Transmission of the U.S. Subprime Crisis to Emerging Markets: Evidence on the Decoupling-Recoupling Hypothesis

Michael Dooley and Michael Hutchison
University of California, Santa Cruz

# Transmission of U.S. subprime crisis to emerging markets

- How has US subprime crisis transmitted to emerging markets?
- Until Fall 2008, widespread view that EMs were insulated from crisis. "Decoupled"?
  - Why? Widespread reforms, reserve buildup, sectoral balance, less fx debt
- EMs hit hard late by mid-2008: "Recoupling"?

Narrative: Three Phases of Crisis

- Cumulative losses in EM debt and equity markets similar to IC over Feb 2007 – March 2009, but decoupling at beginning
- Phase 1: Feb 2007 – May 19, 2008
  - "Golden period" of decoupling of EM and US
- Phase 2: May 19, 2008 – Lehman Day
- Phase 3: Post-Lehman (9/15/08 – 3/31/09)

Chart 1 U.S. and Emerging Market Equity Prices
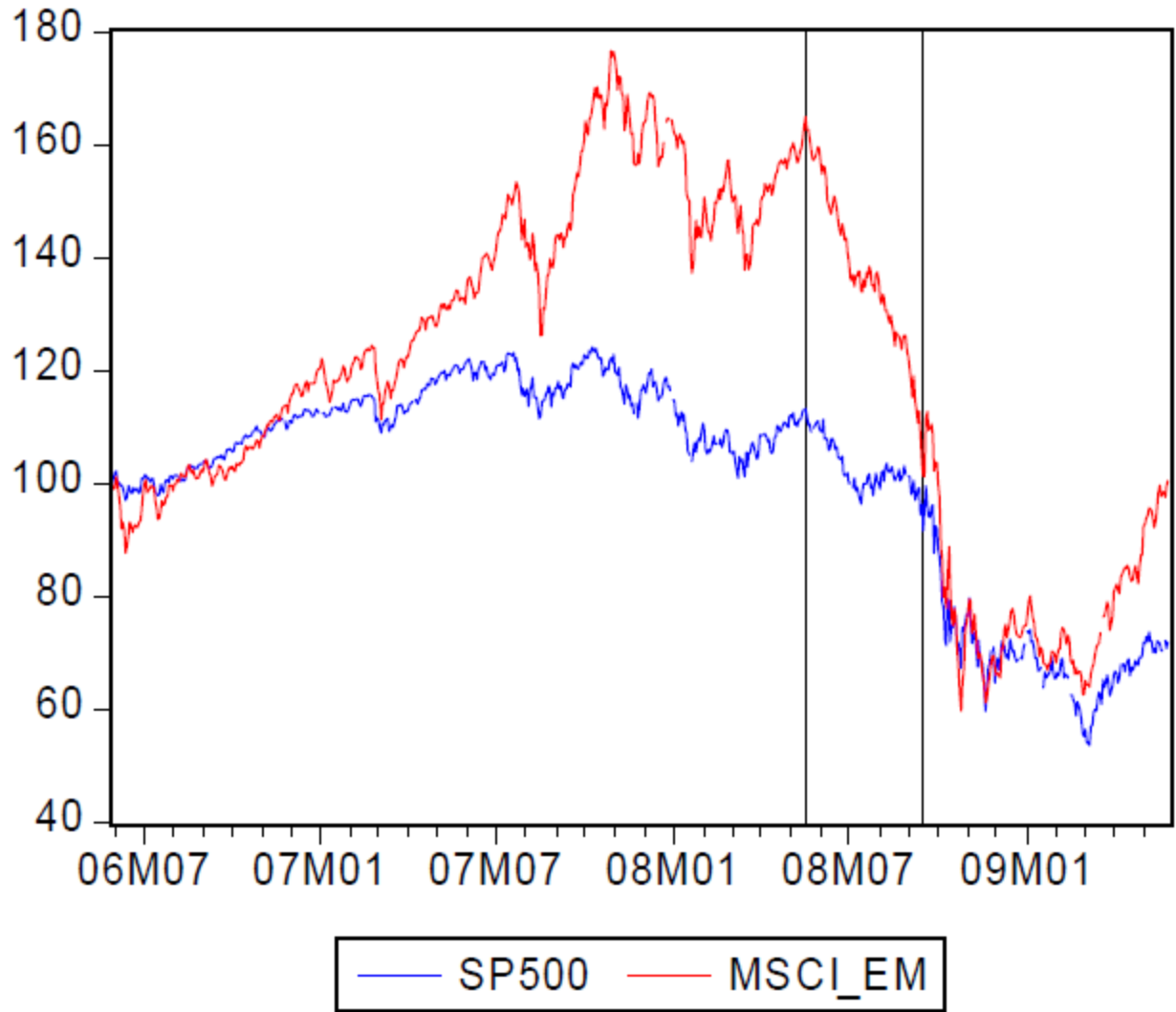
Phase 1: EM outperformed US by 40%. EM currencies appreciated by 10% vs USD, accounting for some of the gain. EM fx reserve accumulation.

Phase 2: EM index fell from 165 to 109, giving back ¾ of relative gains. Output still strong, but market forward looking.

Phase 3: EM financial panic with US following Lehman. Real collapse.

Note: the two vertical lines mark the dates (May 19, 2008 and September 15, 2008) that separate the three phases of the sub-prime crisis.

