Are Systemically Important Banks Really *“**IMPORTANT**”*?

by

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Abstract

The Global Financial Crisis of 2007-2009 saw the collapse of some of the world's oldest financial institutions and the widespread disruption caused to the financial system and the global economy. The failure to predict this crisis and the potential of "too big to fail" banks to cause long-term economic damage resulted in these banks being classified as Global Systemically Important Banks (G-SIBs) and being subjected to increased regulations and high capital buffers to mitigate systemic risk. The focus of this thesis is on interconnectedness, one of the criteria used to categorize these banks as G-SIBs. Our intention is to point out that equal weightage given to all indicators used to calculate systemic importance results in misidentification of G-SIBs. We investigate the interconnectedness of G-SIBs with the global financial system by analyzing volatility spillovers transmitted by each of these banks to different segments of the global financial market. An empirical study is done on the daily equity returns of all G-SIBs and returns in the global equity, investment-grade bond and high-yield bond markets from 2005-2017. We model volatility as time-varying conditional variance in a multivariate framework using asymmetric BEKK-GARCH parameterization. The results suggest that volatility spillovers arising from G-SIBs are independent of size. Only 13 out of 30 G-SIBs effect two or more financial markets and 5 G-SIBs have no spillovers to any global market. Most of the spillovers transmitted by G-SIBs are negative, indicating the stabilizing role of these banks. The high-yield bond market is the major recipient of spillovers among all markets while the equity market is weakly integrated with most G-SIBs. The effect of bad news is seen mostly in the investment-grade bond market where negative shocks actually dampen volatility and suggest a 'flight to quality' effect. Overall, the findings of this thesis indicate that the Financial Stability Board should reevaluate its methodology of classifying banks

as G-SIBs as the results question the disruptive nature of these banks and the importance of size as an equal indicator.

Keywords: G-SIBs, interconnectedness, volatility spillovers, BEKK-GARCH

CHAPTER 1: Introduction

A sound financial system is essential for economic growth and development. It enables smooth allocation of financial resources which promotes economic development and growth. For economic development to continue, it is vital to ensure stability of the financial systems. The Global Financial Crisis (GFC) of 2007-2009 shook the financial system and caused more turmoil in the worldwide financial environment than any past crisis. It revealed the extent of weaknesses present in the global financial system as the collapse of a single financial institution in the US led to funding runs and had global repercussions, resulting in failures of financial institutions across the Atlantic and contracting the real economy worldwide. This spread of market disturbances between geographical regions, or financial contagion due to excessive systemic risk, had not been witnessed in past crises and indicated the extent of integration of financial institutions and global markets. Interconnectedness, which was the main driver behind financial contagion, become a major concern for regulatory authorities. An understanding of the relationship between interconnectedness of major financial institutions and financial stability was essential to prevent future crises from happening. There was global consensus that a thorough assessment of current financial sector practices was required to reduce the vulnerability of the financial system to interconnectedness, and a formal plan was needed for implementation of rigorous financial reforms, both internationally as well as domestically.

The GFC highlighted the significance of individual financial institutions in transmitting adverse shocks to other financial firms, the financial system, and possibly the real economy due to their contribution to global systemic risk. Such institutions were highly interconnected owing to the network of contractual obligations between them which could potentially channel financial distress. These institutions perceived themselves as "too big to fail" (TBTF) and took on greater risks as they knew they would be bailed out by governments if they neared bankruptcy. Prior to the crisis, the importance of these institutions was underscored and there was no supervisory or regulatory control on the activities of these institutions. After the crisis, the interconnectedness of these financial entities was highlighted and consequently, the focus of policymakers shifted to a more macroprudential approach to formulate a strategy that could identify these highly interconnected and systemically important financial institutions (SIFIs). The policymakers recognized it was important to regulate these SIFIs and ensure that the global financial system was more resilient and less vulnerable to negative externalities from these institutions. The first step of the Financial Stability Board (FSB) in developing a crisis prevention mechanism was thus identifying these Global Systemically Important Banks (G-SIBs), and the supervisory reform agenda focused on alleviating the risk stemming from these banks due to their size, complexity and interconnectedness within the financial system.

Capital surcharges and liquidity requirements were imposed on G-SIBs by the Basel Committee of Banking Supervision (BCBS). These stringent measures went beyond the minimum Basel standards, and strove to limit the capacity of these financial institutions to develop systemic importance by limiting their size, structure and range of activities. Such measures would contain the build-up of systemic risk in the financial system, lower the probability of future defaults and reduce the magnitude of costs if any such failures did occur. However, these regulations on G-SIBs did not come without a cost and had important implications regarding their business strategies and operational structures. G-SIBs would be required to hold more superior-quality capital than other firms to account for their importance, and to provide an extra cover against bankruptcy. Since superior quality equity capital is the most expensive source of money, G-SIBs would face an increase in cost of funding. There would be greater demands on liquidity as G-SIBs would be asked to hold more "high-quality liquid assets" (HQLA) which generally do not yield much profit. Any activity perceived as a potential threat to global financial stability could lead to intervention by policymakers, limiting areas of profitable business for banks. Traditional investment banking activities like trading and securitization, which were previously a source of high revenue, would either not be possible or greatly limited. G-SIBs would have to substantially rethink their business strategies. Moreover, there would be an increased need for data and disclosure by supervisory authorities which would lead to higher administrative costs.

As G-SIBs attempt to meet these requirements, they will face a reduction in return on equity as it will be more costly for the banks to do business. The withdrawal of support by governments to bail out G-SIBs would also increase funding costs, which would eventually be passed on to firms and consumers in the form of more expensive loans. The macroeconomic impact of the actions of the G-SIBs to meet higher capital requirements will be a decline in debt-financed consumption and investment, and eventually lead to a decline in GDP growth. Since the marginal economic costs associated with the Basel III prudential regulations are high, overestimating the systemic importance of these banks and incorrectly identifying them may lead to unnecessary regulatory burdens, misallocation of resources, and decline in performance for these firms. Hence, it is imperative that regulatory authorities should be as accurate as possible in classifying a bank as a G-SIB.

The methodology proposed by the FSB to identify banks as G-SIBs is centered on five criteria of size, interconnectedness, substitutability, complexity and cross-jurisdictional activity that can be calculated from accounting information of these institutions. This indicator-based assessment gives equal weightage to all dimensions of systemic importance in classifying banks as G-SIBs. However, the collapse of Lehman Brothers showed that it was interconnectedness of a financial institution with the global financial system, rather than size and other criteria which caused the crisis. At the time of bankruptcy, the assets of Lehman were only $639 billion as compared to JP Morgan Chase and Citigroup which had assets of more than $2 trillion and Goldman Sachs whose assets were above $1 trillion.

As the restrictions placed on G-SIBs by Basel III impose substantial financial and economic costs, this research is meant to address the issue of true identification of G-SIBs to help policy makers in taking optimal actions subsequently. Lehman didn't compare in size but it was its high interconnectedness with the financial system that actually had global repercussions. Since interconnectedness matters highly, it is important to identify correctly which bank is actually systemically important and which is not by looking at its interconnectedness.

Spillovers are one way of understanding interconnectedness of financial institutions and markets and volatility is propagated across markets via spillovers that exert greater impact when markets are more connected (Diebold and Yilmaz, 2015). Spillovers are then a consequence of financial contagion and suggest greater integration between markets (Forbes and Rigobon 2002). Lehman's collapse had spillovers worldwide which indicated the extent to which the bank was integrated with the global economy. Since the volatility process reflects how markets assess and assimilate new information, examination of volatility spillovers between markets can give an indication of the degree of interconnectedness present. Hence, an investigation of transmission of volatility spillovers by G-SIBs will help us justify the global systemically important status of banks due to interconnectedness as the criteria used to define G-SIBs may be imperfect due to equal weightage given to all five measures of systemic importance.

Our analysis shows that volatility spillovers transmitted by the G-SIBs do not depends on the size of the bank as few of these banks cause disruptions in two or more financial markets. Some of the G-SIBs have no spillovers to any of the financial markets. Our finding is similar to Zhou (2009), who found that size could not be an indicator of systemic importance and other measures of systemic importance should be considered, as well as Barth and Schnabel (2013), who argued that even small banks could fail in times of crises due to their interconnectedness. Lu and Hu (2014) concluded that size did matter but beyond a certain size, systemic importance did not increase. However, Pais and Stork (2013) concluded that large banks carried more systemic risk even if size did not impact univariate risk. Moreover, our findings also reveal that most of the spillovers transmitted by G-SIBs are negative, which actually points to the stabilizing role of these banks in the worldwide financial markets.

1.1 Research Objectives

The purpose of this dissertation is to establish if the G-SIBs were actually a source of volatility spillover to financial markets during the GFC due to interconnectedness, and investigating the transmission of financial volatility movements in the period before, during and after the crisis. Previous studies on interconnectedness have tested association either between pairs of SIFIs, among SIFIs and one financial market, or between SIFIs of different regions. This paper contributes to literature by analyzing how interconnected G-SIBs are with the global financial environment by investigating transmission of financial spillovers. Our study will explore which particular segment of the global, financial market is more exposed towards the shocks originated in G-SIBs. We want to see if the degree of interconnectedness is dynamic in nature or not by examining the volatility spillover processes from G-SIBs to different elements of the financial system between January 2005 and May 2017. This time span covers the period before, during and after the 2007-2009 GFC and allows us to analyze the specific patterns and changes in volatility spillover effects from G-SIBs during the crisis and thereafter. This will enable us to see if these relationships are time-varying, and determine how integrated G-SIBs have been with financial markets.

The focus of the study will be to gather enough evidence to substantiate the systemically important status of banks due to interconnectedness and to determine if the impact of G-SIBs is truly global or not. An investigation is also required because the criteria used to define G-SIBs may be imperfect due to equal weightage given to all five measures of systemic importance, and some smaller G-SIBs banks might be more interconnected with the financial system than the larger ones.

1.2 Research Questions

This dissertation seeks to answer two questions:

1) Are G-SIBs really interconnected with the global financial markets by being a source of volatility spillovers to these markets before, during and after the Global Financial Crisis of 2007-09?
2) Which particular segment of the global financial market is more exposed to shocks originating from G-SIBs?

We empirically assess interconnectedness using stock returns of G-SIBs and measures of statistical association. Since direct interconnectedness of financial institutions is a result of counter-party linkages due to positions in certain assets, contractual obligations and interbank claims, it can only be measured if high-frequency balance sheet information is available. As it is difficult to obtain such information, majority of the empirical studies make use of market-based measures to estimate interconnectedness. These measures generally require only stock price data of G-SIBs and return volatilities which are easily obtainable. We also use market-based approaches to measure interconnectedness and use G-SIBs' equity returns to capture volatility spillovers arising from them towards the global financial market.

In volatility spillover literature, majority of the studies have used univariate or multivariate GARCH models as a standard method to examine financial spillovers. We also examine the interconnectedness of G-SIBs with the global financial market by modeling volatility spillovers and transmissions through a multivariate asymmetric "Generalized Autoregressive Conditional Heteroscedasticity" (GARCH) model with BEKK (Baba, Engle, Kraft and Kroner) parameterization. We use the BEKK specification of multivariate GARCH models to extract time-varying conditional covariances between equity returns of G-SIBs and different segments of the global financial market which includes equity markets, investment grade and high-yield bonds market. The BEKK parameterization allows for the presence of cross-market dynamics of conditional covariances, and helps us in detecting volatility transmission and persistence of volatilities between G-SIBs and the various financial markets. The asymmetric part of the model helps us in analyzing the specific impact of bad news for G-SIBs on the global financial markets.

CHAPTER 2: Literature Review

2.1 Global Financial Crisis 2007-2009

The failure of Lehman Brothers on September 15, 2008, changed the world financial markets forever. A bank "too big to fail" filed for bankruptcy as a consequence of trouble in the US housing sub-prime mortgage market. The demise of America's fourth largest investment bank with an asset base of $629 billion heralded the arrival of a Global Financial Crisis (GFC), which was believed to be the most dangerous since the Great Depression of the 1930s.

The roots of the GFC lay in issuing subprime mortgages to borrowers who did not qualify for house loans due to poor credit histories. The mortgages were then packaged together by lenders in large pools, and structured into new financial instruments called collateralized debt obligations (CDO) and asset-backed securities (ABS). These new securitized products were sophisticated and complex, and held the promise of better risk allocation. Due to this, they were considered to be low-risk and were given high ratings by credit rating agencies. They were highly demanded by institutional investors and other banks due to the promise of high yields as compared to low-interest rate corporate bonds of equivalent risk.

The availability of lax credit for house loans and low interest rates had led to a boom in the real estate market in the US with housing prices rising by almost 30% between 2003 and 2007. The unsustainable housing bubble eventually peaked and burst in 2006. Real estate prices started to fall rapidly, leading to defaults on mortgage payments by home-owners. The combination of the collapse of the subprime mortgage market and falling house prices served as a catalyst for the crisis that followed.

The high rates of defaults by home-owners led to a quick decline in the value of mortgage-backed asset securities, and as the price of these structured financial products continued to plunge in 2007, banks were no longer able to find a market for these assets. It became impossible to sell the securities and banks were unable to use them for short-term funding. This led to a severe liquidity crisis in the interbank market and many financial institutions felt the pressure of tightening credit conditions. Major financial institutions, which were heavily invested in these securities, were forced to greatly write down the value of these structured securities due to 'mark-to-market' accounting requirements.

The turmoil in the financial markets did not impact the real economy till the bankruptcy of Lehman Brothers in the fall of 2008. The turbulence from this event and the ensuing market panic affected stock markets globally, and greatly damaged investor confidence due to the sudden rise in risk aversion. Many of the US asset-based securities were held overseas by European countries and other emerging market economies due to ease in capital flows across borders, and thus, the virulent effects of the financial crisis in the US spilled over to Europe and carried on through to the European sovereign debt crisis in 2010. Economies in Asia and Latin America suffered indirect blows with only China and India experiencing some sort of growth in this period. The financial crisis assumed global proportions mainly due to volatility in the highly integrated financial markets and a fall in worldwide demand. Real GDP contracted worldwide as global industrial production fell, international trade declined and unemployment rose (Gros and Alcidi, 2010).

2.2 Emergence of Global Systemically Important Banks

The GFC of 2007-2009 forced the world to recognize the vulnerability of the current financial system, and the resulting global instability and shocks to the real economy that followed from the collapse of a financial institution that was not as big in size as others, but highly interconnected and complex. Unlike the previous financial crises faced by the world, this crisis was a result of systemic risk. “Systemic risk in banking is evidenced by high correlation and clustering of bank failures in a single country, in a number of countries, or throughout the world” (Kaufman and Scott 2003). It is characterized by comovements of various parts of the financial system. Systemic risk is then the probability of the breakdown of the entire financial system because of the failure of a single institution that is a significantly integrated with the economy. Such institutions are a key source of systemic risk and have extraordinary spillover costs associated with their failure. They are considered “too big to fail” (TBTF) because of their large interconnectedness, complexity and size. After the GFC, systemic risk appears to be one of the most challenging area of financial regulation and policy (Scott, 2010).

