



FEDERAL RESERVE BANK *of* NEW YORK

International Capital Flow Pressures

by Linda Goldberg and Signe Krogstrup

Views expressed are those of the author and do not necessarily reflect the position of the Federal Reserve Bank of New York , the Federal Reserve System or the Swiss National Bank. BOK-KIEP-PIIE International Conference “Monetary Policy Options for Small Open Economies” Seoul, Korea July 19 2016.

Introduction

- Extensive discuss about waves of destabilizing capital inflows and outflows, and of policy options for small open economies.
- Long history of research on the topic
 - Which capital flows are stabilizing or destabilizing?
 - What are the drivers?
- Long history of discussion of policy options for small open economies.
 - Toolkits and policy regimes
- More recently, also extensive discussion of implications and options for large open economies.
 - Challenges and focus on safe haven flows, global liquidity

This paper – still preliminary

- Propose modified **Exchange Market Pressure** Index
 - Construct monthly measures for 59 countries, 1980-2015.
 - Explore differences across alternative construction measures
 - Role of weighting schemes and policy regimes
- Propose the **Global Risk Response Index**
 - Time-varying correlation of EMP with VIX
- Evolving Risk-On (so-called Safe Haven) vs Risk-Off status of countries
 - International capital flows pressures changes in amplitude and sign.
- Ultimate goal: How do capital flows respond to global risk, what determines this response, why are things changing?

Measuring Capital Flow Response to Global Risk

- EM capital flow literature typically studies link between global risk and international volumes (gross, net) [eg Forbes and Warnock 2012 JIE].
 - Drawbacks: Volume data is low frequency relative to variation in price data and risk aversion. Available only with lags, revisions, imprecise.
- Safe haven literature focusses more on asset price metrics, for example the link between global risk and exchange rate appreciation.
 - Advantage: Higher frequency data better to match variation in risk.
 - Drawbacks: Capital flows may not lead to exchange rate appreciation if authorities intervene in FX markets or use other instruments.
- Need a measure of appreciation pressures that takes account of FX interventions: **The exchange market pressure index.**

Measuring Exchange Market Pressure

The exchange market pressure (*EMP*) index in the literature combines exchange rate changes and reserves losses. (Girton and Roper, AER 1977)

Study	EMP Measure	Scaling Variable	Weighting
Girton and Roper [1977]	$\left(\frac{\Delta e^n}{e^n}\right) - \left(\frac{\Delta R}{M1}\right)$	M1	Equal
Eichengreen, Rose and Wyplosz [1994]	$w_e \left(\frac{\Delta e^n}{e^n}\right) - w_R \left(\frac{\Delta R}{M1} - \frac{\Delta R^*}{M1^*}\right) + w_i [\Delta(i - i^*)]$	M1	Precision
Kaminsky and Reinhart [1999]	$w_e \left(\frac{\Delta e^n}{e^n}\right) - w_R \left(\frac{\Delta R}{R}\right)$	Reserves	Precision
Aizenman, Ito, and Chinn [2015]	$w_e \left(\frac{\Delta e^n}{e^n}\right) - w_R \left(\frac{\Delta R}{NGDP} - \frac{\Delta R^*}{NGDP^*}\right) + w_i [\Delta(i - i^*)]$	Nominal GDP	Precision
Goldberg and Krogstrup [2016]	$(1 - \bar{w}_R) \left(\frac{\Delta e^n}{e^n}\right) - \bar{w}_R \left(\frac{\Delta R}{m \cdot NGDP}\right)$	monetary base	Goldberg and Krogstrup
e^n	Nominal Exchange Rate		
R	International Reserves		
i	Nominal interest rate (money market rate)		
$M1$ 07-13-2016	M1 is a measure of the money supply that includes all physical money, demand deposits, checking accounts and Negotiable Order of Withdrawal (NOW) accounts.		

Measuring Exchange Market Pressure

The exchange market pressure (*EMP*) index in the literature combines exchange rate changes and reserves losses. (Girton and Roper, AER 1977)

Weighting in the literature is largely “precision weights”

- reflecting controls for signal to noise in data.
- But damps importance of variable that frequently adjusts to shock

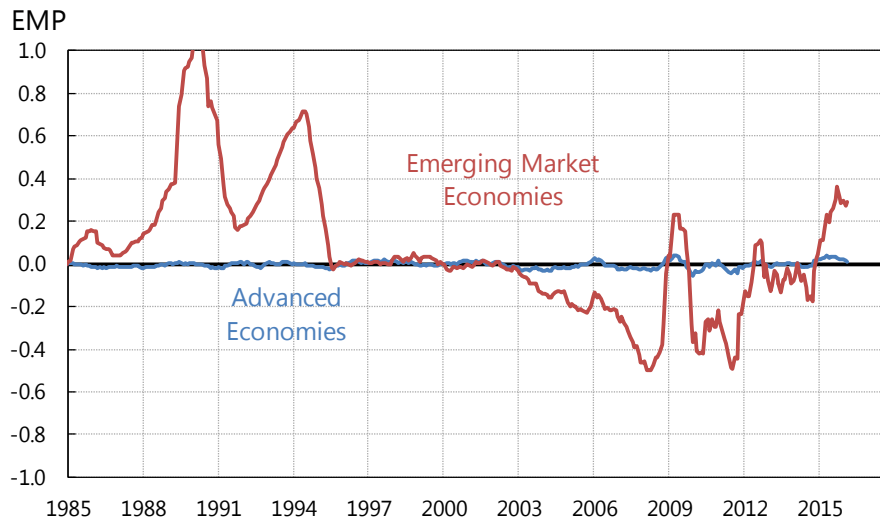
We propose new weights that stress the components which best captures exchange rate regimes. We weight reserves by the money base.

Modified *EMP*:
$$(1 - \bar{w}_R) \left(\frac{\Delta e^n}{e^n} \right) - \bar{w}_R \left(\frac{\Delta R}{m \cdot NGDP} \right)$$

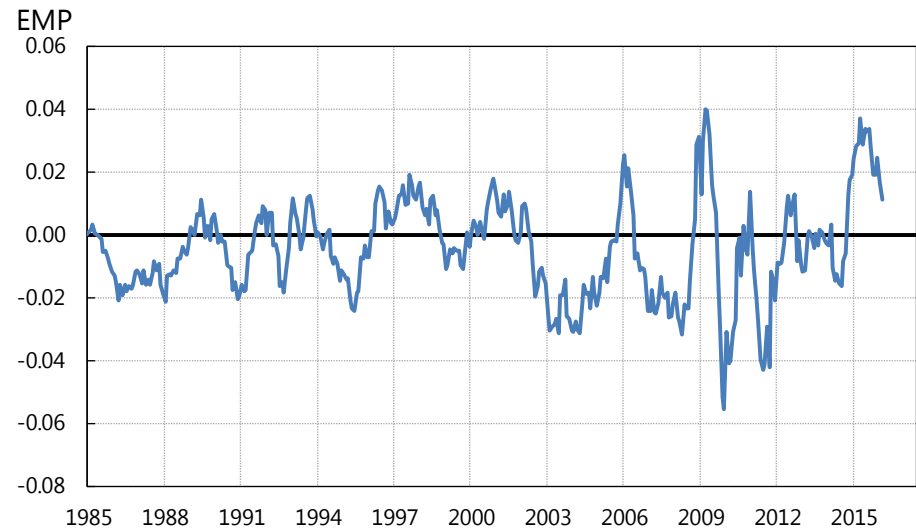
$$\bar{w}_R = \frac{var_R}{var_e + var_R}$$

Emerging Market Economies and Advanced Economies. GDP-weighted Goldberg-Krogstrup EMP Measure.