Chart 2 U.S. Corporate and Emerging Market Bond Spreads

Note: the two vertical lines mark the dates (May 19, 2008 and September 15, 2008) that separate the three phases of the sub-prime crisis.
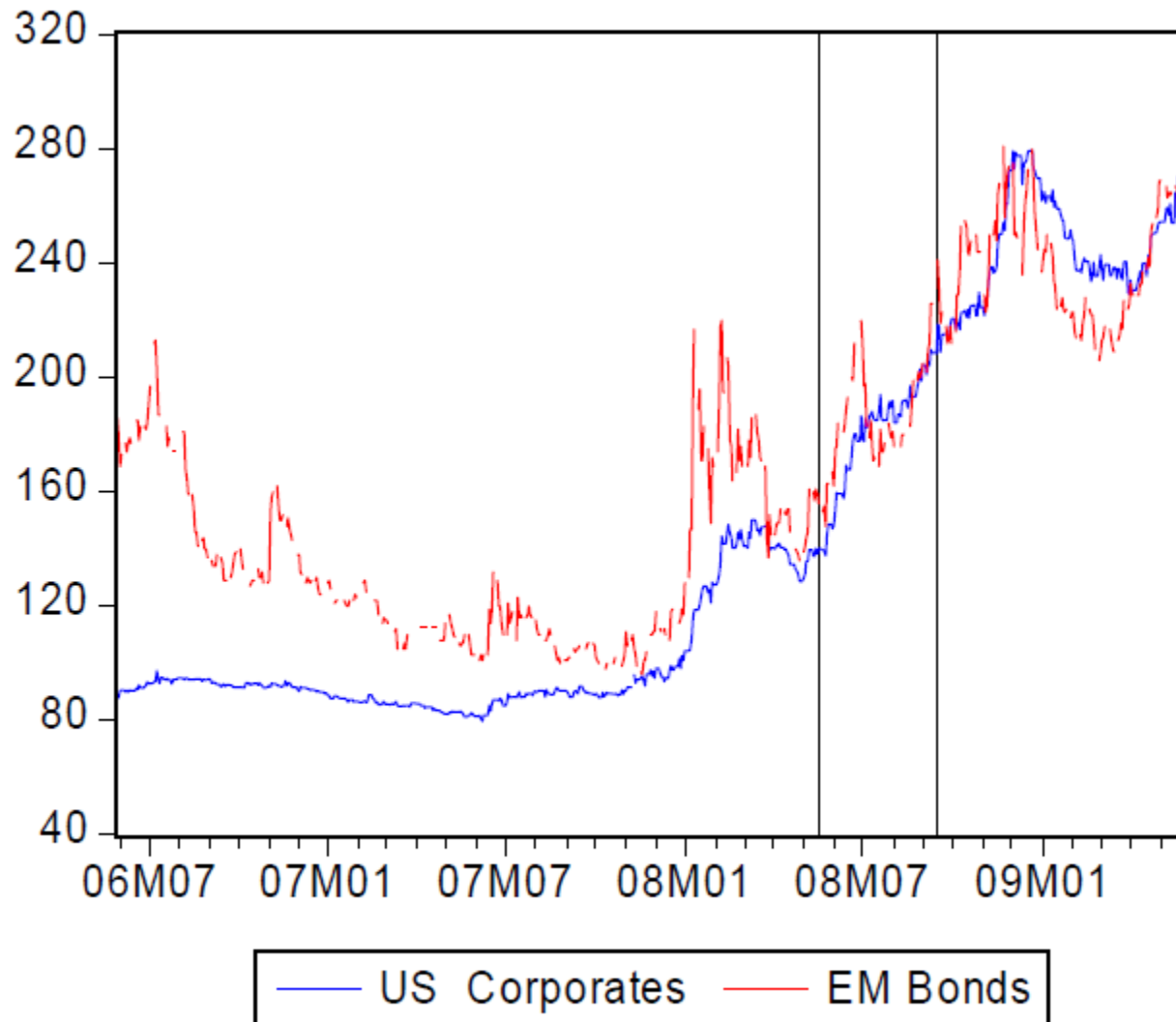
Phase 1: CDX EM (index of CDS for EM sovereign bonds) declined steadily until rising (with US investment grade over Treasuries) in early 2008. Concerns of default emerging in early 2008.

EM equity strong in early 2008, EM CDS rising…

Phase 2: Recoupled-Rose in tandem with US.

Phase 3: Strongly coupled, financial panic..

Key Elements of Study

- Transmission of US shocks to Emerging Mrkts.
    - "event study" in regression context
    - CDS spreads for 14 emerging markets
    - "news" on US subprime crisis
- Decoupling-Recoupling?
    - Review equity, CDS and exchange rates
    - VAR analysis of equity market linkages between Mexico and US over two sub-periods

"News" and CDS Spreads

- U.S. news important in EM CDS?

- Key elements in study:
  - Daily CDS spreads 5yr sovereign bonds
  - 14 EM sample geographically diverse
    - 5 in LA (Arg, Bra, Chile, Col, Mex)
    - 3 in Asia (China, S Korea, Malaysia)
    - 4 in Central Europe (Czech, Poland, Hungary)
    - 3 others (Russia, So. Africa, Turkey)
  - Jan 1, 2007 – Jan 19, 2009 (533 obs)
  - Event study / regression model
  - Big factors, common factors?

What is "News"

- **Bloomberg news reports on subprime crisis**
  - Emphasis on market news
- **St. Louis Fed list of key events in subprime crisis**
  - Emphasis on Treasury, SEC and Fed actions

- **Distill "important" news into 15 categories**

Table1 : Variable Definitions and Example of Events

Event Variable	Definition of Event	Event Example: Date and Description
REG	Important changes in US financial regulations	3-Dec-08 SEC approves measures to increase transparency and accountability at credit rating agencies.
TBS	Policy announcements that will affect the US Treasury's balance sheet	5-Dec-08 Treasury purchases $4 billion in preferred stock in US banks under the Capital Purchase Program.
REALMINUS	Negative news about US growth	11-Dec-08 NBER announces that the economic activity peaked in December 2007 and that the economy has since been in recession.
REALPLUS	Positive news about US growth	11-Dec-08 House approves $14 billion automaker bailout.
FBS	Policy announcements that will expand the Federal Reserve's balance sheet	25-Nov-08 Fed to buy $600 billion of GSE debt, set up ABS program.
HD	Policy announcements directly affecting US residential housing market	20-Nov-09 Fannie Mae and Freddie Mac announce that they suspend mortgage foreclosures until January 2009
CRD	Adverse news from US credit markets	9-Jan-09 US consumer borrowing falls by record $7.9 billion, credit freeze deepens.
REC	Announcement of recapitalization of US financial institutions	10-Oct-08 GE raises $15 billion; Buffett invests $5 billion in preferred shares and warrants.
BR	Bankruptcy or forced merger of US financial institutions	25-Sep-08 Washington Mutual seized by FDIC, JPMorgan buys its deposits.
WD	Announcements of write downs of US financial institutions assets	6-May-08 Fannie May reports Q1 loss of $2.19 billion.
FSD	Expansion of Federal Reserve Swap lines to industrial countries	13-Oct-08 Fed lets European Central banks offer unlimited dollars, removes swap limits.
FSE	Expansion of Federal Reserve Swap lines with emerging markets	29-Oct-08 The FOMC establishes swap lines with Banco Central do Brazil, Banco de Mexico Bank of Korea, and the Monetary Authority of Singapore for up to $30 billion each.
POL	Political developments in US	29-Sep-08 Rescue plan rejected.
LEHMAN	Lehman Brothers	15-Sep-08 Lehman Brothers declares bankruptcy.
TARP_CANCEL	Troubled Assets Relief Program	12-Nov-08 Treasury Secretary Paulson announces that the Treasury has decided not to use TARP funds to buy mortgage related assets.

