

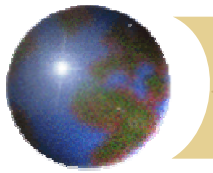
# *Estimating Systemic Risk in the International Financial System*

***Fourth Joint Central Bank Conference on  
Risk Measurement and Systemic Risk  
8-9 November 2005***

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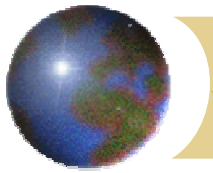
**John Hund  
University of Texas  
at Austin**



## *Relevance of Systemic Risk*

*“In practice, the policy choice of how much, if any, extreme market risk should be absorbed by government authorities is fraught with many complexities. Yet we central bankers make this decision every day[...] The question is whether, ex ante, the **probability of a systemic collapse** was sufficient to warrant intervention.”*

*Alan Greenspan, November 2002*



# *International Financial System*

## ✿ **Is there significant risk of systemic failure in the international financial system?**

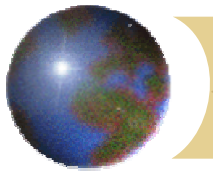
### ✿ Yes

- Increased capital mobility and shortened horizons
- Industry consolidation
- Changes in capital allocation rules
- Increased international capital lending

### ✿ No

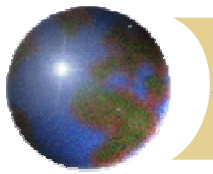
- Burgeoning credit derivative markets
- Global re-insurance and non-bank intermediation

### ✿ Basel II



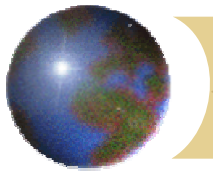
## *Objective and Contribution*

- ❖ **Investigate the resilience of the transmission mechanism of shocks between banks...i.e., how much do shocks to banks propagate?**
  - ❖ Examine a large sample of international banks around significant crisis events (e.g. Asian crisis, 9/11)
  - ❖ Using unique exposure data and three separate approaches, show that banks without direct exposure to events are largely unaffected by crises
    - Abnormal returns to banks
    - Implied default probabilities in option and stock prices
  - ❖ Quantify the impact of crises on the risk of systemic bank failure



# *Related Literature on Systemic Risk*

- ✦ **Theory models of mechanisms by which shocks can be transmitted**
  - ▣ Acharya (2001); Freixas, Parigi & Rochet (2000); Allen & Gale (1998); Rochet & Tirole (1996)
- ✦ **Contagion**
  - ▣ Karolyi (2003); De Bandt & Hartmann (2000); Kho, Lee & Stulz (2000); Kho & Stulz (2000); Bae, Karolyi & Stulz (2003)
- ✦ **Bank default and systemic risk**
  - ▣ Hartmann, Straetmans & de Vries (2005); Gould, Khoury & Naftilan (2004); Gropp & Vesala (2004); Elsinger, Lehar & Summer (2003); Bongini, Laeven & Majnoni (2002); Swindler & Wilcox (2002); DeNicolo & Quast (2001); Kaminsky & Reinhart (1999); Pettway & Sinkey (1980)



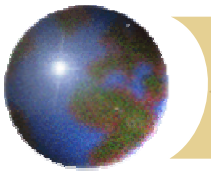
# *Sample and Data Sources*

## ✦ **Sample**

- ✦ 334 banks in 28 countries
- ✦ Represent approximately 80% of global bank equity
- ✦ Manually identify exposure (e.g. loans) to a crisis based on publicly available information (annual reports)

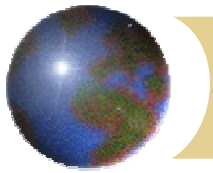
## ✦ **Data**

- ✦ Market values, exchange rates, interest rates from Datastream
- ✦ Accounting info from Thomson ONE Banker Analytics
- ✦ Options data from EUREX/LIFFE, proprietary market makers
- ✦ Annual reports from Global Access



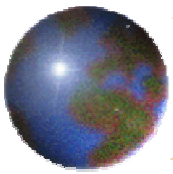
## *Crisis events*

- **Systemic risk is particularly important during major global financial crises**
  - Study reaction of banks around significant currency and credit shocks
    - Mexico: December 1994
    - Asia: July 1997
    - Russia: August 1998
    - LTCM: September 1998
    - Brazil: January 1999
    - WTC: September 2001



