

## 1. Introduction

“Financial disruptions do not respect borders. The crisis has been global, with no major country having been immune. How should we interpret the extraordinary events of the past year, particularly the sharp intensification of the financial crisis in September and October? Certainly, fundamentals played a critical role in triggering those events.... At the same time, however, the events of September and October also exhibited some features of a classic panic.”

**-Benjamin Bernanke, Federal Reserve Chairman, AUGUST 21, 2009<sup>1</sup>**

One year after the August 2007 onset of the Credit Crunch, most major world markets experienced slightly negative average weekly returns; however, as shown in Table 1, after the collapse of Lehman Brothers --- a shock to the U.S. financial market --- global markets behaved differently. After the Lehman shock, weekly returns grew more negative and market volatility increased. Figure 1 (Appendix) shows the correlation that international markets experienced with the U.S. during the Credit Crunch; notice that after the collapse of Lehman Brothers, global correlation of weekly returns with the U.S. market greatly increases.

Why is it that the U.S. and these other markets experienced this increase in comovement? It is possible that the increased comovement was insignificant, caused by fundamentals, or showed signs of contagion.

One possibility is that the observed increase in comovement is a biased result of heteroskedasticity and does not represent a significant deviation from corrected levels of interdependent comovement (Forbes and Rigobon, 2002). Table 2 shows the significance levels for the Spearman Correlation Coefficients reported in Figure 1.

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<sup>1</sup> Chairman Ben Bernanke spoke at the Federal Reserve Bank of Kansas City's Annual Economic Symposium in Jackson Hole, Wyoming, August 21, 2009.

Former Treasury Secretary Hank Paulson attributed the increased comovement to fundamentals, namely “a dramatic increase in capital flows, low interest rates, excessive risk taking and a global search for return.” However during September and October 2008, U.S. financial institutions came under extreme pressure. Federal Reserve Chairman Benjamin Bernanke argued that the particularly sharp intensification of the financial crisis in September and October 2008 exhibited some features of a classic panic.

Another possibility is contagion. If contagion is defined as a significant increase in market comovement after a shock to one country (Forbes and Rigobon, 2002), then using the Credit Crunch as a global fixed point for international financial markets, the collapse of Lehman

PERCENTAGE RETURNS 08/01/2007 - PRESENT	Table 1: FTSE Index Weekly Percentage Returns During the Credit Crunch Before, During and After the October Crash											
	PRE LEHMAN COLLAPSE				OCTOBER CRASH (SEPT 15 to OCT 31)				AFTER OCTOBER CRASH			
	Mean	Std	Var	N	Mean	Std	Var	N	Mean	Std	Var	N
FINANCIAL MARKET												
ARGENTINA_F	-0.14	4.31	18.59	59	-8.31	14.56	212.07	7	1.16	8.03	64.44	39
AUSTRALIA_F	-0.28	4.04	16.34	59	-4.82	14.12	199.43	7	1.05	6.53	42.64	39
AUSTRIA_F	-0.52	3.69	13.62	59	-8.59	11.72	137.36	7	1.05	7.87	61.93	39
BELGIUM_F	-0.52	3.27	10.7	59	-7.55	9.95	99.06	7	0.96	5.89	34.74	39
BRAZIL_F	0.24	5.26	27.71	59	-5.42	19.14	366.21	7	1.63	8.89	79	39
CANADA_F	-0.06	3.18	10.09	59	-5.08	11.79	139.07	7	0.98	7.28	53.06	39
CHILE_F	-0.08	3.86	14.92	59	-4.03	15.26	232.82	7	1.34	4.81	23.16	39
CHINA_F	-0.35	6.37	40.57	59	-5.04	10.69	114.2	7	1.89	5.47	29.93	39
CZECH_F	0.3	3.72	13.85	59	-3.51	15.15	229.41	7	0.81	6.43	41.37	39
DENMARK_F	-0.27	3.07	9.43	59	-5.07	13.17	173.54	7	0.77	6.07	36.86	39
EGYPT_F	-0.09	3.44	11.82	59	-6.88	9.29	86.28	7	1.14	7.1	50.41	39
FINLAND_F	-0.41	4	15.99	59	-4.49	8.44	71.24	7	0.39	6.73	45.25	39
FRANCE_F	-0.27	3.05	9.29	59	-4.32	10.71	114.72	7	0.6	6.38	40.66	39
GERMANY_F	-0.21	2.78	7.72	59	-4.17	12.96	167.97	7	0.62	6.4	40.99	39
GREECE_F	-0.53	3.31	10.98	59	-6.54	14.46	209.02	7	0.8	6.14	37.73	39
HONGKONG_F	-0.25	4.33	18.75	59	-4.38	8.22	67.5	7	1.38	4.63	21.46	39
HUNGARY_F	-0.47	4.14	17.16	59	-7.11	18.44	339.86	7	1.16	9.37	87.72	39
INDIA_F	-0.19	5.03	25.27	59	-6.06	10.86	118.03	7	1.64	6.9	47.57	39
INDONESIA_F	-0.17	5.61	31.48	59	-6.9	10.55	111.26	7	2.26	7.54	56.87	39
IRELAND_F	-0.98	7.77	60.43	59	-3.87	10.82	117.15	7	0.35	5.47	29.94	39
ISRAEL_F	0.09	2.48	6.15	59	-2.81	5.37	28.85	7	0.76	3.32	11.03	39
ITALY_F	-0.43	2.8	7.86	59	-4.54	11.09	122.98	7	0.55	6.98	48.77	39
JAPAN_F	-0.38	2.74	7.52	59	-2.91	6.66	44.36	7	0.39	3.39	11.49	39
KOREA_F	-0.57	4.6	21.15	59	-4.36	18.38	337.64	7	1.28	6.91	47.74	39
MALAYSIA_F	-0.34	3.28	10.74	59	-3.15	4.25	18.09	7	1.01	3.2	10.22	39
MEXICO_F	-0.18	3.49	12.21	59	-4.68	17.54	307.56	7	0.93	7.27	52.84	39
MOROCCO_F	0.35	2.26	5.09	59	-2.61	5.86	34.33	7	0.07	4.15	17.2	39
NETHERLANDS_F	-0.28	2.97	8.8	59	-6.72	9.69	93.96	7	0.84	6.42	41.19	39
NEWZEALAND_F	-0.67	3.53	12.45	59	-3.8	9.23	85.25	7	0.71	5.14	26.44	39
NORWAY_F	-0.3	4.51	20.36	59	-7.3	11.61	134.7	7	1.15	8.96	80.23	39
PAKISTAN_F	-0.76	5.02	25.23	59	-0.95	2.1	4.42	7	0.12	7.67	58.83	39
PERU_F	-0.35	4.67	21.85	59	-6.01	14.21	201.92	7	2.15	7.46	55.7	39
PHILIPPINES_F	-0.35	4.71	22.21	59	-3.78	7.47	55.85	7	1.25	5.21	27.12	39
POLAND_F	-0.31	4.09	16.7	59	-5.27	16.7	278.84	7	0.51	6.73	45.25	39

serves as an exogenous shock to the U.S. financial market and the October Crash provides an opportunity to test for contagion. However, if contagion is defined as enthusiasm for stocks in the U.S. market bringing about enthusiasm for stocks in other markets, regardless of the evolution of market fundamentals (Karolyi and Stulz, 1996), then the implications for the October Crash are not as clear cut. I combine these two frameworks to test for the development of comovements and potential contagion.