Prior to 2008, it was perceived that these TBTF firms would not be allowed to collapse by governments in their respective countries. This enabled them to acquire funding at a lower cost than other firms, thereby allowing them to become even bigger and more integrated. Being aware of their TBTF status, such firms had economic incentive to undertake riskier activities since they knew they were protected against insolvency and would receive a financial bailout from the government. Due to this moral hazard problem and the presence of systemic risk, policymakers and politicians had to rethink the challenges posed by the banking system and recognize the systemic importance of such financial institutions. They responded by enacting several macro-prudential financial reforms to define and measure systemic importance, and imposed more rigorous capital and liquidity requirements. The FSB was set up in April 2009 to tightly regulate financial institutions to limit systemic risk, reduce the likelihood of another financial system meltdown, and to monitor the authorities responsible for financial stability in their respective countries. The term SIFI (systemically important financial institution) became a part of financial lexicon to describe any firm that was systemically risky due to its size, complexity and interconnectedness.

2.3 Global Systemically Important Banks

The BCBS sets the guidelines for world-wide regulation of banks. Even though SIFI includes all firms in the financial services sector, banks were the first type of systemic firms to come under regulatory control as the GFC was centered on banks. The FSB called on the Basel Committee to address this issue. The Basel Committee in 2011 introduced the Basel III, or the Third Basel Accord, which was a voluntary, global regulatory framework to further supervise and strengthen the risk management of banks. It identified 29 institutions as Global Systemically Important Banks (G-SIBs) that would have to adhere to stricter capital and liquidity requirements. A G-SIB was defined as a "financial institution whose distress or disorderly failure, because of its size, complexity and systemic interconnectedness, would cause significant disruption to the wider financial system and economic activity" (BCBS, 2011). The committee's goal was to focus on the systemic risks and the moral hazard problems posed by banks that were previously thought to be too big to fail. The objective was to make banks less vulnerable to future economic and financial shocks by concentrating on better risk management and governance. Table 1 shows the current banks identified as G-SIBs on November 2016 and the capital requirement imposed on them as a percentage of their risk-weighted assets.

Basel III aimed to increase bank capital requirements by strengthening liquidity and reducing leverage. It adopted a series of reforms that "include raising the required quality and quantity of capital in the banking system, improving risk coverage, introducing a leverage ratio to serve as a backstop to the risk-based regime, introducing capital conservation and countercyclical buffers as well as a global standard for liquidity risk" (BIS, 2011). These controls were seen as essential since most G-SIBs focused more on trading and capital market activities as compared to traditional banking activities, and current regulations fell short on monitoring negative externalities generated by G-SIBs.

The Basel Committee introduced an assessment methodology to measure the systemic importance of banks using an indicator-based measurement approach. Using various indicators, the methodology was simpler, more robust, and tried to measure all aspects of systemic importance as compared to other available methodologies. The five main criteria used to classify an institution as a G-SIB were, size, interconnectedness, substitutability, cross-jurisdictional activity and complexity. All indicators were equally-weighted in the measurement and except for size, all other categories had multiple indicators. Within the categories, the indicators were equally-weighted as well. Table 2 shows the weightage given to different indicators in calculating the score for a bank. The score determined for a particular G-SIBs determined the bucket it would be placed in and the relevant capital and liquidity requirements for that bucket would be imposed for the G-SIB.

Table 1: G-SIBs as of November 2017

Bucket	G-SIBs in alphabetical order	Country	G-SIB status year
5 (3.5%)	(Empty)		
4 (2.5%)	JP Morgan Chase	USA	2011
3 (2.0%)	Bank of America	USA	2011
	Citigroup	USA	2011
	Deutsche Bank	Germany	2011
	HSBC	UK	2011
2 (1.5%)	Bank of China	China	2011
	Barclays	UK	2011
	BNP Paribas	France	2011
	China Construction Bank	China	2015
	Goldman Sachs	USA	2011
	ICBC Limited	China	2013
	Mitsubishi UFJ FG	Japan	2011
	Wells Fargo	USA	2011
1 (1.0%)	Agricultural Bank of China	China	2014
	Bank of New York Mellon	USA	2011
	Credit Suisse	Switzerland	2011
	Crédit Agricole	France	2011
	ING Bank	Netherlands	2011
	Mizuho FG	Japan	2011
	Morgan Stanley	USA	2011
	Nordea	Sweden	2011
	Royal Bank of Canada	Canada	2017
	Royal Bank of Scotland	UK	2011
	Santander	Spain	2011
	Société Générale	France	2011
	Standard Chartered	UK	2012
	State Street	USA	2011
	Sumitomo Mitsui FG	Japan	2011
	UBS	Switzerland	2011
	Unicredit Group	Italy	2011

Table 2: Indicator-Based Measurement Approach

Category and Weight	Indicator	Weight of Indicator
"Cross-jurisdictional activity" (20%)	Cross-jurisdictional claims	10%
	Cross-jurisdictional liabilities	10%
"Size" (20%)	Total exposures as defined for use in the Basel III leverage ratio	20%
"Interconnectedness" (20%)	Intra-financial system assets	6.67%
	Intra-financial system liabilities	6.67%
	Wholesale funding ratio	6.67%
"Substitutability" (20%)	Assets under custody	6.67%
	Payments cleared and settled through payment systems	6.67%
	Values of underwritten transactions in debt and equity markets	6.67%
"Complexity" (20%)	OTC derivatives notional value	6.67%
	Level 3 assets	6.67%
	Trading book value and Available for Sale value	6.67%

*(BIS 2011)

Cross-jurisdictional activity: This factor determines the global footprint of banks. The bigger the footprint, the wider the global range of a bank and subsequent spillovers to other countries. This indicator calculates the level of a bank's activities outside its country of establishment in relation to undertakings of its peers in the sample. The level of a bank's claims and liabilities across jurisdictions directly determine the global effect of a bank's failure.

Size: This is a crucial measure of systemic importance. A bank that controls a large part of worldwide banking activities has a greater potential to impair the global financial system since it is more difficult for other banks to take over its activities in the market. The failure of a large bank would be more detrimental to the banking system and investor confidence. A bank's size is calculated by looking at its total exposures.

Interconnectedness: Since all financial institutions have a network of contractual obligations, the systemic risk of a bank is directly linked to its interconnectedness with other financial entities. The level of the bank's intra-financial system assets and liabilities as well as outstanding securities are essential in identifying a bank's systemic importance.

Substitutability: The degree of substitutability of a bank's role as a market participant and client service provider is negatively related to its systemic importance. Banks that are more actively providing services to clients in the world market will pose a bigger cost to their customers during times of distress as compared to other banks. The bank's assets under custody, its payments activity and underwritten transactions in debt and equity markets determine the level of substitutability.

Complexity: The collapse of a complex bank is positively related to its complexity. The more complex the business, organization and operations of a bank, the bigger the costs it imposes on the financial system when it fails. Complexity of banks is measured by the bank's notional level of over-the-counter derivatives, its "level 3 assets" (illiquid assets), and trading and available-for-sale securities.

Calculation of Score: The above methodology calculates a bank's score using the twelve indicators and compares it with the scores of other banks in the group. The score of a bank captures the bank's systemic importance and determines the bucket it is placed into. Basel III has identified five buckets, with each bucket having its own loss absorbency requirement. Banks that are larger, more interconnected, cross-jurisdictional and complex, and less substitutable, will have a higher score in relation to other banks. They will be placed in a higher bucket, and hence, have a "higher loss absorbency" (HLA) requirement. This suggests it is compulsory for such banks to raise additional capital in the range of 1%-3.5% of their risk-weighted assets so as to increase their ability to absorb losses. Moreover, the additional capital has to be "core equity tier one" (CET 1), which is the highest quality capital consisting of common stock and retained earnings. Higher HLA requirements will ensure that G-SIBs are funded by such instruments that make banks less vulnerable to financial distress and increase its resilience as a going-concern. Moreover, these banks will be answerable to stricter supervisory control and special resolution regimes.

Liquidity Ratios: One of the key features of the GFC were drying up of liquidity in the interbank market due to poor liquidity risk management by some banks. To address this issue, the Basel III regulatory framework suggested two minimum standards for funding short and medium-term liquidity. These two parameters are the "net stable funding ratio" (NSFR), and the "liquidity coverage ratio" (LCR). The NSFR addresses liquidity mismatches, while the LCR measures the level of HQA needed to cover 30 days of net cash outflow to survive tight liquidity conditions. It encourages banks to use stable sources of funding and limits risk arising due to maturity mismatch between assets and liabilities over the long-term.

The Third Basel Accord was decided in 2010-2011 and the initial list of G-SIBs was first published by FSB in November 2011. It was mentioned that this list would be updated and buckets revised annually every November based on the previous year's financial data. National authorities would be required to ensure that G-SIBs in their jurisdiction complied with requirements set by international standards. All the G-SIBs designated in the November 2014 list were expected to phase in requirements of higher capital from January 1, 2016. Thereafter, the capital requirements for each G-SIB identified every November were expected to be in place by January within fourteen months. It was anticipated that full implementation of additional buffer capital would be in place by January 1, 2019. In addition to additional buffer capital requirements, the "Total Loss-Absorbing Capacity (TLAC)" requirements for G-SIBs identified in November 2015 would be phased in by January 1, 2019 as well.

2.4 Implications of Basel III for G-SIBs

"The collapse of Lehman Brothers amply demonstrated that the disorderly failure of a global financial firm has strong spillovers across markets and affects financial stability and national economies around the world" (Financial Stability Board, 2010). The Third Basel Accord sought to prevent another catastrophic crisis by reducing the ability of TBTF banks to impair the global financial system by taking excessive risks. Stringent equity requirements of higher amount as well as higher quality capital (CET 1) meant either raising more expensive equity, increasing retained earnings, or reducing risk-weighted assets. This implied higher average funding costs since equity capital is usually perceived to be more costly than debt. Controls on the leverage ratio also reduced the option of using debt capital whereas tighter LCR and NSFR requirements made it necessary to hold liquid assets that generally do not yield much profit. All these measures would compress profitability for most G-SIBs. According to McKinsey (Lüders 2011), the additional capital needed would be equal to approximately 60% of all US and European Tier 1 capital outstanding. The gap in liquidity would be equivalent to almost 50% of all unsettled short-term liquidity. European banks would be affected more as compared to US banks due to their current lower levels of Tier 1 Capital. The pressure on earnings would decrease average return on equity (ROE) for European banks by 4% and 3% for banks in the US.

Banks would also have to redesign their business models and strategies since several core businesses like trading and securitization would be impacted due to limitations placed by Basel III on investment in specific risky areas, which were previously high sources of profitability. The increase in disclosure requirements and displacement of existing business models would also place extra burden on human resources, which would prevent banks in controlling costs. Administrative and operational costs would further rise due to the additional supervisory requirements. The change in traditional sources of revenue and increased cost would further impact profitability.

Besides reducing bank profitability, the requirement of the Third Basel Accord would also have some macroeconomic costs associated with it. The Institute of International Finance (2011) estimated a 2.7% decline in the US GDP, 3% in Europe, 5.5% in UK, 3.7% in Switzerland, and 4% in Japan in a five-year period while the Basel III regulations were implemented. The impact would be felt the least in the US since its banking system norms are more close to the new reforms as compared to other countries. The higher lending costs of G-SIBs would spillover to other non-bank financial intermediaries as demand for credit from these firms would rise, thereby increasing their lending costs as well.

2.5 Systemic Risk and G-SIBs

A financial system is said to be “stable in the absence of excessive volatility, stress, or crises”, Gadanecz and Jayaram (2009). According to Batra (2002), financial stability is possible if key institutions in the financial system and the key markets are stable. When there is financial stability, the financial system shows a high degree of resilience to shocks and the build-up of systemic risk is prevented. There are three types of systemic risk in the financial system as suggested by Scott

(2011). The first type of systemic risk is due to correlation and asset shocks, where a speculative asset bubble bursts and prices of assets fall substantially, resulting in losses. It can have a substantial effect on the financial system if all financial institutions have invested in the same asset. Firms end up selling other assets as well in order to cover losses and reduce exposure. This leads to a decline in prices of other assets as well, leading to a general overall collapse. In the GFC, housing prices tumbled significantly and resulted in breakdown of the subprime mortgage market.

The second type of systemic risk arises due to contagion. According to Allen and Gale (2000), "contagion" is a consequence of excess spillover effects. The entire financial market breaks down as the collapse of one financial institution leads to creditors of others withdrawing funding in a way that resembles a bank run. This has a domino effect which results in the insolvency of other banks. Concerns about the strength of the financial system and erosion of investor confidence leads to an overall collapse.

The third type of systemic risk is due to connectedness, or interconnectedness as it is often referred to. Before the GFC, banks had investment portfolios consisting mostly of financial instruments such as "credit default swaps" (CDS), CDOs and other derivatives. The failure of one bank due to its inability to rollover its debt and defaulting on counterparty obligations based on derivative securities, resulted in the failure of other firms with portfolios of similar composition. Banks were forced to sell their investments at extremely low values because of sudden rise in risk aversion. During the GFC, prices of all bonds plummeted due to refusal by investors to renew short-term repo agreements which had ABS as collateral. Firms had to start liquidating these assets at distressed values, leading to a huge decline in bond prices and evaporation of liquid assets in the interbank market due to non-availability of short-term financing. This indicates why the failure of

Lehman Brothers was so significant: it led to a freezing of the credit markets, and eventually the collapse of the entire financial system.

Since strong financial contagion and interconnectedness due to the presence of systemic risk and the resulting instability were the key features of the GFC, the question arises on how to quantify interconnectedness between G-SIBs and the global financial environment. The equity volatility transmission pattern between G-SIBs and the global financial environment could provide proof of the impact of G-SIBs on various segments of the financial market. It would be interesting to see if empirical evidence supports significant interconnectedness as measured by volatility spillovers from G-SIBs. We intend to show if interconnectedness is truly present to justify the global systemic relevance of banks as proposed by FSB since the criteria used to define G-SIBs may be imperfect due to equal weightage given to all five measures of systemic importance.

2.6 Volatility Spillovers and Interconnectedness

Volatility is the degree to which the prices of financial assets, securities or commodities, or levels of markets, currencies or interest rates fluctuate over time. A volatility spillover occurs when variations in price in one market produce a lagged impact on volatility in other markets. Engle, Ito, and Lin (1990) suggested two hypotheses on how volatility was manifested across markets. The concept of "heat wave" suggested that volatility was market specific: a day of volatility in a market was expected to be followed by another volatile day in the same market. However, the "meteor wave" suggested the presence of volatility spillovers between markets: volatility in one market today would be followed by a volatile day in another market tomorrow. Transmission of volatility between markets was a result of increased integration and the presence of financial contagion (Forbes and Rigobon, 2002) and volatility spillovers through markets were greater when market interdependence was high (Wu, 2001). At the same time, it was observed that there was higher correlation in market returns when volatility rose and key periods of high volatility were seen during market declines or crashes. According to French, Schwert, and Stambaugh (1987), investors demand a greater expected return when the volatility of returns of a stock increases. Due to this reason, return and volatility spillover effects tend to reinforce each other, particularly in times of crises.

