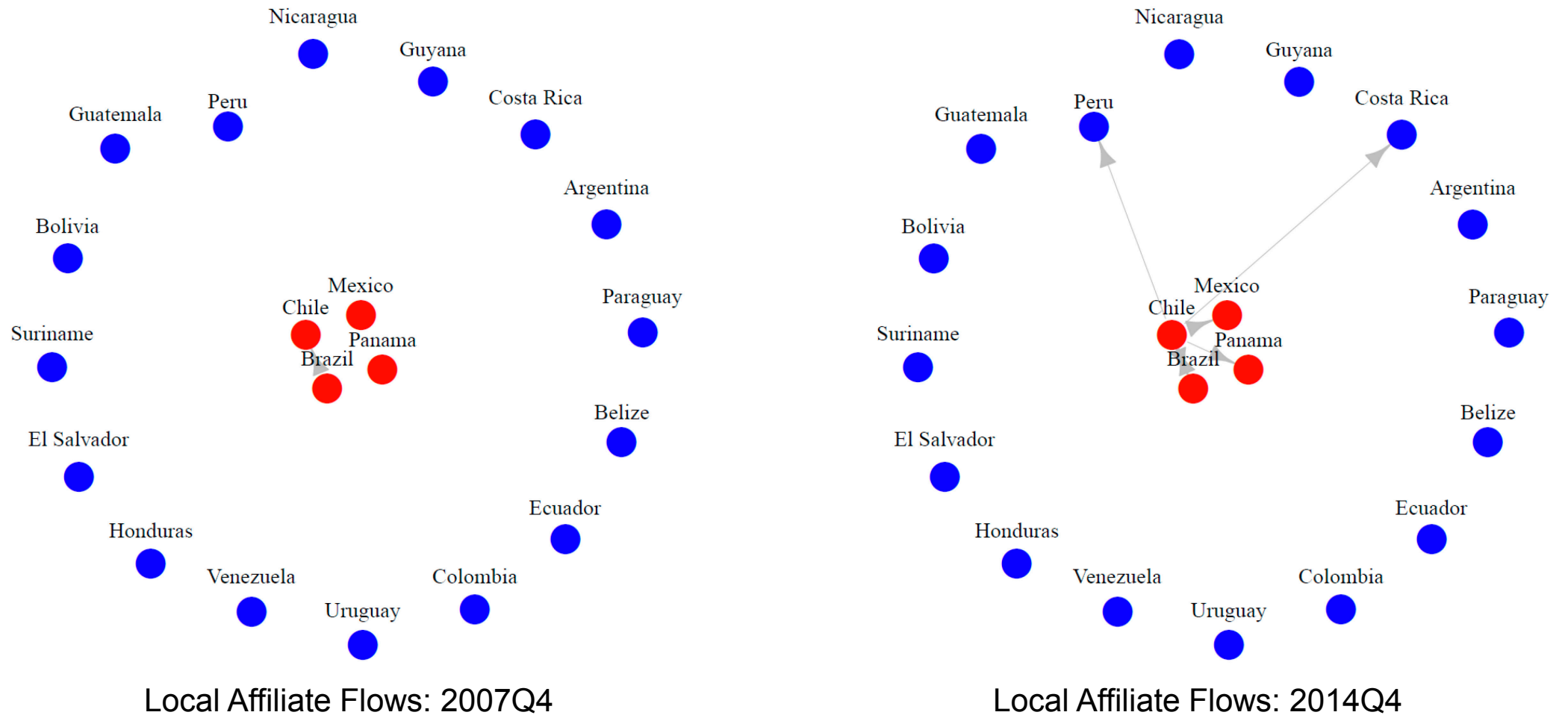


Cross-Border Flows: 2014Q4

Towards a Regionalization Process?

- Previous evidence provides early hints on regionalization of network

The case of Latin America:



Towards a Regionalization Process?

Modularity increases after the crisis at both regional level



Towards a Regionalization Process?

- Regression Analysis

Following literature on the determinants of international financial flows (Papaioannou 2009; Claessens and van Horen 2012; Cerutti, Hale and Minoiu 2016)

$$\text{Log Flow}_{ijt} = \beta_0 + \beta_1 X_{it} + \beta_2 Y_{jt} + \beta_2 Z_{ijt} + \alpha_i + \gamma_j + \delta_t + \varepsilon_{ijt}$$

- X_{it} : lender characteristics
- Y_{jt} : borrower characteristics
- Z_{ijt} : lender-borrower mutual linkages
 - Include common region dummy and interactions with crisis, post-crisis and non-global rest of world lender dummy
 - But also Distance_ij and Trade relationship_ij