TABLE 2: Spearman Correlation Coefficients of FTSE Indices with US FTSE Fund Calculated During the Credit Crunch (Pre and Post Lehman Collapse) Significance Levels Reported Below Coefficients							
	ARGENTINA_F	AUSTRALIA_F	AUSTRIA_F	BELGIUM_F	BRAZIL_F	CANADA_F	CHILE_F
Pre-Lehman	0.27399	0.36937	0.51993	0.60725	0.53711	0.48194	0.57428
	0.0357	0.004	<.0001	<.0001	<.0001	0.0001	<.0001
	ARGENTINA_F	AUSTRALIA_F	AUSTRIA_F	BELGIUM_F	BRAZIL_F	CANADA_F	CHILE_F
Post-Lehman	0.82769	0.88073	0.74209	0.72075	0.85939	0.88418	0.58249
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
	CHINA_F	DENMARK_F	EGYPT_F	FRANCE_F	GERMANY_F	HONGKONG_F	INDIA_F
Pre-Lehman	0.21426	0.41122	0.04097	0.59684	0.55511	0.26242	0.31081
	0.1032	0.0012	0.758	<.0001	<.0001	0.0447	0.0166
	CHINA_F	DENMARK_F	EGYPT_F	FRANCE_F	GERMANY_F	HONGKONG_F	INDIA_F
Post-Lehman	0.7934	0.7585	0.47937	0.84052	0.88319	0.81018	0.656
	<.0001	<.0001	0.0007	<.0001	<.0001	<.0001	<.0001
	INDONESIA_F	IRELAND_F	ISRAEL_F	JAPAN_F	KOREA_F	MALAYSIA_F	NETHERLANDS_F
Pre-Lehman	0.26908	0.41788	0.32309	0.34851	0.32303	0.09807	0.66581
	0.0393	0.001	0.0126	0.0068	0.0126	0.4599	<.0001
	INDONESIA_F	IRELAND_F	ISRAEL_F	JAPAN_F	KOREA_F	MALAYSIA_F	NETHERLANDS_F
Post-Lehman	0.57484	0.65785	0.43965	0.63219	0.7358	0.60333	0.79093
	<.0001	<.0001	0.0022	<.0001	<.0001	<.0001	<.0001
	NORWAY_F	PORTUGAL_F	SINGAPORE_F	SPAIN_F	SWEDEN_F	SWITZERLAND_F	UK_F
Pre-Lehman	0.2052	0.21151	0.37797	0.49117	0.58071	0.51935	0.6111
	0.119	0.1078	0.0032	<.0001	<.0001	<.0001	<.0001
	NORWAY_F	PORTUGAL_F	SINGAPORE_F	SPAIN_F	SWEDEN_F	SWITZERLAND_F	UK_F
Post-Lehman	0.74826	0.72445	0.79599	0.81338	0.77083	0.77169	0.81585
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
	GLOBAL_F	EMERGING2ND_F	CZECH_F	FINLAND_F	GREECE_F	HUNGARY_F	ITALY_F
Pre-Lehman	0.81619	0.33396	0.07487	0.42729	0.45412	0.29889	0.52566
	<.0001	0.0097	0.5731	0.0007	0.0003	0.0215	<.0001
	GLOBAL_F	EMERGING2ND_F	CZECH_F	FINLAND_F	GREECE_F	HUNGARY_F	ITALY_F
Post-Lehman	0.94425	0.77626	0.63787	0.84311	0.6967	0.74727	0.83546
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
	MEXICO_F	MOROCCO_F	NEWZEALAND_F	PAKISTAN_F	PERU_F	PHILIPPINES_F	POLAND_F
Pre-Lehman	0.75044	-0.29684	0.55108	0.07288	0.05587	0.36084	0.42192
	<.0001	0.0224	<.0001	0.5833	0.6743	0.005	0.0009
	MEXICO_F	MOROCCO_F	NEWZEALAND_F	PAKISTAN_F	PERU_F	PHILIPPINES_F	POLAND_F
Post-Lehman	0.86691	0.15597	0.79636	0.07863	0.62923	0.48023	0.62442
	<.0001	0.3006	<.0001	0.6035	<.0001	0.0007	<.0001
	RUSSIA_F	SOUTHAFRICA_F	TAIWAN_F	THAILAND_F	TURKEY_F		
Pre-Lehman	0.21777	0.35441	0.28276	0.33653	0.54091		
	0.0975	0.0059	0.03	0.0092	<.0001		
	RUSSIA_F	SOUTHAFRICA_F	TAIWAN_F	THAILAND_F	TURKEY_F		
Post-Lehman	0.58101	0.75233	0.69312	0.56855	0.68486		
	<.0001	<.0001	<.0001	<.0001	<.0001		

Using a modification of the Forbes-Rigobon regression, the testable implications I derive can be attributed to the perspectives of Paulson and Bernanke and defined within the context of an enthusiasm-framework for contagion. I use the modification to explore if one fundamental factor, the U.S. risk free rate, offers insight into the comovement of the Credit Crunch before and after the fall of Lehman.

I define contagion as a significant increase in market comovement after a shock to one country (Forbes and Rigobon, 2002) and as enthusiasm for stocks in the U.S. market bringing about enthusiasm for stocks in other markets, regardless of the evolution of market fundamentals (Karolyi and Stulz, 1996).

Previous studies of contagion have focused on the Crash of 1987 (Roll, 1988), the Mexican Peso Crisis, the Russian Debt Crisis, the Asian Financial Crisis (Forbes and Rigobon, 2001) and emerging market contagion (Bae, Karolyi and Stulz, 2003). However, unlike the October Crash of 1987, the October Crash of 2008 happened over an extended period of time. Furthermore, the October Crash provides a novel opportunity to test contagion for three main reasons: 1.) Unlike the Mexican Peso Crisis, the Russian Debt Crisis and the Asian Financial Crisis, the shock emanated from the U.S. The October Crash started in the U.S., spread to developed markets and then “spilled” into developing and emerging markets. 2.) Unlike the crash associated with Portfolio Insurance, the value destruction of assets occurred within banks. Here the systemic risk component was held inside the banking sector. This may have led to bank panics (Gorton, 2008). 3.) The October 2008 crash presents an opportunity to study when markets go from bad, because of the Credit Crunch, to worse, because of the US shock due to Lehman’s collapse.

This paper explores how the comovement between the U.S. and international markets developed during the Credit Crunch and how those factors changed during the October Crash. It is organized as follows: Section 1 provides background on the October Crash and the U.S. policy response to the collapse of Lehman. Section 2 motivates my measures for comovement based on previous literature and the uniqueness of the October Crash. Section 3 provides a description of

the data I use to test my measures of comovement. Section 4 discusses my findings. Section 5 concludes the paper and discusses areas in which the work could be expanded.

### **Section 1 Background on the October Crash and the U.S. policy response to Lehman**

Both former Treasury Secretary Henry Paulson and Chairman Benjamin Bernanke cite global economic stewardship as drivers of their policy response to the Credit Crunch and the October Crash. Prior to the collapse of Lehman, several markets indices were actually up relative to 2005; however during September and October, U.S. and European financial institutions came under extreme pressure. As explained by former Treasury Secretary, Henry Paulson, “Managing through this market turmoil while mitigating the impact of the credit crisis is a global as well as a national issue..... The actions taken by Treasury, the Federal Reserve and the FDIC in October have clearly helped stabilize our financial system. Before we acted, we were at a tipping point. Credit markets were largely frozen, denying financial institutions, businesses and consumers access to vital funding and credit.” The TED spread, the difference between the Treasury bill and the London Interbank Rate is commonly used a measure of counterparty risk. During the October Crash the spread grew by a factor of the 3.

Paulson explains that the U.S. has a “special responsibility to the global economy” and that the U.S. housing correction exposed shortcomings in the outdated U.S. regulatory system and “excesses in U.S. and European financial institutions.” He finds that market fundamentals led to the October Crash; “it should not be surprising that after 13 months of stress in the global capital markets, banks from the U.S. to the U.K., from Germany to Iceland, from Russia to France, had difficulties that exposed some of these weaknesses for the first time.” He argues that “a fundamental issue which lies at the heart of our problems [was the] persistent and

growing imbalances [that] fueled a dramatic increase in capital flows, low interest rates, excessive risk taking and a global search for return. Those excesses cannot be attributed to any single nation. There is no doubt that low U.S. savings are a significant factor, but the lack of consumption and accumulation of reserves in Asia and oil-exporting countries and structural issues in Europe have also fed the imbalances.”

Bernanke explains how the events of September and October exhibited features of a classic panic. Citing declines in residential construction and house prices and rising mortgage defaults and foreclosures and forecasts of prospective credit losses at financial institutions both here and abroad and the worsening conditions of Fannie Mae and Freddie Mac, he explains that the unwinding of Lehman Brothers proved exceptionally difficult; government attempts to find a buyer for Lehman failed, and the company’s available collateral fell well short of the amount needed to secure a unsecured loan. The government lacked the resolution authority or the ability to inject capital and “The Federal Reserve and the Treasury were compelled to focus instead on mitigating the fallout from the failure, for example, by taking measures to stabilize the triparty repurchase (repo) market.” Given banks sensitivity to the repo market, this may have led to a bank panic.<sup>2</sup>

## **Section 2 Motivating My Measures for Comovement**

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**Brunnermeier (2008) explains, “Almost 25 percent of total assets were financed by overnight repos in 2007, an increase from about 12.5 percent in the year 2000. Term repos with a maturity of up to three months have stayed roughly constant at 12.5 percent as a fraction of total assets. So has the equity/debt leverage ratio since 2001. In short, repo financing became much more short term. The increase in investment banks’ reliance on overnight financing requires them to roll over a large part of their funding on a daily basis – trend that makes investment banks subject to funding liquidity risk.”**

These two divergent causality perspectives from the leaders of the U.S. policy response to the Credit Crunch and the October Crash motivate my measures for comovement. Using a modification of the Forbes-Rigobon regression, the testable implications I derive can be attributed to the perspectives of Paulson and Bernanke and defined within the context of an enthusiasm-framework for contagion. I use the modification to explore if one fundamental factor, the U.S. risk free rate, offers insight into the comovement of the Credit Crunch before and after the fall of Lehman.

This paper explores the October Crash with relatively simple measures of comovement; they include Spearman's correlation coefficient, the estimated parameters from my modified Forbes- Rigobon regressions and the goodness of fit for each estimated model. I use weekly percentage returns of FTSE country specific indices denominated in dollars to control for currency effects; however, following the Forbes-Rigobon specification I do not include exchange rates as an explanatory variable in my regression. To account for contemporaneous liquidity effects of the Credit Crunch, I control for the TED spread and use the spread between financial commercial paper and non financial commercial paper to control for fundamental counterparty risk within the financial market.

This places an important caveat in my findings. As this paper does not investigate if the collapse of Lehman had elements of a competitive shock or a currency shock. Griffin and Stulz (1997) explore the validity of using weekly return data on 320 industry pairs in six countries from 1975 to 1997. They find that common shocks to industries across countries are more important than competitive shocks. Both industry and exchange rate shocks are more important for industries that produce goods traded internationally, but the importance of these shocks are economically small for these industries as well. While a supposition of my paper is that the



Credit Crunch had elements of a global and competitive shock; the Paulson perspective does not directly provide a testable assumption and the Bernanke bank panic perspective explored in this paper assumes the collapse of Lehman, treated as a direct shock to the United States, caused a global shock to world markets.

