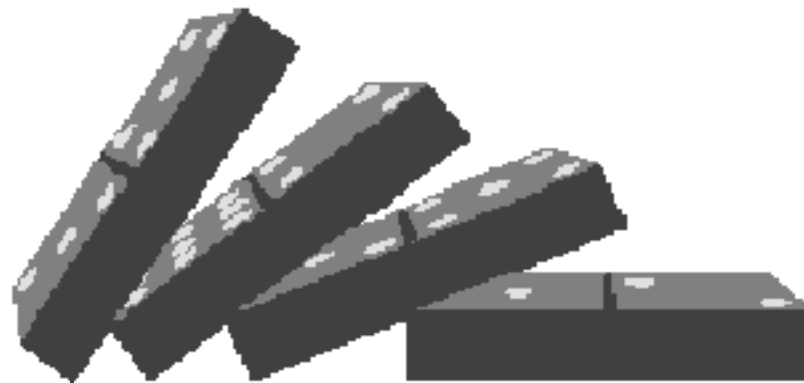


Contagion as Domino Effect in Global Stock Markets



Thijs Markwat, Erik Kole, Dick van Dijk
Erasmus University Rotterdam

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Approach and Main Findings

- We model stock market contagion as a domino effect
- We use an ordered logit model for local, regional and global crashes
- Small crashes are followed by more severe crashes
- Interest rates, volatility and bond returns affect crash probabilities
- Adding local and regional crashes improves a global crash only model

Data

- Daily stock market returns, July 1996-July 2007
- Four regions: US, Europe, Latin America, Asia
 - Asia: India, Korea, Malaysia, Philippines, Taiwan and Thailand
 - Latin America: Argentina, Brazil, Chile, Colombia, Mexico and Venezuela
- S&P / IFC indices for emerging markets
- MSCI indices for developed markets
- All returns in US Dollars

Definitions of crashes

- Crash: return (country or regional) belonging to the lower 5% quantile of the empirical distribution

Then, 4 situations:

- No crash: If no stock index crashes
- Local crash: if between 1 and 3 individual emerging markets crash.
- Regional crash: if a regional index crashes *or* when more than 3 emerging countries crash.
- Global crash: when 2, 3 or 4 regions crash, of which one has to be developed.

Crash Dynamics

- 1810 (63%) days with no crash,
616 (22%) local crashes,
271 (10%) regional crashes,
142 (5%) global crashes
- Crash transition matrix

from \ to	None	Local	Regional	Global
None	0.72	0.19	0.09	0.03
Local	0.57	0.27	0.10	0.06
Regional	0.45	0.27	0.17	0.11
Global	0.27	0.23	0.29	0.20

Crash Dynamics (2)

- Volatility correction

from \ to	None	Local	Regional	Global
None	0.71	0.19	0.08	0.02
Local	0.56	0.29	0.10	0.05
Regional	0.51	0.24	0.16	0.09
Global	0.23	0.24	0.30	0.22

- Crash transition matrix

from \ to	None	Local	Regional	Global
None	0.72	0.19	0.09	0.03
Local	0.57	0.27	0.10	0.06
Regional	0.45	0.27	0.17	0.11
Global	0.27	0.23	0.29	0.20

Methodology

- Ordered logit model
- Dependent variable \Leftrightarrow Types of crashes (ordered as increasing in severity)
- Explanatory variables \Leftrightarrow
 - Lagged local, regional, global crashes (dummy)
 - Lagged interest rates, currency changes, bond returns, stock market volatility.
 - Extreme currency and bond events variable

Empirical results (1)

Currency change LA	-4.08
Currency change Asia	6.55
Bond returns LA	-24.48 * *
Bond returns Asia	-13.81
Bond returns US	35.40 *
Bond Returns Europe	-10.33
Interest level Latin America	0.00
Interest level Asia	0.04 *
Interest level US	0.05
Interest level Europe	0.04
Volatility LA	0.52
Volatility Asia	1.88 *
Volatility US	1.42
Volatility Europe	2.44 *
Extreme FX	0.15 * *
Extreme Bond	0.03
Local	0.40 * *
Regional	0.62 * *
Global	1.21 * *

