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Introduction

- 2

Background on Crisis

- ◆ The financial crisis has its roots in the US housing bubble
 - specifically the impact of the burst of the bubble on the complex financial instruments that were first created using mortgages
- ◆ Reasons for US housing bubble
 - US policy towards home ownership
 - 90s - Federal mandates to subsidize loans for affordable housing and tells Fannie/Freddie to support lending to low income borrowers
 - increased tax incentives for second homes
 - 00s - US HUD requires Fannie/Freddie to dedicate 50% of business to low /moderate income families
 - financial market regulation
 - Dec 2000 – Commodities Futures Modernization Act allows wide range of derivatives (including CDS) to proceed with minimal oversight
 - July 2004 SEC relaxes rule for capital adequacy for 5 US I-banks
 - macroeconomic policies
 - after Dot.com bust, FED drops interest rates to record low levels
 - easy credit encourages speculative activity
 - desire to create some fixed income return spurs creation of new assets that with riskier assets mixed together and parceled out in risk bundles

3

Background on Crisis

- ◆ With cheap credit, limited oversight and pressure to expand home ownership, activity in real estate market boomed
 - ▶ creation of many new and mortgage instruments spurred excessive reach in housing market
 - most instruments not right for most people or catches too complicated
 - lenders didn't care as they passed along loans to repackagers
 - CMO/CDOs and CDSs
 - ▶ CMO/CDOs are simply a pooling of many financial securities which are then cut in two dimensions to allow parsing of securities of different risks
 - ▶ CDSs are insurance contracts written to guarantee the securities that went into the CMO/CDOs
 - these instruments grew massively and were sold to investors all around the world but were priced assuming housing prices would not fall
 - ▶ in Fall of 2005 US housing prices start to fall
 - loans continue to be made but to ever riskier borrowers
 - underwriters move on quantity not quality as demand for securities to make more CDOs still strong
 - loans made in last half of 2005 and 2006 were very risky

4

Background on Crisis

- ◆ In mid 2004 FED starts raising USD interest rates up to 5%
 - ▶ this with continued decline in housing prices causes refinancing to decline and with re-pricing of many “teaser rate” loans defaults start to rise
 - leads to collapse of many firms in the mortgage industry in 2007
 - ▶ drop in value of many CMO/CDO securities causes pressure on investment funds
 - in summer 2007, Bear Stearns announces liquidation of two hedge funds
 - August 2007 see sharp credit squeeze as lenders discover extent of mortgage related securities in portfolios of parties they provide credit to
 - many funds forced to sell other assets (equity) to raise cash
 - realization of losses begin to arise as housing prices continue to tumble
 - ▶ 2008 bring US recognition that its in recession, offer stimulus package
 - bank solvency under pressure and Bear Stearns taken over on March 16
 - US government takes over Fannie/Freddy on Sept 7
 - Lehman collapses on Sept 15
 - AIG needs rescuing on Sept 16
 - all hell breaks loose thereafter for then next 6 weeks as credit market freeze

5

What We Do

- ◆ In this paper we document the impact of the financial crisis that has been evolving over the past few years on equity markets around the world
 - ▶ global equity market performance
 - total market index
 - worldwide financial vs. non-financial sectors
 - ▶ major country and regional equity market performance
 - US, Developed World excluding N America and Emerging Markets
 - financial vs. non-financial sectors
 - ▶ major industry level performance
 - Datastream level 3 industry classifications (10 groups)
 - ▶ financial sector performance
 - major sub-groups within the financial sector
 - ▶ style portfolio performance
 - size (large vs. small stocks) and growth vs. value stocks
 - ▶ volatility indices
 - ▶ correlations across countries, industries and regions

6

Executive Summary

- ◆ Although the credit crises has been ongoing since early 2007, the equity market reaction is basically second order until July/August 2008
 - ▶ the real equity market action (collapse) starts in the middle of Sept 2008 with the bankruptcy of Lehman and the bailout of AIG when credit markets froze up
 - ▶ from September 15 through late October nearly everything fell sharply
 - the impact was universal and severe
 - by the end of 2008, with few exceptions, most equity indices were at 60% or less of their end of 2006 levels, and down over 50% from their highs
 - for most indices, these 32 trading days contain the majority of the decline for the year
 - volatility reached all-time highs and correlations universally rose
- ◆ In this crisis, equity investors had no where to hide

7

Data and Methodology

- ◆ Sample Period
 - focus most of our attention on the period from end of 2006–February 2009
- ◆ Data
 - total return indices
 - market capitalization
 - actual and implied volatility indices
 - regions, sectors, countries and industry level indexes
 - daily frequency
 - USD and local currency
- ◆ Sources
 - DataStream
 - MSCI Barra
 - Ibbotson
 - other

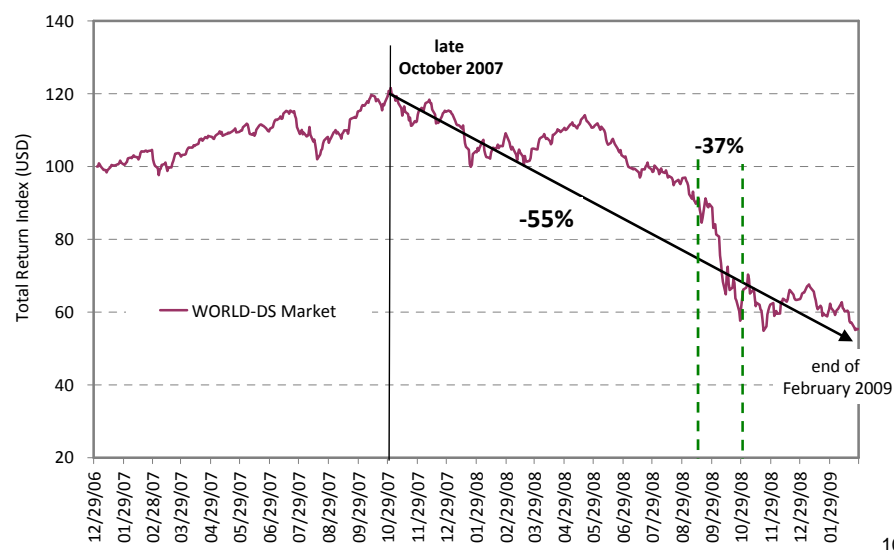
8

Overall Market Performance

- ◆ Heat of the crisis marks the period between September 12 and October 27, 2008
 - World equity markets lost 37%
 - Volatility quadrupled relative to “normal” levels
 - In comparison, the issues in August 2007 surrounding quantitative hedge funds appear pale
- ◆ Emerging markets perform significantly better until mid-2007, but then drop even more sharply than developed markets
 - By the end of the sample period, markets are down an average of 45% relative to the beginning of 2007