The use of cross-market correlation coefficients offers a straightforward measure to examine comovement (Forbes and Rigobon, 2002). If the correlation coefficients increase significantly after the shock, then one can argue that there may have been contagion.

The use of  $R^2$  does not provide a direct test of causality, but provides a relatively intuitive benchmark.

Since equity index behavior can be partly attributable to the technical procedures of index construction (Roll, 1992), to control for potential selection bias, I then compare the FTSE's Spearman correlation coefficients to the findings from a matched sample of international index returns for the S&P 500 and 32 "comparable" domestic indices for 30 international markets. Though a direct test of the intra-industry effects of competitive shock goes beyond the scope of this paper, my motivation for having indices comparable to the SP500 for other major world markets was to see if my findings in the FTSE data are robust. I find the results are robust and supported by my matched sample.

## **Weekly Returns**

I focus on weekly instead of daily, monthly or quarterly comovements for several reasons. Though using weekly returns ignores important dynamics in the auto and cross-covariance of the joint-returns process (Griffin and Karolyi, 1998), the non-synchronous trading periods for different markets around the globe is an institutional feature whose effects I do not

wish to explore. Though the daily horizon is important for risk management purposes and for portfolio managers (Karolyi and Stulz, 1996), given my shorter sample period the bias induced by intraday effects may intensify as the observation interval moves from weekly to daily returns (Griffin and Karolyi, 1998).

### **Credit Crunch Time Horizon**

Typically one would compare “stable” periods to “crisis” periods; however, I compare comovement during the Credit Crisis both before and after the collapse of Lehman. Simply, I compare the correlation with the U.S. after the situation in the U.S. goes from bad to worse (rather than from good to bad).<sup>3</sup> Forbes and Rigobon (2002) show that if two markets show a high degree of comovement during a period of stability, even if the markets continue to be highly correlated after a shock to one market, this may not constitute contagion. They state that if the comovement does not increase significantly, then any continued high level of market correlation suggests strong linkages between two economies that exist in all states of the world (Forbes and Rigobon, 2002). All states of the world include states in which a situation goes from bad to worse. I argue that the comparison of bad to worse remains a valid framework for testing market comovement and contagion.

### **My Model and Hypothesis**

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<sup>3</sup> As Bernanke explains during his Federal Reserve Bank of Kansas City’s Annual Economic Symposium in Jackson Hole, “We know that the National Bureau of Economic Research has determined December 2007 as the beginning of the recession. The U.S. unemployment rate had risen to 5-3/4 percent by July, about 1 percentage point above its level at the beginning of the crisis, and household spending was weakening. Ongoing declines in residential construction and house prices and rising mortgage defaults and foreclosures continued to weigh on the U.S. economy, and forecasts of prospective credit losses at financial institutions both here and abroad continued to increase.”

Forbes and Rigobon (2002) identify three criteria for deciding which pairs of correlations to calculate and test for contagion. These three criteria include: 1) a major shift in market volatility, 2) clear identification of which country generates this shift in volatility, and 3) inclusion of the relevant country as one market in the estimated correlation.

The data presented in Table 1 suggests that these conditions have been sufficiently met. For most markets, during the October Crash, variance of weekly percentage returns increased by a factor of 10. The shock clearly emanated from the U.S. and my paper estimates correlation between the U.S. and other markets. However, I will be using a modification of the Forbes-Rigobon vector autoregressive technique. To ensure that the modification does not eliminate my ability to capture strong economic linkages, I will take a first pass at the data and report the adjusted  $R^2$ .

### **Test 1 Adj $R^2$ of the Modified Forbes-Rigobon Regression Specification**

I use the following modified Forbes-Rigobon regression:

$$R_{country\ j,t} = \alpha + R_{us,t} + R_{us,t-1} + R_{country\ j,t-1} + R_{country\ j,t-2} + i_{us,t-1} + i_{us,t-2} + e_t$$

where  $R_{country\ j}$  is a vector of weekly returns for the country  $j$ ;  $R_{us,t}$  is a vector of weekly returns for the U.S.;  $i_{us}$  is the short-term risk free rate;  $e_t$  is a vector of reduced form disturbances.

The weekly returns are divided into two periods; they are the Credit Crunch before the collapse of Lehman (August 1, 2007 to September 14, 2008) and the Credit Crunch from after the collapse of Lehman to present (September 14, 2008 to July 31, 2009). If movement in returns were fundamental driven, the Adj  $R^2$  should not be higher after the Lehman event;

however if there were conditions suitable for contagion, one should expect to find the Adj R<sup>2</sup> after the collapse of Lehman, will be higher than the previous periods.

**Ho: The Adj R<sup>2</sup> Post-Lehman will not be higher than the Adj R<sup>2</sup> for the entire sample.**

**Ha: The Adj R<sup>2</sup> Post-Lehman will be higher than the Adj R<sup>2</sup> for the entire sample.**

Model 1 Adjusted R-squared Comparing Credit Crunch and Before and After the Collapse of Lehman			
	FULL	PRE	POST
COUNTRY <sub>j-k</sub>	AdjR <sup>2</sup>	AdjR <sup>2</sup>	AdjR <sup>2</sup>
ARGENTINA_F	0.542	-0.049	0.692
AUSTRALIA_F	0.670	0.159	0.813
AUSTRIA_F	0.671	0.253	0.763
BELGIUM_F	0.649	0.442	0.685
BRAZIL_F	0.657	0.301	0.752
CANADA_F	0.689	0.158	0.805
CHILE_F	0.466	0.312	0.542
CHINA_F	0.372	0.097	0.684
DENMARK_F	0.619	0.209	0.688
EGYPT_F	0.260	0.123	0.340
FRANCE_F	0.695	0.386	0.744
GERMANY_F	0.720	0.342	0.787
HONGKONG_F	0.470	0.078	0.716
INDIA_F	0.385	0.232	0.466
INDONESIA_F	0.300	0.119	0.421
IRELAND_F	0.218	-0.007	0.626
ISRAEL_F	0.254	0.111	0.323
JAPAN_F	0.431	0.185	0.570
KOREA_F	0.426	0.193	0.489
MALAYSIA_F	0.274	0.026	0.476
NETHERLANDS_F	0.699	0.518	0.724
NORWAY_F	0.549	0.071	0.671
PORTUGAL_F	0.488	0.124	0.603
SINGAPORE_F	0.490	0.045	0.593
SPAIN_F	0.624	0.332	0.687
SWEDEN_F	0.656	0.374	0.693
SWITZERLAND_F	0.661	0.266	0.737
UK_F	0.733	0.398	0.782
CZECH_F	0.436	-0.033	0.580
FINLAND_F	0.558	0.214	0.697
GREECE_F	0.481	0.143	0.563
HUNGARY_F	0.550	0.020	0.634
ITALY_F	0.618	0.244	0.676
MEXICO_F	0.789	0.572	0.817
MOROCCO_F	0.012	0.147	-0.005
NEWZEALAND_F	0.601	0.330	0.692
PAKISTAN_F	0.013	0.128	-0.009
PERU_F	0.350	0.015	0.556
PHILIPPINES_F	0.286	0.198	0.375
POLAND_F	0.444	0.144	0.511
RUSSIA_F	0.358	0.134	0.421
SOUTHAFRICA_F	0.528	0.101	0.638
TAIWAN_F	0.335	0.102	0.494
THAILAND_F	0.396	0.262	0.447
TURKEY_F	0.497	0.324	0.550

At first past the event does not seem to be purely driven by fundamentals. Having had established the models ability to explain the variation observed in returns, I will now directly test to see if there can be supportive evidence of the Paulson Perspective or the Bernanke Perspective that were explained earlier in this paper. The model will be tested over the entire Credit Crunch, the Credit Crunch before the collapse of Lehman and the Credit Crunch after the collapse of Lehman.

## Test 2 Direct Test for Contagion

I use the following modified Forbes-Rigobon regression:

$$R_{country\ j,t} = \alpha + R_{us,t} + Crash + Crash * R_{us} + R_{country\ j,t-1} \\ + R_{country\ j,t-1} + i_{us,t-1} + i_{us,t-2} + e_t$$

where  $R_{country\ j}$  is a vector of weekly returns for the country j;  $R_{us,t}$  is a vector of weekly returns for the U.S.;  $i_{us}$  is the short-term risk free rate;  $e_t$  is a vector of reduced form disturbances;  $Crash$  is a variable equal to zero before the Lehman event and one after.

If the Paulson Perspective is true and the October Crash was a correction caused by market fundamentals --- specifically low interest rates, then the lagged short-term risk free rates and country specific returns should be significant after the interaction term controls for U.S. and country specific returns during the October Crash.

If the Bernanke Perspective is true and the October Crash was caused by panic-driven enthusiasm in the U.S. that exceeded market fundamentals, then after the fall of Lehman, the interaction term  $Crash * R_{us}$  will be statistically significant.