Table 2: Number of "News" Events Emanating from the U.S.

|	Number of Events During Phases of the Subprime Crisis		
	Phases 1 and 2	**Phase 3**	**Full Sample (Total Events)**
Event	**January 2007– August 2008**	**September 2008– February 2009**	**January 2007- February 2009**
REG	4	12	16
TBS	5	25	30
REALMINUS	1	28	29
REALPLUS	2	6	8
FBS	11	13	24
HD	0	4	4
CRD	0	5	5
REC	13	18	31
BR	16	14	30
WD	34	12	46
FSD	0	8	8
FSE	0	2	2
POL	0	2	2
LEHMAN	0	4	4
TARP_CANCEL	0	1	1

Distribution of News since 2007

- Little "news" until summer 2008
- Most news in fall 2008

Daily Evolution of CDS Spreads
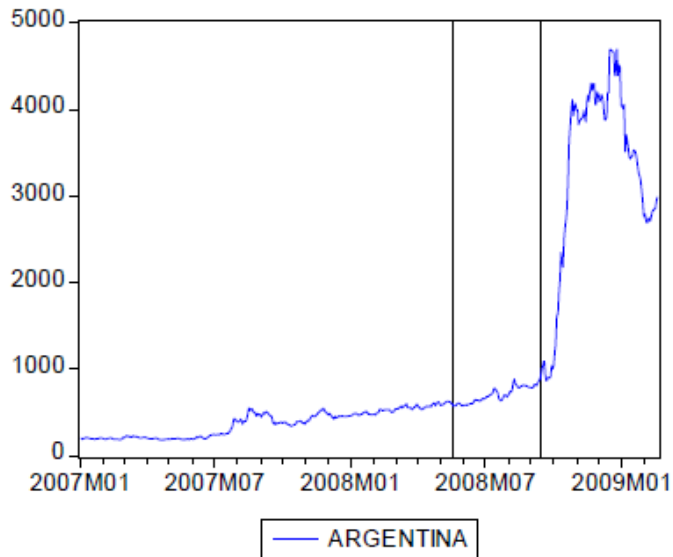
- Remarkably similar pattern in 14 EMs:
- Flat through 2007
- Gradual rise to fall 2008
- Sharp rise fall 2008 and increased volatility

Chart 4   CDS Spreads in Selected Emerging Markets
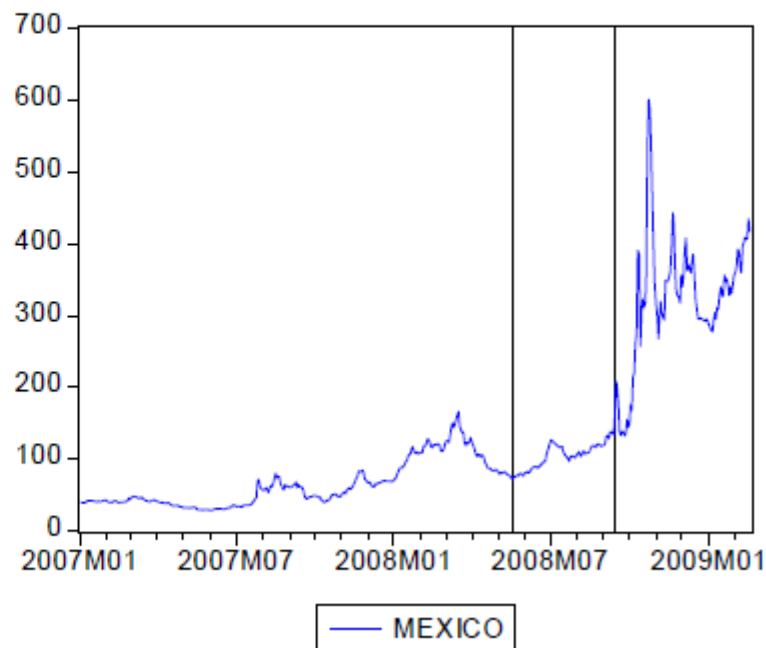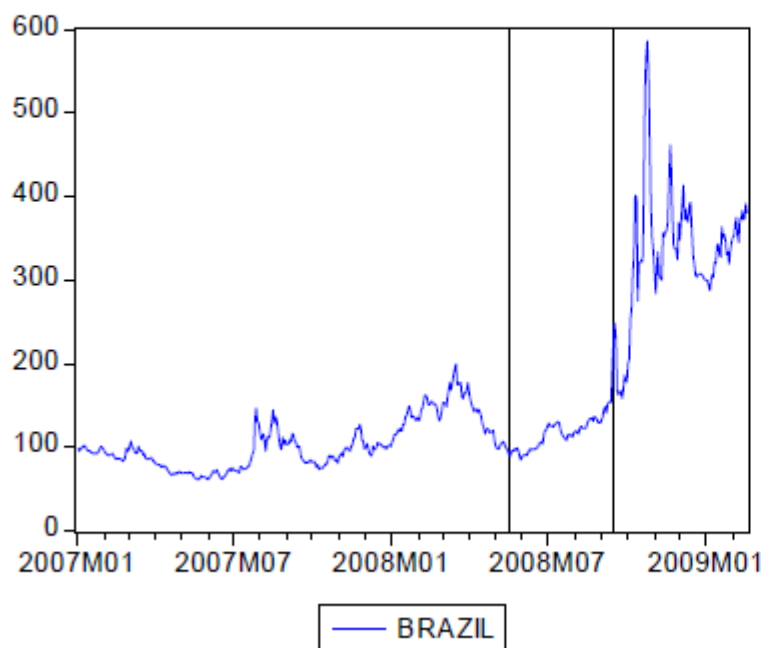
Note: the two vertical lines mark the dates (May 19, 2008 and September 15, 2008) that separate the three phases of the sub-prime crisis.

