Emerging Markets Currency Interconnectedness in the aftermath of the Great Recession

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What is this paper about?

- The spillover effects of the so-called contagion effect of financial/economic crises
- Fragile Five (Brazil, India, Indonesia, South Africa and Turkey)
  - Ren (2016)
- Forex markets
- Great Recession of 2008
- Connectedness via Diebold-Yilmaz
- In anticipation
  - Biggest contributor “own” effects for all currencies

Why do we care?

- Academic interest
- MP maker interest
- Investor interest

Idea

- International investors reshuffle portfolios by cross-country currencies → interactions among currencies (Chadwick, 2018)
- Connected markets spread risks
- Understanding connectedness crucial especially after crises (Engle and Manganelli, 1999)
- Emerging markets more prone to contagion (Aydemir, Guloglu and Saridogan, 2020)
- Dollar as vehicle of transmission

Fragile Five

- Ren (2016)
- Fragile Five: Brazil, India, Indonesia, South Africa and Turkey
- Too dependent on foreign investment to finance growth
- Constant K-inflow~K-flight
- Certain common characteristics: vulnerable to swings in world financial markets
  - high inflation
  - high current account deficit
  - low growth

Literature Review

- Engle (1982): financial contagion
- Large literature about int'l economic crises in developed countries (Antonakakis, et al., 2018)
- BRICS stock markets connected to US (Mensi et al., 2016)
- Latin American countries more susceptible to US MP (Chadwick, 2018)
- Financial markets more connected (Karanasos et al., 2016)
- Financial but no economic connectedness b/w US and GCC (Genc, Jubain and Al-Mutairi, 2010)
- Financial crises have differing impact on exchange rates of Fragile Five countries (Yildirim, 2016)
- Brazil most fragile in Fragile Five (Aydemir, Guloglu and Saridogan (2020)
- Currencies of Fragile Five affected by US MP, especially after Great Recession
- Currencies of Fragile Five performed worse than other emerging markets during the Great Recession (Mishra et al., 2014)