**Ho: The interaction term  $Crash * R_{us}$  will not be statistically significant. Short-term risk free rates and country specific returns will be statistically significant.**  
**H1: The interaction term  $Crash * R_{us}$  will be statistically significant.**

### Test 3 Direct Test for Contagion

I use the following modified Forbes-Rigobon regression:

$$R_{country\ j,t} = \alpha + R_{Global,t} + R_{us,t} + Crash * R_{us} + TED_{m1} + TED_{m3} \\ + FCPS_{m1} + e_t$$

where  $R_{country\ j}$  is a vector of weekly returns for the country  $j$ ;  $R_{Global,t}$  is a vector of weekly returns for the world;  $R_{us,t}$  is a vector of weekly returns for the U.S.;  $TED_{m1,m3}$  is the one month and three month TED spread;  $FCPS$  is the spread on financial commercial paper and non-financial commercial paper;  $e_t$  is a vector of reduced form disturbances;  $Crash$  is a variable equal to zero before the Lehman event and one after.

If the Paulson Perspective is true and the October Crash was a correction caused by market fundamentals --- the global search for return, then after controlling for market liquidity and the priced risk within the financial markets, global returns should be statistically significant and U.S. returns should be statistically insignificant and the TED spread should be statistically significant.

If the Bernanke Perspective is true and the October Crash was caused by panic-driven enthusiasm in the U.S. that exceeded market fundamentals, then after the fall of Lehman, contemporaneous U.S. returns and the interaction term  $Crash * R_{us}$  will be statistically significant and the priced risk in the financial sector should be significant.

**Ho: The interaction term  $Crash * R_{us}$  will not be statistically significant. Short-term risk free rates and country specific returns will be statistically significant.**

**H1: The interaction term  $Crash * R_{us}$  will be statistically significant.**

**Contemporaneous U.S. returns will be statistically significant and the financial commercial paper spread should be significant.**

### Section 3 Description of the Data

In this paper I use a sample of international indices. Weekly price index quotes of 46 FTSE country indices in both local currency and Dollars from January 7, 2000 to July 31, 2009 are drawn from DataStream. I only report findings for the Dollar denominated price quotes. Roughly half of the sample has price data dating back to October 10, 2003. This far exceeds the time series range needed for the analysis conducted within this paper. The data does not contain open and closing quotes.<sup>4</sup> The FTSE series includes returns for Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, China, Denmark, Egypt, France, Germany, Hong Kong, India, Indonesia, Ireland, Israel, Japan, Korea, Malaysia, the Netherlands, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, the U.K., the Czech Republic, Finland, Greece, Hungary, Italy, Mexico, Morocco, New Zealand, Pakistan, Peru, the Philippines, Poland, Russia, South Africa, Taiwan, Thailand and Turkey.

An alternative to using an index designed to replicate country specific returns, is to use a country specific index. Starting with the U.S. and using publically available data I calculated weekly percentage returns for the SP500 using open and closing data from January 1, 2000 to September 28, 2009.<sup>5</sup> I attempted to find comparable country specific indices for the rest of the sample. I used 32 indices for a “matched” sample of 30 countries. The countries include Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, China, Denmark, Egypt, France, Germany, Hong Kong, India, Indonesia, Ireland, Israel, Japan, Korea, Malaysia, Mexico, the Netherlands, New Zealand, Norway, Portugal, Singapore, the U.S., Spain, Sweden, Switzerland and the U.K.; indices used for each country are listed in the appendix.

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<sup>4</sup> Weekly percentage returns were calculated using the following formula:

$$\mathbf{R_{country\ index} = ((P_{t+1} - P_t) / P_t) \times 100}$$

<sup>5</sup> Weekly percentage returns were calculated using the following formula:

$$\mathbf{R_{country\ index} = ((P_{open} - P_{close}) / P_{close}) \times 100}$$

The short term risk free rate used in this paper is the 4 Week Fed TBill Secondary Market Rate. The data is available on a weekly frequency, ending Friday under the Series ID WTBFWK from the Board of Governors of the Federal Reserve System.

The TED spread is computed as the difference between the TBill and the London Interbank Rate. The financial commercial paper spread is the difference between financial commercial paper and non financial commercial paper. Both the TED spread and the financial commercial paper spread were downloaded from the Moody's Ibsons data on WRDS.

#### **Section 4 Findings**

My findings are reported in the Appendix. I fail to find supportive evidence of the Paulson Perspective. Out of the entire sample of weekly returns, only 5 country indices Russia, Turkey, Chile, Japan and Greece, show a TBill coefficient that is significant at the 95% confidence level.

The coefficient of current U.S. returns remains significant for most countries throughout all three test periods; after the collapse of Lehman, the current U.S. returns coefficient is larger for every country with the exception of Chile, Israel, Pakistan, the Philippines and Turkey. Though for Pakistan the current U.S. returns coefficient is not significant at the 95% confidence level for any sample period.

When analyzing weekly returns over the entire Credit Crunch, the model estimates no coefficient significant at the 95% confidence level for Finland, Morocco and Pakistan (with an Adjusted  $R^2$  of 0.5183, 0.0118 and 0.0128 respectively). When analyzing weekly returns prior to the collapse of Lehman, I estimate no coefficient significant at the 95% confidence level for Canada, Ireland and the Czech Republic (with an Adjusted  $R^2$  0.1577, -0.0071 and -0.0330,



respectively). After the Lehman collapse, only Morocco has no coefficient significant at the 95% confidence level (with an Adjusted  $R^2$  of -0.049). When I do not report the results of the Spearman out of sample robustness check; however, the most noticeable divergence between the FTSE data and the market data comes from China. The Shanghai Composite shows no significant correlation with the SP500.

Furthermore the model's explicative power fluctuates strongly depending upon the sample period. Prior to the collapse of Lehman, the model's Adjusted  $R^2$  is relatively low for most countries; however, after Lehman the Adjusted  $R^2$  increases by a factor of 2 or 3. Most notably for Argentina, Ireland, and the Czech Republic the Adjusted  $R^2$  goes from -0.0489, -0.0071 and -0.0330 to 0.6917, 0.6259, 0.5796 respectively.

I do not report the results of the Spearman out of sample robustness check; however, the China out of sample index, the Shanghai Composite index show no statistically significant correlation with the SP500. When comparing the Spearman Correlation Coefficients for the FTSE sample and the matched Sample, I notice routine divergence in the Pre Lehman period and comparable statistically significant correlation coefficients in the Post Lehman period. During the Pre Lehman period the FTSE index reports a higher correlation with the U.S. market than the matched sample does with the SP500; however with the notable exception of China, the general analysis remains the same. During the Credit Crunch, after the collapse of Lehman, international correlation with the U.S. market increased.

## **Section 5 Conclusion**

Using the Credit Crunch as a global fixed point for international financial markets and the collapse of Lehman serves as an exogenous shock to the U.S. I use a sample of 47 international

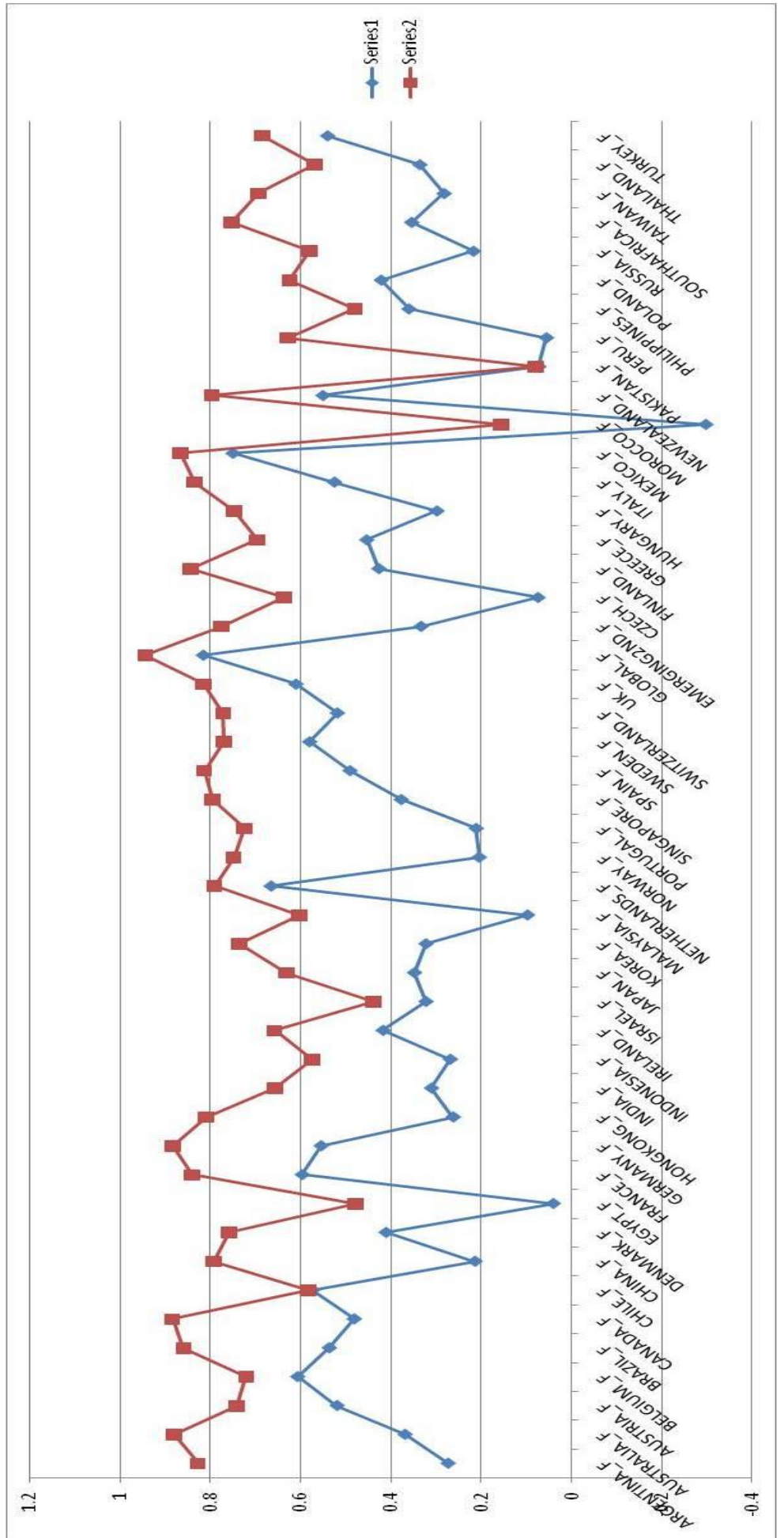
equity markets to explore how comovement between the US and other financial markets evolved during the Crash of October 2008. Using the perspectives of Paulson and Bernanke, the policy leaders of the U.S. response to the Credit Crunch and the October Crash, I test for evidence of contagion. For my sample, I find supportive evidence of contagion, with caveats.