Chart 4   CDS Spreads in Selected Emerging Markets
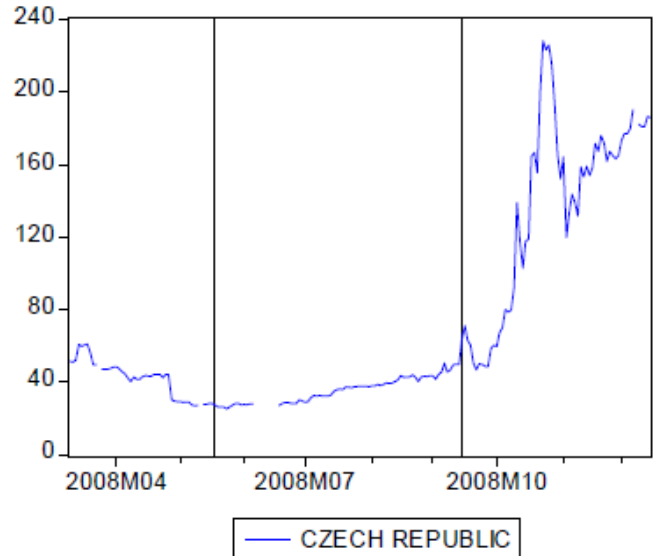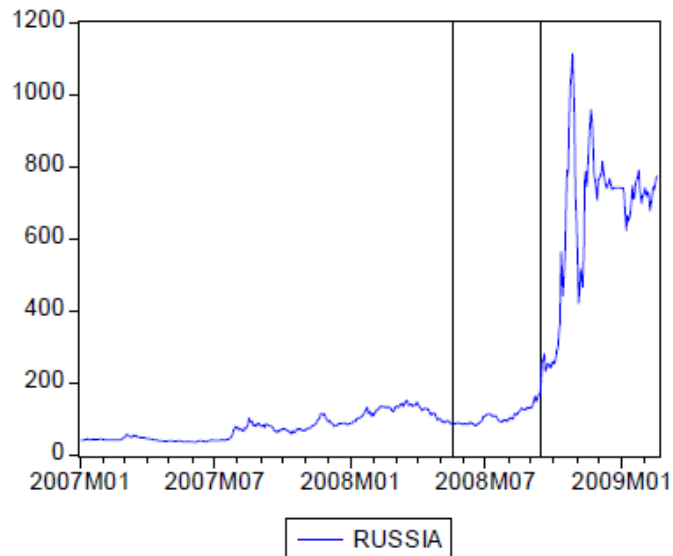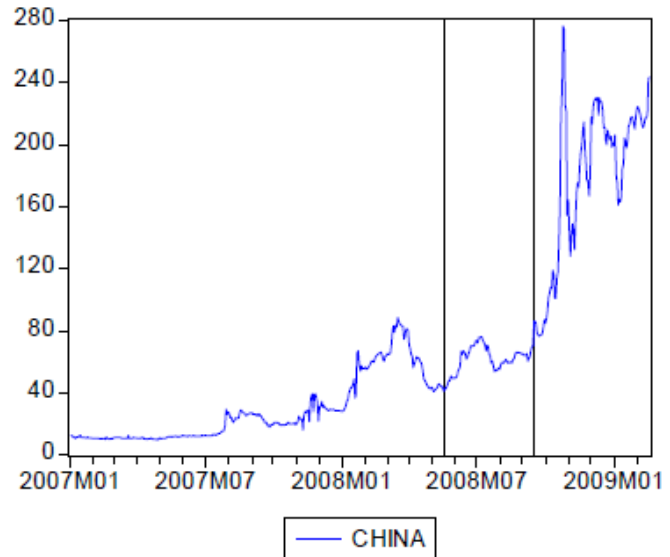
Interpreting Regressions: How did News translate to CDS spreads?

- Explanatory Power

- What matters?

- What is common?

- What is economically important?

Table 3: Response of Emerging Market CDS Spreads to U.S. Events

Variable	Argentina	Brazil	Chile	Colombia	Mexico
C	2.74	0.05	0.18	0.24	0.31
D(CDS5Y(-1))	0.12***	0.29***	0.25***	0.24***	0.29***
BR	-18.56	-0.77	-0.97	-2.44	-2.98
WD	15.41	6.63***	2.04**	6.12***	7.41***
CRD	75.72**	11.19*	-7.82**	5.91	7.15
FSD	-44.33	-31.62***	-4.29	-32.37***	-29.65***
FSE	112.01*	-57.78***	-22.48***	-33.78**	-44.31***
HD	101.80**	11.4	12.58***	12.06	14.21
LEHMAN	100.99***	32.73***	8.11**	25.62***	29.09***
POL	-3.16	19.65**	-6.15	15.75	14.19
REC	8.07	2.05	-0.01	1.66	-1.036
TARP_CANCEL	-126.32*	63.47***	13.80*	63.76***	66.43***
TBS	2.047	-8.48***	0.28	-3.22	-8.07**
FBS	19.94	1.57	0.44	-0.93	0.31
REG	-26.69	-1	-3.81**	-3.14	1.52
REALPLUS	38.73	-11.04**	-8.28***	-15.83***	-13.04**
REALMINUS	0.42	1.74	3.87***	2.1	2.78
Observations	533	533	534	533	533
Adjusted R-squared	0.043	0.258	0.13	0.16	0.2
S.E. of regression	67.035	14.87	7.18	14.6	13.95
Mean depend. Var	6.245	0.43	0.35	0.41	0.54
Log likelihood	-2989	-2106	-1763	-2176	-2152
Durbin-Watson stat	2.08	2.07	1.99	2.09	2.04

Notes: * denotes significance at 90%; ** denotes significance at 95%; *** denotes significance at 99%. Values noted in bold are statistically significant at the 90% level or higher. Sample: January 1, 2007 – February 19, 2009.