Panel A: Advanced Economies vs. Emerging Market Economies



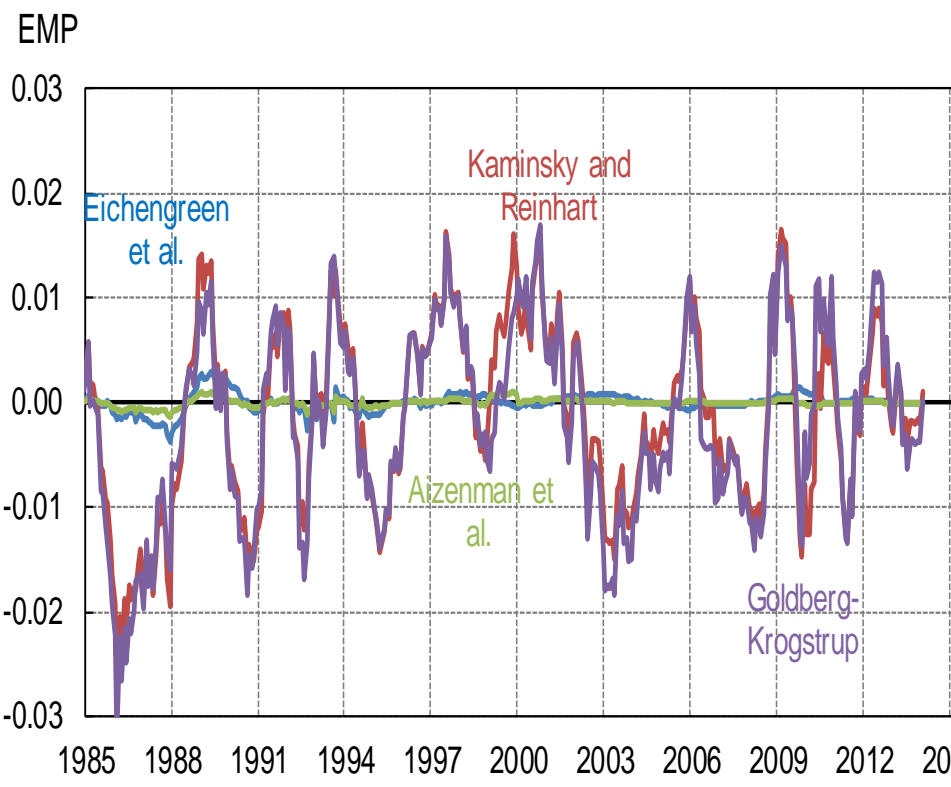
Panel B: Advanced Economies



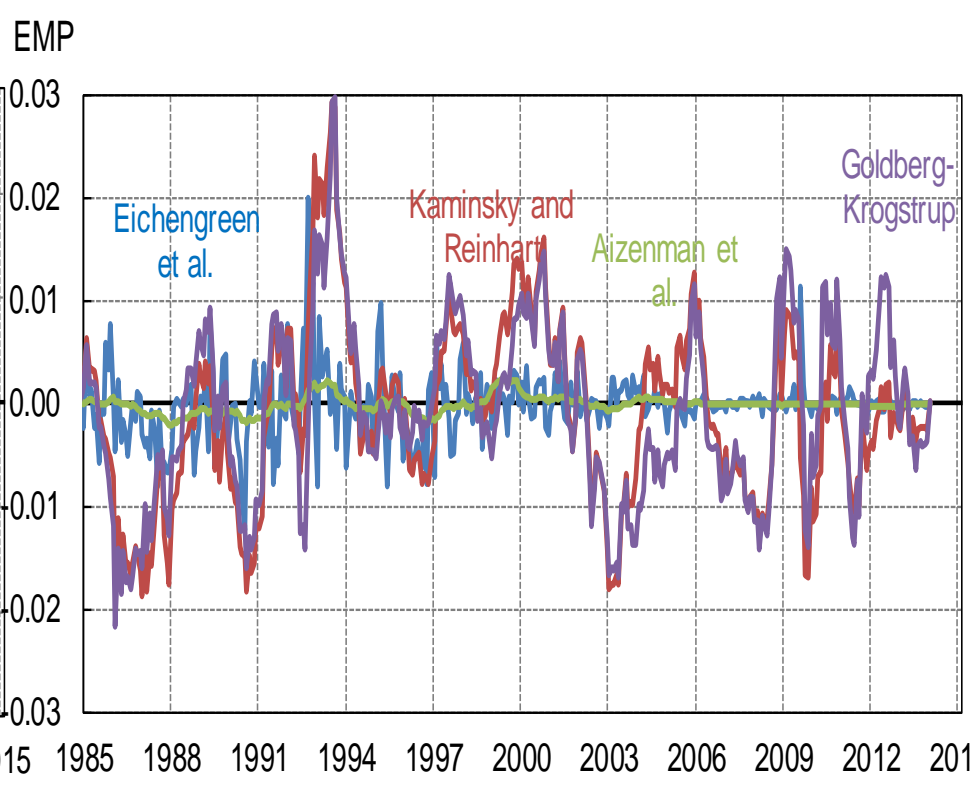
- Periods of outflow pressures (+EMP) and inflow pressures (-EMP).
- Emerging markets historically had much larger EMP than AEs.
- Periods of high volatility, and very low volatility.
- Recent amplitudes less than those historically.
- Amplitudes for advanced economies have increased.

The weighting schemes don't matter much for EMPs of core euro area countries as reserves are seldom used.
 EMP differences across periphery, especially pre-euro area, more substantial and movements noisier.