My event and sample period occur in the midst of a financial crisis and I do not include a control of the liquidity premium. There may be model misspecification with such an omitted variable. This analysis could be expanded with the inclusion of TIPS and the breakeven rate as a control for the U.S. liquidity premium and the inclusion of local risk free rates or proxies for government announced guarantees.

Further research could also establish the uniqueness of the October Crash; an argument I presuppose and do not attempt to prove explicitly within this paper.

Appendix

Figure 1 Spearman Correlation of FTSE Weekly Returns computed from (08/01/2007 – Present); Series 1 Before Lehman Collapse, Series 2 After Lehman Collapse



Estimated Parameters, Credit Crunch (08,2007-Present)

Red denotes  $tstat \geq$  Absolute value (1.96)

COUNTRY,j-k	AdjR^2	Intercept	US	US_LAG	J,LAG	J,LAG2	TBLAG	TBLAG2
ARGENTINA_F	0.5423	0.1373	1.2597	0.3280	-0.0766	0.0891	1.2015	-1.1065
AUSTRALIA_F	0.6695	0.3559	1.1506	0.4801	-0.2009	0.0720	-0.1144	0.1022
AUSTRIA_F	0.6705	0.1370	1.2439	0.7979	-0.3768	0.0997	0.5742	-0.7017
BELGIUM_F	0.6490	0.0271	1.0034	0.3540	-0.0451	0.1258	0.3351	-0.3840
BRAZIL_F	0.6571	0.7814	1.5503	0.2666	-0.1825	0.1034	2.1557	-1.9920
CANADA_F	0.6886	0.3917	1.1792	0.3454	-0.2550	0.0267	1.1823	-1.1558
CHILE_F	0.4659	0.7396	0.8910	0.1432	-0.1341	-0.0101	-2.4072	2.1700
CHINA_F	0.3715	0.8897	0.9125	0.3029	0.0171	0.0588	0.8198	-1.1317
DENMARK_F	0.6187	0.1743	1.0012	0.3888	-0.2017	0.1188	0.0746	-0.1056
EGYPT_F	0.2596	-0.0389	0.5628	0.5613	-0.0442	0.0704	1.4848	-1.1956
FRANCE_F	0.6947	0.0938	1.0448	0.3658	-0.2327	0.0460	-0.1234	0.1276
GERMANY_F	0.7198	0.1199	1.1199	0.2642	-0.1467	0.0946	-0.0166	0.0507
HONGKONG_F	0.4697	0.5369	0.7712	0.2527	-0.0487	0.0952	0.6354	-0.7627
INDIA_F	0.3852	0.3468	0.8853	0.4336	-0.0657	0.2055	-0.4636	0.5630
INDONESIA_F	0.3001	0.5674	0.8434	0.5234	-0.0698	0.1087	-0.7639	0.8323
IRELAND_F	0.2177	-0.4233	0.8010	0.2409	-0.1140	-0.1513	-2.3801	2.1585
ISRAEL_F	0.2539	0.2807	0.3127	0.3045	-0.0743	0.0791	-0.1079	0.1450
JAPAN_F	0.4309	0.0655	0.5073	0.2821	-0.1256	-0.1045	-0.1102	-0.0086
KOREA_F	0.4259	0.7012	1.1108	0.3602	-0.1147	-0.0189	2.4557	-2.6968
MALAYSIA_F	0.2741	0.2259	0.3574	0.2418	0.1519	-0.5072	-0.5072	0.4632
NETHERLANDS_F	0.6992	0.1399	1.0462	0.4826	-0.1615	0.0829	0.6260	-0.6631
NORWAY_F	0.5494	0.4665	1.2486	0.6149	-0.2583	0.1146	4.1633	-4.2153
PORTUGAL_F	0.4875	0.0144	0.7194	0.2916	-0.1534	0.1332	-0.7012	0.6053
SINGAPORE_F	0.4899	0.5905	0.8683	0.2591	-0.0581	0.1229	1.3892	-1.5558
SPAIN_F	0.6238	0.3044	0.9921	0.2226	-0.1093	0.1275	-1.1064	1.0849
SWEDEN_F	0.6559	0.8326	1.2275	0.6011	-0.2886	0.0471	-0.1183	-0.2912
SWITZERLAND_F	0.6608	0.1493	0.7752	0.3925	-0.4138	0.0497	-0.0496	0.0326
UK_F	0.7331	0.1278	1.0524	0.4898	-0.3969	0.0181	1.0107	-1.0474
CZECH_F	0.4360	0.1702	0.9701	0.2826	-0.1303	0.1154	2.1530	-1.8259
FINLAND_F	0.5583	-0.3583	1.0313	0.2246	-0.1054	-0.0449	0.4710	-0.3280
GREECE_F	0.4813	-0.1496	0.9806	0.4333	-0.0735	0.0914	1.4038	-1.3072
HUNGARY_F	0.5497	0.3418	1.4312	0.5253	-0.1132	0.0412	1.5819	-1.5967
ITALY_F	0.6175	0.0286	1.0258	0.3783	-0.1699	0.0684	-0.2614	0.2105
MEXICO_F	0.7886	0.4079	1.4005	0.1666	-0.1306	0.1064	-0.0470	-0.0090
MOROCCO_F	0.0118	-0.3721	0.1553	-0.0919	0.0515	0.0243	0.8321	-0.5266
NEWZEALAND_F	0.6005	-0.0341	0.8247	0.3225	-0.1806	0.0115	0.0543	-0.0353
PAKISTAN_F	0.0128	-0.5884	0.0528	0.2453	0.1407	0.0616	-1.8468	2.0991
PERU_F	0.3503	0.3890	1.0250	0.1956	0.0529	0.1158	0.8756	-0.7336
PHILIPPINES_F	0.2855	0.4141	0.6171	0.2668	-0.1068	-0.0049	-1.2478	1.1735
POLAND_F	0.4435	-0.0864	1.0745	0.3410	-0.0590	0.0554	1.4801	-1.3446
RUSSIA_F	0.3578	0.0357	1.2496	0.4986	-0.1290	0.0414	5.8419	-5.6102
SOUTHAFRICA_F	0.5283	0.8020	1.1264	0.2717	-0.2134	0.1002	3.0553	-3.1616
TAIWAN_F	0.3351	0.3819	0.6387	0.0712	-0.0021	0.0416	0.9415	-1.0949
THAILAND_F	0.3957	0.3938	0.6427	0.5216	-0.1440	0.1040	-1.9057	1.8249
TURKEY_F	0.4973	0.7420	1.3591	0.3938	-0.1466	0.0906	3.7640	-3.7337