Table 3: Response of Emerging Market CDS Spreads to U.S. Events (continued)

Variable	China	Korea	Malaysia	So. Africa	Turkey
C	0.05	-0.3	-0.02	0.2	-0.04
D(CDS5Y(-1))	0.13***	0.19***	0.37***	0.29***	0.27***
BR	-1.17	-2.54	-3.18*	-2.32	-3.81
WD	1.80**	5.56***	4.27***	1.54	5.46**
CRD	-0.49	4.88	3.15	0.6	4.23
FSD	-2.96***	-9.16*	0.01	-27.38***	-22.00***
FSE	-66.82***	-183.16***	-106.51***	-46.14***	-73.76***
HD	7.04*	15.87*	1.64	10.16	35.26***
LEHMAN	7.30***	25.68***	11.78***	26.29***	34.83***
POL	10.47**	23.11***	21.90***	9.24	2.66
REC	-0.6	-2.49	-4.20**	4.31*	4.09
TARP_CANCEL	7.42	26.15**	8.91	95.32***	34.66**
TBS	1.97	8.70***	-0.53	0.5	-6.83**
FBS	3.21**	4.2	5.93***	-3.14	-2.46
REG	1.791	6.63**	2.77	7.17**	8.84**
REALPLUS	-3.04	-5.99	-2.41	-14.87***	-10.31*
REALMINUS	0.13	-1.6	0.65	1.95	2.9
Observations	533	533	533		
Adjusted R-squared	0.24	0.412	0.37	0.28	0.23
S.E. of regression	5.86	11.32	8.61	11.47	14.43
Mean depend. Var	0.34	0.54	0.37	0.62	0.46
Log likelihood	-1690	-2040	-1895	-2048	-2162
Durbin-Watson stat	1.89	1.83	1.875	2.02	2.1

Notes: * denotes significance at 90%; ** denotes significance at 95%; *** denotes significance at 99%.
Values noted in bold are statistically significant at the 90% level or higher. For China, Korea and Malaysia:
all independent variables are lagged one day to take into time differences between U.S. and Asian markets.
Sample: January 1, 2007 – February 19, 2009.

Table 3 (continued): Response of Emerging Market CDS Spreads to U.S. Events

Variable	Russia	Czech Republic	Hungary	Poland
C	0.38	0.87	0.36	2.00
D(CDS5Y(-1))	0.34***	0.07	0.27***	0.06
BR	-4.88	-3.88*	-9.98	-6.28**
WD	2.11	2.05	21.65**	8.78**
CRD	-1.76	5.31	16.97	6.00
FSD	-34.08***	-3.92	-14.62	-17.79***
FSE	-66.49***	-22.43***	-69.16***	-43.17***
HD	63.40***	13.53**	3.21	6.76
LEHMAN	38.64***	8.07*	42.45***	12.93**
POL	-22.41	-16.98***	15.00	4.29
REC	2.96	-1.83	2.74	1.72
TARP_CANCEL	158.09***	-5.04	47.72	24.53*
TBS	-1.04	0.80	-9.97	-2.04
FBS	-8.00	-2.56	1.82	-0.98
REG	17.93***	4.19	1.69	1.31
REALPLUS	-16.37**	-5.07	-10.75	-8.17
REALMINUS	6.41	3.66	9.96	3.62
Observations	533	180	94	133
Adjusted R-squared	0.32	0.13	0.29	0.24
S.E. of regression	20.49	8.51	24.82	11.32
Mean depend. Var	1.26	0.81	3.11	1.66
Log likelihood	-2357	-632	-426	-502
Durbin-Watson stat	2.09	2.11	2.17	2.21

Notes: Dependent variable: change in CDS spread. * denotes significance at 90%; ** denotes significance at 95%; *** denotes significance at 99%. Values noted in bold are statistically significant at the 90% level or higher. Sample: January 1, 2007 – February 19, 2009 except for Czech Republic, Hungary and Poland where samples vary depending on data availability.

Results

- Adj R2 low .04 (Arg) to high .41 (S Korea)
- Mean of Dep variable (change in CDS)
  - 0.34-0.35 (China and Chile) to 1.26-6.25 (Russia and Argentina)
- Lagged dependent included; no residual autocorrelation apparent

Resuts (continued)

- **Common Factors: Bad News**
  - ☐ Lehman: 4 annoucements, all 14 EM hit sig., average effect ranging from 7bp (China) to over 100bp (Arg)
  - ☐ Write downs, housing develop., cancel TARP all had systematic negative effects
    - ▪ WD: 14 positive, of which 10 significant
    - ▪ HD: 14 positive, 7 significant
    - ▪ TARP_Cancel: 13 positive, 9 significant

Summary (continued)

- Common Factors: Good News
- Swap arrangements with EM (FSE) and developed countries (FSD), positive news on real side of US economy
  - FSE: 13 lowered, 13 significant
  - FSD: 13 lowered, 9 significant
  - REALPLUS: lower in 13 cases, 7 significant
- Argentina usually the exception

Why didn't the dog bark, Dr. Watson?

- ■ Major policy actions taken by the Treasury and Fed had no systematic effect
  - □ TBS, FBS, REG
  - □ Much news attention, but didn't transmit or was anticipated before annoucement

# Summary: EM coupled with US and "News" matters…usually

- Series of write-downs, reported losses and downgrades of US financial institutions, and Lehman brought big jumps in CDS

- Positive news about US economy and swap agreements lowered CDS

- Dozens of Treasury and Fed programs didn't move CDS spreads (deposit insurance coverage, Fed CP Funding Facilty, FDIC programs, etc.)

News matters, but what about decoupling-recoupling?

- More "news" in latter sample, so more variation
- But have linkages, or transmission of a given shock, changed?
- Timing of developments in EM equity, CDS and exchange rates…
  - Similar patterns across EMs!