Mutual Linkages

	Cross-Border			Local		
	(1)	(2)	(3)	(4)	(5)	(6)
Mutual Linkages:						
Region	-0.0969 (0.0970)	-0.0520 (0.101)	-0.318*** (0.117)	-0.389 (0.308)	-0.485 (0.322)	-0.542 (0.396)
Region * Post-Crisis		-0.0736 (0.0731)	-0.169** (0.0846)		0.0466 (0.182)	-0.0854 (0.188)
Region * Crisis		-0.0613 (0.0660)	-0.0639 (0.0728)		0.306* (0.159)	0.292* (0.163)
Region * Peripheral			0.682*** (0.177)			-0.196 (0.679)
Region * Peripheral * Post-Crisis			0.278** (0.136)			0.928* (0.491)
Region * Peripheral * Crisis			-0.00421 (0.120)			0.224 (0.434)
<u>Log Distance</u>	-1.030*** (0.0710)	-1.031*** (0.0711)	-1.010*** (0.0718)	-1.500*** (0.225)	-1.504*** (0.225)	-1.517*** (0.231)
Lender Share of Export to Borrower	0.0135 (0.0107)	0.0134 (0.0107)	0.0153 (0.0110)	0.0884*** (0.0293)	0.0888*** (0.0293)	0.0896*** (0.0293)

- Log distance significant and negative
- Peripheral lenders (non-global, rest of world) drive regional preference.

Lender/Borrower Characteristics

Lender Characteristics:

Lender Outflow Restriction	0.243 (0.245)	0.251 (0.245)	0.183 (0.242)	2.070*** (0.716)	2.064*** (0.715)	1.811** (0.704)
Lender Bank Assets to GDP	-0.00126 (0.00217)	-0.00126 (0.00217)	-0.000862 (0.00218)	0.0249*** (0.00685)	0.0252*** (0.00686)	0.0258*** (0.00691)
Lender Credit to GDP	0.0124*** (0.00281)	0.0124*** (0.00281)	0.0115*** (0.00284)	-0.0171*** (0.00621)	-0.0171*** (0.00626)	-0.0170*** (0.00634)
Lender Log GDP per capita	0.742*** (0.161)	0.744*** (0.161)	0.660*** (0.169)	0.874 (0.540)	0.832 (0.544)	0.492 (0.520)

Borrower Characteristics:

Borrower Inflow Restriction	0.187 (0.199)	0.178 (0.199)	0.181 (0.200)	0.838 (0.804)	0.871 (0.800)	0.815 (0.792)
Borrower Capital Account Openness	-0.0230 (0.0502)	-0.0235 (0.0503)	-0.0179 (0.0501)	-0.0212 (0.172)	0.00237 (0.174)	0.0126 (0.172)
Borrower Institutional Quality	0.0254*** (0.00632)	0.0248*** (0.00635)	0.0228*** (0.00636)	0.0158 (0.0183)	0.0164 (0.0185)	0.0119 (0.0189)
Borrower Credit to GDP	0.00618*** (0.00138)	0.00616*** (0.00138)	0.00599*** (0.00137)	0.00757* (0.00420)	0.00729* (0.00420)	0.00721* (0.00423)
Borrower Log GDP per capita	0.676*** (0.120)	0.668*** (0.121)	0.643*** (0.123)	1.078*** (0.344)	1.032*** (0.348)	0.940*** (0.346)

- Traditional Lender and Borrower determinants significant and with correct sign

Results largely hold at finer sub-regional level

	Cross-Border			Local		
	(1)	(2)	(3)	(4)	(5)	(6)
<u>Mutual Linkages:</u>						
Sub-region	-0.0540 (0.126)	-0.190 (0.134)	-0.386** (0.152)	0.195 (0.310)	0.390 (0.347)	0.462 (0.360)
Sub-region * Post-Crisis		0.279** (0.116)	0.0527 (0.142)		-0.276 (0.347)	-0.626* (0.368)
Sub-region * Crisis		0.0230 (0.114)	-0.146 (0.139)		-0.324 (0.226)	-0.401* (0.243)
Sub-region * Peripheral			0.753*** (0.260)			-0.614 (1.149)
Sub-region * Peripheral * Post-Crisis			0.352 (0.244)			1.810* (1.033)
Sub-region * Peripheral * Crisis			0.360 (0.225)			0.658 (0.609)
Log Distance	-0.996*** (0.0534)	-0.994*** (0.0533)	-0.959*** (0.0542)	-1.295*** (0.164)	-1.296*** (0.164)	-1.272*** (0.164)
Lender Share of Export to Borrower	0.0143 (0.0109)	0.0149 (0.0109)	0.0165 (0.0103)	0.0893*** (0.0293)	0.0884*** (0.0294)	0.0922*** (0.0298)