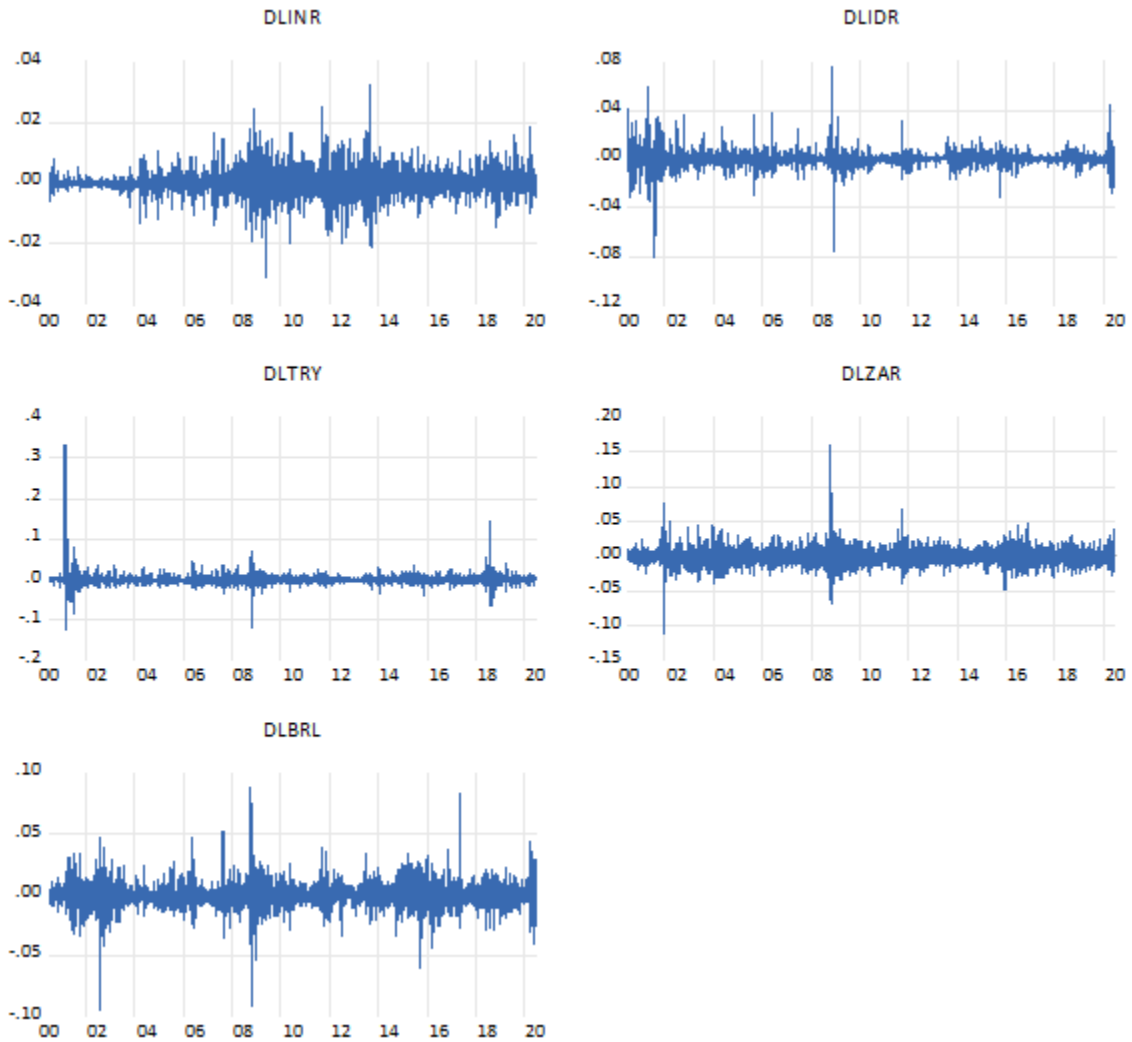
What we want to do

- No paper for connectedness of Fragile Five via DY

Data and Variables

- Financial returns:
  - Leptokurtic
  - Skewness in univariate distributions
  - Especially true for high frequency data
- $R_t = log(s_t - s_{t-1})$
  - s_t: exchange rate of the currency vis-à-vis the US dollar
- $R_t^+ = \begin{cases} R_t \; if \; R_t > 0 \\ 0 \; otherwise \end{cases}$ *depreciation of the currency against the US dollar*
- $R_t^- = \begin{cases} R_t \; if \; R_t < 0 \\ 0 \; otherwise \end{cases}$ *'good news'*

Returns


DLINR
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DLIDR
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DLZAR
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DLBRL
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00 02 04 06 08 10 12 14 16 18 20

Statistics

	DLINR	DLIDR	DLTRY	DLZAR	DLBRL
Mean	0.000101	9.39E-05	0.000461	0.000180	0.000213
Maximum	0.032513	0.076165	0.334807	0.161723	0.089188
Minimum	-0.030639	-0.080828	-0.125647	-0.111771	-0.093604
Std. Dev.	0.003810	0.005760	0.010790	0.011137	0.009533
Skewness	0.297544	-0.135057	6.469231	0.750308	0.146908
Kurtosis	9.997425	34.65576	201.1890	16.40651	13.37126
Jarque-Bera	10720.52	217844.5	8574635.	39559.27	23400.28
Probability	0.000000	0.000000	0.000000	0.000000	0.000000
Observations	5217	5217	5217	5217	5217

Statistics

- Average returns ≅ zero
- Differences in STDEV reflect volatility
- $Range = Max - Min$:

Country	Range
DLTRY	0.465
DLZAR	0.272
DLBRL	0.179
DLIDR	0.156
DLINR	0.063

- High kurtosis: fat tails
- JB: Rej H0: Normality

ECMT Theory: DY

- Diebold-Yilmaz: forecast error variance decomposition from VAR
- Connectedness: Integration: Spillovers
- Covariance-stationary VAR(p) with N variables (countries):
  - $y_t = \sum_{i=1}^{p} A_i y_{t-i} + \epsilon_t$
- Connectedness index via 'generalized variance decomposition' as opposed to Cholesky decomposition (Diebold and Yilmaz, 2014; Pesaran and Shin, 1998; Koop, Pesaran and Potter, 1996)
- h-step forecast error variance of i due to exogenous shocks to j:
  - $f_{ij}^{h} = \frac{\sigma_{jj}^{-1} \sum_{h=0}^{h-1} (e_i' A_h \Sigma e_j)^2}{\sum_{h=0}^{h-1} (e_i' A_h \Sigma A_h' e_i)}$

The Forecast Error Variance Decomposition (FEVD)

- How much of the future uncertainty in one of the endogenous variables is accounted for by future shocks into another variable in the estimation system
- Fraction of the overall forecast variance for a variable that can be attributed to each of the driving shocks in all the endogenous variables in the system

Contributions: *to* and *from*

- "Contribution *to* others" of i
  - $\sum_{j=1}^{N} f_{ij}^{h}$ for $i \neq j$,
- "Contribution *from* others" of i
  - $\sum_{j=1}^{N} f_{ji}^{h}$ for $i \neq j$
  - shares of shocks received from other markets in total variance of forecast error for each shock
  - adds up to 100 percent of all shocks including the "*own*" shock