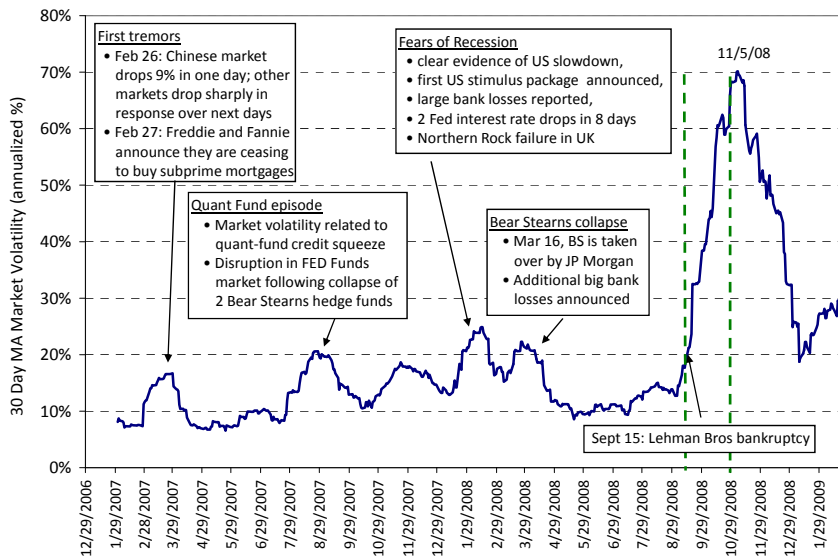
9

World Market Return



10

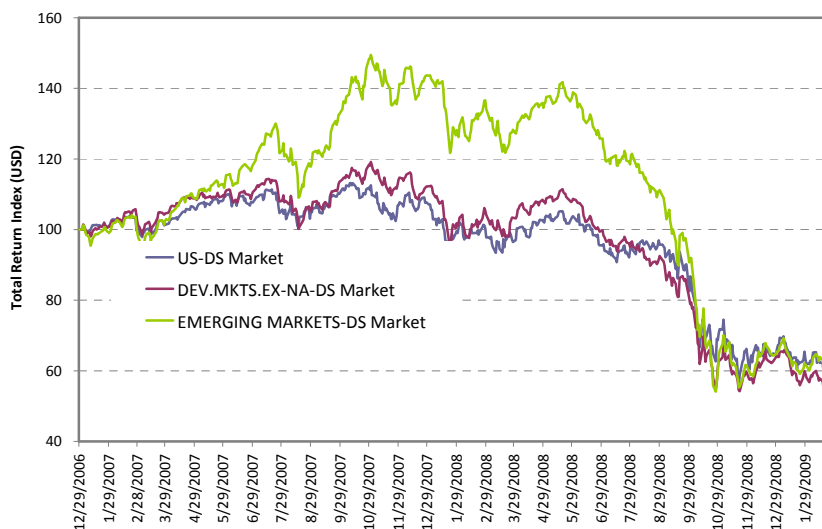
World Market Volatility



11

Regional Market Performance

Component Markets



12

Overall Market Performance

◆ Historical perspective

- 2008 and first two months of 2009 are worst period in modern investing era for world market
- for US, current market decline since peak (-54%) is only surpassed by the Great Depression (-83%)
 - worse than the burst of the dot com bubble (-30%)
 - but not the fastest drop

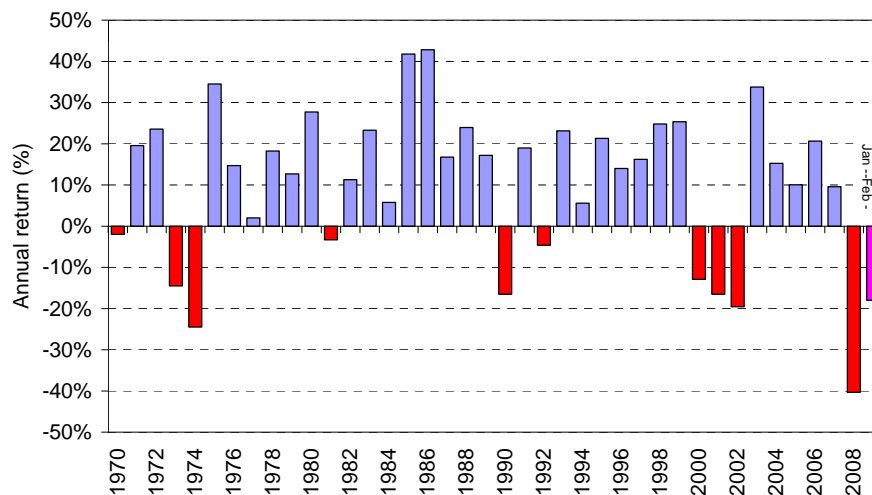
◆ How long until its over? (US evidence)

- average time to return to peak
- excluding the Great Depression: 44 months
 - suggests mid 2011
- including the Great Depression: 60 months
 - suggests Fall 2012
- just using Great Depression: 15.3 years
 - suggests not until early 2023

13

Relative Size of Market Collapse

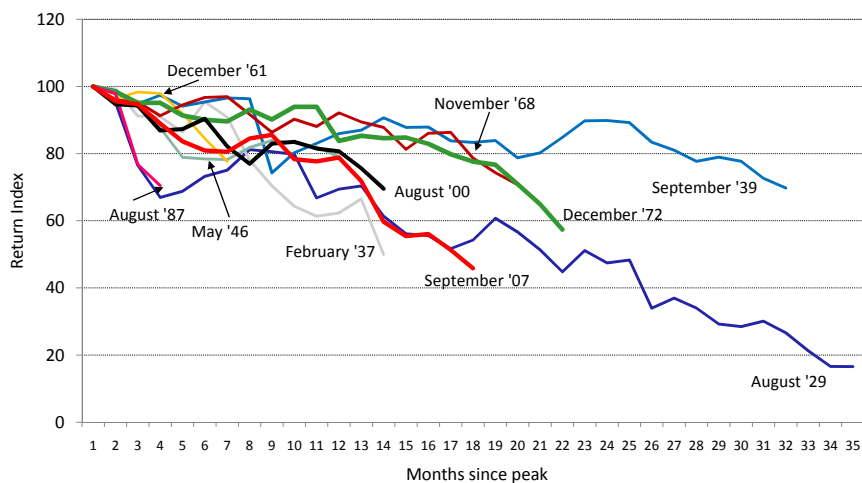
MSCI World Market Return
annual 1970 - 2008 plus Jan-Feb 2009