Chart 3 Equity Markets in the U.S. and Selected Emerging Markets
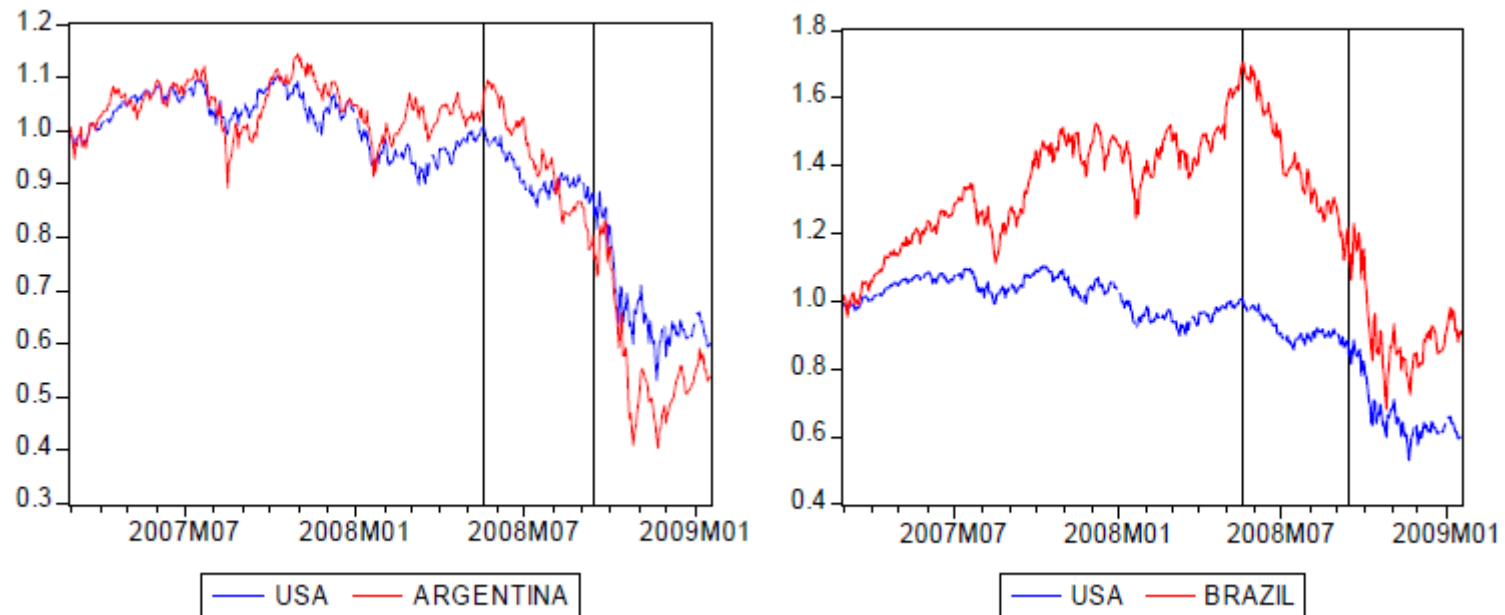
Note: the two vertical lines mark the dates (May 19, 2008 and September 15, 2008) that separate the three phases of the sub-prime crisis. The stock index for the USA is the SP500. Stock indices for EM are in local currency values. Indices normalized to unity on February 27, 2007.

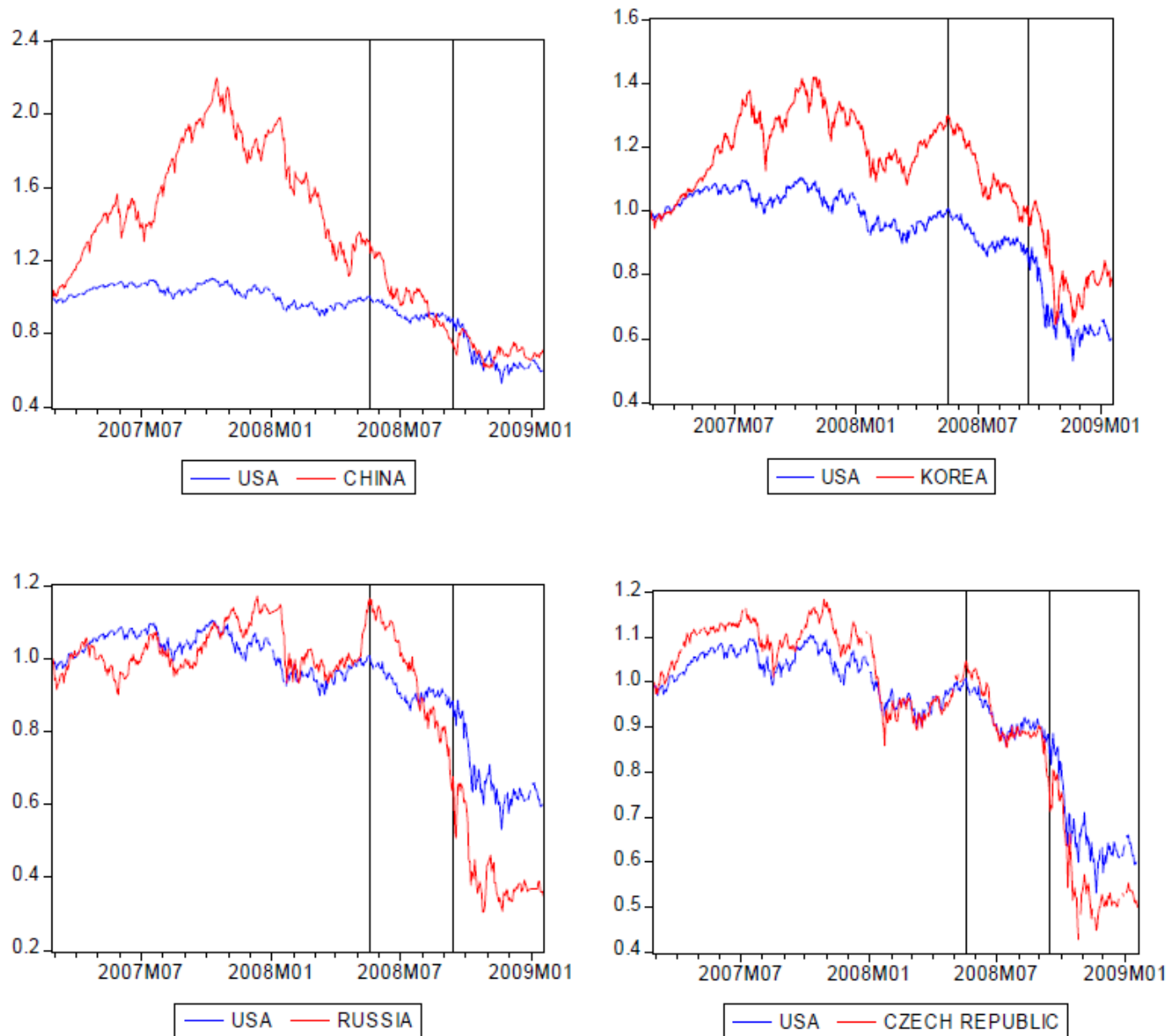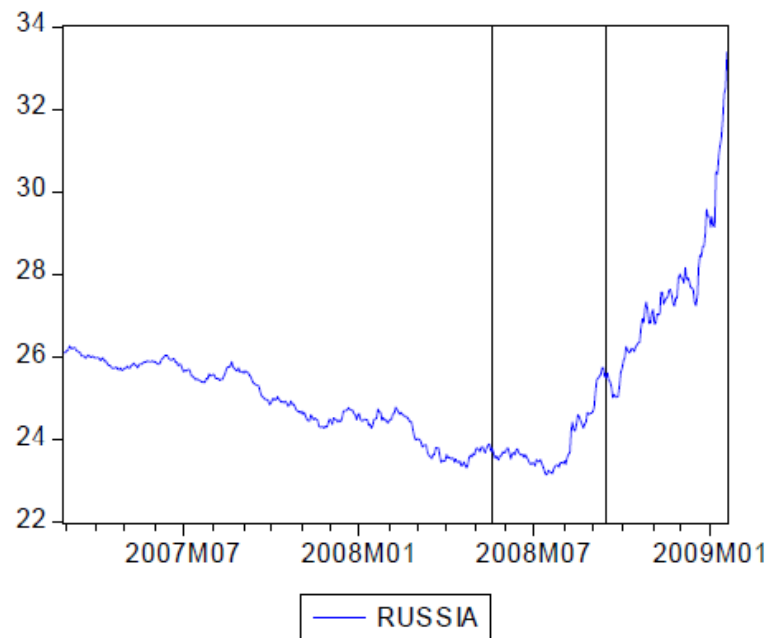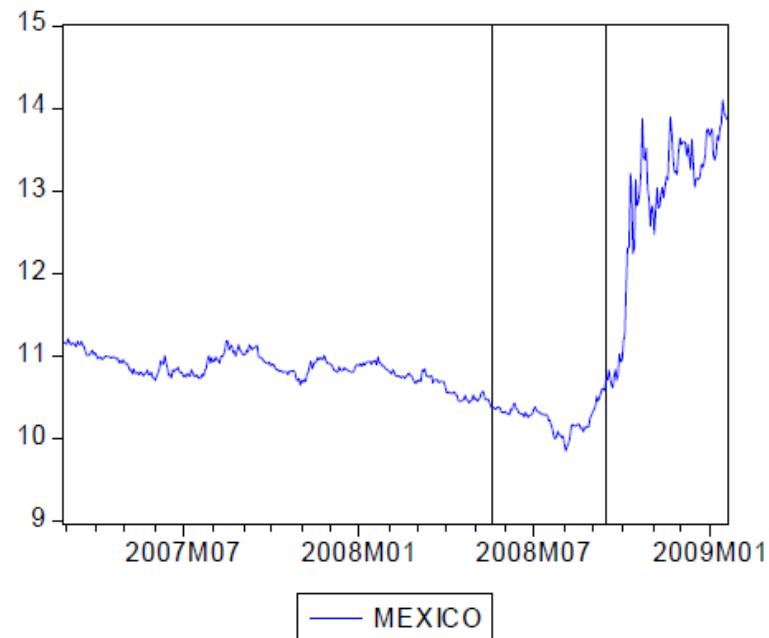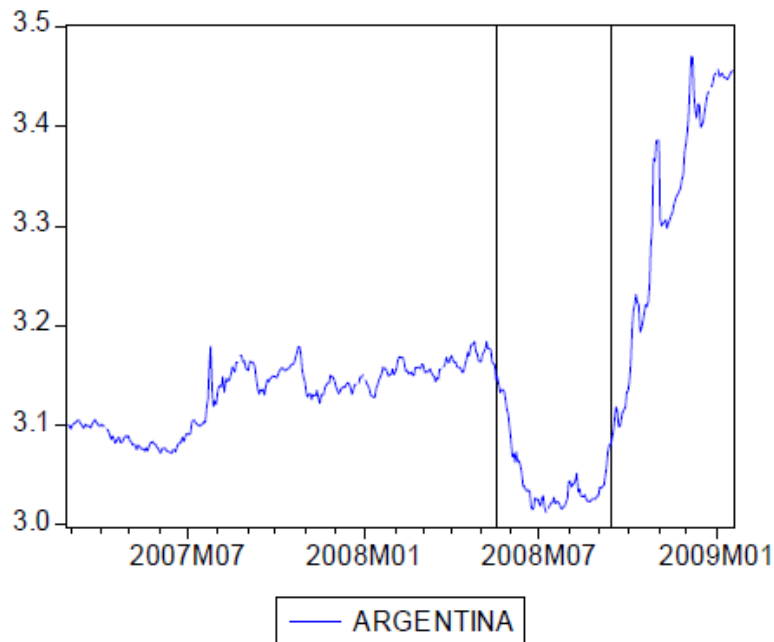Chart 3   Equity Markets in the U.S. and Selected Emerging Markets