Spillover index

- For N variables (countries):
  - $sp_N = \frac{1}{N}\sum_{i,j=1}^{N} f_{ij}^{h}$
- mathematical average of all "*to*" or "*from*" contributions with the exclusion of the "own" contribution
- $sp_N = 0$: No connection or systematic risk in the system
- $sp_N = 1$: All risk is driven by system interactions/dynamics, disabling any one country isolating from the spillovers of another

Analysis
UR Tests: ADF

Variables	Constant/Trend	Opt Lag	Test Stat	5%CV	UR/NoUR?	Differencing
DLINR	Constant	4	-29.09263	-2.861899	NoUR	Level
DLIDR	Constant	4	-29.08363	-2.861899	NoUR	Level
DLTRY	Constant	1	-54.87483	-2.861899	NoUR	Level
DLZAR	Constant	0	-73.61455	-2.861899	NoUR	Level
DLBRL	Constant	0	-68.17878	-2.861899	NoUR	Level

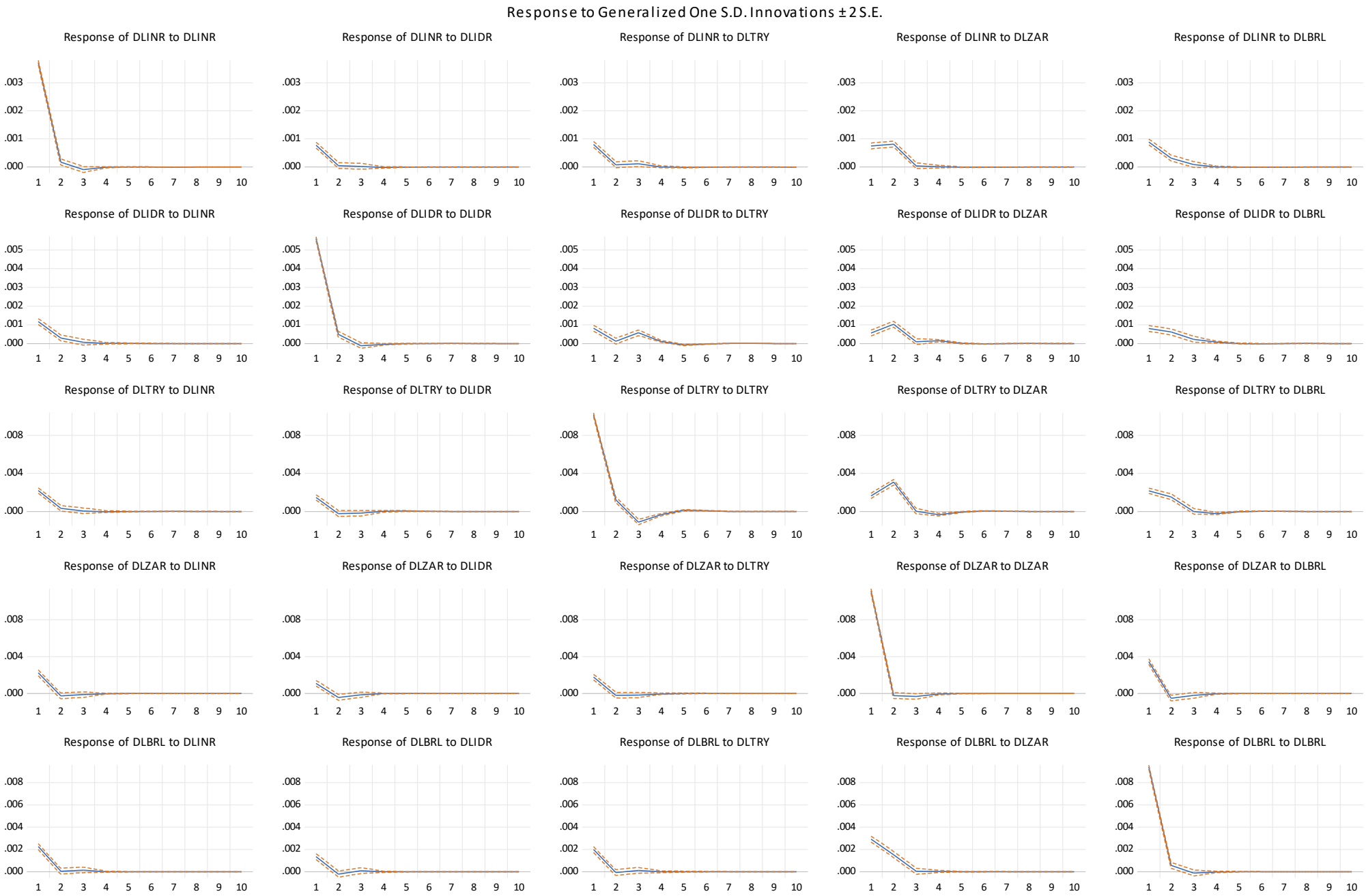
Analysis
UR Tests: KPSS

Variables	Constant/Trend	Opt Lag	Test Stat	5%CV	UR/NoUR?	Differencing
DLINR	Constant	2	0.188405	0.463000	NoUR	Level
DLIDR	Constant	2	0.054245	0.463000	NoUR	Level
DLTRY	Constant	1	0.201219	0.463000	NoUR	Level
DLZAR	Constant	4	0.110691	0.463000	NoUR	Level
DLBRL	Constant	1	0.310074	0.463000	NoUR	Level

VAR Opt Lag

Lag	LogL	LR	FPE	AIC	SC	HQ
0	91108.31	NA	4.31e-22	-35.00607	-34.99978	-35.00387
1	91540.08	862.5402	3.69e-22	-35.16237	-35.12458	-35.14915
2	91650.72	220.8157	3.57e-22	-35.19528	-35.12599*	-35.17105*
3	91681.42	61.20950	3.56e-22	-35.19747	-35.09669	-35.16222
4	91719.30	75.46197	3.54e-22	-35.20242	-35.07014	-35.15615
5	91756.74	74.50337	3.53e-22*	-35.20720*	-35.04342	-35.14992
6	91769.83	26.03065	3.54e-22	-35.20263	-35.00735	-35.13433
7	91789.44	38.94377	3.55e-22	-35.20055	-34.97379	-35.12124