14

Overall Market Performance

Major US Market Declines



15

Overall Market Performance

Date of Peak	Return to trough	Months: peak to trough	Months: peak back to peak
September 2007	-54.14%	17*	???
August 1929	-83.41%	34	184
February 1937	-50.04%	13	85
September 1939	-30.27%	31	45
May 1946	-21.76%	11	41
December 1961	-22.28%	6	16
November 1968	-29.23%	19	28
December 1972	-42.62%	21	42
August 1987	-29.53%	3	21
August 2000	-30.48%	13	77
average	-37.74%	16.8	59.9
average w/o 1929	-32.03%	14.6	44.4

* still declining

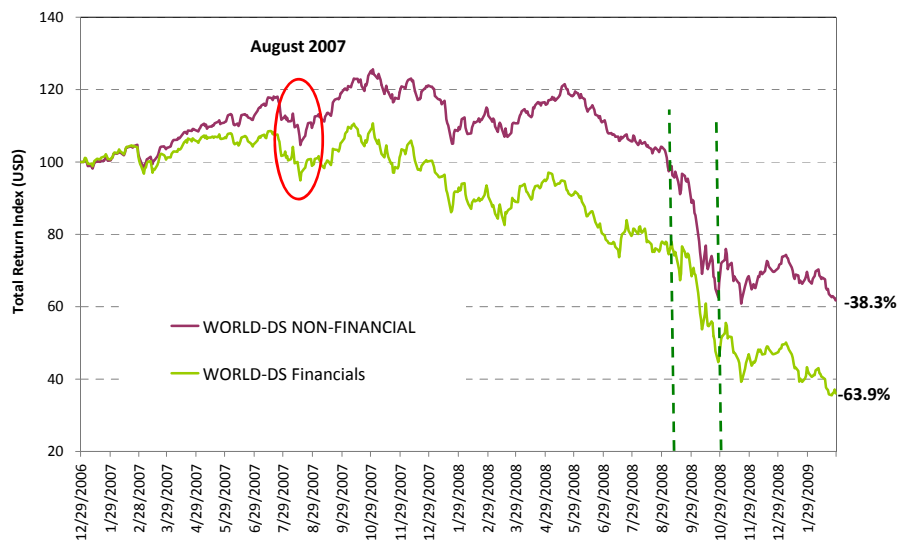
16

Market Sector Performance

- ◆ Epicenter of current crisis is the financial sector
 - not surprisingly, financial stocks (-64%) are hit harder than non-financial stocks (-38%)
 - Financials start losing value in November 2007, while non-financials maintain valuations until late Spring 2008, but then drop by similar extent
 - volatility of financials is 50% higher than non-financials
 - initially this is a crisis of the financial sector in Dev Mkts
 - US financials start underperforming in early 2007
 - Dev Mkt financials begin underperforming in mid 2007
 - in Emerging Markets, financials and non-financials perform similarly and start major decline in mid 2008
 - difference between financials and non-financials smaller
 - EM financials don't start underperforming until beginning of 2008
 - all sectors fall sharply in 32 day crisis period

17

Financial vs. Non-Financial Sector Performance



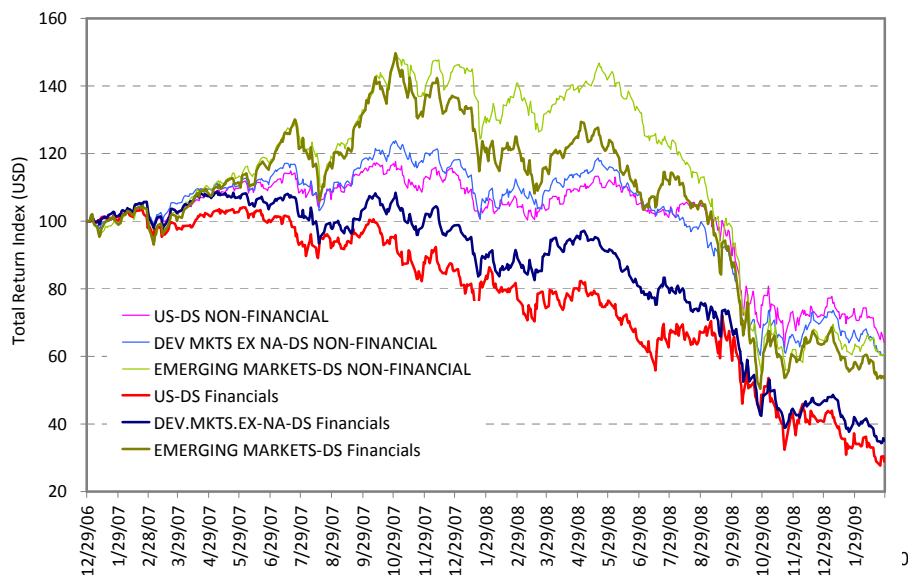
18

Sector Performance from Peak of Crisis



19

Sector Performance across Regions



Statistics on Sector Performance

Total Return Index (USD)	US-DS Financials	DEV.MKTS. EX-NA-DS Financials	EMERGING MARKETS-DS Financials	US-DS Non- Financials	DEV MKTS EX NA-DS Non- Financials	EMERGING MARKETS-DS Non-Financials
Return 12/31/06- 2/27/09	-71.1%	-65.0%	-46.6%	-35.9%	-39.8%	-40.1%
Stdev (annualized)	49.9%	32.1%	33.0%	28.8%	24.8%	28.3%
Return 12/31/06-12/31/07	-14.2%	-1.2%	36.4%	13.6%	18.2%	46.2%
Stdev (annualized)	21.4%	16.6%	21.5%	14.7%	13.9%	18.0%
Return 12/31/07-12/31/08	-49.6%	-52.7%	-52.8%	-34.3%	-39.5%	-54.9%
Stdev (annualized)	63.0%	41.1%	41.3%	37.5%	31.9%	35.5%
Return 9/12/08-10/27/08	-34.2%	-41.7%	-47.7%	-32.3%	-34.5%	-45.3%
Stdev (annualized)	103.8%	75.5%	76.4%	69.1%	57.7%	67.0%
Return 12/31/08-2/27/09	-33.3%	-25.1%	-17.0%	-14.1%	-15.7%	-9.1%
Stdev (annualized)	76.6%	39.6%	32.6%	31.5%	25.1%	27.0%
Max daily return	14.4%	11.6%	11.1%	12.0%	7.5%	8.8%
Date	11/24/08	09/19/08	09/19/08	10/13/08	10/13/08	09/19/08
Min daily return	-15.0%	-9.3%	-8.7%	-9.0%	-7.3%	-9.6%
Date	12/01/08	10/10/08	10/06/08	10/15/08	10/10/08	10/06/08