Spillover effects between financial markets and asset prices have been prevalent since markets became globally integrated since the early 1980's. The earlier studies of returns and volatility spillovers focused mainly on shock and volatility transmission across developed countries. The October 1987 Crash encouraged academicians and researchers to look at the linkages across major stock markets of the developed world. Most of the studies analyzing interdependencies of markets used some sort of GARCH model. Hamao et al., (1990) used a univariate GARCH model to investigate Granger causality between stock markets of US, UK and Japan before and following the 1987 crash and found indication of price volatility spillover from the markets in the US and UK to Japanese markets. Lin, Engle, & Ito (1994) investigated empirically how returns and volatilities of Tokyo and New York stock market indices were correlated by using a single extraction model with GARCH processes. An EGARCH model was used by Koutmos & Booth (1995) to examine the asymmetric impact of good as well as bad news on US, UK and Japanese stock markets.

More recently, substantial literature came up on examination of spillovers between stock markets of developed countries using multivariate GARCH models (Kutlar & Torun, 2014; Wang & Wang, 2010), BRIC economies (Syriopoulos et al. 2015), emerging economies (Gębka and Serwa 2007;

Hwang 2014) and combination of these economies (Singh, Kumar, and Pandey 2010) since interdependencies between stock markets play a crucial role in global portfolio and risk management in times of extreme volatilities. Majority of these studies have found evidence of spillovers from the more developed countries to the developing countries.

Most of the researchers have studied spillover effects across markets. However, since the financial meltdown of the last decade, a number of studies have analyzed spillovers and relationships within the banking sector, or between banks and other financial institutions. Moussa (2014) investigated return and volatility spillover effects among large and small banks in five different countries of Southeast Asia using EGARCH and found that equity returns of both small and large banks had an effect on each other. He concluded that interdependencies between returns did exist, with more substantial negative excess of spillover in returns from the bigger to the smaller banks. Gropp & Moerman (2004) used bank equity prices and applied Monte Carlo simulation to study contagion in a sample of European banks. They found evidence of relationships between banks in specific countries, as well as across major banking systems in Europe. Gropp, Duca, & Vesala (2006) and Hartmann, Straetmans, & Vries (2005) found similar results of cross-border transmission of distress from one banking system to another.

In a seminal paper, Adams, Füss, & Gropp (2014) investigated risk spillovers among four sectors of major financial institutions, commercial banks, investment banks, hedge funds, and insurance companies using a value-at-risk approach. Their findings revealed that the size and duration of spillovers significantly altered with the state of the market. The spillovers of risk were considerably minor in normal times, however, they increased greatly during volatile times. A study by Elyasiani, Kalotychou, Staikouras, & Zhao (2014) complemented the previous research and found strong volatility and return transmissions inside and across the US, UK, EU and Japanese banking and insurance firms. Returns and volatility spillovers from the US towards other markets were stronger, and the spillover effects across geographical markets were amplified during the GFC, and pointing towards the presence of contagion during crisis period.

In recent times, academic literature has come up on interconnectedness and size of systemically financial institutions. Pais & Stork (2013) employed Extreme Value Theory (EVT) to assess the difference in individual and systemic risk of large and small banks within individual countries, as well as across the European Union (EU) as whole. They found that univariate risk of banks was not impacted by size, however, systemic risk went up significantly for large banks. Irresberger, Bierth, and Weiß (2017) argued that firm size was the only significant predictor in identifying a financial institution as a G-SIB. Elyasiani et al. (2014) explored the relationship between pairs of SIFIs and found that size, leverage and funding fragility majorly influenced the transmission dynamics. The largest SIFIs were more likely to pass on contagious shocks to other financial institutions in crisis periods compared to smaller banks. However, Lu and Hu (2014) found opposing results using a three bank model. Even though systemic importance of smaller banks was less, beyond a certain size, systemic importance ceased to increase. Systemic importance did not vary directly with bank size, and hence, size was not dominant predictor of systemic importance. Barth and Schnabel (2013) argued that bank size was a crude estimate of systemic risk and even small banks would need to be saved in times of crises due to being highly interconnected.

Several researchers have looked at the effects of contagion during periods of crises. Most of the literature has looked on equity market indices of different countries (Bekaert and Wu, 2000; Dimitriou, Kenourgios, and Simos, 2013; Forbes and Rigobon, 2002; Yu, Fung, and Tam, 2010) or shown integration of financial sectors of individual countries with the worldwide financial sector (Baur 2012; Bekaert and Wu, 2000). A few papers have analyzed interconnectedness of financial institutions. An analysis of the interconnectedness and systemic risk of financial institutions based on stock prices by Billio et al. (2012) revealed that among all financial firms, the banking sector was the most important source of connectedness due to its inability to survive large and rapid losses. This made banks the largest contributors of systemic risk in the financial system. Further, Chen et al. (2014) concluded that banks created substantial systemic risk for the insurance sector but not the other way round. Large insurance companies were a source of contagion for other financial institutions but the level of this contagion was much lesser as compared to banks (Elyasiani et al., 2014; Podlich and Wedow, 2013). Further evidence was provided by Hammoudeh, Nandha, and Yuan (2013) in their exploration of the relationship between the various US financial sectors. Banks were found to transmit the most risks to other financial sectors whereas the insurance sector showed the least propagation of shocks across financial sectors. Irresberger, Bierth, and Weiß (2017), however, argued that there was minimal evidence based on balance sheet and stock market data that interconnectedness or higher leverage raised the level of systemic risk contributed by an individual institution. A study by Liu et al. (2015) suggested that due to increased regulatory control, some forms of interconnectedness like interbank credit exposures shrank materially since the financial crisis.

Previous literature on interconnectedness of financial institutions has attempted to empirically analyze interdependency using various approaches. Even though interconnectedness is an essential indicator of systemic importance, there is still no consensus on how to measure it. There are two distinct types of financial interconnectedness: direct and indirect. Direct interconnectedness exists due to direct relationships between counterparties through transactions, obligations, contracts and other arrangements. Indirect interconnectedness is due to exposure to common risk factors that affect all entities even though there might be no direct relationships between them. Distress can spread between them due to mark-to-market losses, margin calls, and market volatility effects due to similar risk management practices. Since it is challenging to find information on details of direct relationships, majority of the papers have calculated interconnectedness by using publicly available information of equity and CDS spread prices combined with balance sheet information.

One of the earlier studies by Nicolo and Kwast (2002) measured interdependencies by taking correlations of percentage changes in stock prices of US large and complex financial institutions and used a GARCH constant coefficient to detect time variation in correlations between pairs of financial institutions. Billio et al. (2012) measured interconnectedness of US banks, insurance companies, hedge funds, and brokers within the system using principal components analysis of the correlations of monthly stock returns of indexes between all institutions. They also focused on pairwise Granger causality between institutions. Chen et al. (2014) worked with information on intraday stock prices and premiums on CDS and used linear and non-linear Granger causality tests to capture interconnectedness amongst players in the insurance sector. Other studies employed multivariate GARCH modelling of bank stock prices (Elyasiani et al. 2014) and CDS prices of global banks and insurers to quantify interconnectedness (Podlich and Wedow, 2013). In a study related to the global banking insurance sector, Irresberger, Bierth, & Weiß (2017) used Marginal Expected Shortfall as suggested by Acharya et al. (2017) and changes in conditional value at risk (CoVaR) as suggested by Adrian & Brunnermeier (2016) to measure interconnectedness. Adams, Füss, and Gropp (2014) examined interconnectedness between four financial groups in the US by utilizing a state-dependent sensitivity Value-at-Risk (SDSVaR) model. They determined spillover effects and transmission of shocks using a two-stage quantile regressions and IRFs. Bhar and

Nikolova (2013) utilized time-varying price of risk methodology to capture interconnectedness of financial markets of developed economies.

A seminal paper by Diebold & Yilmaz (2009) developed a methodology to measure connectedness of various stock markets by using return spillovers and volatility spillovers. They constructed a spillover index using variance decompositions of joint asset return forecasts through vector autoregression (VAR). This approach took a network view of markets with nodes representing assets and variance shares determining the weights of links. The spillover index generated could be used to look at pairwise spillovers as well as calculate the degree of market connectedness. However, the 2009 methodology results were sensitive to variable ordering and in Diebold and Yilmaz (2012), the authors developed a general framework where they overcame this issue. Alter & Beyer (2014) extended this methodology and measured interconnectedness by estimating spillovers from and to governments and banks in the EU using a VAR model of daily changes in CDS spreads. Diebold & Yılmaz (2014) also tracked both daily and average time-varying connectedness of stock return volatilities major U.S. financial institutions by using variance decompositions. They continued with this approach in Diebold & Yilmaz (2015) and calculated equity return volatility connectedness in the network of main US and European financial institutions, 2004–2014. They found connectedness was higher from America to Europe was more in 2007-2008 but it became bidirectional in 2008. They also found evidence of European financial institutions effecting US ones more post 2011.

Tables 3 and 4 provide a summary of the literature reviewed for this research.

Table 3: Volatility Spillover Studies

Author	Sample	Variable	Methodology	Result
Hamao et al. (1990)	Tokyo, London, NY	Stock market	ARCH, GARCH-M	Significant spillover to Tokyo
Koutmos & Booth (1995)	Tokyo, London, NY	Stock market	EGARCH	Stronger impact of bad news than good
Pan et al. (2000)	US, Asia-Pacific	Stock market	Modified cointegration, GARCH effects	Highly integrated stock markets
Wang & Wang (2010)	US, Japan, China	Stock market	Univariate GARCH, BEKK-GARCH	Strong volatility spillovers
Kutlar & Torun (2014)	10 developed, emerging countries	Stock market	BEKK-GARCH, CCC-GARCH	Strong spillovers from developed to emerging economies
Hwang (2014)	10 Latin American countries	Stock market	DCC-GARCH	Higher volatility during crisis period, indicating contagion
Syriopoulos et al. (2015)	US, BRIC	Stock market	Disaggregated VAR (1) - GARCH (1, 1)	Significant return and volatility spillovers

Table 4: Interconnectedness & Spillovers between Banking Systems

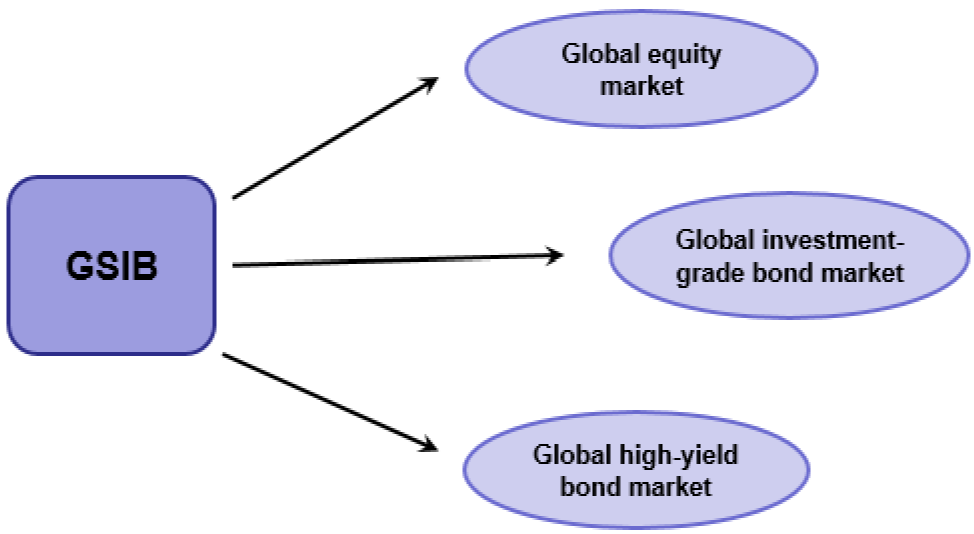
Author	Sample	Variable	Methodology	Result
Gropp & Moerman (2004)	EU banks	Equity prices	Monte Carlo Simulation	Evidence of relationship
Hartmann et al. (2005)	US, EU banks	Equity prices	Extreme Value Theory	Systemic risk higher in America compared to the euro area.
Gropp et al. (2006)	EU banks	Equity prices	Multinomial Logit Model	Significant cross-border contagion
Billio et al. (2012)	Pairs of US FIs in four sectors	Equity prices	PCA, Granger Causality	Banks largest contributors of systemic risk in the financial system
Hammoudeh et al. (2013)	Index of US banks, insurers, financial service institutions	CDS spreads	GIRF, GVCD	Sectors' credit risk responded more to credit events in banks compared to other two sectors
Podlich & Wedow (2013)	Index of global banks, insurers	CDS spreads	DCC-GARCH	SI banks were statistically and economically more interconnected than any other group of financial firms
Callice (2014)	CDS Index, SIFIs	Equity prices	SVAR, MGARCH	Stock returns for all SIFIs has inverse association to shocks in the CDS index market. US banks more effected than European SIFIs
Adams et al. (2014)	Global FIs	Equity prices	Impulse Response Functions	Greater spillovers during volatile periods. Hedge funds transmit the most shocks
Elyasiani et al. (2014)	US, UK, EU, Japan banks and insurers	Equity prices	BEKK-GARCH	Stronger return and volatility spillovers from the US to other markets
Moussa (2014)	SE Asia banks	Equity prices	EGARCH	More substantial negative surplus of return spillovers from larger to smaller banks
Diebold & Yilmaz (2014, 2015)	Pairs of US, European SIFIs	Stock prices	VAR, Variance decompositions	Direction of connectedness from US to Europe in 2007-08, bi-directional in 2008, and from Europe to US in 2011
Irresberger et al.(2017)	Global banks, insurers	Stock prices	Marginal Expected Shortfall, ΔCoVar	Inconclusive results regarding systemic relevance of banks and insurers during GFC
Acharya et al. (2017)	Global FIs	Stock prices	Systemic Expected Shortfall	Economic model of systemic risk

CHAPTER 3: Methodology

Our study complements the existing literature on interconnectedness and volatility spillovers. However, it is different from other studies as we use volatility spillovers to capture interconnectedness between every G-SIB and different parts of the global financial environment, and trace the evolution of interdependencies in the period before, during and after the GFC. Our goal is to establish which of the designated G-SIBs actually have a "global" effect on the financial markets by being a source of volatility spillover. In our opinion, no other study has yet tried to validate the global systemically important status of G-SIBs by examining their relationship with the global financial markets.

Diebold and Yilmaz (2015) have looked at interconnectedness among financial institutions across the Atlantic as well as among country banking systems. Other studies like Elyasiani et al. (2014) have explored interconnectedness among equity returns of different portfolios of SIFIs, while Calice (2014) have analyzed the linkages between the equity returns of SIFIs and the CDS index market. Our research is more comprehensive and looks at the interconnectedness of all G-SIBs with the global equity, investment-grade bond and high-yield bond markets. We want to examine which segment of the financial market is more exposed to shocks originating from G-SIBs, and which of the G-SIBs are more interconnected with the financial market. To capture interconnectedness, Diebold & Yilmaz (2015) have used variance decompositions of joint asset returns while Elyasiani et al. (2014) and Calice (2014) have used multivariate GARCH modelling We also recognize that multivariate GARCH models have successfully measured volatility clustering and the dynamic relationships between various markets and institutions. We add to the growing body of research on interconnectedness by utilizing multivariate GARCH with asymmetric BEKK parameterization to test the transmission of volatility between G-SIBs and different segments of the financial market. Our study will be able to determine which of the 30 designated G-SIBs are truly globally systemic due to the presence of interconnectedness.

Figure 1: Theoretical Framework



3.1 Background of the Model

As mentioned earlier in the paper, we use the multivariate "Generalized Autoregressive Conditional Heteroskedasticity" (GARCH) model with asymmetric BEKK parameterization to investigate volatility spillovers from G-SIBs to various segments of the financial market.