8	91808.82	38.45150	3.56e-22	-35.19839	-34.94013	-35.10806
9	91831.81	45.56497	3.56e-22	-35.19762	-34.90786	-35.09627
10	91848.21	32.49439	3.57e-22	-35.19432	-34.87306	-35.08195
11	91879.51	61.92889	3.56e-22	-35.19674	-34.84399	-35.07336
12	91918.05	76.16968*	3.55e-22	-35.20194	-34.8177	-35.06754

IRF


Response to Generalized One S.D. Innovations ± 2 S.E.
Response of DLINR to DLINR
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Response of DLBRL to DLZAR
Response of DLBRL to DLBRL

IRF

Total Spillovers (Connectedness) for All Currencies

	DLINR	DLIDR	DLTRY	DLZAR	DLBRL	From Othe
DLINR	80.26	3.54	3.86	7.11	5.24	19.74
DLIDR	4.02	86.41	2.79	3.85	2.93	13.59
DLTRY	3.71	1.71	80.06	9.19	5.32	19.94
DLZAR	3.51	0.98	2.20	84.90	8.42	15.10
DLBRL	4.63	1.69	3.65	9.87	80.16	19.84
Contribution to others	15.87	7.92	12.50	30.02	21.92	88.23
Contribution including own	96.12	94.33	92.56	114.92	102.08	17.65

Total Spillovers (Connectedness) for All Currencies

- Interconnectedness among the currencies (17.65)
- biggest contributor “own” (over 80 for all currencies)
- If own excluded, the highest impact goes from
  - ZAR → BRL (9.87), TRY (9.19), INR (7.11)
  - BRL → ZAR (8.42)
  - INR → others (weakest)
- “Contribution to others”
  - ZAR → 30%
  - BRL → 21.92%
  - IDR → 7.92%

Net Pairwise Directional Spillover

	DLINR	DLIDR	DLTRY	DLZAR	DLBRL	Net Shocks	Conclusion
DLINR	0.00	-0.48	0.14	3.60	0.61	-4.36	Net receiver
DLIDR	0.48	0.00	1.08	2.88	1.24	-5.20	Net receiver
DLTRY	-0.14	-1.08	0.00	6.99	1.67	-8.66	Net receiver
DLZAR	-3.60	-2.88	-6.99	0.00	-1.45	8.44	Net transmitter
DLBRL	-0.61	-1.24	-1.67	1.45	0.00	0.22	Net transmitter