- financials hit much harder than non-financials in total
 - US and DM financials more than EMs
 - EM sectors fared much better 2007 but worse 2008 and fall more in crisis period
- volatility highest in financials, especially US and stays high even after crisis

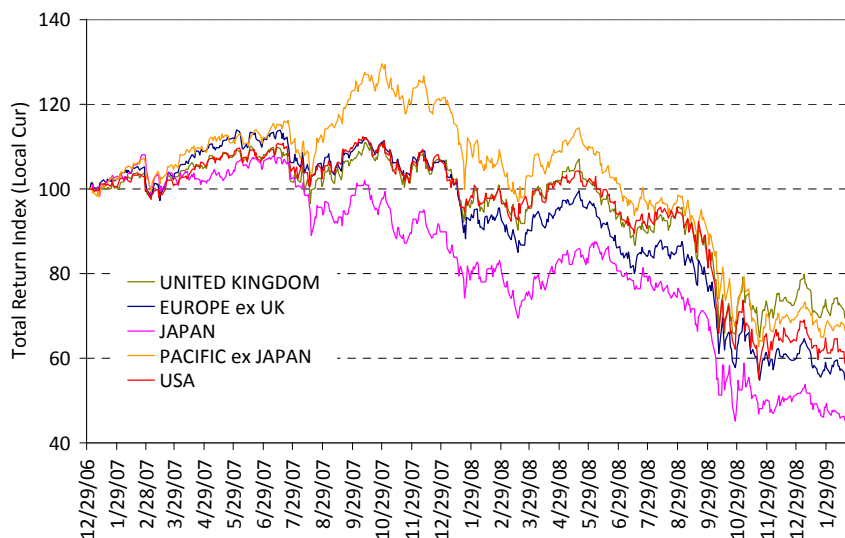
21

Country Market Analysis

- ◆ Developed Markets
 - Japan underperforms and Pacific ex-J does outperforms until crisis period
 - performance somewhat disparate in local currency (LC)
 - Japan falls most and UK falls least
 - in USD terms results are more tightly packed due to XR changes
 - UK and Europe fall most due to depreciation against USD
 - in USD all markets exit crisis period at similar performance levels
- ◆ Emerging Markets
 - EM regions outperform US market in 2007 and early 2008, but crash to US market return levels during crisis period
 - a USD investor is no worse off holding EM portfolios than US market portfolio over period
 - exchange rate impact not as prevalent in EM markets
 - Chinese market movement more spectacular
 - big run-up in fall 07 but end period just slightly above other EMs
 - in USD terms China down only 20% on end of 2006 levels

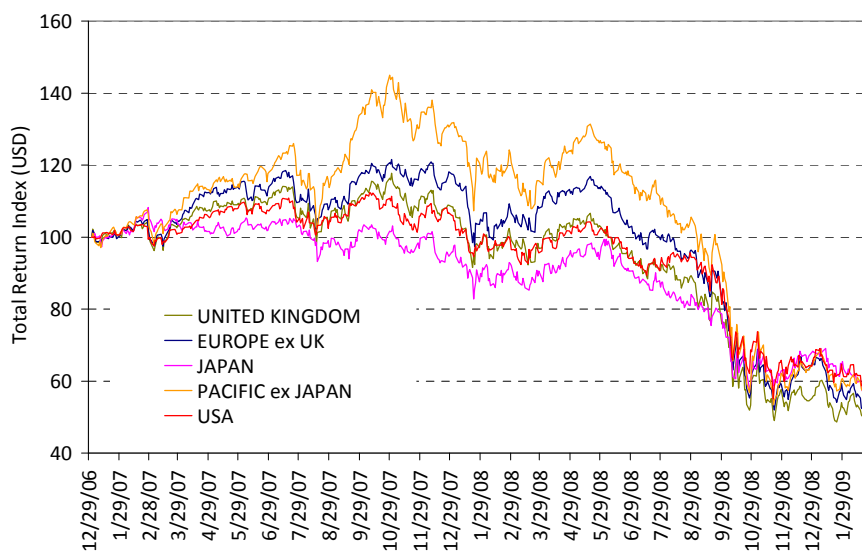
22

Developed Country Market Performance (LC)



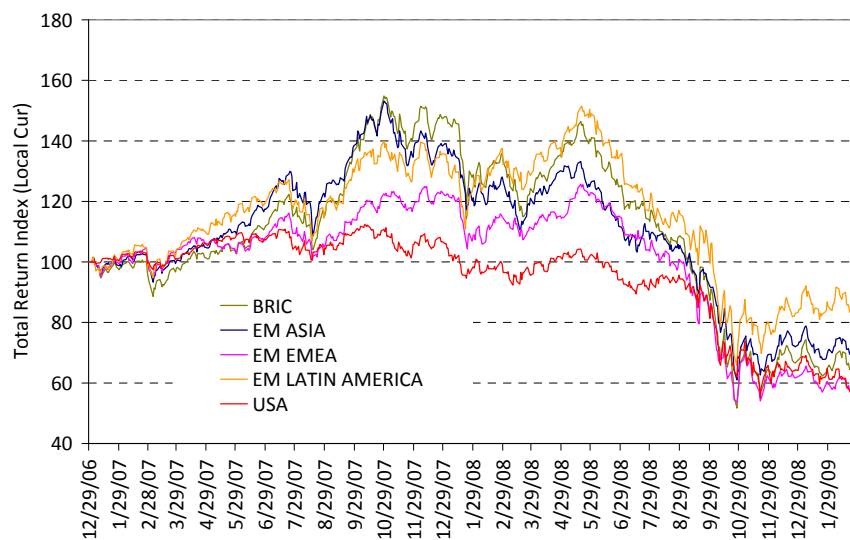
23

Developed Country Market Performance (USD)