The ARCH models developed by Engle (1982) and the generalized version (GARCH) by Bollerslev (1986) were used to model financial time series displaying stylized features such as fat-tailed distributions, volatility clustering or time varying correlations. Volatility clustering is the positive correlation of price variations observed in speculative market where phases of high volatility are likely to be followed by phases of high volatility, and periods of low volatility cluster together. A large previous shock will add a larger value to the current variance level while a smaller shocks adds a smaller value. GARCH models were able to capture the fact that volatilities of returns in asset clustered over time (Goeij and Marquering, 2004). These models were widely used in finance to capture the time variation in bank stock returns' volatility and were successful in predicting volatility. The earlier GARCH studies were univariate in nature and their objective was to estimate the conditional variance of returns of a financial time series. The conditional variance equations estimated the time varying nature of the residuals that were generated from the mean equation. However, the univariate models overlooked the possibility of contemporaneous cross correlation over a set of assets and did not consider the conditional covariance between the two time series. When modeling time-varying volatilities, the multivariate generalization (MGARCH) were a better solution as they took cross-sectional information into account and could examine the simultaneous volatility clustering of several markets or assets as well as analyze their co-movements. In a multivariate framework, the purpose was to simultaneously estimate the conditional covariance matrix of at least two series of financial returns denoted by H_t. Modeling the structure of conditional variance was quite useful in analyzing volatility spillovers and transmission effects (Silvennoinen and Teräsvirta, 2009).

The first multivariate GARCH model for the conditional variance-covariance matrix, the VEC model, was introduced by Bollerslev, Engle, & Wooldridge (1988). It was a simple extension of the univariate GARCH model to the multivariate case. In this model, conditional variance and covariance was a function of all lagged conditional variances and covariances, as well as lagged squared returns and cross-products of returns. However, this model required estimation of a big number of parameters and restrictions had to be placed to confirm positive definiteness of the variance covariance matrix. To overcome this problem, Baba, Engle, Kraft, & Kroner (1990) (BEKK) presented a multivariate GARCH model, BEKK-GARCH, to examine volatility spillovers between assets. The specifications of this model looked at the effect of the lagged values of the residual and conditional variance on its own conditional variance, as well as the effect the other series' residuals and conditional variance had. The BEKK model was more parsimonious and the conditional variance–covariance matrix was positive definite by construction as it worked with quadratic forms. The BEKK model was able to capture cross-market effects in the variance-covariance equations.

One of the primary characteristics of multivariate GARCH models, including the BEKK model, was that they enforced symmetric response of volatility to both positive and negative shocks. However, empirical evidence has shown that along with leptokurtic asset returns with fat-tail distribution, volatility in financial markets also exhibits asymmetric effects (Black, 1976; Christie, 1982). This so-called leverage effect or asymmetric volatility phenomena assumes that negative and positive innovations impact conditional volatility differently in the equity market. When stock prices fall, the debt-equity ratio of companies rise, leading to an increase in financial leverage and eventually risk. Thus, decreases in price led to greater volatility than rise in stock price. The volatility-feedback approach suggested by Campbell and Hentschel (1992) and Bekaert and Wu (2000) indicated that rising volatility led to increases in required returns on stocks, thereby lowering stock prices and leading to asymmetries in volatility. To accommodate this leverage effect , the asymmetric BEKK-GARCH model was proposed by Kroner and Ng (1998) in a multivariate framework. It was an extension of the Glosten, Jagannathan, and Runkle (1993) univariate asymmetric model and it allowed for asymmetric response of volatility where negative shocks (bad news) of the same magnitude resulted in a greater rise in stock volatility than positive shocks (good news). The asymmetric BEKK model effectively captured this volatility asymmetry and the negative relationship between equity returns and future volatility.

Some of the studies have also used a constant conditional correlation (CCC) GARCH specification (Elyasiani et al. 2007) even though correlations between asset returns are time-varying (Cappiello, Engle, and Sheppard 2006). Even though CCC GARCH models require less parameters and are easier to estimate, they are incapable of capturing interactions among assets in the model. Since our purpose is to examine the time-varying covariance matrix and look at the volatility transmissions between equity returns of G-SIBs and global financial market indices, we will be using the asymmetric bivariate BEKK-GARCH model developed by Kroner and Ng (1998). In this manner, we will be able to incorporate the time variation in co-movements of returns and capture the effect of bad news on volatility.

We use a bivariate GARCH (1, 1) model as it has been shown that conditional mean and variance models with a lag of 1 provide the best fit, and higher order lags are not significant (Chou 1988; Song, Liu, and Romilly 1998; Theodossiou, Kahya, and Koutmos 1997). Models with small lags like GARCH (1, 1) are adequate to handle the changing variance (Franses and Van Dijk, 1996; Gokcan, 2000) and capture the volatility clustering present in the data (Brooks and Persand, 2003).

3.2 Data

We use equity returns of G-SIBs as a measure of stability of the financial system since stock prices suggest the future outlook of investors regarding the prospects of these banks, and poor stock market performance of G-SIBs can have serious repercussions for the financial system. We take daily closing equity for all 30 G-SIBs in the list published by FSB in November 2017. This study also utilizes daily closing prices of the global and regional equity, bonds, and high-yield bonds. We use the "Morgan Stanley Capital International World Index" (MSCI World) [MXWO] as a standard for the global equity market as suggested by Harvey (1991), De Santis and Gerard (1997), Chari and Henry (2002), Verma and Soydemir (2006), Abugri (2008) and Esqueda, Assefa, and Mollick (2012). This index is a global equity benchmark and consists of 1,648 stocks from 23 developed market countries. The index is in USD and assumes that dividends are reinvested.

To proxy the global investment-grade bond market, we use the "Citi World Broad Investment-Grade Bond Index" (WorldBIG) [IGB], which tracks the performance of global fixed income markets consisting of government and corporate debt in the global, investment-grade universe. Investment-grade bonds are defined as those bonds which have been assigned a minimum rating of BBB- by S&P or Baa3 by Moody's. We also use the "Merrill Lynch Global High Yield Index" (HW00) [HYB] as a proxy for global bonds below investment grades. This index monitors the performance of corporate debt that is not investment grade and publicly issued in the key local or eurobond markets. To qualify as below investment-grade, the bonds must be rated BB+ or below by S&P, or Ba1 or below by Moody's.

When using daily data, there is the problem of having non-trading days due to national holidays. For days where there is no equity price or index level available due to holidays, we have taken the past day's daily return only. We have used the Bloomberg database to collect all the data used in this study and used the RATS software to estimate our model.

We examine volatilities arising from each of the 30 G-SIBs to each financial market from January 3, 2005 to May 5, 2017. This time span includes the period before, during and after the GFC. This means we have 120 different models of volatilities. Furthermore, we also divide our sample period into pre-crisis and post-crisis period, and then separately look at volatilities arising from G-SIBs during both of these periods to see if there is a difference in behavior in these time periods. We have used January 3, 2005 to September 26, 2008 as our pre-crisis period, and September 27, 2008 to May 5, 2017 as the post-crisis period. However, one of the G-SIB, Agricultural Bank of China went public in 2010 and as such, we have examined volatilities for the bank post-2010. Moreover, China Construction Bank made an initial public offering in October 2005, Bank of China went public in June 2006 and Industrial & Commercial Bank of China was listed in October 2006, and the analysis has been the done on the period since listing.

3.3 Descriptive Statistics

Daily equity and index returns are calculated by taking the natural logarithm of today and yesterday's price or index level and calculating the difference. The summary statistics for the log return series for the entire sample period are given in Table 5. An initial review of the data gives us useful insights. The mean returns for more than half the G-SIBs are negative which means these banks have an average daily loss. Royal Bank of Scotland, Citigroup and Unicredit Bank have the highest average negative return. The variance is a simple estimate of volatility in finance and the North American (NA) and European banks show a higher variance in returns as compared to the Asian G-SIBs. This points towards the more volatile nature of G-SIBs in these regions. Royal Bank of Scotland, Citigroup, Bank of America, and Morgan Stanley exhibit the highest variance. In fact, variance in returns of Royal Bank of Scotland considerably surpasses variance in returns of other G-SIBs probably due to its ill-fated takeover of ABN-AMRO Bank in October 2007, which at 49 billion pounds was reported as the largest deal in the history of financial services. However, Royal Bank of Scotland's efforts to successfully finance this takeover failed and it was bailed out by the government in 2008. The bank has still not recovered from its takeover and has reported losses ever since.

The Jarque-Bera statistic is significant at the 1% for all G-SIBs and the financial markets, and fails to accept the null hypothesis of normally distributed returns. The kurtosis statistic, as seen in Table 5, is higher than 3 for all return series. Kurtosis gives the amount of probability in both tails of a distribution and a value greater than 3 means that the series have fatter tails and higher peaks relative to the normal distribution and are leptokurtic. Leptokurtosis is a phenomena that occurs when a distribution has a shape with fatter and longer tails and narrower peaks as compared to a normal distribution. Due to these fat tails, the probability distribution forecasts movements of three or more standard deviations more often than normal distributions. These fat tails present a higher risk as the probability of extreme events occurring, such as large price swings, is higher and much larger in size than in comparison to a normal distribution.

We also find positive skewness in returns for most of the G-SIBs. A series is said to have a positive skew if its tail on the right hand side is longer and fatter. A positive skewed value means that the probability of getting positive shocks in these banks is higher than getting negative shocks. A negative skew implies that large negative returns are more likely than positive ones. However, when combined with a negative mean return, it means that the overall performance of stock is negative with positive outliers. Table 5 shows that out of the 18 G-SIBs that exhibit positive skewness, 10 have negative mean returns. Moreover, due to positively skewed returns we have taken the natural logarithm of returns as mentioned earlier.

To check for the autoregressive conditional heteroskedastic (ARCH) effect in data, Engle's Lagrange Multiplier test is performed. The results of the test shows that all return series are conditionally heteroskedastic at the 1% level of significance. To check for any serial autocorrelation in returns, the Ljung–Box (LB) Q-statistic is calculated. Again, the LB-statistic is highly significant at the 1% level for all G-SIBs and financial market return series, showing the existence of significant autocorrelation in the return series as well as suggesting the presence of time varying volatility.

The summary statistics indicate that the return series of all G-SIBs and financial markets are leptokurtic, significantly fat-tailed and high peaked. Moreover, the returns are serially autocorrelated and heteroskedastic. These features are consistent with GARCH effects and such models are appropriate for data displaying these characteristics. Also, when data exhibits non-zero skewness, GARCH (1, 1) models are preferred over ARCH model in the interest of parsimony.

It is a stylized fact that most financial series contain unit roots and are non-stationary. However, GARCH models are applied to stationary series only so it is important to test all return series for stationarity, which requires that the means and the variances of the series are not time dependent. Both the augmented Dickey-Fuller (ADF) test as well as the Phillips and Perron's (PP) test have been done to verify the absence of a unit root. The null hypothesis in both these hypotheses is the existence of a unit root or non-stationarity. Most empirical studies apply the ADF test, however, the PP tests are robust to general forms of heteroskedasticity in the error term. We have calculated both statistics, and rejected the null hypothesis of presence of unit roots for all return series. Hence, we can conclude that all preliminary conditions have been satisfied and we can use an asymmetric VAR(1)-BEKK-GARCH (1, 1) process to model conditional variance-covariance between G-SIBs and global financial markets.

The correlations between the log return series of G-SIBs and financial markets is given in Table 6. All G-SIBs have a high positive correlation with the global equity market, with NA and European banks being more highly correlated than Asian Banks. The correlation between the banks return and HYB is also positive but the magnitude of correlation is much lower. The behavior of NA banks is different in this market as the correlation coefficient is lower in value than that of European and Asian banks. The investment-grade bond market correlation is negative for all banks, indicating that returns for G-SIBs move in the opposite direction to returns in the global investment-grade market. The strength of the relationship is again stronger for NA and European banks as compared to Asian G-SIBs.

Table 5: Descriptive Statistics of GSIBs, EQU, IGB & HYB Returns

	EQU	IGB	HYB	Bank of America	Bank of New York	Citigroup	Goldman Sachs	JP Morgan Chase	Morgan Stanley	Royal Bank of Canada	State Street
Mean	0.015	0.015831	0.027	-0.021	0.009	-0.065	0.024	0.025	-0.002	0.033	0.017
Maximum	9.096	1.181	2.434	30.210	22.159	45.632	23.482	22.392	62.585	13.658	27.266
Minimum	-7.325	-0.966	-4.970	-34.206	-31.687	-49.470	-21.022	-23.228	-29.965	-14.445	-89.250
Variance	1.068	0.048	0.108	10.866	5.868	11.980	5.329	6.164	10.588	2.008	9.455
Skewness	-0.499	-0.082	-1.821	-0.328	-0.126	-0.525	0.297	0.350	1.662	0.324	-7.316
Kurtosis	9.774	1.863	25.854	24.295	23.067	38.864	17.033	17.436	58.046	14.704	232.021
JB-Test	12947.673	469.015	91430.043	79221.731	71373.629	202730.164	38961.578	40843.861	453400.629	29056.429	7249190.495
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ADF	-50.577**	-57.172***	-35.263***	-59.093***	-55.465***	-54.001***	-59.369***	-63.453***	-56.755***	-58.180***	-64.993***
PP	-50.419***	-57.229***	-35.673***	-59.068***	-68.501***	-54.057***	-59.448***	-63.785***	-56.969***	-58.299***	-65.577***
Observations	3219	3219	3219	3219	3219	3219	3219	3219	3219	3219	3219

	Wells Fargo	Banco Santander	Barclays	BNP Paribas	Credit Suisse	Deutsche Bank	Crédit Agricole	HSBC	ING Bank	Nordea Bank	Royal Bank of Scotland
Mean	0.018	-0.010	-0.029	0.008	-0.034	-0.033	-0.010	-0.005	-0.003	0.023	-0.090
Maximum	28.341	20.877	54.951	18.977	24.611	22.522	23.361	14.423	25.653	14.923	30.505
Minimum	-27.210	-22.172	-28.564	-19.117	-17.667	-17.294	-15.088	-20.799	-32.136	-12.032	-109.573
Variance	7.147	4.866	9.910	6.325	5.899	6.420	7.411	2.857	9.158	4.016	14.225
Skewness	0.916	-0.136	1.223	0.187	0.224	0.217	0.248	-0.328	-0.072	0.448	-8.217
Kurtosis	25.698	9.790	39.691	9.114	10.757	8.985	6.433	16.139	15.414	6.635	235.725
JB-Test	89024.323	12864.902	212096.303	11160.794	15545.908	10852.447	5583.256	34992.801	31870.824	6011.646	7489038.611
P-value	0.000	0.000	0.000	0.000	0	0	0	0	0	0	0.000
ADF	-64.328***	-55.293***	-54.11***	-56.291***	-52.423***	-53.704***	-54.560***	-57.965***	-55.221***	-59.053***	-49.976***
PP	-64.537***	-55.297***	-54.150***	-56.315***	-52.291***	-53.676***	-54.484***	-58.064***	-55.219***	-59.270***	-49.947***
Observations	3219	3219	3219	3219	3219	3219	3219	3219	3219	3219	3219