* 5% significance

** 1% significance

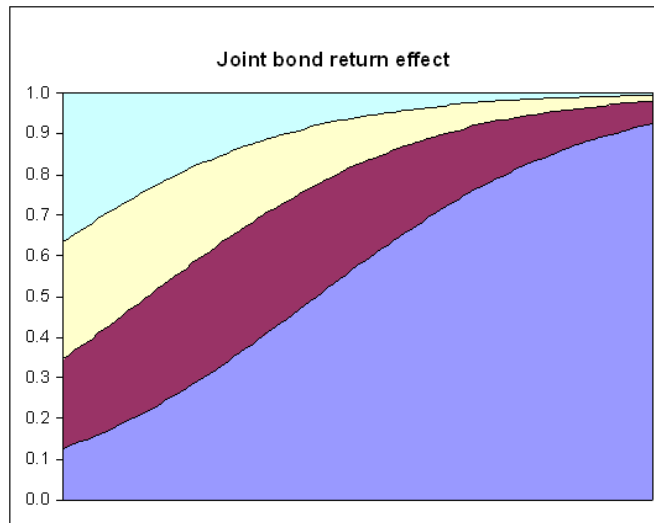
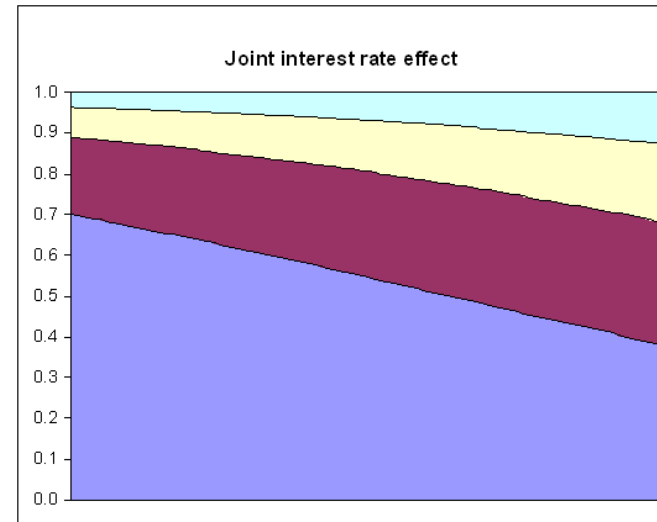
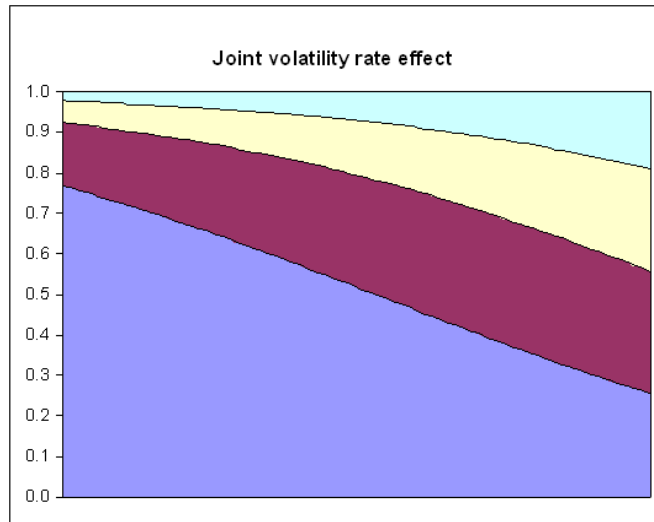
- High significance for domino variables
- Other financial variables some significance
- Except for currency changes all groups jointly significant at 1% level!

Empirical results (2)

- Nonlinear model \Leftrightarrow Marginal effects not constant
- Probabilities on crash occurrences while
 - Varying the variable under consideration (min / max)
 - Other variables at their mean
- For the crash dummies this results in:

from \ to	None	Local	Regional	Global
None	0.65	0.21	0.09	0.05
Local	0.57	0.25	0.12	0.06
Regional	0.52	0.27	0.13	0.08
Global	0.38	0.3	0.19	0.13

Empirical results (3)