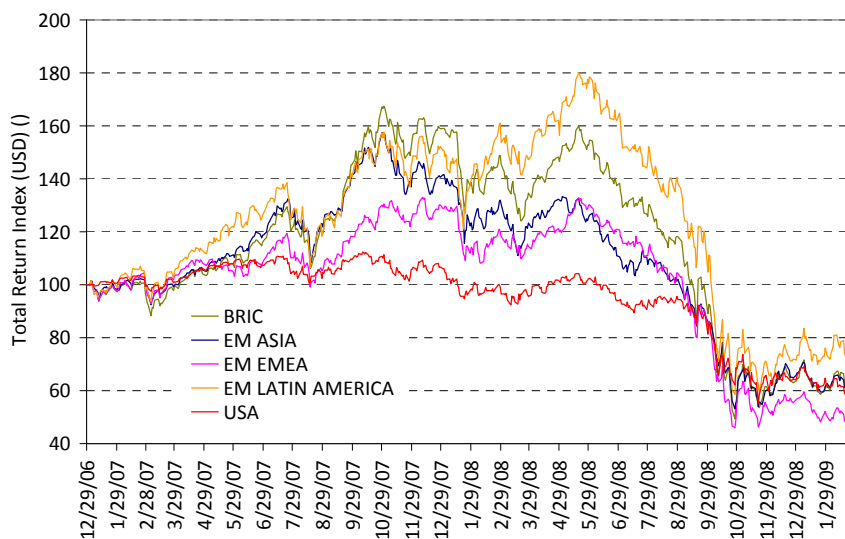
24

EM Regional Market Performance (LC)



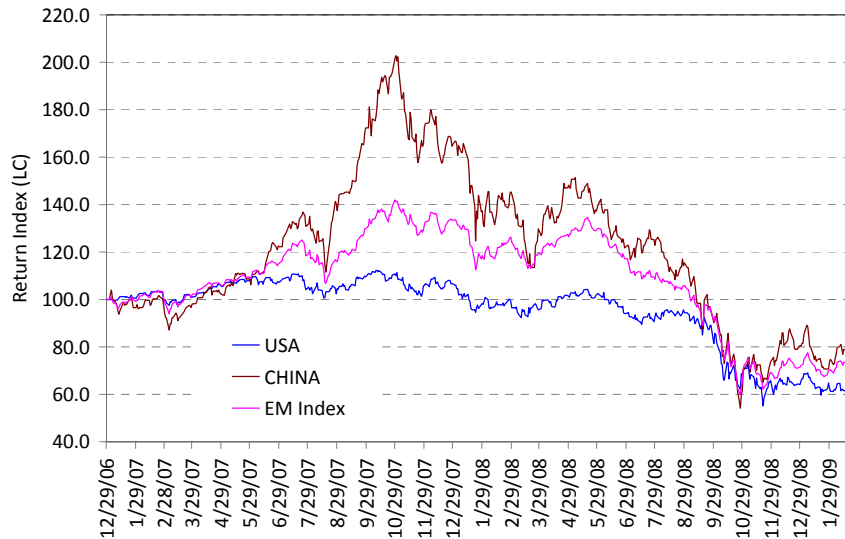
25

EM Regional Market Performance (USD)



26

China, EM and USA Market Performance (LC)



27

Industry Performance

- ◆ Results for 10 DataStream level 3 industry groups from 6 regions
- ◆ United States and Other Developed Markets
 - Oil&Gas and Basic Materials top performers until 2008
 - Financials at bottom of spread the entire period
 - clearly crisis hit financials worse than any other industry
 - US financials under perform more than in Other Developed Mkts
 - US industry end in 3 groups: non tradables, tradables and finance
 - on average other Developed markets non financial industry fare worse
 - likely to due XR effect
 - Basic Materials and Industrials are hardest hit in the crisis
 - in both markets Financials lose 25% in fist two months of 2009

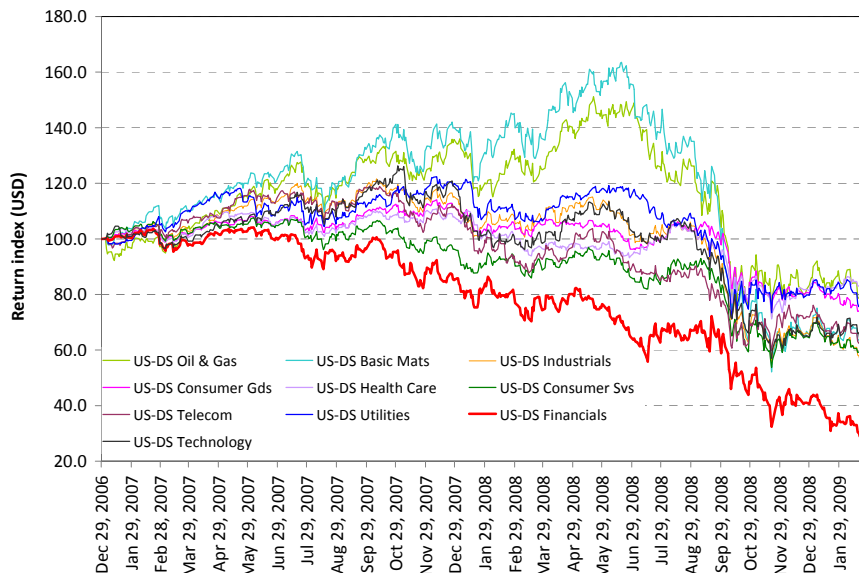
Industry Performance

◆ Emerging Markets

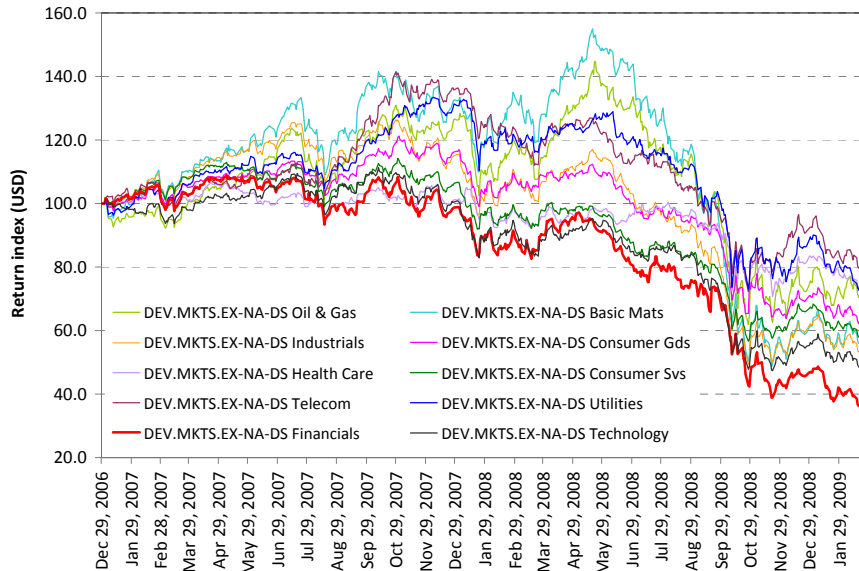
- Financials are not the biggest loser in the crisis, though they show the worst performance in 2009
 - Technology is worst (-52%), Health Care best (-16%)
 - Basic Materials perform extremely well for most of the sample period, but is hard hit in the peak of the crisis
 - drops almost 70% from peak in early 2008
- do not see sharp drop in early 2009 as in developed markets