Table 5 (cont'd): Descriptive Statistics of GSIBs, EQU, IGB & HYB Returns

	Société Générale	Standard Chartered	UBS	Unicredit Group	Agri. Bank of China	Bank of China	China Constr. Bank	Ind & Com Bank of China	Mitsubishi	Mizuho	Sumitomo Mitsui
Mean	-0.007	-0.002	-0.028	-0.060	0.012	0.004	0.033	0.017	-0.012	-0.028	-0.018
Maximum	21.425	26.237	27.506	19.007	9.641	20.045	20.904	9.568	14.635	16.739	15.570
Minimum	-23.034	-17.947	-18.891	-27.166	-10.423	-16.127	-13.204	-10.575	-15.831	-16.034	-16.384
Variance	7.987	6.010	6.108	9.119	1.975	3.922	4.450	3.117	4.931	5.231	5.444
Skewness	-0.116	0.308	0.159	-0.177	-0.049	0.336	0.497	-0.022	0.203	0.189	0.190
Kurtosis	7.685	11.698	13.026	6.827	12.492	10.141	9.553	7.615	4.394	7.295	6.048
JB-Test	7929.051	18403.754	22771.480	6268.870	11555.413	12271.243	11558.021	6635.778	2611.314	7157.498	4925.214
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ADF	-52.804***	-57.275***	-51.439***	-55.307***	-42.062***	-54.895***	-55.465***	-51.247***	-52.051***	-53.170***	-53.320***
PP	-52.732***	-57.390***	-51.221**	-55.331***	-42.144***	-54.951***	-55.501***	-51.255***	-51.969***	-53.165***	-53.331***
Observations	3219	3219	3219	3219	1777	3219	3007	2746	3219	3219	3219

*** significance at 1%, ** significance at 5%

Table 6: Correlation between G-SIB and Financial Markets Return

	EQU	IGB	HYB
NA Banks			
Bank of America	0.613	-0.225	0.215
Bank of New York	0.637	-0.263	0.147
Citigroup	0.611	-0.221	0.254
Goldman Sachs	0.675	-0.233	0.268
JP Morgan Chase	0.624	-0.260	0.144
Morgan Stanley	0.684	-0.220	0.287
Royal Bank of Canada	0.590	-0.205	0.277
State Street	0.571	-0.228	0.170
Wells Fargo	0.584	-0.219	0.144
Europe Banks			
Banco Santander	0.674	-0.217	0.444
Barclays	0.564	-0.182	0.422
BNP Paribas	0.625	-0.237	0.390
Credit Suisse	0.639	-0.184	0.438
Deutsche Bank	0.699	-0.244	0.400
Crédit Agricole	0.622	-0.206	0.423
HSBC	0.614	-0.198	0.362
ING Bank	0.679	-0.178	0.466
Nordea Bank	0.616	-0.180	0.373
Royal Bank of Scotland	0.452	-0.132	0.323
Société Générale	0.616	-0.213	0.440
Standard Chartered	0.592	-0.165	0.411
UBS	0.623	-0.214	0.396
Unicredit Group	0.566	-0.195	0.381
Asia Banks			
Agricultural Bank of China	0.123	0.025	0.086
Bank of China	0.365	-0.022	0.347
China Construction Bank	0.390	-0.026	0.361
Ind & Com Bank of China	0.396	-0.033	0.382
Mitsubishi UFJ FG	0.303	-0.011	0.337
Mizuho FG	0.291	-0.001	0.327
Sumitomo Mitsui FG	0.281	-0.008	0.329

The summary statistics for the log return series for the pre-crisis and the post-crisis period are shown in Tables 7 and 8. In the pre-crisis period, half the banks have negative mean returns while the same is true for the post-crisis period. The returns of Morgan Stanley, ING Bank, Crédit Agricole, and Bank of China have turned positive from negative in the post-crisis period while the reverse has happened for Banco Santander, Credit Suisse, HSBC and Standard Chartered. The European G-SIBs seem to have taken a hit after the crisis.The variance of returns of almost all G-SIBs is more in the post-crisis period in comparison to the entire sample period as well as the pre-crisis period. Only Mizuho Bank, Industrial & Commercial Bank of China, Bank of China and China Construction Bank have a higher variance in the period before the GFC. This suggests that volatility has actually reduced for these banks post-crisis and they have become more stable.

The return series for both pre-crisis and post-crisis period are leptokurtic, significantly fat-tailed and with high peaks. There is presence of serial autocorrelation as the ARCH-LM test is significant. The null hypothesis of presence of stationary roots is rejected for both the ADF and PP test. Therefore, the characteristics of the return series for both pre-crisis and post-crisis period are similar to those in the entire sample period, and we can use the VAR(1) – ABEKK – GARCH specification for these periods also. A graphical depiction of the descriptive statistics of the total, pre-crisis and post-crisis period can be seen in the Appendix.

Table 7: Pre-Crisis Descriptive Statistics of GSIBs, EQU, IGB & HYB Returns

	EQU	IGB	HYB	Bank of America	Bank of New York	Citigroup	Goldman Sachs	JP Morgan Chase	Morgan Stanley	Royal Bank Canada	State Street
Mean	0.008	0.016	0.008	-0.024	0.004	-0.090	0.028	0.021	-0.065	0.047	0.022
Maximum	5.568	0.802	0.960	20.346	12.294	21.531	18.386	15.486	18.785	8.714	12.217
Minimum	-3.670	-0.881	-1.306	-23.965	-13.119	-16.422	-14.985	-14.253	-27.728	-4.703	-10.455
Variance	0.619	0.053	0.048	5.388	4.005	5.185	4.555	4.698	6.698	1.693	4.088
Skewness	-0.003	-0.089	-0.905	0.998	0.494	1.002	0.479	0.917	-0.761	0.824	0.245
Kurtosis	4.222	1.235	5.425	29.558	9.277	18.320	12.408	13.156	21.039	5.540	6.234
JB-Test	723.433	63.183	1327.408	35617.853	3532.116	13782.820	6285.390	7161.107	18057.239	1355.677	1586.929
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ADF	-28.131***	-31.623***	-19.500***	-32.147***	-37.751***	-29.705***	-32.550***	-33.330***	-29.168***	-31.005***	-34.571***
PP	-28.082***	-31.723***	-19.682***	-32.279***	-38.602***	-29.70***	-32.572***	-33.706***	-29.138***	-31.117***	-34.807***
Observations	974	974	974	974	974	974	974	974	974	974	974

	Wells Fargo	Banco Santander	Barclays	BNP Paribas	Credit Suisse	Deutsche Bank	Crédit Agricole	HSBC	ING Bank	Nordea Bank	Royal Bank of Scotland
Mean	0.019	0.018	-0.045	0.025	0.007	-0.018	-0.035	0.000	-0.026	0.026	-0.088
Maximum	28.341	12.190	25.647	16.131	17.095	8.620	23.361	14.423	19.247	12.217	27.728
Minimum	-12.339	-9.435	-10.362	-10.122	-9.014	-8.632	-10.259	-6.590	-11.082	-8.159	-11.001
Variance	4.588	2.107	5.290	3.186	3.392	2.596	4.674	1.589	3.119	2.704	5.547
Skewness	2.791	0.197	1.693	0.784	0.923	0.088	1.337	1.519	0.815	0.785	1.708
Kurtosis	36.624	8.426	18.652	8.985	11.499	3.845	16.648	20.789	17.914	5.909	23.648
JB-Test	55701.298	2887.665	14583.637	3376.486	5504.715	601.349	11537.523	17914.172	13131.939	1517.152	23169.154
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ADF	-34.672***	-35.095***	-31.352***	-31.638***	-29.011***	-30.688***	-33.121**	-35.239***	-31.408***	-34.718***	-29.751***
PP	-35.218***	-35.260***	-31.492***	-31.789***	-28.963***	-30.726***	-33.235***	-35.607***	-31.449***	-35.133***	-29.769***
Observations	974	974	974	974	974	974	974	974	974	974	974

Table 7 (cont'd): Pre-Crisis Descriptive Statistics of GSIBs, MXWO, IGB & HYB Returns

	Société Générale	Standard Chartered	UBS	Unicredit Group	Agri. Bank of China	Bank of China	China Constr. Bank	Ind & Com Bank of China	Mitsubishi	Mizuho	Sumitomo Mitsui
Mean	-0.007	0.038	-0.074	-0.025	-	-0.016	0.105	0.066	-0.011	-0.010	-0.008
Maximum	15.671	12.217	27.506	12.585	-	15.405	14.896	9.568	12.516	18.785	14.162
Minimum	-10.142	-8.159	-18.891	-9.319	-	-10.189	-12.623	-10.524	-8.249	18.785	-10.277
Variance	4.105	4.094	5.665	2.841	-	4.526	6.162	7.558	4.868	5.405	5.380
Skewness	0.726	0.621	0.832	0.179	-	0.489	0.425	0.111	0.500	0.151	0.467
Kurtosis	9.961	6.139	27.789	5.607	-	7.606	5.254	2.512	3.236	3.586	3.890
JB-Test	4112.038	1592.176	31451.102	1280.984	-	1484.975	899.389	132.787	465.403	525.652	649.585
P-value	0.000	0.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000
ADF	-29.680***	-33.424***	-27.757***	-32.589***	-	-25.020***	-26.631***	-20.361***	-28.981***	-29.997***	-29.869***
PP	-29.676***	-33.665***	-27.601***	-32.719***	-	-25.230***	-26.671***	-20.385***	-28.970***	-30.013***	-29.875***
Observations	974	974	974	974	-	606	762	501	974	974	974

*** significance at 1%, ** significance at 5%

Table 8: Post-Crisis Descriptive Statistics of GSIBs, EQU, IGB & HYB Returns

	EQU	IGB	HYB	Bank of America	Bank of New York	Citigroup	Goldman Sachs	JP Morgan Chase	Morgan Stanley	Royal Bank Canada	State Street
Mean	0.019	0.0157	0.036	-0.019	0.012	-0.054	0.022	0.026	0.025	0.027	0.014
Maximum	9.096	1.1810	2.434	30.210	22.159	45.632	23.482	22.392	62.585	13.658	27.266
Minimum	-7.325	-0.9660	-4.970	-34.206	-31.687	-49.470	-21.022	-23.228	-29.966	-14.445	-89.250
Variance	1.262	0.0457	0.134	13.247	6.678	14.931	5.666	6.802	12.277	2.145	11.786
Skewness	-0.561	-0.0779	-1.855	-0.463	-0.250	-0.636	0.239	0.205	2.032	0.174	-7.560
Kurtosis	9.365	2.1998	23.659	21.032	23.975	34.575	18.121	17.752	59.000	16.952	213.565
JB-Test	8321.909	454.9201	53647.227	41456.904	53790.164	111974.218	30738.194	29492.919	327158.834	26893.092	4287806.528
P-value	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ADF	-42.608***	-47.645***	-29.499**	-49.495***	-57.849***	-45.114***	-49.863***	-53.411***	-48.575***	-49.419***	-55.577***
PP	-42.514***	-47.678***	-29.732**	-49.455***	-58.241***	-45.200***	-49.950***	-53.522***	-48.923***	-49.492***	-55.989***
Observations	2245	2245	2245	2245	2245	2245	2245	2245	2245	2245	2245

	Wells Fargo	Banco Santander	Barclays	BNP Paribas	Credit Suisse	Deutsche Bank	Crédit Agricole	HSBC	ING Bank	Nordea Bank	Royal Bank of Scotland
Mean	0.017	-0.021	-0.022	0.001	-0.052	-0.040	0.000	-0.007	0.007	0.022	-0.091
Maximum	27.535	20.877	54.951	18.977	24.611	22.522	19.854	13.389	25.653	14.923	30.505
Minimum	-27.210	-22.172	-28.564	-19.117	-17.667	-17.294	-15.088	-20.799	-32.136	-12.032	-109.573
Variance	8.260	6.064	11.918	7.689	6.988	8.081	8.601	3.408	11.780	4.587	17.994
Skewness	0.558	-0.148	1.110	0.115	0.124	0.219	0.048	-0.569	-0.125	0.373	-8.410
Kurtosis	22.552	8.218	37.516	7.874	9.587	7.552	4.549	14.062	12.339	6.261	210.014
JB-Test	47690.590	6325.421	132117.550	5803.933	8602.618	5352.300	1936.739	18618.564	14248.482	3718.376	4152215.580
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ADF	-53.763***	-45.209***	-44.810***	-46.813***	-43.884***	-44.864***	-44.677***	-47.434***	-46.491***	-48.532***	-41.443***
PP	-53.812***	-45.183***	-44.888***	-46.831***	-43.796***	-44.863***	-44.644***	-43.796***	-46.513***	-48.658***	-41.472***
Observations	2245	2245	2245	2245	2245	2245	2245	2245	2245	2245	2245

Table 8 (cont'd): Post-Crisis Descriptive Statistics of GSIBs, MXWO, IGB & HYB Returns

	Société Générale	Standard Chartered	UBS	Unicredit Group	Agri. Bank of China	Bank of China	China Constr. Bank	Ind & Com Bank of China	Mitsubishi	Mizuho	Sumitomo Mitsui
Mean	-0.008	-0.020	-0.008	-0.075	-	0.010	0.009	0.006	-0.012	-0.036	-0.023
Maximum	21.425	26.237	19.400	19.007	-	20.045	20.904	9.531	14.635	16.739	15.570
Minimum	-23.034	-17.947	-15.155	-27.166	-	-16.127	-13.204	-10.575	-15.831	-16.034	-16.384
Variance	9.673	6.843	6.302	11.845	-	3.761	3.869	2.128	4.960	5.158	5.474
Skewness	-0.211	0.247	-0.092	-0.170	-	0.283	0.510	-0.272	0.078	0.206	0.073
Kurtosis	6.443	11.856	7.879	5.141	-	11.049	12.166	9.439	4.887	9.070	6.961
JB-Test	3900.325	13172.140	5810.167	2482.865	-	11449.902	13941.609	8361.934	2236.302	7710.781	4534.049
P-value	0.000	0.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000
ADF	-43.964***	-47.400***	-43.613***	-45.997***	-	-48.935***	-49.294***	-48.968***	-43.216***	-43.861***	-44.157***
PP	-43.919***	-47.469***	-43.528***	-46.028***	-	-48.949***	-49.291***	-49.066***	-43.145***	-43.871***	-44.207***
Observations	2245	2245	2245	2245	-	2245	2245	2245	2245	2245	2245

*** significance at 1%, ** significance at 5%

3.4 Model Specification

In our study, we examine interconnectedness by exploring the volatility spillovers originating from the equity returns of each G-SIB to various parts of the financial markets. We let $r_{i,t}$ be the percentage daily return of each G-SIB's stock, MSCI World Index, Citi World Broad Investment-Grade Bond Index and Merrill Lynch Global High Yield Index at a particular time *t*, where $P_{i,t}$ is the level of the stock price or index.