Core Euro Area
 GDP-Weighted EMP Index



Periphery Euro Area
 GDP-Weighted EMP Index



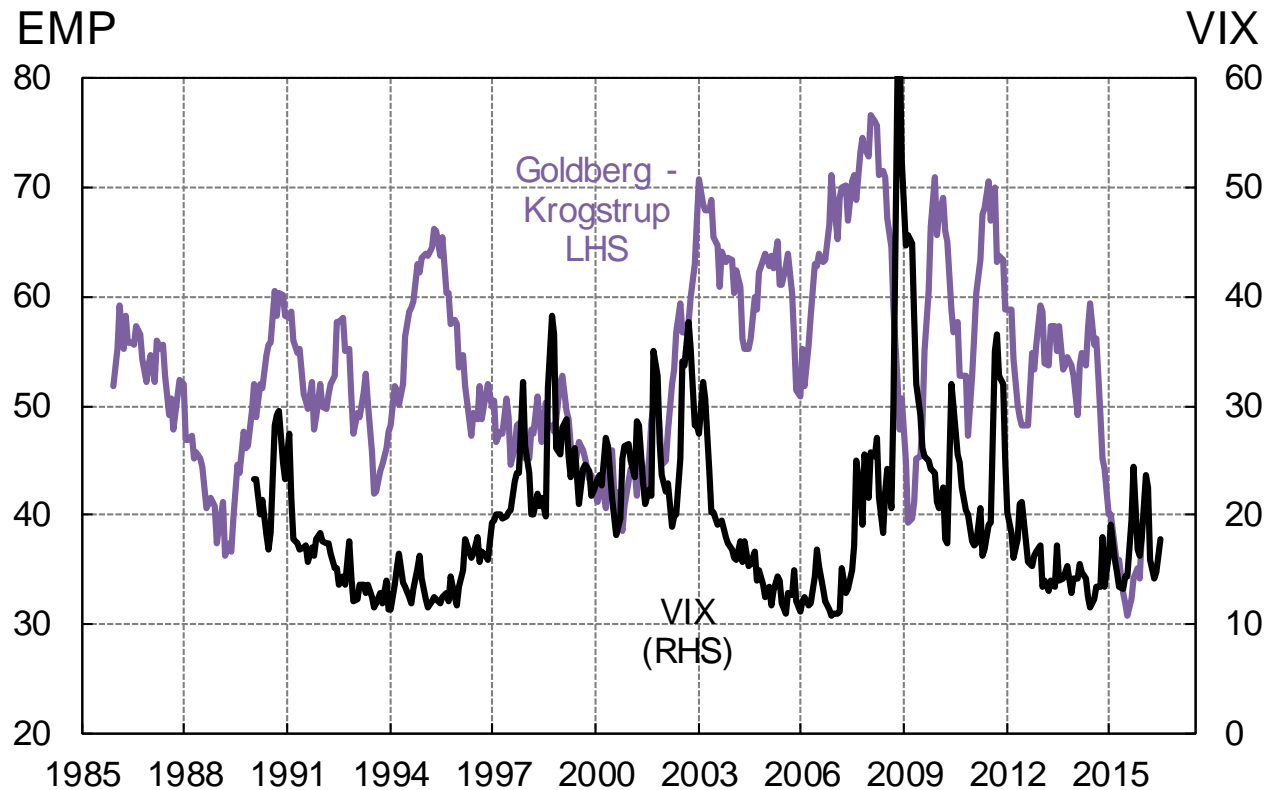
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Note: Core includes Austria, Belgium, Germany, Finland, France, and the Netherlands.

Note: Periphery includes Spain, Greece, Ireland, Italy, and Portugal.

The share of countries experiencing capital inflow (currency appreciation) pressures varies widely. More countries experience inflow pressures when risk conditions are low.

Share of Countries with Appreciation Pressure



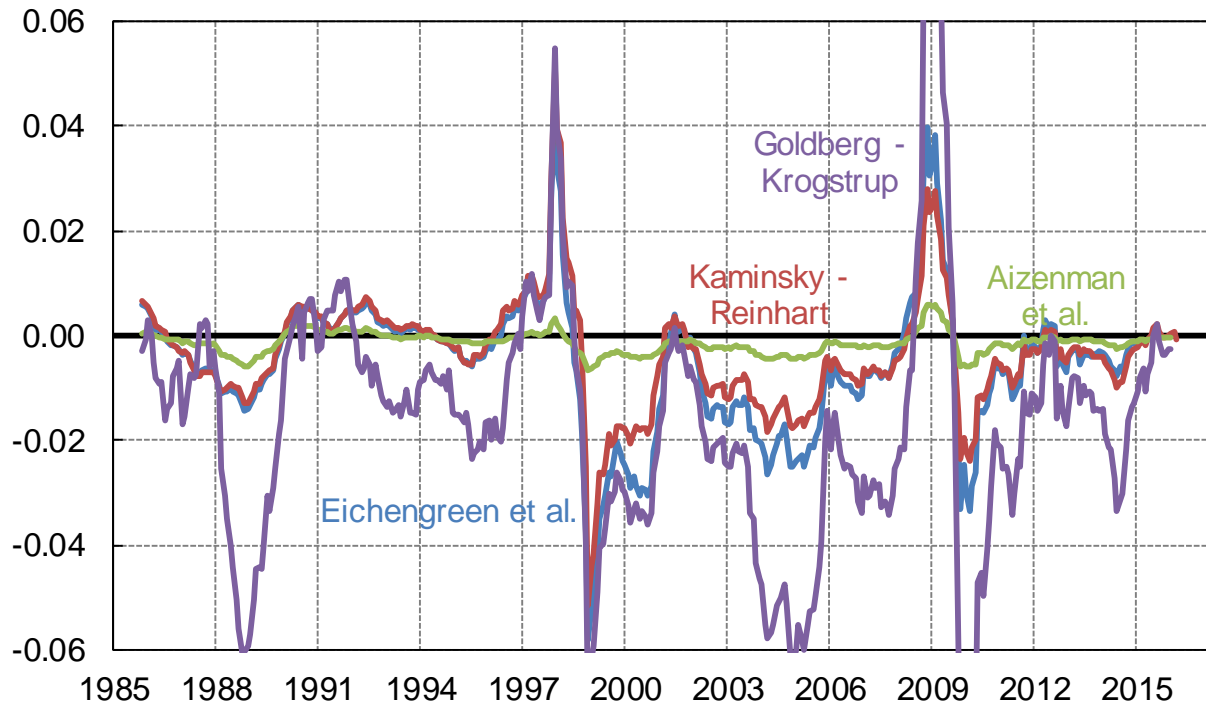
1985 – 1992: average of 47 countries have data (out of 59). 1993-2015 an average of 58 countries have data. GDP-weighted Goldberg-Krogstrup EMP Measure shown.

Exchange Market Pressure Index by Country.