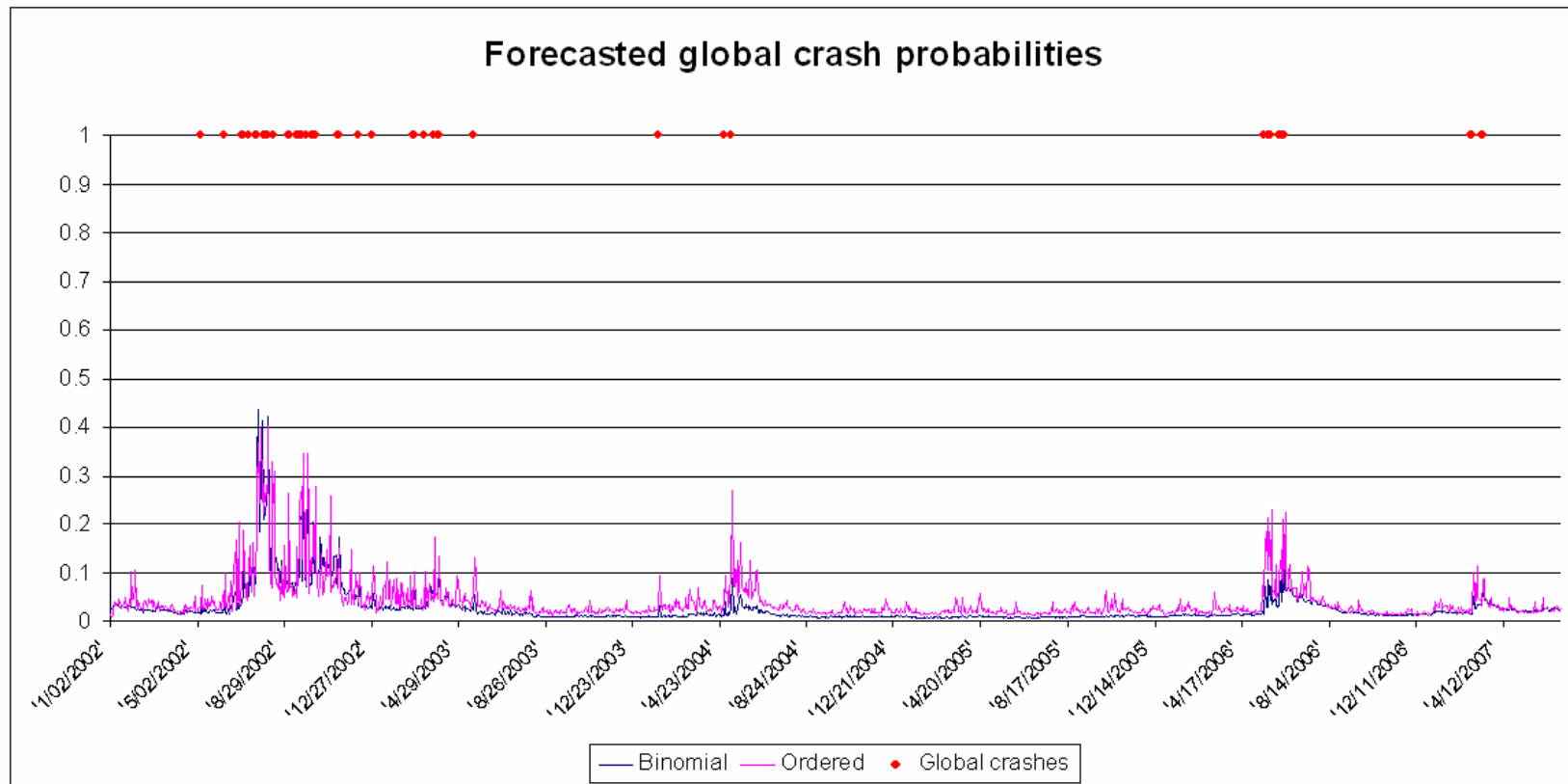
- Global Crash
- Regional Crash
- Local Crash
- No Crash

Out of sample forecasting

- We construct global crash indicator (0/1 variable)
- Approach: forecasting global crashes with both models
- Re-estimation of model over the sample July 1996 – December 2001
- Variable selection approach:

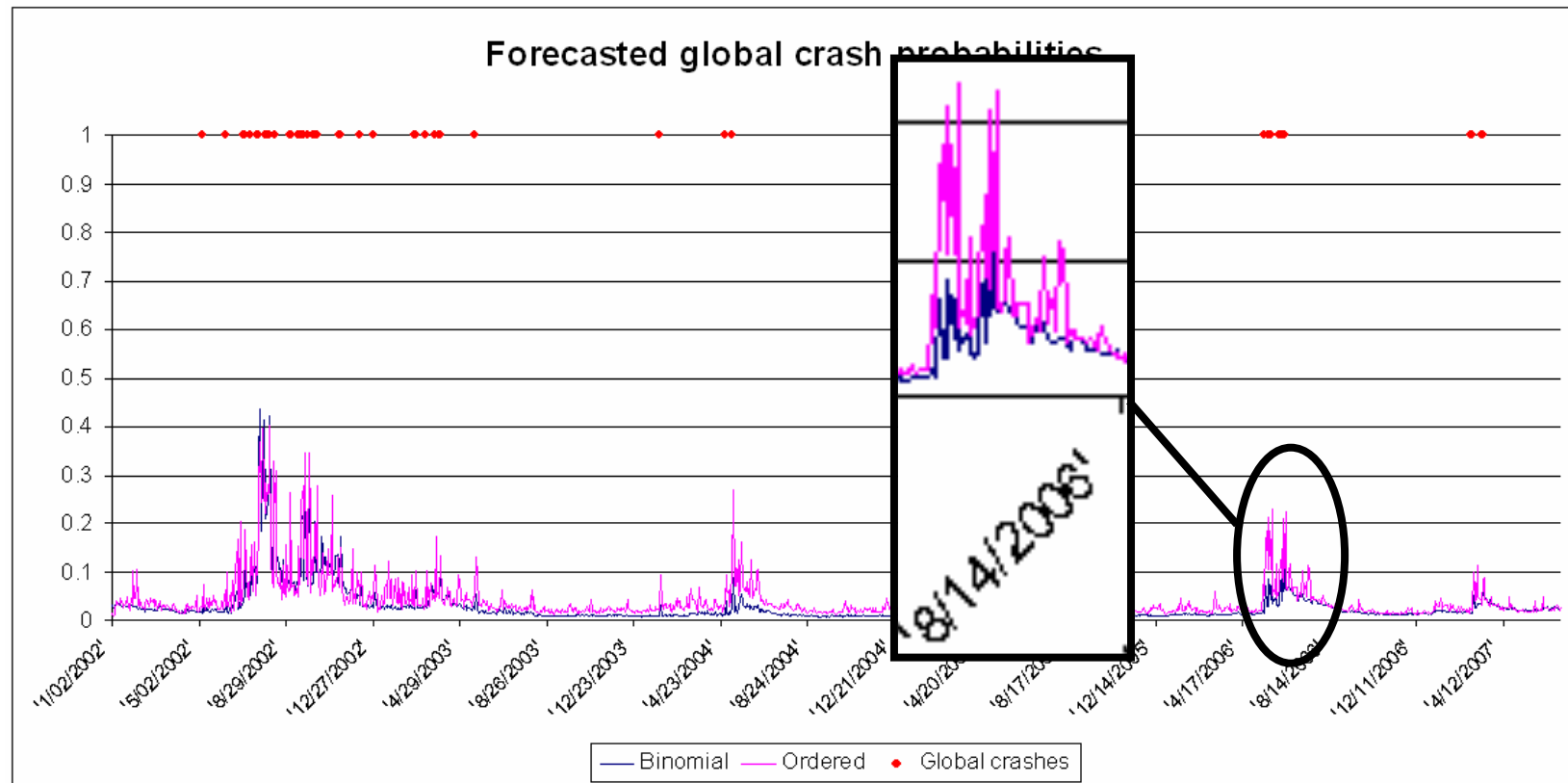
Ordered	Binomial
Bond returns LA	Bond returns LA
Bond returns US	Interest level US
Interest level Latin America	Volatility Asia
Volatility Asia	Volatility Europe
Volatility Europe	Global
Extreme FX	
Local	
Regional	
Global	

Out of sample forecasting (2)



Ordered model outperforms binomial model

Out of sample forecasting (2)



Ordered model outperforms binomial model

Conclusions

- Stock market contagion should be modeled as a domino effect
- Interdependence channels are stock markets, bond markets and interest rates
- Adding local and regional crashes to a global crash model improves forecasting performance
- Investors should always pay attention to emerging markets, even when they are not exposed to these markets.