We take the natural logarithm of prices as suggested by Andersen et al. (2003) to obtain approximate normality since volatilities tend to have asymmetric distributions with a right skew.

$$r_{\imath,t} = \left(\ln P_{i,t} - \ln P_{i,t-1}\right) \times 100 \tag{1}$$

Since we are interested in analyzing the time-varying covariance matrix, we specify the conditional mean equations for the G-SIB and financial market price returns as a vector autoregressive (VAR) process with a lag of 1 in the following manner:

$$\begin{bmatrix} r_{B,t} \\ r_{F,t} \end{bmatrix} = \begin{bmatrix} \alpha_{10} \\ \alpha_{20} \end{bmatrix} + \begin{bmatrix} \beta_{11} \\ \beta_{21} \end{bmatrix} R_{B,t-1} + \begin{bmatrix} \beta_{12} \\ \beta_{22} \end{bmatrix} R_{F,t-1} + \begin{bmatrix} \varepsilon_{B,t} \\ \varepsilon_{F,t} \end{bmatrix}$$

$$\varepsilon_t = z_t H_t^{1/2} \text{ where } \varepsilon_t = \begin{bmatrix} \varepsilon_{B,t} \\ \varepsilon_{F,t} \end{bmatrix} \text{ and, } \varepsilon_t | \Omega_{t-1} \sim N(0, H_t) \tag{2}$$

In the equation above, $r_{B,t}$ is the return of the G-SIB at time *t*, $r_{F,t}$ is the return of the financial market under consideration at time *t*, and the returns are a function of own past returns as well as cross-market past returns. In this manner, the parameter coefficients $\beta_{11}$and β_{22} estimate own price return spillovers whereas β_{12} and β_{21} measure the cross-mean spillover between the G-SIB and the financial market.

Given the available past information set Ω_{t-1}, ε_t is the residuals vector generated from the VAR process with the corresponding conditional variance-covariance matrix H_t. The conditional error terms, $\varepsilon_{B,t}$and $\varepsilon_{F,t}$ are assumed to be normally distributed with the information set Ω_{t-1} including all market information used in our model which is present at time $t - 1$.

The parameterization chosen for the conditional variance-covariance matrix H_t is the multivariate asymmetric BEKK-GARCH model. This model combined with the VAR(1) model will help us investigate the relation between the variance of the G-SIB returns and the variance of the financial market returns.

The covariance matrix, H_t, of an asymmetric BEKK-GARCH model is then represented as:

$$H_t = C'C + A'\varepsilon_{t-1}\varepsilon_{t-1}'A + G'H_{t-1}G + Dv_{t-1}v_{t-1}'D \quad (3)$$

where H_t is the conditional covariance matrix, A, G and D are $N \times N$ parameter matrices, and C is an upper triangular $N \times N$ matrix of constants. It can be seen from the above equation that if the diagonal elements of C are positive, the covariance matrix $H_t$will be positive definite too. For a bivariate case, the asymmetric BEKK-GARCH (1, 1) model can be specified in the following way:

$$\begin{bmatrix} h_{11} & h_{12} \\ h_{21} & h_{22} \end{bmatrix} = \begin{bmatrix} c_{11} & c_{12} \\ c_{21} & c_{22} \end{bmatrix}' \begin{bmatrix} c_{11} & c_{12} \\ c_{21} & c_{22} \end{bmatrix}' + \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}' \begin{bmatrix} \varepsilon_{1,t-1}^2 & \varepsilon_{1,t-1}, \varepsilon_{2,t-1} \\ \varepsilon_{2,t-1}, \varepsilon_{1,t-1} & \varepsilon_{2,t-1}^2 \end{bmatrix}' \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \quad (4)$$

$$+\begin{bmatrix} g_{11} & g_{12} \\ g_{21} & g_{22} \end{bmatrix}' \begin{bmatrix} h_{11,t-1} & h_{12,t-1} \\ h_{21,t-1} & h_{22,t-1} \end{bmatrix} \begin{bmatrix} g_{11} & g_{12} \\ g_{21} & g_{22} \end{bmatrix} + \begin{bmatrix} d_{11} & d_{12} \\ d_{21} & d_{22} \end{bmatrix}' \begin{bmatrix} v_{1,t-1}^2 & v_{1,t-1}, v_{2,t-1} \\ v_{2,t-1}, v_{1,t-1} & v_{2,t-1}^2 \end{bmatrix}' \begin{bmatrix} d_{11} & d_{12} \\ d_{21} & d_{22} \end{bmatrix}$$

The total number of parameters to be calculated in the asymmetric BEKK-GARCH model is 33. The coefficient A measures the degree to which conditional variances show correlation with past squared errors or the effect of lagged shocks and shows the ARCH effect of volatility. The particular parameter A_{ij}indicates the effect of the volatility of financial time series i on series j. The coefficient G indicates the relation between current conditional variance to past conditional variances or the effect of past volatilities and reveals the GARCH effect of volatility. The element G_{ij} points towards the persistence of volatility transmission between series i and series j. "Volatility is persistent if today's return has a significant effect on the variance many periods in the future", Engle and Patton (2001). How persistent a series is depends on how many lags of a series are significant, the more lags the more persistent the series is. The last coefficient,D, captures the asymmetric property of the time-varying variance-covariance and shows the asymmetric volatility effect. D is a dummy variable which is equal to 1 if ε_t is negative and zero otherwise. When bad news arrives in the market, D assumes a value of 1 and becomes zero when there is good news.

The diagonal elements in A and G estimate the effect of own past shocks and conditional volatilities and capture the "heat wave" suggested by Engle et al. (1990), while the diagonal elements in D focus on the response of the series to its own past negative innovations. However, the cross market impact of shocks and volatility spillovers among the two series or the "meteor shower" is measured by the non-diagonal elements in A and G. In order for the volatility spillover effect to exist between G-SIBs and the different segments of the financial markets, the non-diagonal parameters of both

A and G should be significantly different from zero. If the parameters a_{12} and g_{12} are significant, it implies the presence of volatility spillovers from G-SIBs to financial markets. If a_{21} and g_{21} are significant, then global financial markets transmit volatility shocks to the G-SIBs.

The off-diagonal elements of matrix D measure the cross-market asymmetric response and show the response of the series to bad news or negative shocks from the other series. If d_{12} is positive and significant, then negative innovations from G-SIBS will lead to increase in volatilities in the global financial market.

Utilizing equation (4), the three bivariate asymmetric BEKK-GARCH (1, 1) equations are estimated using G-SIB stock returns and various financial market indices. These equations estimate the two conditional variances and the conditional covariances simultaneously:

$$h_{BB,t} = c_{11}^2 + a_{11}^2\varepsilon_{B,t-1}^2 + 2a_{11}a_{22}\varepsilon_{B,t-1}\varepsilon_{F,t-1} + a_{21}^2\varepsilon_{F,t-1}^2 + g_{11}^2h_{BB,t-1} + 2g_{11}g_{21}h_{BF.t-1} + g_{21}^2h_{FF,t-1+}d_{11}^2v_{B,t-1}^2 + 2d_{11}d_{22}v_{B,t-1}v_{F,t-1} + d_{21}^2v_{F,t-1}^2, \tag{5}$$

$$h_{BF,t} = c_{11}c_{12} + a_{11}a_{12}\varepsilon_{B,t-1}^2 + (a_{21}a_{12+}a_{11}a_{22})\varepsilon_{B,t-1}\varepsilon_{F,t-1} + a_{21}a_{22}\varepsilon_{F,t-1}^2 + g_{11}g_{12}h_{BB,t-1} + (g_{11}g_{12} + g_{11}g_{22})h_{BF.t-1} + g_{21}g_{22}h_{FF,t-1} + d_{11}d_{12}v_{B,t-1}^2 + (d_{21}d_{12+}d_{11}d_{22})v_{B,t-1}v_{F,t-1} + d_{21}d_{22}v_{F,t-1}^2, \tag{6}$$

$$h_{FF,t} = c_{21}^2 + c_{22}^2 + a_{12}^2\varepsilon_{B,t-1}^2 + 2a_{12}a_{22}\varepsilon_{B,t-1}\varepsilon_{F,t-1} + a_{22}^2\varepsilon_{F,t-1}^2 + g_{12}^2h_{BB,t-1} + 2g_{12}g_{22}h_{BF.t-1} + g_{21}^2h_{FF,t-1} + d_{12}^2v_{B,t-1}^2 + 2d_{12}d_{22}v_{B,t-1}v_{F,t-1} + d_{22}^2v_{F,t-1}^2, \tag{7}$$

Equation (5) is the conditional variance equation of a particular G-SIB, equation (7) of the financial market under consideration and equation (6) is the conditional covariance equation of the G-SIB and the financial market. The two conditional variance equations, (5) and (7), and the conditional covariance equation (6) at time *t*, are linear functions depending on the lagged volatility shocks denoted by lagged square residuals ($\varepsilon_{B,t-1}^2, \varepsilon_{F,t-1}^2$), lagged conditional variances from both series at time *t*-1 ($h_{11,t-1}, h_{22,t-1}$), cross product of lagged shocks in both series at time *t*-1 ($\varepsilon_{B,t-1}\varepsilon_{F,t-1}$), and the lagged covariance ($h_{12.t-1}$) term.

These equations explain the transmission of shocks and volatility through time and across the equity returns of G-SIBs and indices. The coefficients of the own past squared residuals represent the own volatility spillover effects of the series itself while the coefficients of the cross residuals reflect the cross market volatility spillover from G-SIBs to financial markets or vice versa. The coefficients of the lagged covariances from both series are the most important as they signify the persistence of conditional volatility and how strongly the G-SIBs are transmitting volatility to the financial market or the other way around. However, since the GARCH process generates standard errors of the elements of the matrices only and it is difficult to measure the standard errors of the squared residuals and lagged covariances in the variance-covariance equations, we will be interpreting the following coefficients:

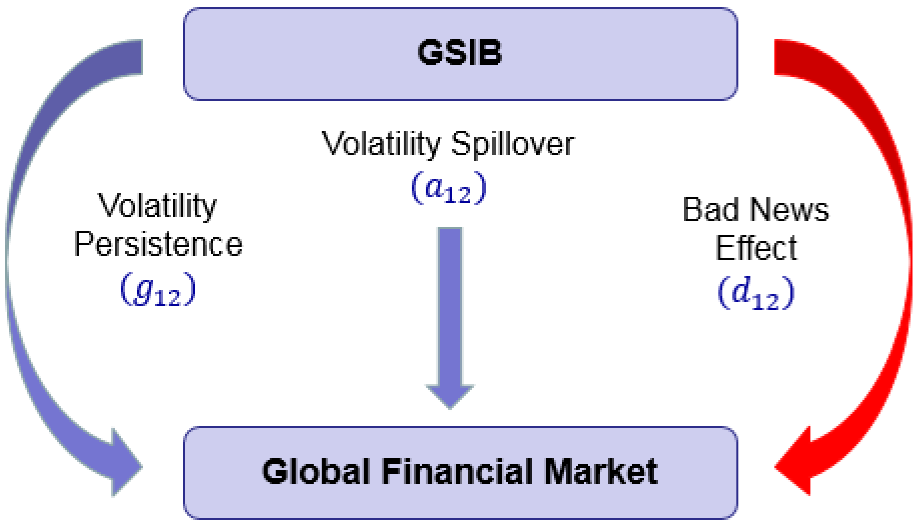
$\boldsymbol{a_{12}}$**:** Volatility spillover from GSIB to financial market (effect of lagged shocks).

$\boldsymbol{g_{12}}$**:** Volatility persistence from GSIB to financial market (effect of lagged volatilities).

$\boldsymbol{d_{12}}$**:** Effect of bad news on volatility spillover from GSIB to financial market.

We estimate our model for two pairs of series at a time, with the first series denoting the equity returns of G-SIBs and the second series denoting the indices of either the global equity, investment-grade bond or high-yield bond market as seen in Figure 2. In this manner, we will be estimating 90 different models. We also estimate all these models separately for the pre-crisis as well as the post-crisis period.

Figure 2: Spillover between a G-SIB and a Financial Market



The mean equation using a VAR(1) process and the asymmetric bivariate BEKK-GARCH (l, l) model can then be estimated simultaneously by maximizing the following log-likelihood function:

$$L(\theta) = -T\ln(2\pi) - \frac{1}{2}\sum_{t=1}^{T}[\ln|H_t| + \varepsilon_t' H_t^{-1}\varepsilon_t] \tag{8}$$

where *Ω* is the vector of all unknown parameters and *T* is the total number of observations of each series of returns vector r_t.

The non-linear optimization problem is solved by the "Broyden, Fletcher, Goldfarb and Shanno (BFGS) maximum likelihood method". This algorithm iteratively solves unconstrained nonlinear optimization problems and produces maximum likelihood parameter estimates along with their asymptotic standard errors. It is hill-climbing optimization technique which calculates the covariance matrix of the estimated parameters. However, it is sensitive to initial guess values and different values will lead to different estimates, resulting in incorrect moves in the initial iterations. For this reason, a simplex procedure with 20 iterations is used as a preliminary estimation method in order to preestimate initial parameter values. The values estimated by simplex are then used as initial estimates rather than guess values by the BFGS algorithm (Doan, 2013).

3.5 Hypotheses

We present the following three hypotheses for each pair of G-SIB and global financial market for the whole sample period and the pre-crisis and the post-crisis period as well.

H1: $\boldsymbol{a_{12} = 0}$

No spillovers in volatility from GSIB to financial market

H2: $\boldsymbol{g_{12} = 0}$

No persistence in volatility from GSIB to financial market

H3: $\boldsymbol{d_{12} = 0}$

No bad news effect on volatility from GSIB to financial market

CHAPTER 4: Results & Discussion

Under the asymmetric BEKK specification described above, the results are given in Tables. Each table presents the estimates of the relevant parameters describing volatility spillover, persistence of volatility and the presence of the leverage effect between the G-SIBs and the financial market under consideration.

4.1 Volatility Spillover

Table 9 looks at the volatility transmission from the G-SIBs to the global equity market, investment-grade market and the high-yield bond market. The arrival of new information is viewed as the main source of volatility in financial assets or markets and transmission of volatility may provide evidence of integration and interconnectedness between the banks and the financial market. The estimated ARCH response of EQU, IGB and HYB to innovations in G-SIBs, or volatility spillover, is captured by a12. Both positive and negative coefficients show the importance of GSIBs in the financial system. A positive coefficient implies that shocks originating from GSIB will increase volatility in the financial market while a negative coefficient means that shocks originating from GSIB will dampen volatility in the financial market and have a stabilizing effect the next trading day.

There is evidence of small or no volatility spillover from G-SIBs to the global equity market as there are few statistically significant parameters. The lack of proof in case of volatility spillovers in the case of equity markets is quite surprising. Only eleven of the G-SIBs have significant spillover effects at the 5% level and out of these, only three banks are from North America (NA). The three NA banks, Morgan Stanley, Bank of New York and Goldman Sachs, are not the largest banks in the region by total assets but they are more integrated with the global equity market as compared to the larger banks in NA like JP Morgan, Wells Fargo, Bank of America, and Citigroup. The situation is somewhat similar in Europe. The two largest banks in the European region, HSBC and BNP Paribas, have no significant volatility transmission to EQU while the comparatively smaller banks by total assets size like Banco Santander, ING, Nordea and Unicredit are more linked to the equity market. However, the largest bank in the world, Industrial & Commercial Bank of China, does transmit volatility to EQU but the magnitude of the shock is smaller as compared to the other G-SIBs causing spillovers.