Indexes are the 12-month moving average using the nominal exchange rate vis-à-vis the USD.

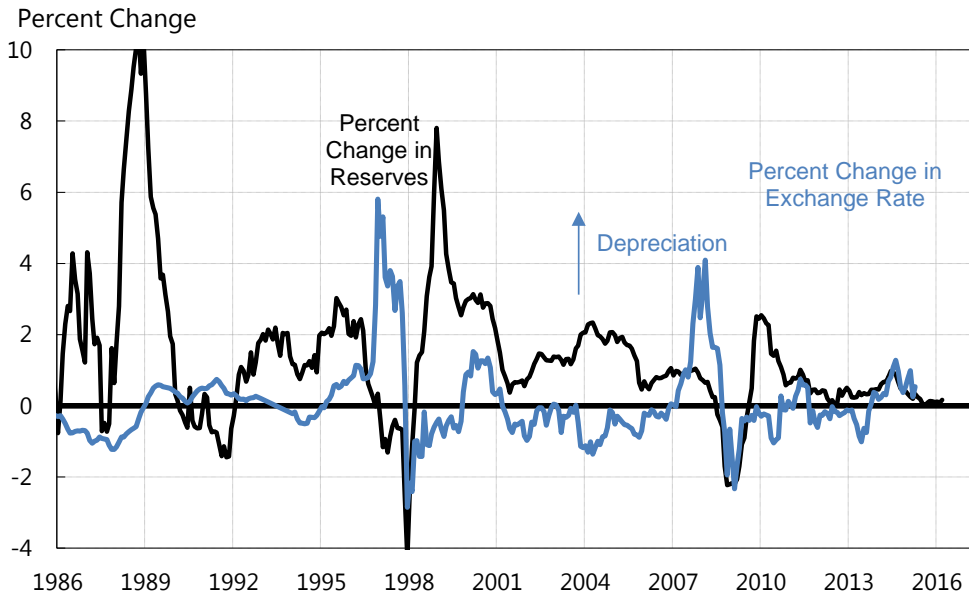
Panel B: Korea

EMP

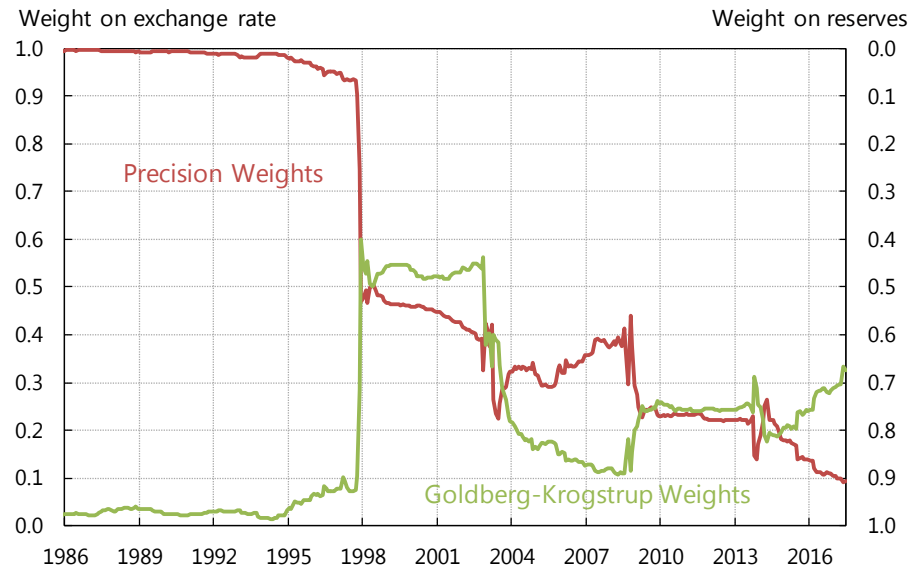


Components of the index illustrate the respective roles of reserves, exchange rates, and the weighting scheme.