Appendix A

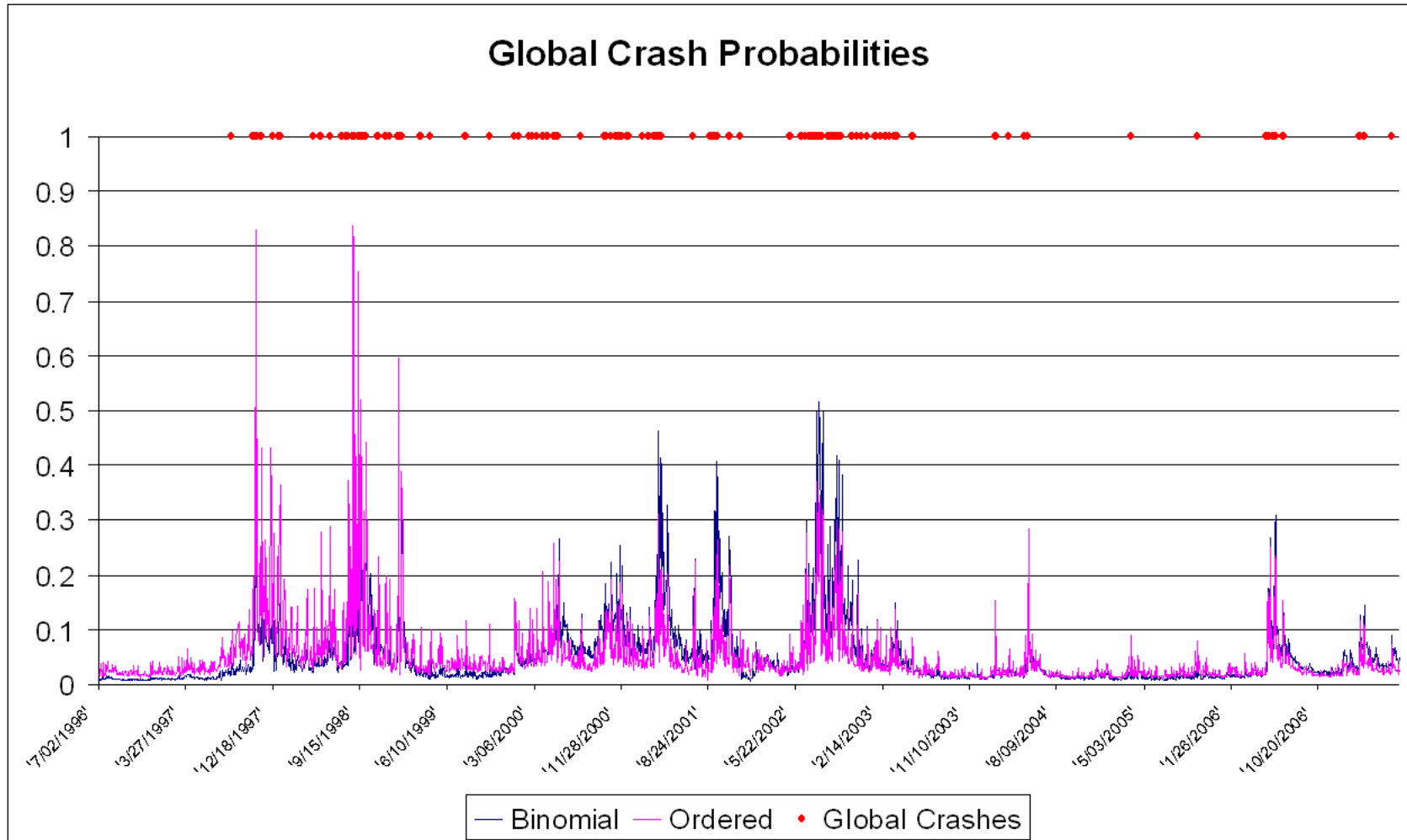
- Stationary Bootstrap

from \ to	None	Local	Regional	Global
None	0.68	0.20	0.08	0.04
Local	0.61	0.24	0.10	0.05
Regional	0.55	0.25	0.13	0.07
Global	0.44	0.22	0.21	0.13

- Crash transition matrix

from \ to	None	Local	Regional	Global
None	0.72	0.19	0.09	0.03
Local	0.57	0.27	0.10	0.06
Regional	0.45	0.27	0.17	0.11
Global	0.27	0.23	0.29	0.20

Appendix B



In-sample global crash probabilities of binomial and ordered logit models