The absolute magnitude of the coefficient for volatility spillover is the highest for Nordea Bank at -0.075 followed by Bank of New York at -0.061. It is important to mention that Nordea Bank is the 45th largest bank in the world yet it is taking the lead in volatility transmission to the global equity market. Moreover, according to the systemic importance scores released by the FSB in November 2017, Nordea Bank has the second-lowest score on interconnectedness among all G-SIBs.

It is interesting to note that Bank of New York, Goldman Sachs, Morgan Stanley, Barclays, Deutsche Bank, Nordea Bank, Industrial & Commercial Bank of China, and Mizuho Bank have negative volatility spillovers to EQU. This indicates that the first lag term shock of these G-SIBs has a negative effect on current volatility in the equity market. This means that high volatility in the bank's stock today will lead to low volatility in the equity market the next trading day. This finding has important implications about the role of G-SIBs. Even though volatility spillovers have usually been considered as destabilizing forces, the transmission of negative spillovers from these

G-SIBs to global equity market may actually serve to stabilize the market. The importance of this stabilizing role of G-SIBs should be seriously considered by regulators.

Out of all the banks, only three of the G-SIBs, Banco Santander, ING Bank and Unicredit Group are causing disruption in EQU by transmitting positive shocks. The size of the coefficient is much larger for Banco Santander and ING Bank as compared to Unicredit Group. Moreover, all three banks belong to the European region and as mentioned earlier, are not the largest banks in Europe by asset size.

The global investment-grade bond market is also not the recipient of spillovers from most of the G-SIBs. Only twelve G-SIBs are transmitting volatility, however, an equal number of banks contribute positive and negative news shocks to IGB. Bank of New York, Royal Bank of Canada, HSBC, UBS, China Construction Bank and Mizuho Bank have positive coefficients with Royal Bank of Canada having the largest parameter value of 0.01. Bank of America, JP Morgan Chase, State Street, Banco Santander, Barclays and Royal Bank of Scotland have significant negative coefficients. The role of these six G-SIBs in the global investment-grade market is stabilizing.

Compared to the global equity market, the shocks originating from G-SIBs affect the global investment-grade market more although the magnitude of the spillover is much smaller as compared to the global equity market. The more interesting finding is that the global high-yield bond market is the most effected with eighteen G-SIBs having an impact on its volatility. In NA, only Citigroup and Royal Bank of Canada have no impact on HYB. The sign of the spillover coefficient is negative for fourteen banks, reinforcing the stabilizing role that G-SIBs are playing in the global financial markets. JP Morgan has the largest absolute coefficient among banks transmitting negative spillovers. Overall, the magnitude of the parameters for the global high-yield bond market are more than for the investment-grade bond market.

The results also reveal that the larger G-SIBs in terms of size have a stronger link with the debt markets as compared to the equity market. The two largest banks in NA, JP Morgan Chase and Bank of America, negatively transmit spillovers to the both global debt markets and actually reduce volatility in these markets. The largest bank in Europe, HSBC, behaves in a similar fashion. The two debt markets are recipients of spillovers from HSBC as well, however, the nature of spillover to the investment-grade market is positive and causes a rise in volatility the next trading day. Mizuho Bank is the only Asian bank transmitting shocks to both IGB and HYB but the type of spillover to IGB is again positive.

We can also see from Table 9 that Bank of New York, Banco Santander and Mizuho Bank are the most integrated with the global financial system as they have spillovers to all markets. However, for all three banks, the spillovers is positive in only one market. Remarkably, all three banks lie in bucket 1 based on the five measures suggested by FSB. As mentioned earlier, FSB has categorized G-SIBs in 5 buckets. The higher the bucket the bank is in, the greater the systemic importance of the bank and the higher the capital buffer requirements. If we look only at the interconnectedness score computed by FSB, Bank of New York is number 28 on the list, Mizuho Bank is 24 and Banco Santander is at 20. Hence, we can see that measure of systemic importance might be flawed as banks displaying the most interconnectedness with the financial markets on account of volatility spillover transmission have been placed in the lowest bucket. JP Morgan Chase is the only bank placed in bucket 4 but it is not causing spillovers to all global financial markets. Moreover, the nature of the spillover from JP Morgan is negative in both markets.

Royal Bank of Canada, the newest member of the G-SIB list, has impact on only one global financial market. In the earlier section, it was mentioned that Royal Bank of Scotland has the highest negative mean return as well as the highest variance in returns. However, this G-SIB has spillovers to only the global investment-grade market, underscoring its importance in causing shocks to financial markets. The results also show that Citigroup, Crédit Agricole, Standard Chartered, Agricultural Bank of China, and Sumitomo Bank have no interconnectedness with any of the three global financial markets as they are not causing any volatility transmission to these markets. It is worthwhile to mention that Agricultural Bank of China is the 3rd largest bank in the world, Crédit Agricole the 11th largest, Citigroup 12th and Sumitomo the 16th largest. However, none of the global financial markets are recipients of shocks from any of these G-SIBs.

Table 9: Volatility Spillover from G-SIBs to the Global Financial Markets (a12)

	EQU		IGB		HYB	
	a12	**Standard Error**	**a12**	**Standard Error**	**a12**	**Standard Error**
North American Banks						
Bank of America	0.004	0.006	-0.003***	0.001	-0.012***	0.002
Bank of New York	-0.061***	0.011	0.003**	0.001	-0.018***	0.002
Citigroup	-0.012	0.007	0.000	0.001	-0.003	0.004
Goldman Sachs	-0.032**	0.013	0.001	0.003	0.008***	0.002
JP Morgan Chase	0.000	0.017	-0.004**	0.002	-0.020***	0.002
Morgan Stanley	-0.044***	0.009	0.001	0.001	-0.014***	0.002
Royal Bank of Canada	-0.021	0.020	0.010***	0.002	0.010	0.008
State Street	-0.002	0.010	-0.003***	0.001	0.007***	0.002
Wells Fargo	-0.013	0.009	0.001	0.002	-0.017***	0.002
European Banks						
Banco Santander	0.055***	0.011	-0.003**	0.001	-0.011***	0.004
Barclays	-0.017**	0.009	-0.003***	0.001	-0.002	0.003
BNP Paribas	0.001	0.015	-0.001	0.002	-0.015***	0.002
Credit Suisse	-0.001	0.010	-0.001	0.003	-0.007***	0.003
Deutsche Bank	-0.009***	0.002	0.000	0.002	-0.012***	0.003
Crédit Agricole	-0.016	0.010	0.000	0.001	-0.005	0.003
HSBC	-0.017	0.013	0.006***	0.002	-0.018***	0.004
ING Bank	0.058***	0.018	-0.003	0.001	-0.008***	0.003
Nordea Bank	-0.075***	0.011	0.002	0.002	-0.012***	0.003
Royal Bank of Scotland	-0.009	0.007	-0.003***	0.001	-0.002	0.002
Société Générale	0.008	0.013	-0.002	0.001	-0.009***	0.002
Standard Chartered	-0.009	0.007	-0.002	0.002	0.000	0.002
UBS	-0.004	0.008	0.005***	0.002	-0.001	0.003
Unicredit Group	0.018***	0.006	-0.001	0.001	0.003	0.002
Asian Banks						
Agricultural Bank of China	-0.016	0.010	0.003	0.003	-0.004	0.003
Bank of China	-0.025	0.019	0.004	0.002	0.009**	0.004
China Construction Bank	0.000	0.011	0.005***	0.002	0.002	0.002
Ind & Com Bank of China	-0.015**	0.006	0.002	0.002	-0.003	0.002
Mitsubishi UFJ FG	-0.003	0.007	0.002	0.002	0.005**	0.002
Mizuho FG	-0.017**	0.008	0.006***	0.001	-0.005***	0.002
Sumitomo Mitsui FG	-0.007	0.008	-0.001	0.002	0.003	0.002

*** significance at 1%, ** significance at 5%

4.2 Volatility Persistence

Volatility is defined to persistent if the return today significantly effects future volatilities. As new information continually arrives in the market, past volatility of a financial series can impact future volatility of another series. The cross market persistence of volatility from G-SIBs to the global equity market is estimated by the coefficient g12. Table 10 looks at the volatility persistence from the G-SIBs to the global equity market, investment-grade market and the high-yield bond market. Fifteen of the G-SIBs show statistically significant volatility persistence at the 5% level. Moreover, with the exception of Bank of New York and Agricultural Bank of China, all other G-SIBs with negative volatility spillovers have a positive, significant GARCH coefficient, indicating that from a long-term point of view, low volatility will persist in the global equity market. ING Bank is the only bank with positive spillovers to EQU and causing volatility to persist.

The scenario appears to be different in the case of the global investment-grade bond market. Only Royal Bank of Canada, State Street, Santander and Mizuho Bank have significant conditional persistence, however, with the exclusion of Royal Bank of Canada, the magnitude of persistence is quite small. The high-yield bond market tells a different story with volatility persisting for more G-SIBs. The two of the largest bank in NA, JP Morgan Chase and Bank of America, are transmitting negative spillovers to the HYB and have significant conditional persistence as well. On the other hand, the positive shocks exported by Goldman Sachs and State Street Bank tend persist in the high-yield market as well. Bank of New York is one of the banks most integrated with the financial markets, however, volatility spillovers arising from it do not persist in the market. Moreover, the significant persistence is only seen in the debt market in the case of Banco

Santander and Mizuho Bank, which are the two other banks most integrated with the three financial markets.

The global equity and high-yield bond market seem to be more sensitive as more of the G-SIBs cause volatility to persist in those markets. Comparable to the volatility spillover parameters, the magnitude of persistence is also larger in these two markets as compared to the investment-grade bond market. The mixed results concerning volatility persistence may point towards the highly integrated and complex balance sheet structure of these G-SIBs as well as the impact of cross holdings and network effects.

Table 10: Volatility Persistence from G-SIBs to the Global Financial Markets (g12)

	EQU		IGB		HYB	
	g12	**Standard Error**	**g12**	**Standard Error**	**g12**	**Standard Error**
North American Banks		-				
Bank of America	0.008***	0.002	0.000	0.000	0.003***	0.000
Bank of New York	0.005	0.003	0.001	0.000	0.000	0.001
Citigroup	0.008***	0.003	0.008	0.041	0.002***	0.001
Goldman Sachs	0.01***	0.003	0.000	0.001	0.002***	0.001
JP Morgan Chase	0.002	0.005	0.001	0.000	0.003***	0.001
Morgan Stanley	0.005**	0.002	0.000	0.000	0.001*	0.001
Royal Bank of Canada	0.021	0.012	0.010***	0.002	0.003*	0.002
State Street	0.007	0.005	0.001***	0.000	0.002***	0.000
Wells Fargo	0.011***	0.003	0.000	0.000	0.003***	0.001
European Banks						
Banco Santander	-0.008	0.004	0.001**	0.000	0.003**	0.001
Barclays	0.010***	0.002	0.000	0.000	0.002*	0.001
BNP Paribas	0.008	0.004	0.001**	0.000	0.001	0.001
Credit Suisse	0.002	0.003	0.001	0.000	0.001	0.001
Deutsche Bank	0.004***	0.000	0.000	0.000	0.001	0.001
Crédit Agricole	0.012***	0.003	0.000	0.000	0.003***	0.001
HSBC	0.019***	0.004	0.000	0.000	0.004***	0.001
ING Bank	-0.011**	0.005	0.001***	0.000	0.000	0.001
Nordea Bank	0.030***	0.006	0.001	0.001	0.002	0.001
Royal Bank of Scotland	0.010***	0.003	0.001	0.000	0.003***	0.001
Société Générale	0.004	0.004	0.001**	0.000	0.001*	0.001
Standard Chartered	0.012***	0.003	0.000	0.000	0.006***	0.001
UBS	0.006***	0.003	0.000	0.000	0.001	0.002
Unicredit Group	0.000	0.002	0.000	0.000	0.002***	0.001
Asian Banks						
Agricultural Bank of China	0.005	0.004	-0.001	0.001	0.001	0.001
Bank of China	0.021	0.024	-0.001	0.001	-0.002	0.003
China Construction Bank	0.002	0.005	-0.001	0.001	0.000	0.001
Ind & Com Bank of China	0.007***	0.002	-0.001	0.001	0.001***	0.001
Mitsubishi UFJ FG	0.002	0.002	-0.001***	0.001	-0.002***	0.001
Mizuho FG	0.005	0.003	-0.001***	0.000	-0.002**	0.001
Sumitomo Mitsui FG	0.000	0.003	-0.001	0.001	0.000	0.001

*** significance at 1%, ** significance at 5%

4.3 Bad News Effect

The bad news effect coefficient tests whether expected and unexpected past-day shocks are asymmetric in nature or not. This means shocks of equal magnitude associated to bad news have more effect on current volatility or conditional variance than shocks related with good news. A positive coefficient implies that unexpected bad news for the G-SIB increases volatility of returns while a negative coefficient means that volatility will reduce. Table 11 gives the coefficients of volatility transmission from the G-SIBs to the global equity market, investment-grade market and the high-yield bond market.

The bad news effect is barely seen in the equity market. The asymmetric coefficient is significant at the 5% level for only Morgan Stanley, HSBC, ING Bank and UBS. This provides evidence that negative returns shocks to only these banks will produce volatility in the global equity market. As expected, the sign of the coefficient for these banks is positive, suggesting that negative events for these G-SIBs increases volatility in the equity market more than positive events. Furthermore, bad news in none of the Asian Banks increases volatility in EQU. Hence, adverse reports about G-SIBs will not produce a rise in stock volatility in the global equity market.

Almost all G-SIBs have significant asymmetric coefficients in the global investment-grade market. However, most of these coefficients are negative, implying that bad news for G-SIBs will cause a reduction in volatility in the investment-grade debt market and IGB is safer from the impact of bad news compared to other financial markets. However, the HYB responds differently than IGB. The analysis of volatility interdependence shows significant asymmetric effects between G-SIBs and the high-yield bond market and in most cases the coefficient is positive. HYB is the recipient of shocks from negative news from the G-SIBs as volatility increases in the market.

Hence, we can see that overall the bad news effect is more evident for equities and high-yield bonds than for investment-grade bonds. We feel that this may be due to the "flight to safety" or "flight to quality" effect, where during turbulent times, investors shift their capital to securities which are "safer" and less likely to experience loss in value. Historically, equity and high-yield securities have faced a sell-off when the headlines are negative. It has been observed that investors have a sudden and strong preference for holding liquid assets during volatile times as their risk aversion increases and there is a flight to quality (Cox et al. 2004). An empirical study of developed economies of US, Japan and other European countries showed that such flights are a common feature in many crises periods (Baur & Lucey, 2009). Also, bond investors are generally more sophisticated than equity investors and reallocate money to debt securities in time of bad news. The flight to quality effect was also seen during the global financial crisis when spreads for high-yield bonds in the US and Europe increased greatly, as investors shifted their funds from subprime mortgage-backed securities to the Treasury bond market (Brière et al., 2012; Longstaff, 2010).

In our research, we feel that as the global investment-grade bond market securities are more liquid and safer than equity securities or high-yield bonds, a negative asymmetric coefficient for IGB suggests that the presence of this flight to safety effect.

A very different situation appears in the case of Asian banks regarding the flight to quality effect. Asian banks are causing an increase in volatility spillover in the investment-grade bond market due to negative shocks compared to NA and European banks. This behavior could be due to investors evaluating bad news from Asian G-SIBs differently as compared to NA and European banks, as we feel the closed nature of Chinese and Japanese economies could be making investors more cautious where these banks are concerned. Bad news from Asian G-SIBs will be treated by investors as a cause for concern and produce disruption in the investment-grade bond market.