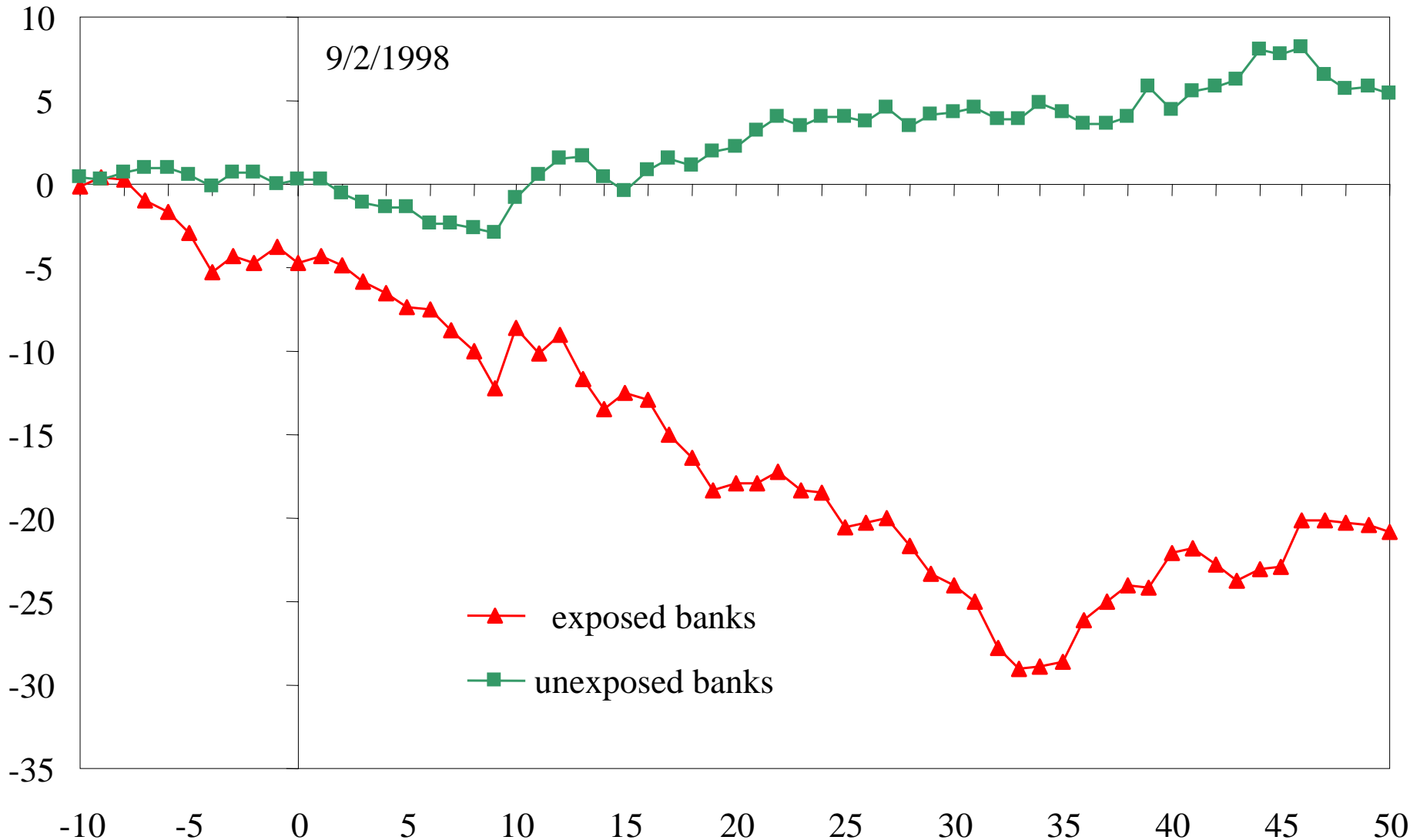
## *Returns to Banks Without Exposure*

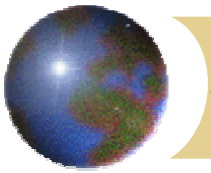
- ❖ **Negative returns to unexposed banks can be interpreted as a measure of systemic risk**
  - ❖ In efficient markets, negative information affects unexposed banks through increased risk to the financial system
  - ❖ Cumulative abnormal returns (CAR) of portfolios of unexposed banks
  - ❖ Control for market, interest rate, currency risks
- ❖ **Note that negative CAR of 100% represents systemic failure**