Chart 5 Exchange Rates in Selected Emerging Markets

Correlations among national equity markets indicate strong linkages with US, and generally stronger since fall 2008…

Table 4 — **Equity Market Linkages During the Three Phases of the Financial Crisis**

Correlations of USA SP500 with Stock Index in:	Phase 1 2/27/2007 to 5/18/2008	Phase 2 5/19/2008 to 9/14/2008	Phase3 9/15/2008 to 1/19/2009	Phase 2 to Phase 3 Change in Correlation	Phase 2 to Phase 3 % Change Correlation
ARGENTINA	0.64	0.42	0.66	0.24	57%
BRAZIL	0.73	0.60	0.83	0.23	38%
CHILE	0.53	0.62	0.64	0.03	4%
CHINA	0.16	0.23	0.24	0.01	4%
COLOMBIA	0.32	0.16	0.50	0.34	210%
CZECH	0.28	0.26	0.38	0.12	45%
HUNGARY	0.21	0.28	0.50	0.22	78%
KOREA	0.47	0.39	0.34	-0.05	-13%
MEXICO	0.72	0.77	0.83	0.06	8%
MALAYSIA	0.46	0.42	0.40	-0.02	-5%
POLAND	0.36	0.24	0.49	0.25	103%
RUSSIA	0.24	0.29	0.29	0.00	0%
SOAFRICA	0.22	0.39	0.46	0.07	17%
TURKEY	0.33	0.21	0.44	0.24	115%

Note: Correlations shown are between percent changes in the SP500 and percent changes in local currency stock market price indices. Korea, China and Malaysia are one-day ahead.

More on linkages…

- Mexico has strongest linkages with US
- Have they changed?
- Consider Bivariate VAR model of US-Mexico equity market linkages
- Estimate VAR
  - Lag length
  - Granger causality
  - Impulse response functions

Model estimates as percentage change. Lag length tests indicate 3 lags:

Table 5: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1748.27	NA	6.90e-08	-10.81	-10.79	-10.80
1	1770.17	43.38	6.18e-08	-10.92	-10.85*	-10.90
2	1778.39	16.19	6.02e-08	-10.95	-10.83	-10.90
3	1790.67	24.04	5.72e-08*	-11.00*	-10.84	-10.94*
4	1792.62	3.79	5.79e-08	-10.99	-10.78	-10.90
5	1795.54	5.64	5.83e-08	-10.98	-10.72	-10.88
6	1798.09	4.89	5.88e-08	-10.97	-10.67	-10.85
7	1804.02	11.32*	5.81e-08	-10.98	-10.63	-10.84
8	1807.58	6.73	5.83e-08	-10.98	-10.58	-10.82
9	1809.24	3.14	5.92e-08	-10.97	-10.52	-10.79
10	1811.55	4.31	5.98e-08	-10.96	-10.47	-10.76

* indicates lag order selected by the criterion.