Estimated Parameters, Credit Crunch (Pre-Lehman)									
Red denotes tstat>= Absolute value (1.96)									
COUNTRY,j-k	AdjR^2	Intercept	US	US_LAG	J,LAG	J,LAG2	TBLAG	TBLAG2	
ARGENTINA_F	-0.0489	-0.1502	0.4641	0.1160	-0.0162	0.0130	-0.2962	0.3639	
AUSTRALIA_F	0.1586	-0.9799	0.7084	0.5139	-0.0862	0.0194	0.7698	-0.3518	
AUSTRIA_F	0.2534	-0.2209	0.8817	0.4423	-0.1392	0.0973	-0.6277	0.6105	
BELGIUM_F	0.4424	-0.7609	0.9724	0.3426	-0.1359	0.1314	-0.5757	0.7826	
BRAZIL_F	0.3014	-1.2630	1.3158	0.2339	0.0367	0.0075	1.6470	-0.8350	
CANADA_F	0.1577	-0.2963	0.6832	0.2318	0.0162	-0.0247	0.4503	-0.2617	
CHILE_F	0.3118	-0.4153	0.9451	-0.0296	-0.0021	-0.0366	-0.7763	0.9908	
CHINA_F	0.0974	-1.3253	0.7401	1.0217	-0.0016	-0.0642	2.2653	-1.7097	
DENMARK_F	0.2094	-0.3902	0.6491	0.3713	-0.0490	-0.0326	0.0951	0.0306	
EGYPT_F	0.1228	-2.5838	0.1987	0.4241	0.0795	-0.1579	1.2005	-0.0012	
FRANCE_F	0.3857	-0.5760	0.8682	0.3102	-0.1405	-0.0157	-0.0092	0.2269	
GERMANY_F	0.3415	-0.7219	0.7432	0.3458	-0.1142	0.1100	-0.2816	0.5713	
HONGKONG_F	0.0776	-1.4402	0.5872	0.5243	-0.0525	0.0637	0.3762	0.2113	
INDIA_F	0.2324	-2.6395	0.8082	0.7556	-0.1320	0.1856	-1.1249	2.3168	
INDONESIA_F	0.1192	-3.6846	0.5581	0.6481	-0.0702	-0.2155	2.3511	-0.6629	
IRELAND_F	-0.0071	-2.4585	0.4834	-0.0730	-0.0508	-0.2004	-3.0802	3.5419	
ISRAEL_F	0.1108	-0.5534	0.4179	0.3511	-0.0079	-0.0229	1.0359	-0.6547	
JAPAN_F	0.1845	-0.2207	0.4959	0.3933	-0.2403	-0.2389	1.3245	-1.3222	
KOREA_F	0.1930	-1.5418	0.8041	0.8089	-0.1676	-0.1657	2.3926	-1.8461	
MALAYSIA_F	0.0263	-2.0090	0.2114	0.3615	-0.0429	-0.0150	0.7404	0.0523	
NETHERLANDS_F	0.5183	-0.2886	0.9745	0.3039	-0.0266	0.0260	0.0624	0.0525	
NORWAY_F	0.0712	-0.1642	0.7195	0.6102	-0.0362	-0.0277	2.9280	-2.8043	
PORTUGAL_F	0.1242	-0.8498	0.3663	0.3287	0.0592	0.2222	-0.8788	1.0864	
SINGAPORE_F	0.0454	-0.5765	0.5588	0.3278	-0.0694	0.0076	0.7910	-0.5783	
SPAIN_F	0.3315	-0.9819	0.6915	0.1291	-0.0626	0.2606	-0.8890	1.2707	
SWEDEN_F	0.3741	-0.0413	1.1281	0.6282	-0.3295	0.0496	0.1364	-0.2569	
SWITZERLAND_F	0.2657	-0.4492	0.5844	0.1760	-0.1875	-0.0855	0.0095	0.1545	
UK_F	0.3983	-0.7329	0.8040	0.2948	-0.2265	-0.0584	0.3763	-0.1563	
CZECH_F	-0.0330	-1.3543	0.3400	0.2164	-0.0528	0.0186	1.8968	-1.1269	
FINLAND_F	0.2141	-2.3307	0.7813	0.3306	-0.0517	-0.2953	0.8215	0.0258	
GREECE_F	0.1431	-1.4985	0.6514	0.3504	-0.0619	0.0248	-0.1440	0.6269	
HUNGARY_F	0.0195	-0.5954	0.5789	0.1964	-0.1250	-0.0367	0.0811	0.0900	
ITALY_F	0.2437	-0.7310	0.6669	0.3451	-0.1646	0.0500	0.3255	-0.1404	
MEXICO_F	0.5720	-0.3041	1.1362	-0.0099	0.0292	0.0082	-0.3549	0.4975	
MOROCCO_F	0.1465	-0.3632	-0.2064	-0.0090	0.2677	0.1755	1.0128	-0.8166	
NEWZEALAND_F	0.3298	-2.3570	0.7660	0.3199	-0.1549	-0.1292	1.0794	-0.2394	
PAKISTAN_F	0.1282	-4.9435	0.3573	0.5943	-0.2097	-0.0197	-0.9535	2.7958	
PERU_F	0.0150	-3.6504	0.1497	0.1299	0.0559	-0.1246	0.3752	1.0724	
PHILIPPINES_F	0.1984	-1.8244	0.8034	0.6034	-0.0559	-0.0791	0.5052	0.3035	
POLAND_F	0.1444	-0.6585	0.8526	0.3427	-0.1222	-0.1279	0.9479	-0.6728	
RUSSIA_F	0.1343	-1.3414	0.6880	0.3204	0.0292	0.3598	2.4799	-1.9480	
SOUTHAFRICA_F	0.1009	-0.6442	0.8169	0.3659	-0.1650	0.0467	1.5822	-1.2292	
TAIWAN_F	0.1015	-0.9579	0.5843	0.5491	-0.1630	-0.0557	1.4098	-1.0374	
THAILAND_F	0.2621	-1.3281	0.5044	0.6628	-0.1603	0.2374	-1.0147	1.5676	
TURKEY_F	0.3242	-1.4146	1.5742	0.8622	-0.3064	0.1256	5.5216	-4.6293	

Estimated Parameters, Credit Crunch (Post-Lehman)									
Red denotes tstat>= Absolute value (1.96)									
COUNTRY,j-k	AdjR^2	Intercept	US	US_LAG	J,LAG	J,LAG2	TBLAG	TBLAG2	
ARGENTINA_F	0.6917	-0.0757	1.4174	0.3070	-0.0567	0.0890	3.1721	-0.9256	
AUSTRALIA_F	0.8127	0.5299	1.2604	0.5014	-0.2456	0.0861	-4.6396	4.8166	
AUSTRIA_F	0.7634	1.0722	1.2767	0.9347	-0.4881	0.0753	-5.0016	-1.0779	
BELGIUM_F	0.6848	0.2394	0.9910	0.3407	-0.0134	0.1205	3.7311	-3.7946	
BRAZIL_F	0.7516	1.5103	1.5774	0.4164	-0.3173	0.0987	2.2809	-3.1063	
CANADA_F	0.8054	0.5691	1.2756	0.4617	-0.3744	0.0055	-0.2670	0.3113	
CHILE_F	0.5421	1.9189	0.8452	0.2079	-0.2103	0.0095	-13.3589	6.2211	
CHINA_F	0.6840	0.7998	1.0036	0.0737	0.1187	0.1126	2.1417	-0.6057	
DENMARK_F	0.6881	0.0457	1.0770	0.3773	-0.2104	0.1439	0.5833	1.0448	
EGYPT_F	0.3400	1.6086	0.5777	0.5953	-0.1298	0.0867	-8.1262	-0.1242	
FRANCE_F	0.7437	0.1158	1.0863	0.3970	-0.2690	0.0590	-0.5813	1.2963	
GERMANY_F	0.7873	0.0751	1.2117	0.1876	-0.1094	0.0948	0.2695	1.0666	
HONGKONG_F	0.7155	1.0417	0.8116	0.1542	-0.0100	0.0477	2.0078	-3.0281	
INDIA_F	0.4661	0.8922	0.8947	0.3285	-0.0123	0.1629	5.9159	-5.4119	
INDONESIA_F	0.4207	0.8650	0.9142	0.5712	-0.1572	0.2331	-2.2527	4.4430	
IRELAND_F	0.6259	0.6418	0.7312	0.5830	-0.4919	-0.1250	-2.9146	-1.2472	
ISRAEL_F	0.3227	0.7982	0.3034	0.2882	-0.0959	0.0933	-5.3032	2.4156	
JAPAN_F	0.5695	0.4134	0.5221	0.2197	-0.0516	-0.0679	-6.1956	3.4605	
KOREA_F	0.4890	0.9321	1.1866	0.1913	-0.0515	0.0231	6.6928	-6.0917	
MALAYSIA_F	0.4760	0.6208	0.3949	0.2157	0.0707	0.1753	-1.9160	1.1026	
NETHERLANDS_F	0.7244	0.7230	1.0337	0.5311	-0.2123	0.0881	-0.9644	-2.2742	
NORWAY_F	0.6711	0.8247	1.3146	0.6644	-0.3286	0.1165	3.8344	-5.1495	
PORTUGAL_F	0.6032	0.2882	0.7964	0.3175	-0.2398	0.0929	-3.9285	3.3096	
SINGAPORE_F	0.5933	0.6298	0.9255	0.1889	0.0027	0.1424	4.8441	-3.7432	
SPAIN_F	0.6869	0.2576	1.0657	0.2864	-0.1564	0.1123	-1.5631	3.6799	
SWEDEN_F	0.6934	0.8219	1.2630	0.5709	-0.2616	0.0473	0.0642	0.5394	
SWITZERLAND_F	0.7372	0.3435	0.7990	0.4844	-0.5099	0.0664	-2.3558	1.7778	
UK_F	0.7818	0.0873	1.0932	0.5627	-0.4513	0.0275	3.2838	-1.5074	
CZECH_F	0.5796	-0.2460	1.1143	0.3061	-0.1474	0.1391	4.8060	0.3923	
FINLAND_F	0.6972	0.0852	1.0738	0.2378	-0.1504	0.0032	-0.3457	-0.2625	
GREECE_F	0.5626	-0.6136	1.0405	0.3996	-0.0158	0.1196	11.5126	-5.6010	
HUNGARY_F	0.6340	0.3728	1.5880	0.5688	-0.1160	0.0534	2.7063	-1.3691	
ITALY_F	0.6763	0.1758	1.1162	0.3690	-0.1697	0.0718	-4.6467	4.0729	
MEXICO_F	0.8174	0.3784	1.4523	0.1675	-0.1379	0.1204	1.0852	0.1245	
MOROCCO_F	-0.0049	-0.3035	0.2464	-0.1032	-0.0150	-0.0044	-3.5312	2.9852	
NEWZEALAND_F	0.6917	0.6181	0.8186	0.4228	-0.2982	0.0584	-2.4872	0.9502	
PAKISTAN_F	-0.0089	-0.0914	0.0005	0.2141	0.3125	-0.0247	1.4237	-0.6682	
PERU_F	0.5561	-0.1361	1.2265	0.2394	0.0291	0.1990	7.0688	1.2001	
PHILIPPINES_F	0.3746	1.5585	0.5582	0.2886	-0.2807	-0.0071	-6.2048	1.4030	
POLAND_F	0.5112	-0.7582	1.1291	0.3326	-0.0252	0.1244	9.8145	-3.5246	
RUSSIA_F	0.4212	-0.4880	1.3637	0.5421	-0.1414	0.0179	19.8172	-11.7113	
SOUTHAFRICA_F	0.6384	0.7033	1.1776	0.2053	-0.1818	0.1272	10.0785	-7.2325	
TAIWAN_F	0.4942	0.7033	0.6696	-0.1376	0.1710	0.0518	0.0957	-1.6884	
THAILAND_F	0.4472	1.2358	0.6800	0.4694	-0.1386	0.0320	-8.7192	4.8047	
TURKEY_F	0.5500	0.8743	1.3432	0.2311	-0.0484	0.0628	5.1230	-3.9691	