29

US Industry Performance

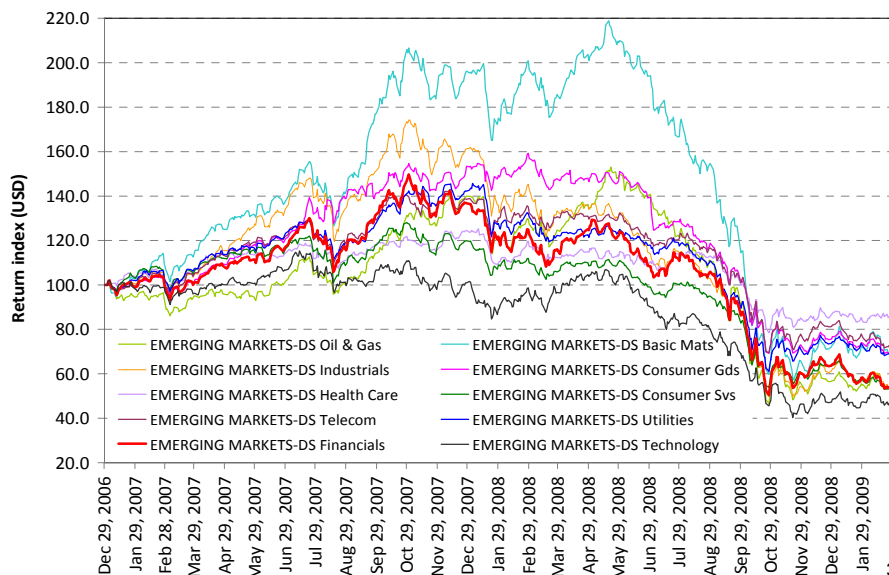


Other Dev Markets Industry Performance



31

EM Region Industry Performance



32

Financial Sector Performance

◆ Consider sub-industries of financials

- banks, insurance companies, real estate, financial services
- sub-industry all move pretty much together

● USA

- (Commercial) Banks (-77%) underperform most for the period; Insurance does “best” (-62%)
 - Financial Services (Investment Banks) perform badly in the peak of the crisis
- returns are very volatile - Banks have annualized volatility of 100%

● Other Developed Markets

- very similar performance across sub industries
- Insurance slightly outperforms (-59%); Banks do worst (-69%)

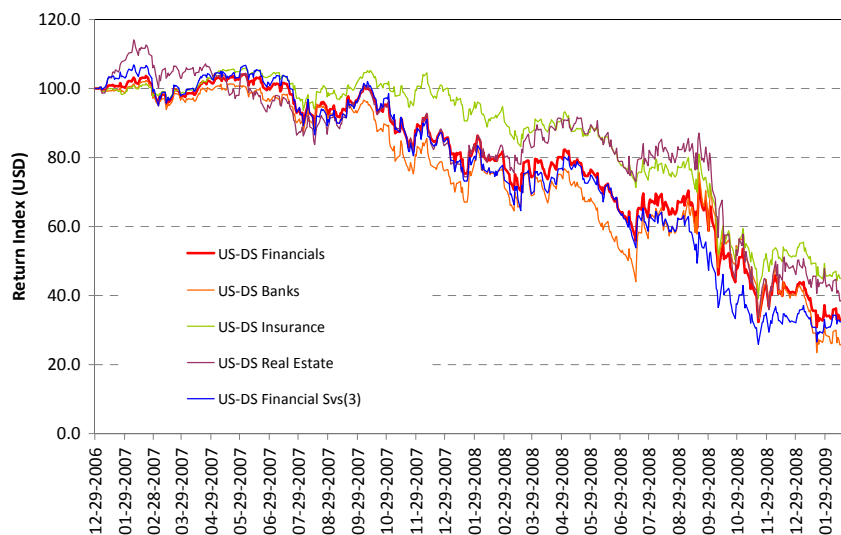
● Emerging Markets

- Banks drive aggregate performance
- Insurance slightly outperforms (-31.3%); real estate is worst (-63.5%)