Endogenous variables: DLOG(SP500INDEX) and DLOG(STOCKINDX_MEXICO), Sample: 1/01/2007 to 1/19/2009, Included observations: 323

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

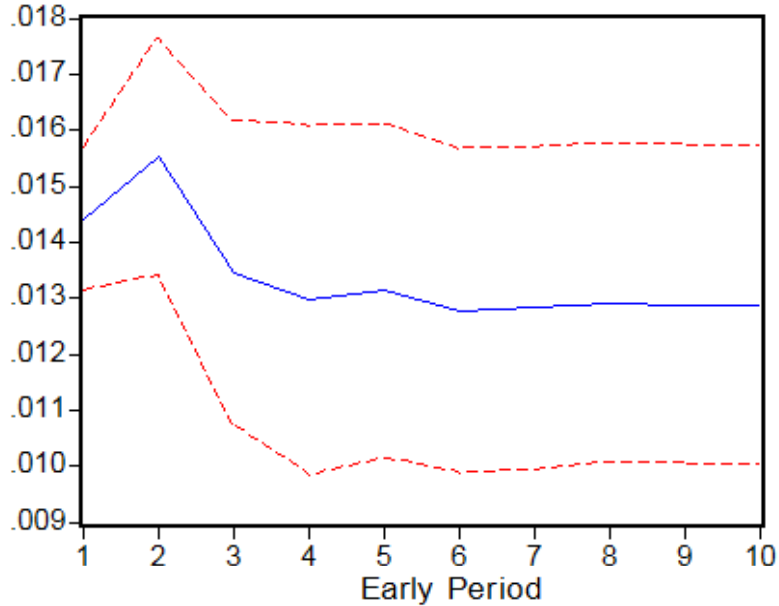HQ: Hannan-Quinn information criterion

Granger causality tests indicate U.S. equity prices "cause" (predict) Mexican equities over full sample period, mainly in latter period…

Table 6: VAR Granger Causality Tests

| Excluded	Chi-sq	df	Prob.
a. Full Sample (1/1/07–2/19/08)			
DLOG(SP500INDEX)	10.572	3	0.014
b. Early Sample (1/1/07–8/31/08)			
DLOG(SP500INDEX)	2.221	3	0.528
c. Late Sample (9/1/08–2/19/09)			
DLOG(SP500INDEX)	5.767	3	0.124

Dependent variable: DLOG(STOCKINDX_MEXICO)

Full Sample
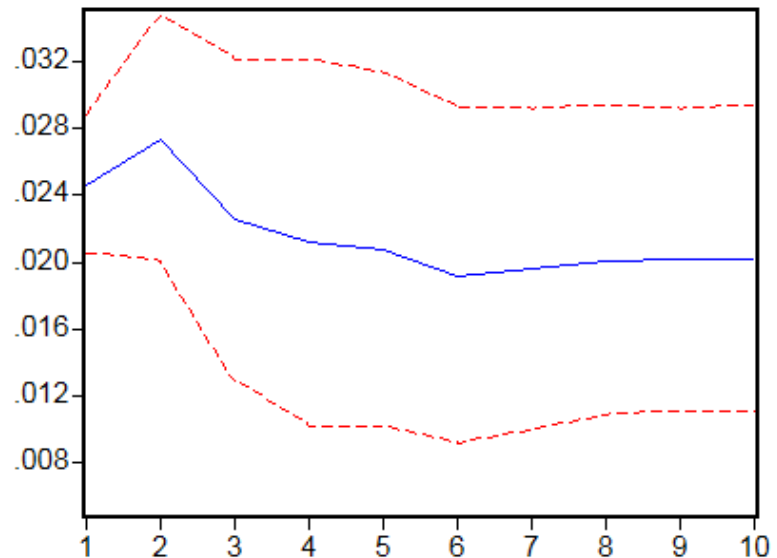**Accumulated Response**
DLOG(STOCKINDX_MEXICO) to DLOG(SP500INDEX)

Early Period
Accumulated Response
LOG(STOCKINDX_MEXICO) to DLOG(SP500INDEX)
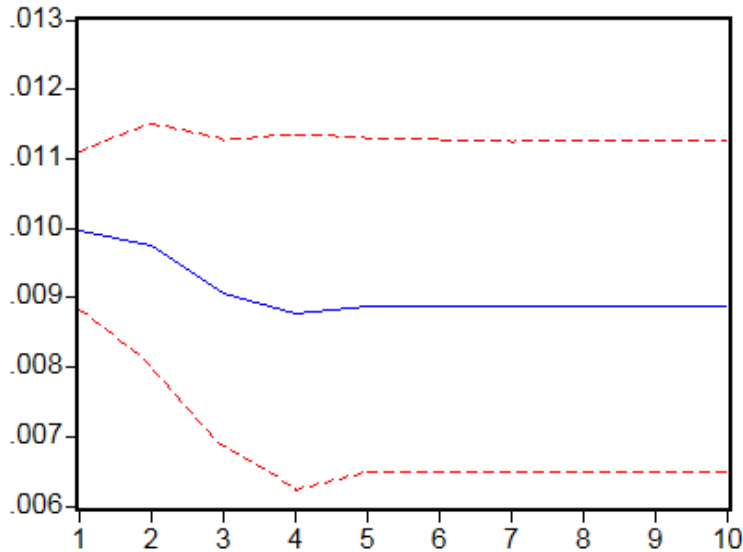
Late Sample
Accumulated Response
DLOG(STOCKINDX_MEXICO) to DLOG(SP500INDEX)

Impulse responses over 3 sample periods: strongest response in latter sample period

Conclusions

- US news transmitted to EMs, as reflected in CDS spreads
- Market news critical, policy news is not
- Remarkably similar evolution in EM equity, CDS and exchange rates markets
- US Subprime crisis hit EMs in three phases: decoupled until 2008, progressive harder hit and panic after Lehman
- Evidence of both more "news" and greater linkage