## Test 2 Results

Estimated Parameters, Credit Crunch (08,2007-Present)

Red denotes significant at the 99% level

Blue denotes significant at the 95% level

Green denotes significant at the 90% level

COUNTRY_j-k	Adj R-Sq	Intercept	US	CRASH	USCRASH	J,LAG	J,LAG2	TBILLLAG	TBILLLAG2
ARGENTINA_F	0.558	0.017	0.516	0.164	0.936	0.062	0.051	-0.486	0.465
AUSTRALIA_F	0.630	-0.434	0.604	0.890	0.693	0.052	0.055	-2.309	2.392
AUSTRIA_F	0.570	0.523	0.773	-0.474	0.503	0.014	0.096	-2.045	1.664
BELGIUM_F	0.617	-0.387	0.970	0.424	0.056	0.176	0.073	-0.169	0.264
BRAZIL_F	0.637	-0.559	1.298	1.560	0.331	-0.079	0.104	1.067	-0.612
CANADA_F	0.695	-0.189	0.650	0.612	0.638	-0.057	0.020	-0.050	0.156
CHILE_F	0.459	0.287	0.915	0.489	-0.004	-0.059	-0.021	-2.625	2.500
CHINA_F	0.327	-0.889	0.559	1.835	0.459	0.117	0.033	-1.441	1.705
DENMARK_F	0.595	-0.389	0.608	0.600	0.503	0.025	0.091	-0.932	1.021
EGYPT_F	0.145	-0.612	0.051	0.728	0.662	0.147	-0.031	0.091	0.142
FRANCE_F	0.672	-0.333	0.813	0.478	0.288	0.005	0.038	-0.978	1.058
GERMANY_F	0.731	-0.597	0.679	0.815	0.533	0.019	0.087	-0.873	1.070
HONGKONG_F	0.422	-0.809	0.510	1.436	0.324	0.082	0.078	-0.969	1.242
INDIA_F	0.331	-1.005	0.653	1.584	0.264	0.102	0.180	-1.221	1.588
INDONESIA_F	0.227	-1.904	0.512	2.821	0.407	0.063	0.088	-1.870	2.578
IRELAND_F	0.208	-1.744	0.518	1.493	0.357	-0.061	-0.182	-2.561	2.731
ISRAEL_F	0.105	0.081	0.315	0.207	-0.013	0.101	0.047	-0.742	0.750
JAPAN_F	0.336	0.281	0.390	-0.248	0.125	0.067	-0.098	-1.072	0.821
KOREA_F	0.395	-0.328	0.659	1.131	0.548	0.006	-0.023	0.726	-0.739
MALAYSIA_F	0.194	-0.874	0.151	1.219	0.253	0.173	0.101	-1.436	1.694
NETHERLANDS_F	0.651	0.144	0.934	-0.073	0.134	0.147	0.032	-0.430	0.356
NORWAY_F	0.499	-0.011	0.641	0.396	0.709	0.003	0.099	1.825	-1.817
PORTUGAL_F	0.480	-0.809	0.283	0.967	0.546	0.041	0.096	-1.583	1.680
SINGAPORE_F	0.460	-0.200	0.531	0.818	0.409	0.076	0.110	0.047	-0.009
SPAIN_F	0.627	-0.871	0.667	1.372	0.419	0.025	0.107	-1.250	1.532
SWEDEN_F	0.603	0.013	0.947	0.679	0.346	0.018	0.028	-1.150	0.996
SWITZERLAND_F	0.618	-0.265	0.538	0.437	0.319	-0.118	0.058	-0.850	0.911
UK_F	0.699	-0.547	0.765	0.728	0.370	-0.074	0.031	0.035	0.112
CZECH_F	0.452	-1.485	0.341	1.882	0.755	-0.006	0.094	1.125	-0.362
FINLAND_F	0.557	-1.539	0.746	1.362	0.326	0.022	-0.051	-0.176	0.684
GREECE_F	0.439	-1.428	0.611	1.431	0.408	0.130	0.065	0.751	-0.260
HUNGARY_F	0.541	0.050	0.578	0.348	1.016	0.088	0.014	-0.619	0.493
ITALY_F	0.608	-0.465	0.591	0.547	0.544	0.052	0.045	-1.594	1.638
MEXICO_F	0.790	-0.327	1.151	0.811	0.321	-0.040	0.107	-0.608	0.757
MOROCCO_F	0.034	-0.472	-0.231	0.182	0.474	0.035	0.010	0.255	0.021
NEWZEALAND_F	0.518	-0.902	0.718	1.126	0.157	0.019	0.000	-0.589	0.765
PAKISTAN_F	-0.020	-2.453	0.101	2.241	-0.080	0.138	0.068	-0.665	1.440
PERU_F	0.401	-2.838	0.231	3.803	0.970	0.100	0.072	0.198	0.852
PHILIPPINES_F	0.229	-0.398	0.677	0.992	-0.057	-0.016	-0.004	-2.096	2.164
POLAND_F	0.414	-0.677	0.815	0.670	0.294	0.084	0.042	0.581	-0.310
RUSSIA_F	0.338	-2.202	0.586	2.534	0.768	0.007	0.034	4.667	-3.805
SOUTHAFRICA_F	0.510	-0.231	0.830	1.108	0.358	-0.095	0.105	1.821	-1.673
TAIWAN_F	0.318	-0.171	0.479	0.651	0.201	0.014	0.045	0.087	-0.107
THAILAND_F	0.268	-0.356	0.406	0.782	0.303	0.090	0.063	-3.123	3.145
TURKEY_F	0.467	-0.285	1.436	1.209	-0.095	0.002	0.083	3.323	-3.088

Test3 Results

Country	Adj. R	Constant	global_d	us_d	uscrash	ted_m1	ted_m3	fcps_m1
Argentina	0.757	0.05	2.12***	-1.14***	0.38*	-0.37	0.99	-3.91*
Australia	0.895	0.40	2.27***	-1.22***	0.20	0.81	-0.95	-0.04
Austria	0.862	0.76	2.45***	-1.17***	-0.09	0.65	-1.04	-1.76
Belgium	0.804	0.40	1.64***	-0.35**	-0.36**	-0.61	0.49	-1.99*
Brazil	0.835	-0.23	2.68***	-0.89***	-0.13	-2.60**	3.13*	0.83
Canada	0.866	0.75	1.75***	-0.72***	0.23*	0.25	-0.72	1.11
Chile	0.575	-0.05	1.35***	-0.21	-0.24	-1.24	1.79	-2.53
China	0.578	-0.25	2.39***	-1.32***	-0.11	0.87	-0.48	-1.46
Colombia	0.598	-0.49	1.18***	-0.10	-0.22	-3.35***	4.19***	-2.82
Czech	0.652	0.76	2.00***	-1.35***	0.44*	0.19	-0.34	0.64
Denmark	0.854	0.01	2.01***	-1.00***	0.06	0.18	0.13	-1.72
Egypt	0.368	-0.06	1.36***	-1.09***	0.29	0.45	0.55	-7.87***
Finland	0.787	-0.66	1.93***	-0.77***	-0.12	0.15	0.48	-1.75
France	0.929	-0.44	1.92***	-0.71***	-0.11	-0.68	1.05	0.07
Germany	0.928	-0.77**	1.75***	-0.73***	0.20**	-0.55	1.30**	-1.08
Greece	0.720	0.23	2.27***	-1.23***	-0.09	-0.20	0.16	-1.25
HongKong	0.707	-0.13	1.87***	-0.94***	-0.14	0.09	0.20	-1.49
Hungary	0.730	1.01	2.47***	-1.45***	0.52**	0.84	-1.86	2.52
India	0.522	-0.10	2.01***	-0.88**	-0.29	-0.82	1.56	-4.38**
Indonesia	0.522	1.76	2.31***	-1.30***	-0.26	3.42**	-3.52*	-6.26**
Ireland	0.208	-0.99	1.08***	-0.23	-0.05	1.60	-1.15	-2.24
Israel	0.272	1.98**	0.65***	-0.26	-0.15	1.55*	-2.90**	1.51
Italy	0.873	-0.57	2.05***	-1.04***	0.12	-0.12	0.53	-0.43
Japan	0.596	0.33	1.26***	-0.65***	-0.13	0.46	-0.90	0.99
Korea	0.625	-1.03	2.37***	-1.31***	0.16	-1.14	1.74	-0.36
Malaysia	0.496	0.18	1.36***	-0.95***	-0.07	0.69	-0.67	-1.70*
Mexico	0.838	-0.75	1.12***	0.26	0.14	-1.54	2.25*	-0.69
Morocco	0.268	0.69	0.98***	-1.05***	0.27*	-0.00	0.17	-2.48*
Nether	0.821	0.64	1.59***	-0.34*	-0.24*	-0.58	0.13	0.16
NewZeal	0.724	-0.80	1.49***	-0.49**	-0.14	-0.39	0.94	-1.88*
Norway	0.766	0.89	2.69***	-1.59***	0.20	-0.40	-0.44	1.97
Pakistan	-0.0183	0.38	0.64	-0.41	-0.27	2.85*	-3.57	0.20
Peru	0.549	-0.62	2.01***	-1.41***	0.53*	-0.18	1.24	-4.20**
Philipians	0.387	0.57	1.49***	-0.53*	-0.38	0.33	-0.76	0.24
Poland	0.615	0.70	2.13***	-0.96***	-0.09	0.10	-0.59	1.07
Portugual	0.770	-0.83	1.69***	-1.05***	0.17	-0.94	1.55	-1.90
Russia	0.492	0.26	2.36***	-1.48***	0.49	-2.20	1.18	5.70
Singapore	0.730	0.16	1.93***	-0.99***	-0.06	0.02	0.10	-1.84
SouthAfr	0.746	-0.02	2.24***	-1.03***	0.01	-2.01*	1.53	4.64
Spain	0.859	-1.01**	1.80***	-0.77***	0.06	0.04	1.25	-3.65***
Sweden	0.786	0.23	2.02***	-0.68***	-0.09	0.13	-0.48	0.89
Switz	0.792	-0.53	1.38***	-0.54***	0.05	0.17	0.42	-1.16
Taiwan	0.540	0.56	1.45***	-0.71**	-0.10	0.68	-1.14	0.04
Thailand	0.535	0.66	1.71***	-0.90***	-0.21	0.87	-0.78	-4.16**
Turkey	0.570	0.86	2.01***	-0.40	-0.27	-0.04	-0.64	2.36
UK	0.897	-0.55	1.75***	-0.64***	0.04	-0.45	0.79	0.17