CAR4

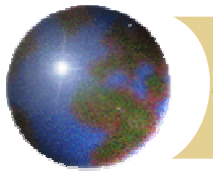
# *Russian/LTCM Crisis*





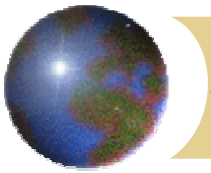
## *CARs and Systemic Risk: Results*

- ✦ **CARs of unexposed banks are economically and statistically small**
  - ✦ Only 9/11 shows significantly negative CARs
  - ✦ Largest effects for Russian/LTCM crisis and 9/11
  - ✦ Banks with low public support tend to outperform banks with high support
- ✦ **Low negative returns to unexposed banks suggest little threats to the global financial system**



# *Structural Credit Risk Models*

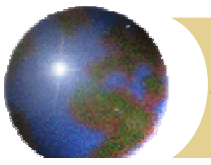
- ✦ **Extract default probabilities from observed equity prices using structural credit models**
  - ✦ Derive pre- and post-crisis estimates, calculate the change, and aggregate by exposure
  - ✦ Much of the model mis-specification error washes out in the inter-temporal comparison
- ✦ **Use Merton model for simplicity**
  - ✦ As in deposit insurance models
  - ✦ But...estimate by maximum likelihood, as in Duan et al. (2003), Laeven (2002), etc.
  - ✦ Using equity volatility transformation has various econometric disadvantages