33

Financial Sector Performance

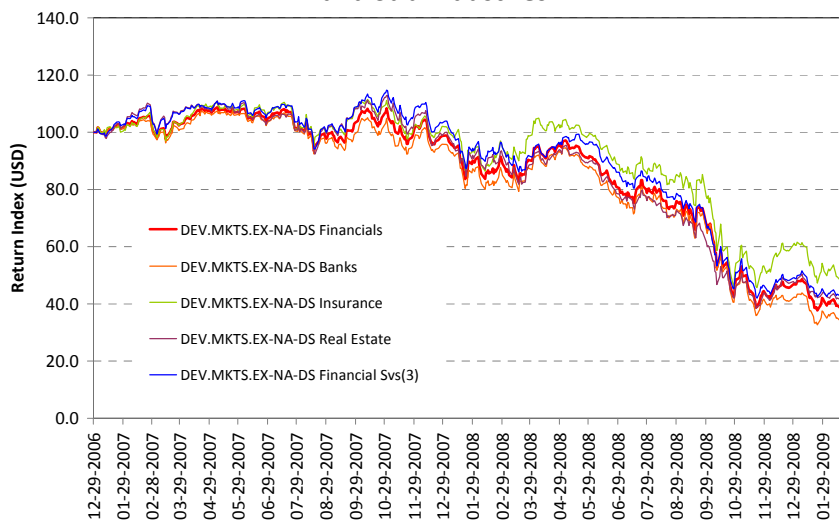
US Financial Sector and Sub-industries



34

Financial Sector Performance

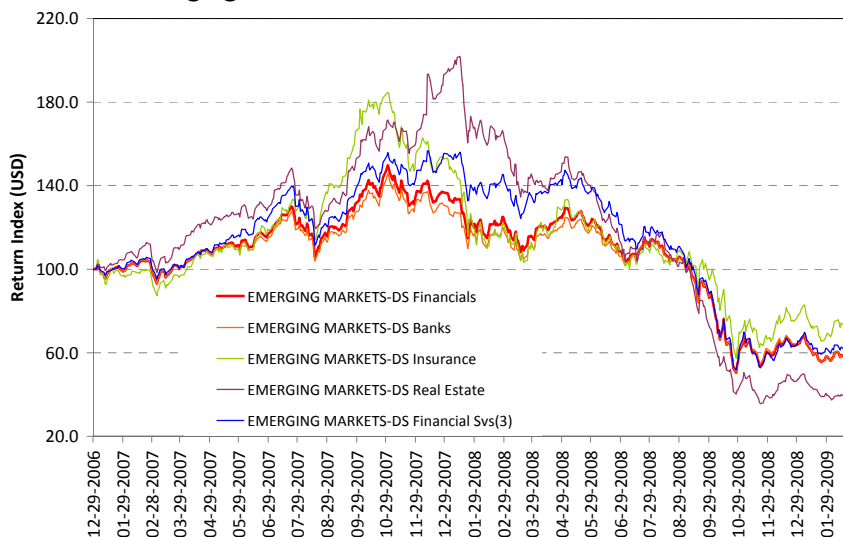
Developed Markets ex NA Financial Sector and Sub-industries



35

Financial Sector Performance

Emerging Markets Financial Sector and Sub-industries



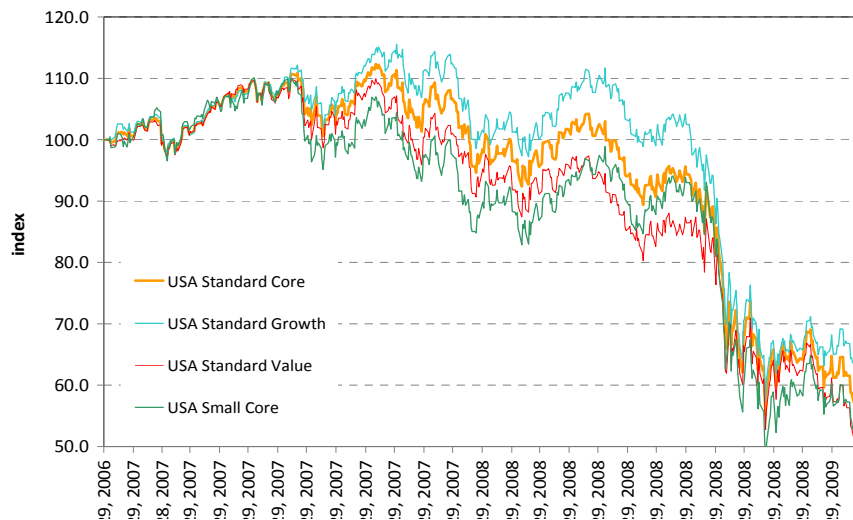
36

Style Portfolio Performance

- ◆ Look at Style portfolios
 - style refers to a specific set of characteristics for the stocks in the portfolio
 - the common styles we look at relate to
 - firm size - large versus small
 - growth versus value – distinguished by the relative market of the firms equity to its reported book (accounting) value
- ◆ Use MSCI data so look at USA and EAFE
 - performance diverges in July-October 2007 – credit crunch
 - all styles show huge drops in the peak of the crisis
 - not much difference in terms of peak crisis reaction
 - overall growth outperforms other styles, while the small portfolio performs worst;
 - at the end of the period performance differs by about 10%

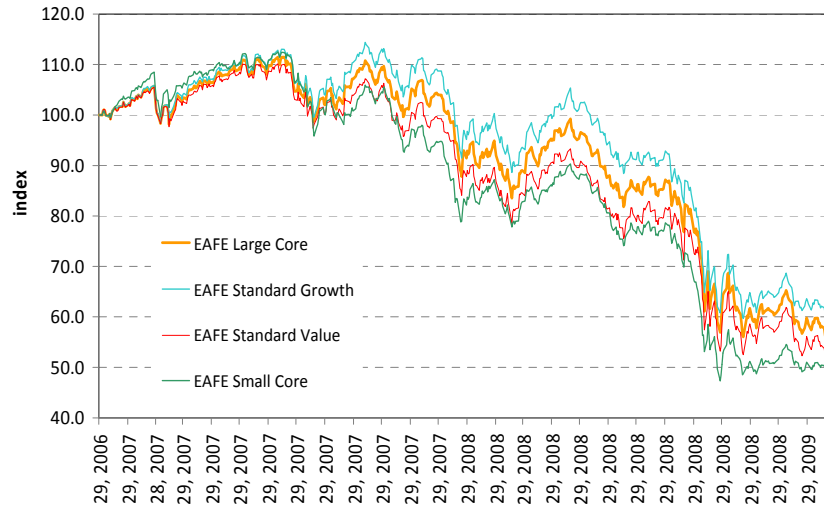
37

Style Portfolio Performance



38

Style Portfolio Performance



39

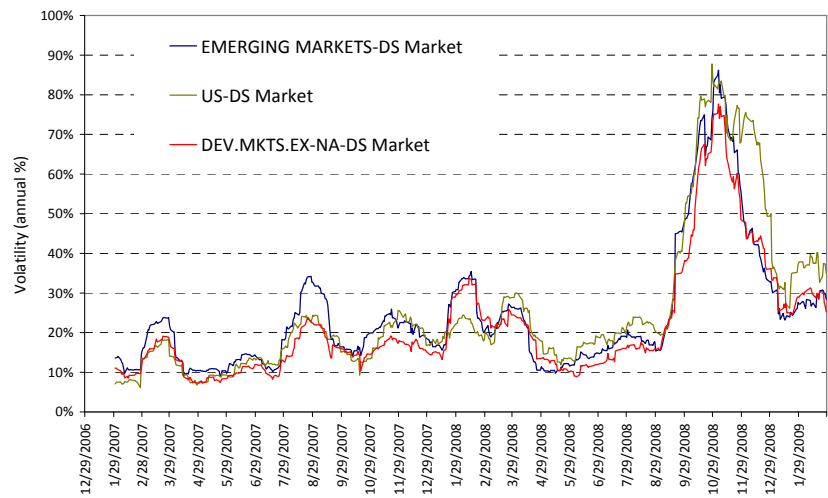
Volatility

- ◆ We saw the pattern of global equity volatility earlier
 - ▶ during the crisis it rose to 4-5 times normal levels
 - we look at rolling standard deviations of returns
 - annualized 30-day rolling window return volatility
 - implied volatility backed out of option prices
 - if we see the price of an option, since the other inputs to pricing an option besides the assumed future volatility are directly observable today we can solve for the assumption about stock price volatility in the future that would produce the observed option price today
 - ▶ Implied volatilities taken from equity index options (30 days)
- ◆ Massive increase in volatility
 - ▶ despite some previous bumps volatility really rises in Sept 08
 - ▶ volatility patterns are virtually identical across countries/ regions
 - EM volatility rises more than in DM in the early turmoil periods
 - increases during the peak period are identical
 - ▶ implied volatilities are similar to realized volatilities, suggesting that investors expected past volatility to continue