Panel B: Korea

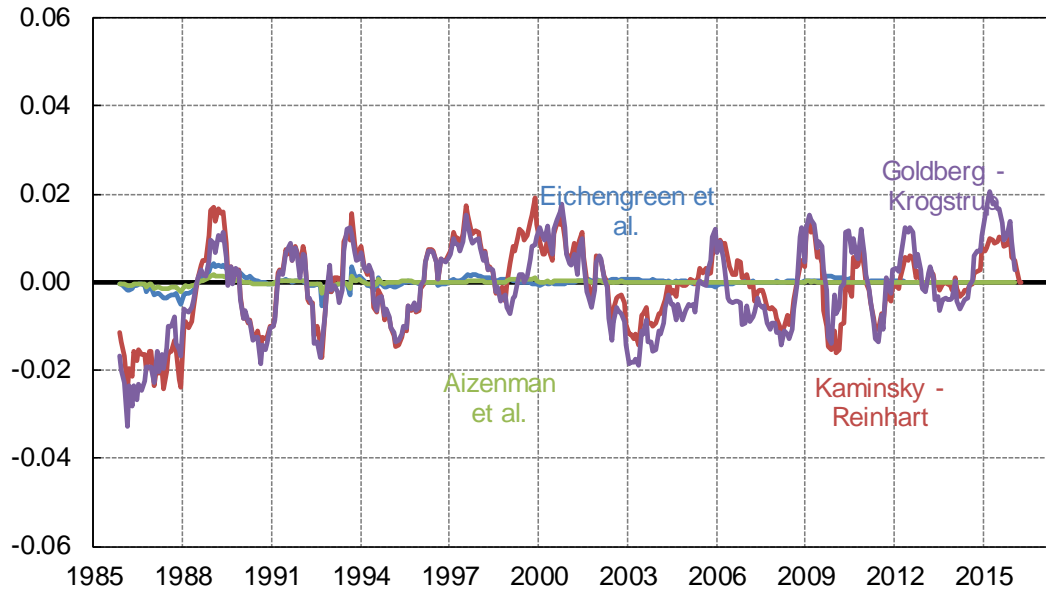


Panel B: Korea



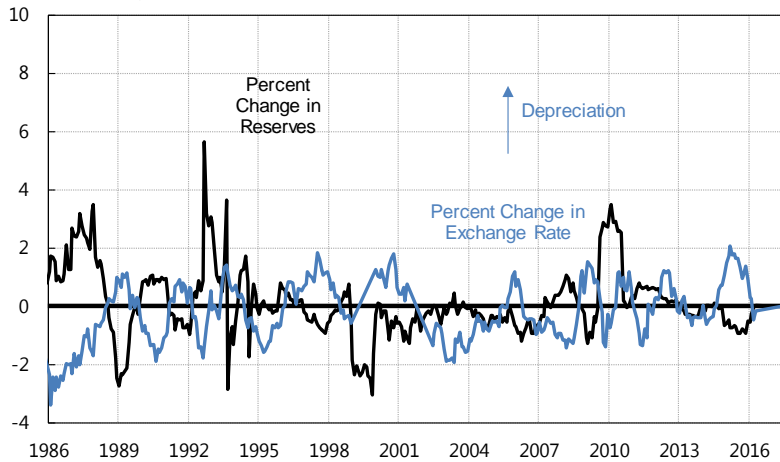
Panel C: Germany

EMP



Panel C: Germany

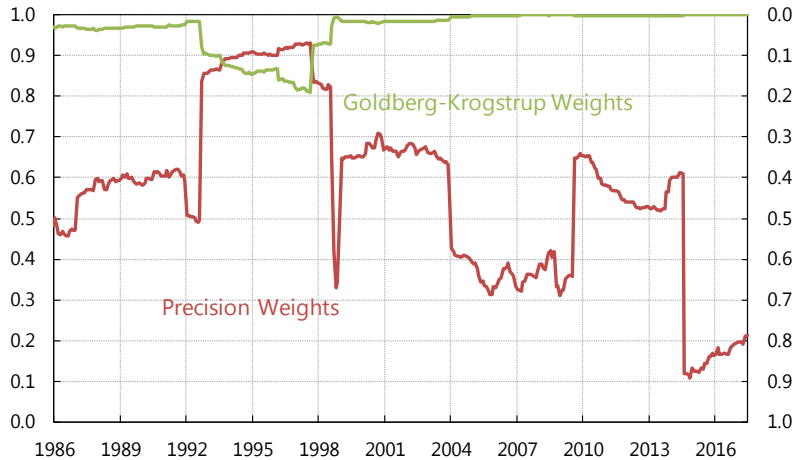
Percent Change



Panel C: Germany

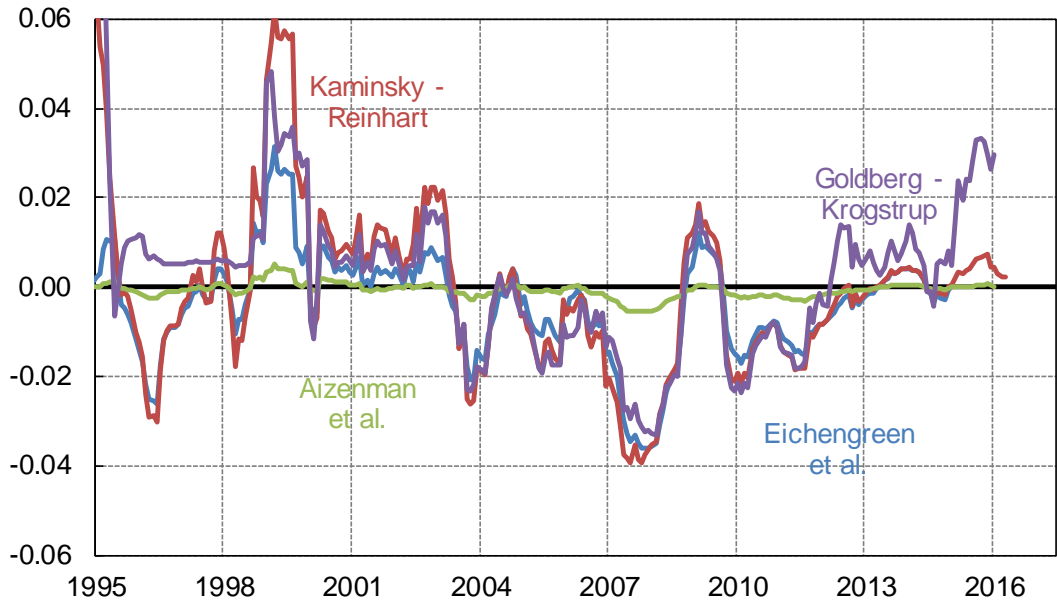
Weight on exchange rate

Weight on reserves



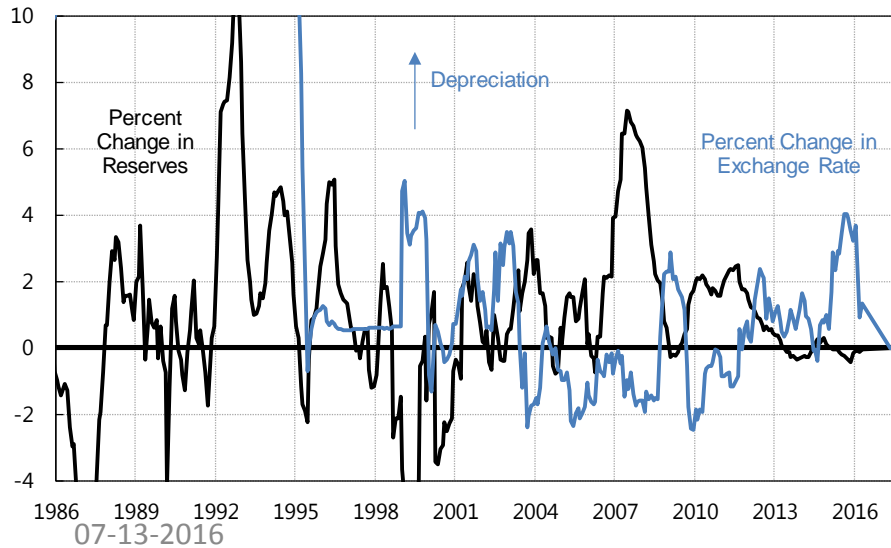
Panel D: Brazil

EMP



Panel D: Brazil

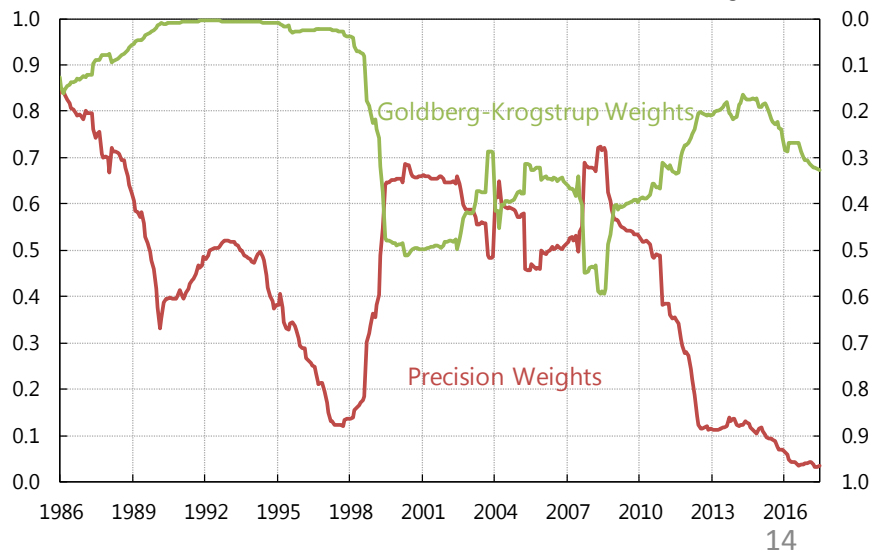
Percent Change



Panel D: Brazil

Weight on exchange rate

Weight on reserves



The Global Risk Response Index (the *GRR*)

A novel measure of capital flow pressure responsiveness to global risk.