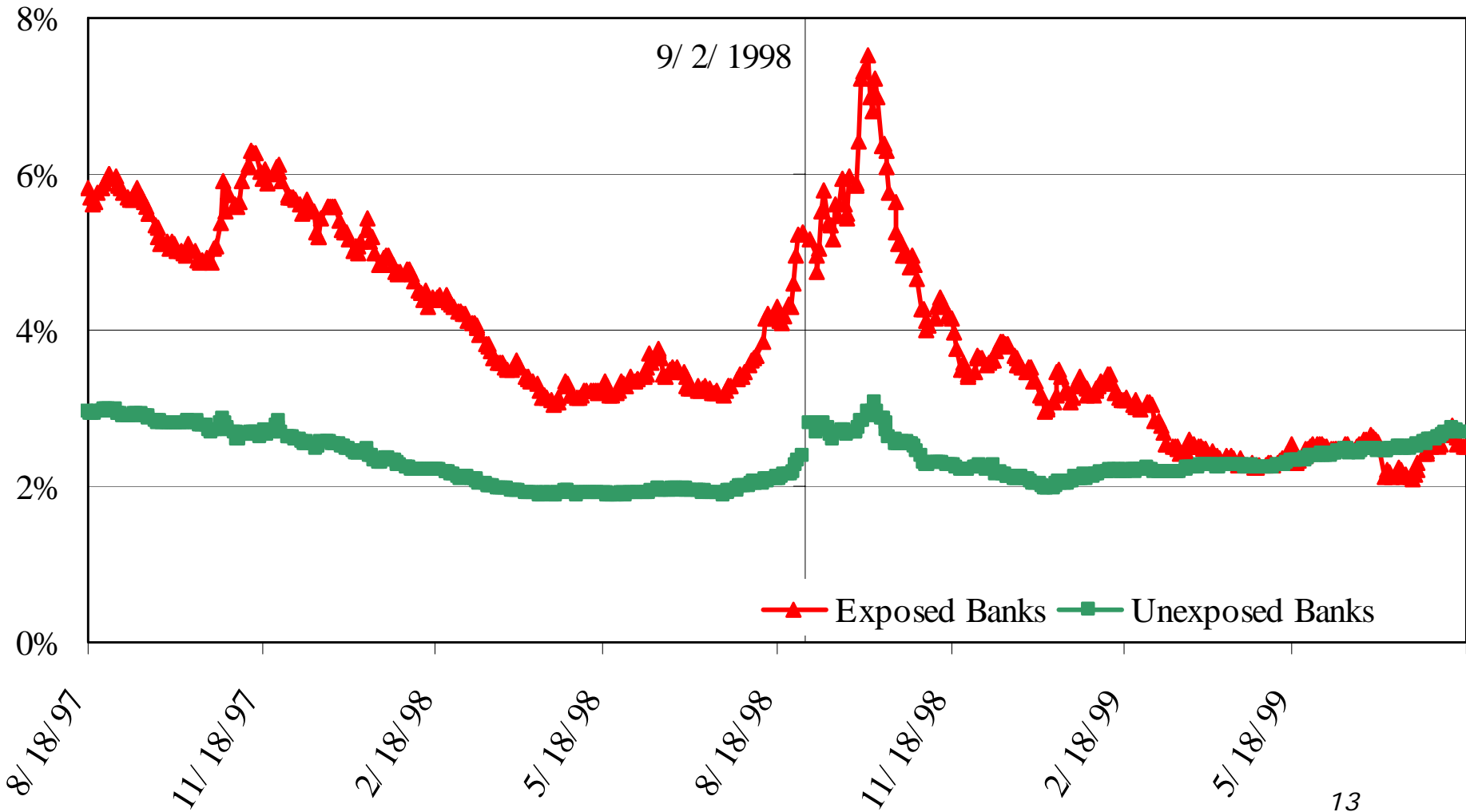
# *Structural Credit Risk Models*

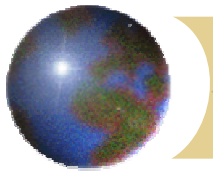
## ❖ **Implementation of structural model estimation**

- ❖ We use constant maturity of 1 year (consistent with fixed examination period)
- ❖ Interest rates corresponding to country or region
- ❖ Use LC equity from 1 year before and after the crisis
- ❖ Use 2 measures of bank failure points
  - Demand deposits + short-term debt
  - Demand deposits + short-term debt + .5(LT debt)
- ❖ Interpolate between accounting endpoints



# *Russian/LTCM Crisis*

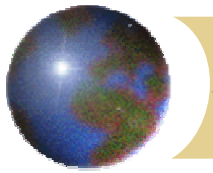




# *Structural Credit Risk Model: Results*

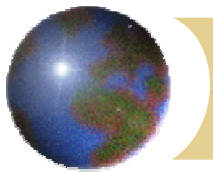
## ✦ Empirical findings

- ✦ Small changes in default probabilities and distances to default of unexposed banks
  - Across crises, increase of default risk is less than 1%
  - Strongest effects for European banks
- ✦ Example: Average default probabilities increased from 2.4% to 2.8% during the Russian/LTCM crisis
- ✦ Little evidence of major threat to the global banking system