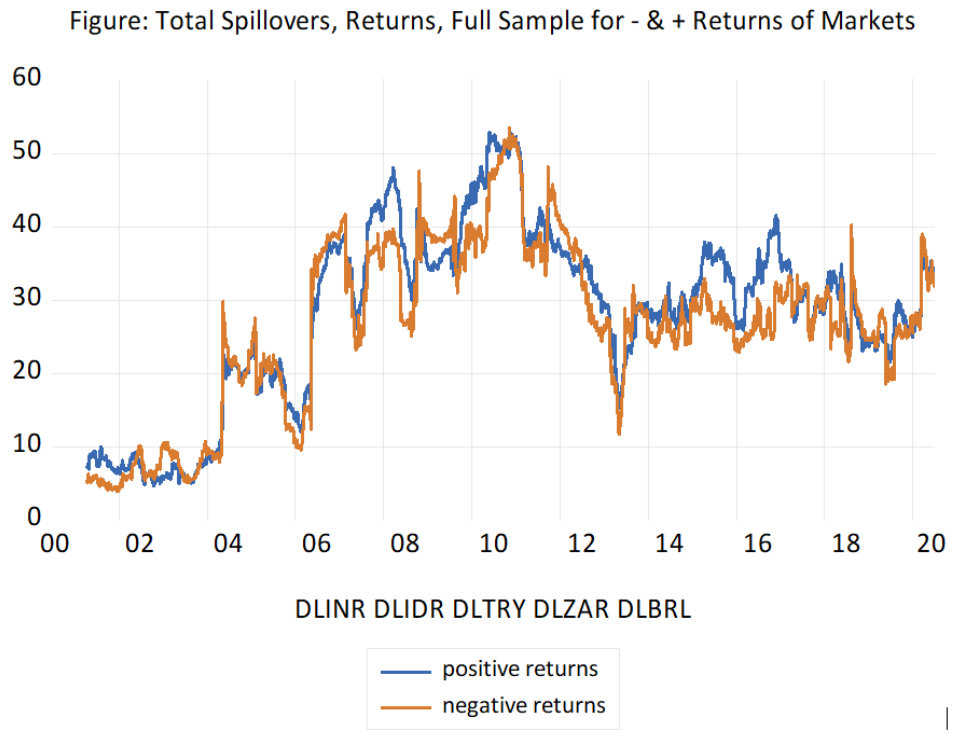
- Net pairwise directional spillovers quite small
  - each currency pair has 'equal' effects over each other
- most ‘unbalanced’ feedback effects b/w
  - ZAR & TRY (6.99)
  - ZAR & INR (3.60)

Dynamic Spillovers

Figure: Total Spillovers, Returns, Full Sample

- Window length is 200
  - Also tried 50 and 100 similar results
- Total connectedness of the system varies over time
- Large spikes around 2004, 2008 and 2011
- Connectedness in currency markets up prior to the global recession (Fall 2007)
- Heightened awareness
  - subsides after 2010
  - takes a drastic dive around 2013
  - climbs back up to some extent afterwards

Good vs Bad News



- Connectedness for the bad news: 15%
- Connectedness for the good news: 10%

Discussion of findings
Brazil

- Export revenues ⇔ commodity prices ($)
- Corr(Com Prices,USD)<0 (2003-mid 2016)
- Volatility in currency depends on the US economy and movements in the USD (Aloui et al., 2011)

Discussion of findings
India

- Export revenues ⇔ manufactured products
- Trade: low open
- Rupee insulated from global financial shocks such as the Lehman bankruptcy (Dimitriou et al., 2013)

Discussion of findings
All countries

- Shock durations relatively long (persistent)

Conclusions

- What: The spillover effects of the so-called contagion effect of financial/economic crises via DY
- Why: Academic/MP/Investor interest
- Findings:
  - Biggest contributor “own” effects for all currencies
  - ‘Bad news’ spreads faster than ‘good news’

Conclusions

Further study

- Literature not in agreement about measurement of tech (Mincer and Danninger 2000)
- Other technology indicators
  - Consumer Price Index for All Urban Consumers: Information technology, hardware and services, Index Dec 1988=100, Monthly
    - 'Specification leads to singular matrix in at least one sub-sample
  - Solow residual
  - Technology Diffusion (Comin and Hobijn (2004) and others)
- Alternative STDEV: fractional cointegration
- *Guardedly state that info tech has probably led to reduced divergence among inflation across regions in the USA, but did not kill price divergence as its power is not unlimited*

THANK Y'ALL FOR LISTENING!

- QUESTIONS
- COMMENTS
- CONCERNS
- ADDITIONS/SUBTRACTIONS

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Appendix

This paper is presented at

- ***Economic Research Forum*** "**THE GCC ECONOMIES IN THE WAKE OF COVID19: CHARTING THE ROAD TO RECOVERY AND RESILIENCE**"on Mar 9-10th, 2021 in Online
- ***Economics Seminar Series*** on Sept. 17, 2019 in American University of Sharjah