**Table 3: Out of Sample Spearman Correlation Coefficients with SP500  
(significance levels and number of observations)**

	<b>ARGENTINA</b>	<b>AUSTRALIA1</b>	<b>AUSTRALIA2</b>	<b>AUSTRIA</b>	<b>BELGIUM</b>	<b>BRAZIL</b>
<b>Pre Lehman</b>	0.0651 0.26841 48	<.0001 0.52011 51	<.0001 0.5558 51	<.0001 0.59509 50	<.0001 0.77953 50	<.0001 0.57825 51
	<b>ARGENTINA</b>	<b>AUSTRALIA1</b>	<b>AUSTRALIA2</b>	<b>AUSTRIA</b>	<b>BELGIUM</b>	<b>BRAZIL</b>
<b>Post Lehman</b>	<.0001 0.8229 41	<.0001 0.85222 40	<.0001 0.84985 41	<.0001 0.8015 40	<.0001 0.80725 42	<.0001 0.88324 42
	<b>CANADA</b>	<b>CHILE</b>	<b>CHINA</b>	<b>DENMARK</b>	<b>EGYPT</b>	<b>FRANCE</b>
<b>Pre Lehman</b>	<.0001 0.6794 50	<.0001 0.57514 52	-0.03941 0.7815 52	<.0001 0.59582 48	0.08131 0.5627 53	<.0001 0.88494 53
	<b>CANADA</b>	<b>CHILE</b>	<b>CHINA</b>	<b>DENMARK</b>	<b>EGYPT</b>	<b>FRANCE</b>
<b>Post Lehman</b>	<.0001 0.90707 42	<.0001 0.70574 41	0.08938 0.5885 39	<.0001 0.85144 40	<.0001 0.67515 30	<.0001 0.87989 42
	<b>GERMANY</b>	<b>HONGKONG</b>	<b>INDIA1</b>	<b>INDIA2</b>	<b>INDONESIA</b>	<b>IRELAND</b>
<b>Pre Lehman</b>	<.0001 0.83364 51	0.41974 0.0018 53	0.44549 0.0009 52	0.42805 0.0024 48	0.2615 0.0638 51	0.49459 0.0003 49
	<b>GERMANY</b>	<b>HONGKONG</b>	<b>INDIA1</b>	<b>INDIA2</b>	<b>INDONESIA</b>	<b>IRELAND</b>
<b>Post Lehman</b>	<.0001 0.91484 44	<.0001 0.87892 41	<.0001 0.74308 41	<.0001 0.65067 41	<.0001 0.69867 37	<.0001 0.70937 41
	<b>ISRAEL</b>	<b>JAPAN</b>	<b>KOREA</b>	<b>MALAYSIA</b>	<b>NETHERLANDS</b>	<b>NORWAY</b>
<b>Pre Lehman</b>	0.42303 0.0014 54	<.0001 0.60132 45	0.40523 0.0035 50	0.20317 0.1445 53	<.0001 0.83057 53	0.36567 0.0115 47
	<b>ISRAEL</b>	<b>JAPAN</b>	<b>KOREA</b>	<b>MALAYSIA</b>	<b>NETHERLANDS</b>	<b>NORWAY</b>
<b>Post Lehman</b>	<.0001 0.5909 42	<.0001 0.83286 36	<.0001 0.70612 41	<.0001 0.64906 36	<.0001 0.85281 42	<.0001 0.78602 41
	<b>PORTUGAL</b>	<b>SINGAPORE</b>	<b>SPAIN</b>	<b>SWEDEN</b>	<b>SWITZERLAND</b>	<b>UK</b>
<b>Pre Lehman</b>	0.5142 0.0001 50	0.32122 0.0202 52	<.0001 0.74977 49	<.0001 0.72369 49	<.0001 0.85878 50	<.0001 0.80189 51
	<b>PORTUGAL</b>	<b>SINGAPORE</b>	<b>SPAIN</b>	<b>SWEDEN</b>	<b>SWITZERLAND</b>	<b>UK</b>
<b>Post Lehman</b>	<.0001 0.7858 42	<.0001 0.7752 42	<.0001 0.85724 42	<.0001 0.86774 41	<.0001 0.8499 43	<.0001 0.89596 42

Out of Sample Matched Index

Appendix	Out of Sample Country Indices		
COUNTRY	COUNTRY INDEX	SOURCE	
ARGENTINA	MERVAL: BUENOS AIRES STOCK EXCHANGE (BOLSA D	YAHOO FINANCE	
AUSTRIA	ATX (Austria) (ATX)	YAHOO FINANCE	
AUSTRALIA	All Ordinaries (Australia) ^AORD, SP_ASX200	YAHOO FINANCE	
BELGIUM	EURONEXT BEL-20 (^BFX)	YAHOO FINANCE	
BRAZIL	IBOVESPA - BM&F BOVESPA SAO PAULO	YAHOO FINANCE	
CHILE	IPSA - COMPOSED OF 40 MOST HEAVILY TRADED STC	YAHOO FINANCE	
CHINA	Shanghai Composite (China) 000001.SS	YAHOO FINANCE	
CANADA	S&P/TSX COMPOSITE INDEX	YAHOO FINANCE	
DENMARK	OMX Copenhagen 20 (Denmark) OMXC20.CO	YAHOO FINANCE	
EGYPT	EGX 30 INDEX	YAHOO FINANCE	
FRANCE	CAC 40 (France) (^FCHI)	YAHOO FINANCE	
GERMANY	DAX (Germany) (^GDAXI )	YAHOO FINANCE	
HONGKONG	Hang Seng (Hong Kong) ^HSI	YAHOO FINANCE	
INDIA	BSE 30 (India) ^BSESN, ^NSEI S&P CNX NIFTY (India)	YAHOO FINANCE	
INDONESIA	Jakarta Composite (Indonesia) ^JKSE	YAHOO FINANCE	
IRELAND	ISEQ20 (Ireland) (^IETP)	YAHOO FINANCE	
ISRAEL	TEL AVIV TA-100 IND	YAHOO FINANCE	
ITALY	S&P Mib (Italy) FTSEMIB.MI	YAHOO FINANCE	
JAPAN	NIKKEI 225 (^N225)	YAHOO FINANCE	
KOREA	Seoul Composite (South Korea) ^KS11	YAHOO FINANCE	
MALAYSIA	FTSE Bursa Malaysia KLCI Index	YAHOO FINANCE	
MEXICO	IPC - (^MXX)	YAHOO FINANCE	
NETHERLANDS	AEX (Netherlands) (^AEX )	YAHOO FINANCE	
NORWAY	Total Share (Norway) ^OSEAX	YAHOO FINANCE	
NEWZEALAND	NZSE 50 (New Zealand) ^NZ50	YAHOO FINANCE	
PORTUGAL	PSI 20 (Portugal) - ^PSI20	YAHOO FINANCE	
SINGAPORE	Strait Times (Singapore) ^STI	YAHOO FINANCE	
SPAIN	Madrid General (Spain) - (^SMSI )	YAHOO FINANCE	
SWEDEN	OMX Stockholm 30 (Sweden) (^OMXSPI)	YAHOO FINANCE	
SWITZERLAND	Swiss Market (Switzerland) ^SSMI	YAHOO FINANCE	
UK	FTSE 100 (United Kingdom) (^FTSE )	YAHOO FINANCE	

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