40

Volatility

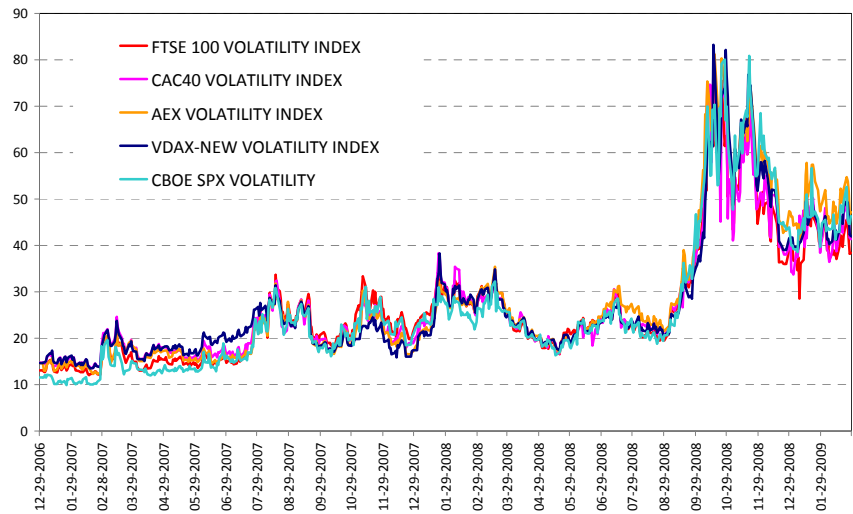
Moving Average 30-Day Market Return Standard Deviation



41

Volatility

Implied Volatility Indexes
US and Various European Markets
12/29/06 - 2/27/09



42

Correlations

◆ Cross Country/Regional Correlations

- ▶ non-trivial increase in average correlations in the crisis period
 - stronger increase in Developed Markets during peak
 - stronger increase in Emerging Markets after peak
- ▶ appears EMs are more correlated with each other and with DMs even after crisis

◆ Industry Correlation

- ▶ average correlation with industries across regions increases by 32% from 0.44 to 0.60, and drops back to 0.53 after October 2008

◆ Temporal Pattern of Daily Correlations

- crisis has impacts temporal pattern of price shocks across regions (USA, PAC, EUR)
 - ▶ regions more connected
 - Europe and the United States are the primary locations for disclosure of important information into the markets during the crisis

43

Correlations

◆ Average correlations across country/regional markets

- Developed markets are
 - ▶ US, UK, Europe ex-UK, Japan, and Pacific ex- Japan
- EM markets are
 - ▶ EM Latin America, EM Asia, EM EMEA and BRIC
- intermarket are the average cross-market (EM-DM) correlations

	<u>Developed Market</u>		<u>Emerging Markets</u>		<u>Intermarket</u>	
		% chg		% chg		% chg
Pre-Crisis Period 1/1/07 - 9/12/08	0.425		0.585		0.506	
Crisis Period 9/15/08 - 10/27/08	0.597	41%	0.793	36%	0.685	35%
Post Crisis Period 10/28/08 - 2/27/09	0.437	2.9%	0.681	16.4%	0.569	12.4%

44

Correlations

- ◆ Correlations are average of daily correlations amongst industry portfolio returns for US, Dev ex-NA and EM groups
 - averages are done pre crisis, peak crisis and post peak crisis

	Pre Crisis	Crisis Period	Post Crisis	% increase	
	1/01/07 - 9/12/08	9/15/08 - 10/27/08	10/28/08 - 2/29/09	Crisis	Post Crisis
Oil & Gas	0.528	0.600	0.615	13.6%	16.4%
Basic Mats	0.608	0.647	0.673	6.5%	10.7%
Industrials	0.428	0.561	0.556	31.1%	30.0%
Consumer Gds	0.361	0.577	0.555	59.7%	53.8%
Health Care	0.365	0.524	0.448	43.7%	22.9%
Consumer Svs	0.487	0.562	0.565	15.5%	16.0%
Telecom	0.457	0.731	0.541	59.9%	18.3%
Utilities	0.380	0.762	0.502	100.4%	31.9%
Financials	0.449	0.609	0.510	35.6%	13.5%
Technology	0.342	0.390	0.379	14.2%	10.8%
Average	0.440	0.596	0.534		

45

Correlations

- ◆ Table reports pair wise correlation of daily returns
 - with various possible 1 day temporal shifts
 - ▶ numbers read correlation of return on day t for region in first column with return in each region on day t-1, t, or t+1
- results suggest an increase in the price transmission within day PAC to EUR, and USA to PAC with smaller rise in EUR to USA

Daily Correlations										
2007-Aug 2008	t-1			t			t+1			
	PAC	EUR	US	PAC	EUR	US	PAC	EUR	US	
	PAC _t	0.004	0.490	0.591	1.000	0.370	0.073	0.004	-0.044	-0.051
	EUR _t	-0.044	-0.124	0.290	0.370	1.000	0.484	0.490	-0.124	-0.097
	USA _t	-0.051	-0.097	-0.163	0.073	0.484	1.000	0.591	0.290	-0.163
9/12 - 10/27	t-1			t			t+1			
	PAC	EUR	US	PAC	EUR	US	PAC	EUR	US	
	PAC _t	0.084	0.481	0.806	1.000	0.657	0.123	0.084	-0.365	-0.290
	EUR _t	-0.365	-0.113	0.354	0.657	1.000	0.646	0.481	-0.113	-0.245
	USA _t	-0.290	-0.245	-0.174	0.123	0.646	1.000	0.806	0.354	-0.174

46

Summary & Conclusion

- ◆ While there was earlier turmoil in financial markets, the financial crisis really started after the collapse of Lehman Brothers
- ◆ In the peak of the crisis, from September 15 to October 28, 2008, nearly everything fell sharply
 - Massive destruction of shareholder value across industries, sectors, countries and investment styles
 - By the end of 2008, most equity indices were at 50% or less of their end of 2006 levels, and down 60% from their highs
 - Volatility quadrupled and remained twice prior levels
 - As markets dropped in tandem, correlations increased
- ◆ Consequently, equity investors were hit hard and had no where to hide as diversification benefits did not materialize

47