Conclusions

- Without proper adjustment, country-level banking statistics suffer from multiple data issues that distort the actual role of each country in cross-border lending
- Overall shrinkage in the scale of cross-border lending masks rich dynamics inside the network, which are unable to be captured by aggregate indicators
- De-globalization argument is overly simplified
 - Aggregate retrenchment mostly a feature of retrenchment in Europe rather than global banking (In line with McCauley et al 2017)
 - More interesting, clear upward trend in the level of regional fragmentation of the banking network (both in terms of cross-border and affiliate lending)

Background Slides

Background: Country Classification

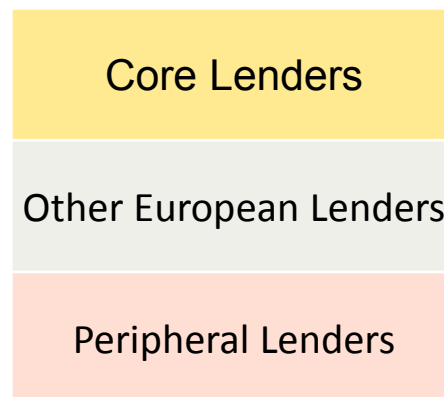
Lender (Reporting Country) Regions and Sub-Regions

Country	Region	Sub-Region
Australia	Oceania	Australia and New Zealand
Brazil	Americas	South America
Chile		
Mexico		Central America
Panama		
Canada		Northern America
United States		
Hong Kong SAR	Asia	Eastern Asia
Japan		
Taiwan Province of China		
India		Southern Asia
Singapore		South-Eastern Asia
Turkey		Western Asia
Greece		Europe
Italy		
Portugal		
Spain		
Denmark	Northern Europe	
Finland		
Ireland		
Sweden		
United Kingdom	Western Europe	
Austria		
Belgium		
France		
Germany		
Luxembourg		
Netherlands		
Switzerland		

All Regions and Sub-Regions in Sample

Africa	Americas	Asia	Europe	Oceania
Western Africa	Northern America	Western Asia	Western Europe	Australia and New Zealand
Eastern Africa	South America	Eastern Asia	Eastern Europe	Melanesia
Northern Africa	Central America	South-Eastern Asia	Northern Europe	Micronesia
Southern Africa	Caribbean	Southern Asia	Southern Europe	Polynesia
Middle Africa		Central Asia		

Reporting Country Classification (based on size of foreign claims and geographical location)



Background: Summary Statistics

	N	Mean	SD	Min	Max	Source/Note
Flows						
Log Cross-Border Flows	54845	-2.93	2.79	-13.82	6.55	BIS
Log Local Flows	15682	-3.56	3.46	-19.12	5.70	BIS
Mutual Linkages:						
Common Region	257462	0.22	0.41	0	1	United Nations
Log Geographical Distance	257462	8.70	0.82	4.18	9.90	CEPII GeoDist
Lender Export to Borrower (Share of Total Export)	235106	0.54	2.54	0.00	86.52	Direction of Trade Statistics
Lender Characteristics:						
Lender Overall Outflow Restriction	187596	0.20	0.26	0	1	Fernandez et al. (2017)
Lender Bank Assets to GDP	211528	116.42	45.66	24.38	257.42	World Bank
Lender Credit to GDP	251672	102.11	53.49	0.09	298.10	International Financial Statistics
Lender Log GDP per capita	235074	10.28	0.90	6.61	11.67	World Bank
Borrower Characteristics:						
Borrower Overall Inflow Restriction	103428	0.34	0.31	0	1	Fernandez et al. (2017)
Borrower Capital Account Openness	197048	0.44	1.62	-1.89	2.39	Chinn and Ito (2006)
Borrower Institutional Quality	181250	70.08	9.25	24.00	92.50	International Country Risk Guide
Borrower Credit to GDP	228318	49.21	45.38	0.09	312.12	International Financial Statistics
Borrower Log GDP per capita	221560	8.44	1.54	4.97	11.67	World Bank

Background: Centrality Measures

- Katz-Bonacich Centrality
 - α : attenuation constant
 - β : positive exogenous component

- Authority/Hub Score
 - Eigenvectors of matrix product.
 - Asterisks (*): “Share” network.

$$\mathbf{x}_t = (I - \alpha A_t^T)^{-1} \beta$$

$$auth_{it} = \alpha_t \sum_j A_{jit}^* hub_j$$

$$hub_{it} = \beta_t \sum_j A_{ijt}^* auth_j$$

$$\lambda_t \mathbf{auth}_t = A_t^{*T} A_t^* \mathbf{auth}_t$$

$$\lambda_t \mathbf{hub}_t = A_t^* A_t^{*T} \mathbf{hub}_t$$

$$\lambda_t = (\alpha_t \beta_t)^{-1}$$