GRR measures the correlation between *EMP* and *VIX* across $t - n$ and t .

$$GRR_t^c = \rho_{EMP, VIX} = \frac{-E_{i=t-n,t}[(EMP_i^c - \mu_{EMP^c})(VIX_i - \mu_{VIX})]}{\sigma_{EMP^c} \sigma_{VIX}}$$

$GRR_t^c > 0$: country specific “safe haven” behavior of private flows.

- $GRR_t^c < 0$: country specific “risk off” behavior of private flows.
- The GRR does not reflect the average direction of capital flows, only the implied correlation of these with the *VIX*.

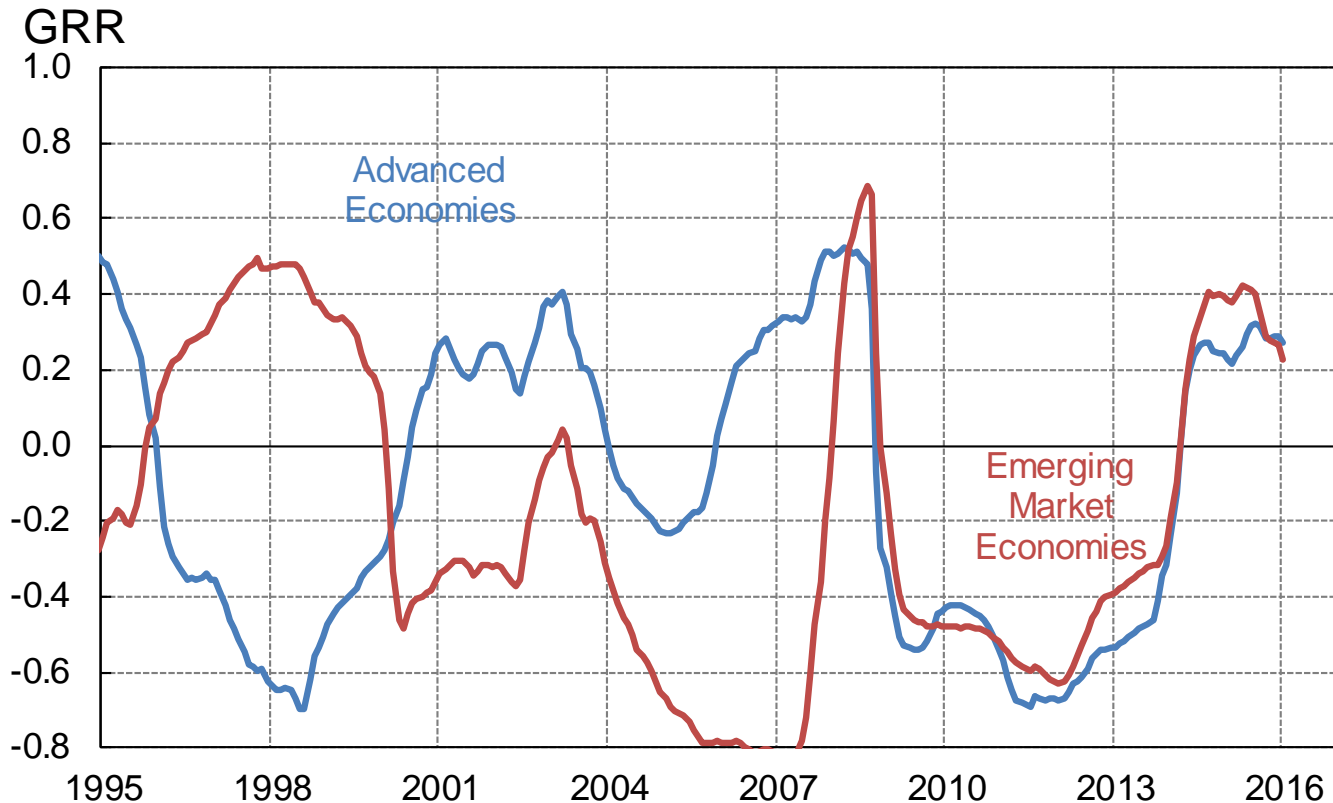
The Global Risk Response Index: The Data

- Monthly data for panel of 59 emerging and advanced economies,
- 1984-2015. Most data available from mid-1990s.
- Source: IFS, Datastream, National Sources.
- Bilateral exchange rates to capture appreciation pressures (exception U.S. and U.K.) *n = 60 months*

Global Risk Response Index for Advanced Economies and Emerging Market Economies.

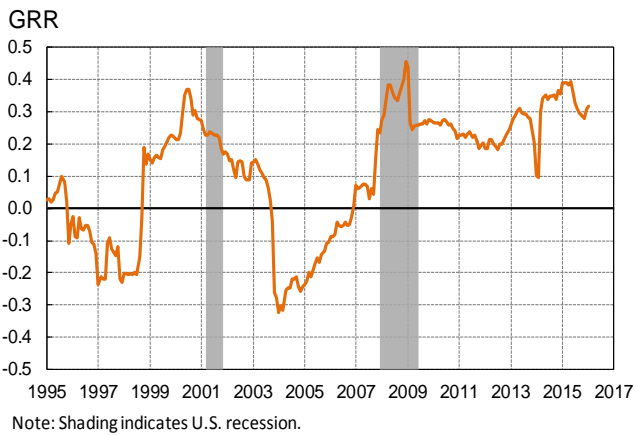
AE and EMs moved from being on opposite sides of pressure, to behaving more similarly with country-specific discrimination.

Advanced Economies and Emerging Market Economies

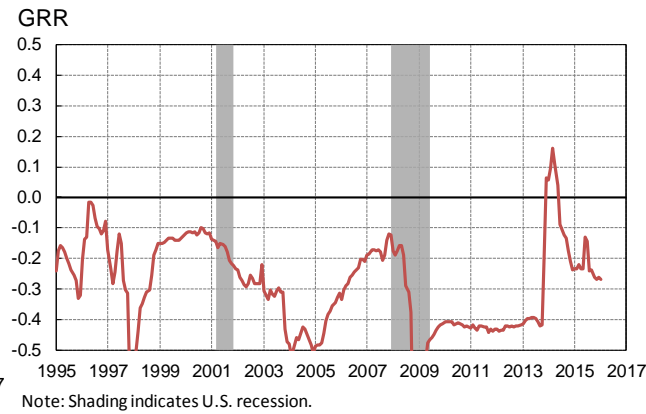


Global Risk Response Index (Correlation between the EMP and VIX). Country status as “safe haven” evolves considerably over time.