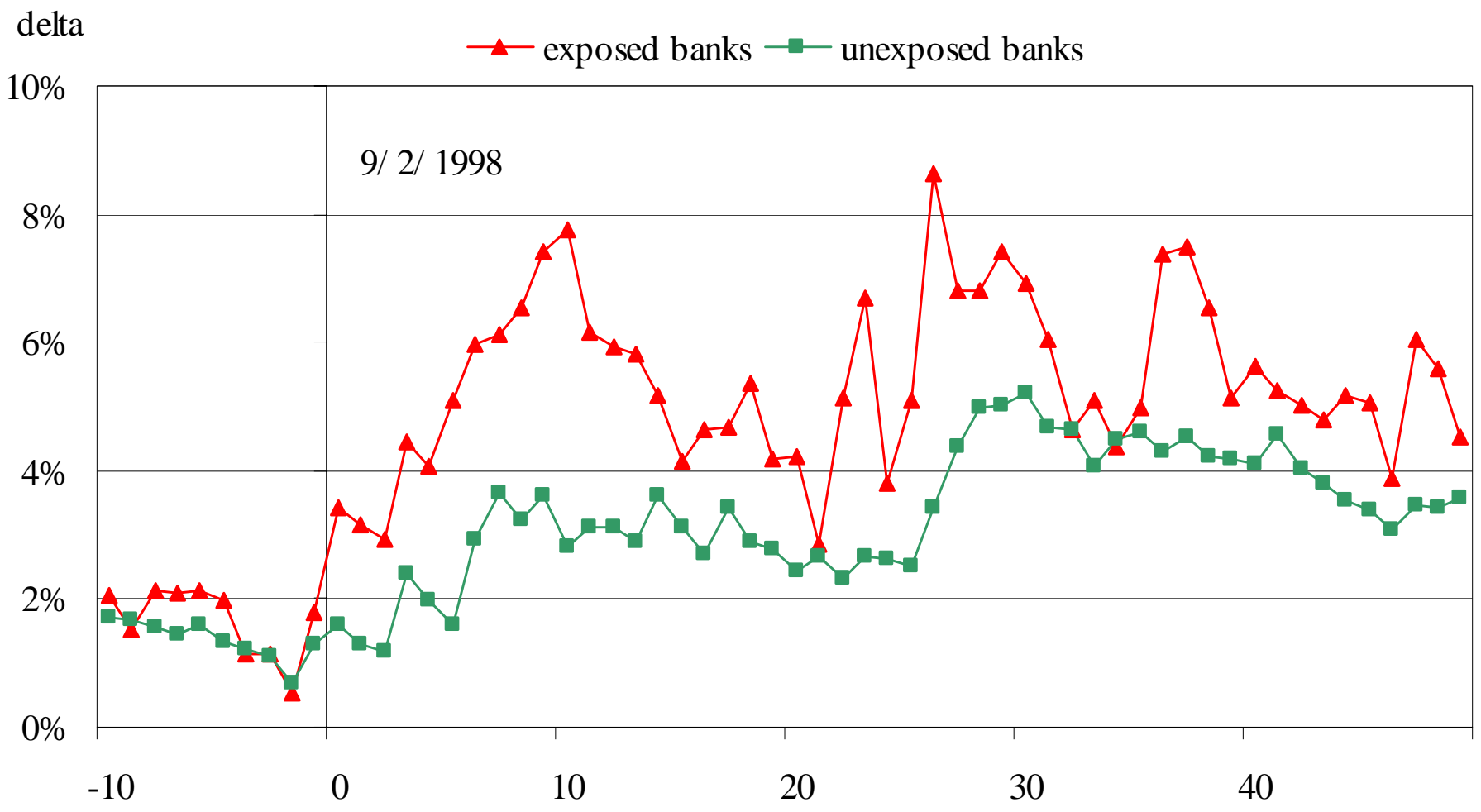


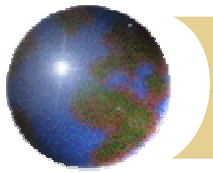
# *Systemic Risk and Equity Option Prices*

- ❖ **Probability of an equity price drop to zero is the probability of bank failure**
  - ❖ Model by Câmara (2001) prices options assuming that the equity price process is a diffusion with a positive probability of a jump to zero
  - ❖ Invert the model to use options data to imply failure probabilities
- ❖ **Estimate for banks using LIFFE/EUREX and proprietary U.S. market makers**
  - ❖ 62 U.S. banks and 14 major European banks
  - ❖ "Close"-to-ATM put and call prices
  - ❖ Maturities between 15 and 195 days
  - ❖ Average of 46.2 options per bank and day



# *Russian/LTCM Crisis*

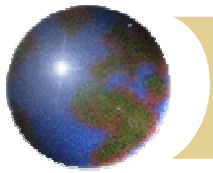




# *Equity Option Approach: Results*

## ✦ **Empirical findings**

- ✦ Little difference of implied failure probabilities between unexposed and exposed bank portfolios
- ✦ Crises do not immediately raise the probability of systemic failure in the international banking system
  - Across crises, average increase of default risk of less than 2.5%
  - Fixed-effects panel estimation shows no significant increases in default probabilities
  - Example: Average increase of default probabilities of unexposed banks of about 1-2% during Russian/LTCM crisis and 9/11



## *Summary and Conclusions*

- ✦ Paper develops methods for assessing the risk of systemic failure of the global financial system
- ✦ For emerging market currency and credit crises and 9/11, evidence of systemic risk is overall very low
- ✦ Results are consistent with several explanations
  - ✦ Shocks may not be large enough
  - ✦ Effective policy intervention may have limited the risks
  - ✦ Methods are not able to accurately measure risks
  - ✦ Risk of systemic failure may not be as large as many observers believe
- ✦ Financial intermediaries on a global scale may be more robust than often thought or feared