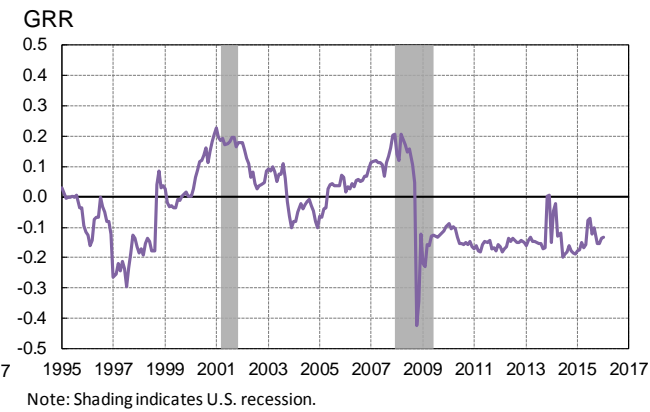
Panel A: Japan



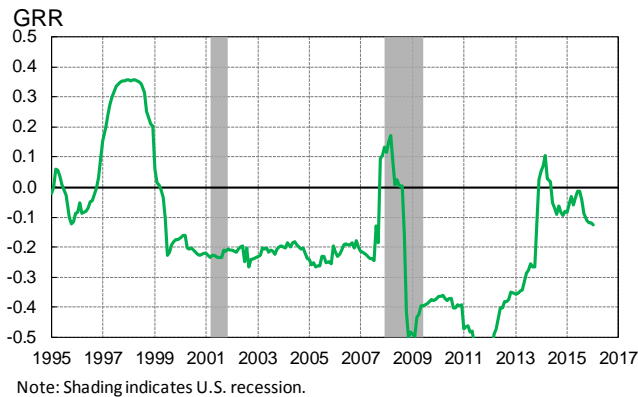
Panel B: Korea



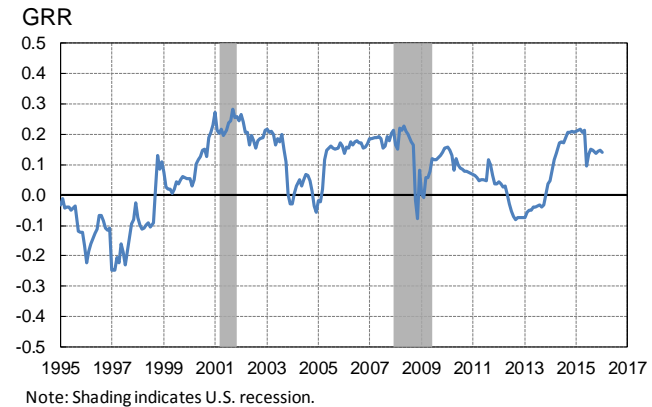
Panel C: Germany



Panel D: Brazil



Panel E: Switzerland



Global Risk Response Index Heat Map. GRR over 60-month intervals.

Top 10 Safe Havens	1990-1995	1995-2000	2000-2005	2005-2010	2010-2015
United States	-0.15	-0.02	0.26	0.31	0.22
Denmark	0.03	-0.03	0.09	0.34	0.11
Japan	0.03	0.21	-0.24	0.27	0.39
Slovenia	--	0.02	0.13	0.11	-0.03
Switzerland	-0.03	0.05	-0.02	0.16	0.21
Hong Kong, China	--	--	-0.14	0.37	0.01
Venezuela, RB	0.12	0.18	-0.01	-0.10	0.04
Guatemala	-0.28	0.18	-0.01	-0.07	0.00
Chile	0.19	-0.07	-0.02	-0.07	0.23
Argentina	-0.29	-0.02	0.09	-0.14	0.07

Note: Blue indicates positive correlation between VIX and capital inflow pressures. Red indicates negative correlation.

Bottom 10 Safe Havens	1990-1995	1995-2000	2000-2005	2005-2010	2010-2015
Colombia	0.18	-0.13	-0.41	-0.21	-0.03
Poland	-0.06	-0.19	-0.15	-0.33	-0.24
Canada	-0.03	-0.12	-0.05	-0.21	-0.11
Singapore	0.12	-0.04	-0.30	-0.16	-0.17
Malaysia	-0.09	0.23	-0.49	-0.45	-0.01
Brazil	-0.02	-0.17	-0.24	-0.36	-0.08
Bolivia	-0.19	-0.23	-0.14	-0.25	0.02
Turkey	0.04	-0.07	-0.11	-0.48	-0.22
Korea, Rep.	-0.24	-0.12	-0.49	-0.41	-0.23
Russian Federation	--	--	-0.44	-0.68	-0.01

Note: Blue indicates positive correlation between VIX and capital inflow pressures. Red indicates negative correlation.

Next steps

- EMP and GRR show that capital flow pressures vary considerably, respond to global risk, and correlations shift over time.
- Evolving safe haven status. Why?
 - Complementary to Avdjiev, Gambacorta, Goldberg and Schiaffi using BIS data on cross-border loans and international debt securities showing changing responses to Fed Funds and VIX : VIX sensitivity now higher on debt securities, lower on loan flows.

Next:

- Depart from previous literature that focuses on the role of domestic macroeconomic fundamentals in driving foreign capital in or out during risk-off episodes.
- Argue that resident capital flows and recent changes in domestic financial market structure may play a more important role for a country's capital flow response to global risk than previously thought.

Thank you.

Table 2: Monthly frequency of the EMP from 1984.

Country	CC	Time Frame	Observations	AE/EM	Country	CC	Time Frame	Observations	AE/EM
United States	US	12/1984 - 1/2016	374	AE	India	IN	12/1984 - 1/2016	374	EM
Great Britian	GB	12/1984 - 1/2016	374	AE	Iceland	IS	12/1984 - 1/2016	374	AE
Argentina	AR	12/1984 - 1/2016	374	EM	Italy	IT	12/1984 - 1/2016	374	AE
Austria	AT	12/1984 - 1/2016	374	AE	Japan	JP	12/1984 - 1/2016	374	AE
Australia	AU	12/1984 - 1/2016	374	AE	Korea, Rep.	KR	12/1984 - 1/2016	374	EM
Bangladesh	BD	12/1984 - 1/2016	374	EM	Sri Lanka	LK	12/1984 - 1/2016	374	EM
Belgium	BE	12/1984 - 1/2016	374	AE	Lithuania	LT	2/1993 - 1/2016	263	EM
Bolivia	BO	12/1984 - 1/2016	374	EM	Luxembourg	LU	2/1992 - 1/2016	288	AE
Brazil	BR	12/1984 - 1/2016	374	EM	Latvia	LV	3/1993 - 1/2016	269	EM
Canada	CA	12/1984 - 1/2016	374	AE	Mexico	MX	12/1984 - 1/2016	374	EM
Switzerland	CH	12/1984 - 1/2016	374	AE	Malaysia	MY	12/1984 - 1/2016	374	EM
Chile	CL	12/1984 - 1/2016	374	EM	Nicaragua	NI	2/1992 - 1/2016	288	EM
China	CN	12/1984 - 1/2016	374	EM	Netherlands	NL	12/1984 - 1/2016	374	AE
Colombia	CO	12/1984 - 1/2016	374	EM	Norway	NO	12/1984 - 1/2016	374	AE
Czech Republic	CZ	3/1993 - 1/2016	275	AE	New Zealand	NZ	12/1984 - 1/2016	374	AE
Germany	DE	12/1984 - 1/2016	374	AE	Panama	PA	12/1984 - 1/2016	374	EM
Denmark	DK	12/1984 - 1/2016	374	AE	Peru	PE	12/1984 - 1/2016	374	EM
Estonia	EE	3/1993 - 1/2016	275	AE	Philippines	PH	12/1984 - 1/2016	374	EM
Spain	ES	12/1984 - 1/2016	374	AE	Poland	PL	8/1986 - 1/2016	354	EM
Finland	FI	12/1984 - 1/2016	374	AE	Portugal	PT	12/1984 - 1/2016	374	EM
France	FR	12/1984 - 1/2016	374	AE	Romania	RO	12/1984 - 1/2016	368	EM
Great Britian	GB	12/1984 - 1/2016	374	AE	Russian Federation	RU	2/1995 - 1/2016	252	EM
Greece	GR	12/1984 - 1/2016	374	EM	South Africa	ZA	12/1984 - 1/2016	374	EM
Guatemala	GT	12/1984 - 1/2016	374	EM	Sweden	SE	12/1984 - 1/2016	374	AE
Hong Kong, China	HK	1/1997 - 1/2016	228	EM	Singapore	SG	12/1984 - 1/2016	374	AE
Croatia	HR	2/1993 - 1/2016	276	AE	Slovenia	SI	2/1992 - 1/2016	287	EM
Hungary	HU	11/1989 - 1/2016	316	EM	Slovak Republic	SK	3/1993 - 1/2016	275	EM
Indonesia	ID	12/1984 - 1/2016	374	EM	Thailand	TH	12/1984 - 1/2016	374	EM
Ireland	IE	12/1984 - 1/2016	374	EM	Turkey	TR	3/1987 - 1/2016	347	EM
Israel	IL	12/1984 - 1/2016	374	EM	Venezuela, RB	VE	12/1984 - 1/2016	374	EM

Table 3: GRR Summary Statistics. 5-year rolling correlation between EMP and VIX. 1994-2015

Country	Average	Standard Deviation	Minimum	Maximum	Country	Average	Standard Deviation	Minimum	Maximum
United States	0.14	0.18	-0.20	0.52	Finland	-0.07	0.11	-0.41	0.21
Denmark	0.13	0.13	-0.41	0.41	Thailand	-0.07	0.19	-0.66	0.44
Japan	0.12	0.19	-0.32	0.46	Philippines	-0.07	0.16	-0.44	0.33
Slovenia	0.09	0.11	-0.19	0.28	South Africa	-0.07	0.12	-0.52	0.20
Switzerland	0.07	0.12	-0.25	0.28	Hungary	-0.07	0.15	-0.45	0.24
Hong Kong, China	0.06	0.22	-0.36	0.41	Lithuania	-0.08	0.11	-0.33	0.16
Venezuela, RB	0.04	0.09	-0.20	0.40	Ireland	-0.08	0.10	-0.43	0.20
Guatemala	0.04	0.12	-0.28	0.37	Luxembourg	-0.08	0.12	-0.41	0.21
Chile	0.00	0.12	-0.20	0.31	Czech Republic	-0.09	0.16	-0.54	0.22
Argentina	0.00	0.16	-0.62	0.26	Slovak Republic	-0.09	0.22	-0.55	0.28
Iceland	-0.01	0.11	-0.23	0.22	United Kingdom	-0.10	0.18	-0.66	0.23
Panama	-0.01	0.08	-0.20	0.35	Sri Lanka	-0.10	0.12	-0.35	0.16
Sweden	-0.02	0.13	-0.48	0.27	India	-0.11	0.20	-0.52	0.27
Estonia	-0.02	0.06	-0.20	0.14	Indonesia	-0.11	0.18	-0.49	0.18
Italy	-0.03	0.11	-0.42	0.20	Peru	-0.12	0.21	-0.47	0.28
Australia	-0.03	0.09	-0.26	0.20	China	-0.12	0.21	-0.48	0.25
Spain	-0.03	0.12	-0.43	0.21	Latvia	-0.13	0.12	-0.63	0.13
Bangladesh	-0.03	0.10	-0.29	0.26	Mexico	-0.13	0.18	-0.60	0.21
Netherlands	-0.04	0.13	-0.43	0.25	Romania	-0.13	0.14	-0.49	0.18
Nicaragua	-0.04	0.13	-0.23	0.40	Colombia	-0.14	0.15	-0.42	0.25
France	-0.04	0.12	-0.42	0.23	Poland	-0.14	0.17	-0.48	0.29
Germany	-0.04	0.13	-0.42	0.23	Canada	-0.14	0.10	-0.53	0.06
Belgium	-0.04	0.13	-0.43	0.23	Singapore	-0.15	0.14	-0.58	0.16
Israel	-0.04	0.14	-0.34	0.34	Malaysia	-0.16	0.27	-0.54	0.30
Austria	-0.05	0.12	-0.43	0.22	Brazil	-0.16	0.21	-0.53	0.36
New Zealand	-0.05	0.15	-0.37	0.26	Bolivia	-0.17	0.16	-0.40	0.43
Portugal	-0.05	0.10	-0.44	0.19	Turkey	-0.20	0.18	-0.64	0.08
Croatia	-0.06	0.14	-0.44	0.21	Korea, Rep.	-0.29	0.15	-0.77	0.16
Norway	-0.06	0.10	-0.41	0.15	Russian Federation	-0.45	0.22	-0.75	0.05
Greece	-0.06	0.11	-0.48	0.22					