The only G-SIB causing a positive asymmetric response in all three global financial markets is Morgan Stanley. Bad news from Morgan Stanley is transmitted to all financial markets, causing an increase in volatility in returns in these markets. Morgan Stanley is number 22 according to interconnectedness score and in the lowest bucket overall. However, the impact of Morgan Stanley is felt most out of all 30 G-SIBs where negative news is concerned.

In the earlier section, we observed that Bank of New York, Banco Santander and Mizuho Bank were the most integrated with the global financial markets as they transmitted spillovers in all three areas. However, unexpected bad news from these G-SIBs impacts the markets in a different manner. Bank of New York increases volatility in both debt markets but not the equity market. Banco Santander causes a reduction in volatility in the global debt market only when there are negative shocks while Mizuho Bank transmits positive spillovers to the global high-yield market when the news is unfavorable.

Table 11: Bad News Effect from G-SIBs to the Global Financial Markets (d12)

	EQU		IGB		HYB	
	d12	**Standard Error**	**d12**	**Standard Error**	**d12**	**Standard Error**
North American Banks						
Bank of America	0.001	0.011	-0.001	0.001	0.006	0.0031
Bank of New York	0.013	0.017	0.011***	0.002	0.014***	0.0036
Citigroup	0.023	0.011	-0.004***	0.001	0.0017	0.0045
Goldman Sachs	0.008	0.042	-0.007***	0.002	-0.015***	0.0039
JP Morgan Chase	0.032	0.017	-0.007***	0.002	0.007**	0.0037
Morgan Stanley	0.042***	0.012	0.005***	0.001	0.014***	0.0029
Royal Bank of Canada	0.039	0.020	-0.011***	0.003	-0.0125	0.0078
State Street	-0.011	0.015	-0.005***	0.001	-0.015***	0.0030
Wells Fargo	-0.011	0.017	-0.008***	0.002	0.0053	0.0044
European Banks						
Banco Santander	-0.015	0.013	-0.007***	0.002	0.008	0.0042
Barclays	-0.014	0.011	-0.001	0.001	-0.0073	0.0074
BNP Paribas	-0.003	0.012	-0.008***	0.002	0.013***	0.0032
Credit Suisse	0.017	0.010	-0.007***	0.003	0.024***	0.0033
Deutsche Bank	-0.001	0.003	-0.005***	0.002	0.022***	0.0032
Crédit Agricole	-0.009	0.010	0.006***	0.002	-0.012***	0.0039
HSBC	0.030**	0.016	-0.011***	0.003	0.019***	0.0052
ING Bank	0.033**	0.013	-0.006***	0.002	0.014***	0.0027
Nordea Bank	0.020	0.017	-0.009***	0.002	0.022***	0.0044
Royal Bank of Scotland	0.010	0.009	0.000	0.001	0.0020	0.0027
Société Générale	-0.003	0.012	-0.005***	0.001	0.015***	0.0027
Standard Chartered	-0.004	0.009	-0.001	0.002	-0.011***	0.0028
UBS	0.030***	0.010	-0.010***	0.002	0.0148	0.0102
Unicredit Group	0.001	0.007	-0.004***	0.001	-0.0043	0.0028
Asian Banks						
Agricultural Bank of China	0.018	0.016	0.008***	0.003	0.0013	0.0054
Bank of China	0.048	0.013	0.012***	0.002	-0.016**	0.0062
China Construction Bank	0.050	0.013	0.010***	0.003	-0.0061	0.0058
Ind & Com Bank of China	-0.015	0.015	0.010***	0.002	0.0007	0.0035
Mitsubishi UFJ FG	0.018	0.009	0.008***	0.003	-0.014***	0.0030
Mizuho FG	0.018	0.010	-0.004	0.002	0.014***	0.0017
Sumitomo Mitsui FG	0.017	0.010	0.008***	0.002	-0.008**	0.0038

*** significance at 1%, ** significance at 5%

4.4 Pre-Crisis vs. Post-Crisis Period

We divide our sample period into pre-crisis and post-crisis period to see if there are any changes in the transmission of volatility spillovers during both periods. We define the pre-crisis period from Jan 3, 2005 to September 26, 2008, and the post-crisis period from September 27, 2008 to May 5, 2017. Table 12 compares the volatility spillover effects for all financial market in the period before and after GFC. An investigation of the shock coefficient, a12, reveals that more banks are transmitting volatility to the global equity mark in the post-crisis period as compared to the pre-crisis period. The stabilizing role of NA Banks in the equity market is more pronounced in the post-crisis period as spillovers turn from positive to negative, remain negative, or disappear completely. Citigroup in particular was transmitting positive spillovers in the pre-crisis period but the effect has disappeared in the post-crisis period. In Europe, the reverse scenario can be seen. Fewer banks had spillover effects and most of the spillovers were negative. However, post-crisis, more banks are transmitting shocks to the global equity market and the role is disruptive rather than stabilizing. Banco Santander, Barclays, BNP Paribas, ING Bank and Unicredit Group increase volatility post-crisis in EQU when bad news arrives for these banks. In the pre-crisis period, only negative shocks from Société Générale produced volatility. In Asia, only Industrial & Commercial Bank of China has significant negative coefficients in both periods. Interestingly, the magnitude of the spillovers is greater in the pre-crisis period than it is the post-crisis period.

NA banks have a similar impact on the investment-grade bond market post-crisis. Previously, only Bank of America, Wells Fargo and Bank of New York produced negative volatility spillovers. After the crisis, only Morgan Stanley and Bank of New York have insignificant coefficients. More banks are transmitting spillovers and the coefficient is negative in majority cases. However, the impact of spillovers from Wells has gone from negative to positive in the post-crisis period. The impact on IGB due to spillovers from European banks is almost similar in both periods. European G-SIBs contributed to stability in the time before the GFC and the stabilizing role is still being played by these banks. Banco Santander, ING Bank and Société Générale have gone from causing disruptions before in GYB being to stabilizing now. Credit Suisse and Deutsche Bank had no effect on volatility in the pre-crisis period but have a stabilizing impact later on.

The high-yield bond market has become more susceptible to transmissions from G-SIBs in the post-crisis period. Previously only NA banks had significant spillovers to HYB but this market has become more receptive post-crisis as European and Asian banks are also causing spillovers. The spillovers in most cases are negative and serve to stabilize the high-yield debt market. It is important to note that Citigroup transmitted negative spillovers in the period before the crisis to HYB but has no effect afterwards.

In the previous section, we had stated that Bank of New York, Banco Santander and Mizuho are the most integrated with the financial system. It can be seen from the results that Bank of New York increased volatility in the global markets in the pre-crisis period but it now has negative spillovers. Mizuho Bank had no significant coefficients in the pre-crisis period and no spillovers in any of the global financial markets but the effect has reversed in the post-crisis period. Banco Santander has also become more integrated with the system in the post-crisis period as previously it only transmitted volatility to the investment-grade bond market.

Table 13 shows volatility persistence is more or less the same in the global equity market. More banks are causing volatility to persist in the global investment-grade in the post-crisis period but the coefficients are lesser in comparison to the pre-crisis period. Volatility spillovers in HYB have increased in the period following the crisis but volatility is not persisting.

Remarkably, the asymmetric coefficient is significant for more banks in relation to the global equity market in the post-crisis period than in the pre-crisis period as seen in Table 14. Moreover, the size of the coefficient is much larger too, indicating that unanticipated news shocks will cause an increase in volatility in EQU. For the global investment-grade debt market, the coefficients remain mostly negative in Europe, probably due to the 'flight to quality' effect mentioned earlier. However, the flight to quality effect was more pronounced in NA in the pre-crisis period as negative news for most G-SIBs reduced volatility in EQU but this effect is almost absent post-crisis. Asia exhibits similar behavior in the investment-grade bond market. Similar to the overall volatility spillover effect, the asymmetric effect is also felt more for the high-yield bond market in the post-crisis period. Majority of the G-SIBs in all three regions produce an increase in volatility in HYB when negative information reaches the market.

Table 15 gives a summary of results for all banks during the total, pre-crisis and post-crisis periods.

Table 12: Pre-Crisis & Post-Crisis Volatility Spillover from G-SIBs to the Global Financial Markets (a12)

	PRE-EQU		POST-EQU		PRE-IGB		POST-IGB		PRE-HYB		POST-HYB	
	a12	S.E.	a12	S.E.	a12	S.E.	a12	S.E.	a12	S.E.	a12	S.E.
NA Banks												
Bank of America	0.004	0.006	-0.009	0.009	-0.008***	0.003	-0.003**	0.001	-0.012***	0.0027	-0.013***	0.002
Bank of New York	0.003**	0.014	-0.042**	0.017	-0.008***	0.003	0.003	0.002	0.013***	0.0034	-0.018***	0.002
Citigroup	0.057***	0.016	-0.012	0.007	-0.002	0.004	-0.002**	0.001	-0.011***	0.002	-0.003	0.004
Goldman Sachs	-0.032**	0.013	-0.032**	0.013	0.008	0.005	-0.006***	0.002	-0.008***	0.003	0.008***	0.002
JP Morgan Chase	-0.005	0.019	0.000	0.017	-0.002	0.005	0.005***	0.001	-0.016***	0.003	-0.024***	0.003
Morgan Stanley	-0.031	0.019	-0.052***	0.012	-0.003	0.004	0.002	0.001	-0.011***	0.003	-0.014***	0.002
Royal Bank of Canada	-0.009	0.030	-0.021	0.020	-0.006	0.005	-0.016***	0.003	-0.022***	0.004	0.010	0.008
State Street	0.056***	0.021	-0.002	0.010	0.006	0.004	-0.004***	0.001	0.004	0.008	0.007***	0.002
Wells Fargo	0.007	0.015	-0.013	0.009	-0.012***	0.003	0.005***	0.001	0.016***	0.003	-0.017***	0.002
Europe Banks												
Banco Santander	0.047	0.028	0.055***	0.011	0.007**	0.003	-0.006***	0.002	-0.009	0.006	-0.018***	0.003
Barclays	-0.017**	0.009	0.036***	0.011	-0.013***	0.003	-0.004***	0.001	0.014***	0.003	-0.006***	0.002
BNP Paribas	-0.084***	0.020	0.042***	0.014	-0.007	0.005	-0.002	0.002	-0.015***	0.002	-0.018***	0.002
Credit Suisse	0.024	0.025	-0.001	0.010	0.002	0.004	-0.006***	0.001	0.000	0.006	-0.007***	0.003
Deutsche Bank	0.010	0.040	-0.009***	0.002	-0.005	0.004	0.004**	0.002	-0.006	0.005	-0.012***	0.003
Crédit Agricole	0.019	0.018	-0.016	0.010	-0.011***	0.003	0.000	0.002	-0.005	0.003	-0.015***	0.002
HSBC	-0.022	0.030	-0.017	0.013	0.022***	0.006	0.009***	0.002	0.028***	0.006	-0.018***	0.004
ING Bank	-0.061***	0.013	0.058***	0.018	0.011***	0.004	-0.006***	0.001	-0.004	0.005	-0.012***	0.003
Nordea Bank	0.001	0.023	-0.075***	0.011	-0.006	0.003	0.006***	0.002	-0.002	0.003	-0.012***	0.003
Royal Bank of Scotland	-0.021	0.015	-0.009	0.007	-0.011***	0.004	-0.003***	0.001	0.018***	0.003	-0.002	0.002
Société Générale	0.052***	0.018	0.008	0.013	0.008**	0.004	-0.004**	0.002	-0.005	0.004	-0.009***	0.002
Standard Chartered	-0.009	0.007	-0.009	0.009	-0.015***	0.004	-0.004**	0.002	0.009**	0.004	0.000	0.002
UBS	0.009	0.033	-0.004	0.008	-0.003	0.003	-0.001	0.003	-0.005	0.003	-0.001	0.003
Unicredit Group	-0.010	0.020	0.018***	0.006	0.021***	0.004	0.000	0.001	0.017***	0.005	0.003	0.002
Asia Banks												
Agri. Bank of China	-	-	-	-	-	-			-	-	-	-
Bank of China	0.007	0.019	-0.025	0.019	0.004	0.004	0.007***	0.002	0.004	0.004	0.009**	0.004
China Const. Bank	0.013	0.015	0.000	0.011	-0.009***	0.001	-0.007**	0.003	0.001	0.003	0.002	0.002
I & C Bank of China	-0.028**	0.013	-0.015**	0.006	0.006	0.004	0.003	0.002	-0.008**	0.004	-0.003	0.002
Mitsubishi UFJ FG	-0.009	0.012	-0.003	0.007	0.006***	0.002	0.002	0.002	-0.002	0.003	0.005**	0.002
Mizuho FG	-0.006	0.016	-0.017**	0.008	0.004	0.003	0.006***	0.002	-0.003	0.003	-0.005***	0.002
Sumitomo Mitsui FG	-0.015	0.012	-0.007	0.008	-0.007***	0.002	0.004**	0.002	0.006**	0.002	0.006**	0.002

*** significance at 1%, ** significance at 5%

Table 13: Pre-Crisis & Post-Crisis Volatility Persistence from G-SIBs to the Global Financial Markets (g12)

	PRE-EQU		POST-EQU		PRE-IGB		POST-IGB		PRE-HYB		POST-HYB	
	g12	**S.E.**	**g12**	**S.E.**	**g12**	**S.E.**	**g12**	**S.E.**	**g12**	**S.E.**	**g12**	**S.E.**
NA Banks												
Bank of America	0.008***	0.002	0.009***	0.003	0.0025	0.0015	0.000	0.000	0.0031***	0.0010	0.004***	0.001
Bank of New York	0.003	0.010	0.002	0.005	0.0041	0.0013	0.001	0.001	0.0037	0.0026	0.001	0.001
Citigroup	0.006	0.009	0.950***	0.007	0.004***	0.001	0.000	0.000	0.002	0.001	0.002***	0.001
Goldman Sachs	0.011***	0.003	0.011***	0.003	-0.008***	0.001	0.001**	0.000	0.001	0.001	0.002***	0.001
JP Morgan Chase	0.017	0.009	0.002	0.005	-0.002	0.001	0.000	0.001	0.002***	0.001	0.002	0.001
Morgan Stanley	0.003	0.006	0.002	0.003	-0.001	0.001	0.000	0.000	0.000	0.001	0.001	0.001
Royal Bank of Canada	0.015	0.018	0.021	0.012	-0.012***	0.001	0.002**	0.001	0.001	0.001	0.003	0.002
State Street	0.070***	0.012	0.007	0.005	-0.006***	0.001	0.000***	0.000	0.005**	0.002	0.002***	0.000
Wells Fargo	0.022***	0.006	0.011***	0.003	0.005***	0.001	-0.001	0.001	0.000	0.001	0.003***	0.001
Europe Banks												
Banco Santander	-0.006	0.023	-0.008	0.004	-0.004***	0.000	0.001***	0.000	0.003	0.003	0.003**	0.001
Barclays	0.010***	0.002	-0.006**	0.003	-0.001	0.001	0.000	0.000	0.000	0.001	0.002	0.001
BNP Paribas	0.098***	0.023	-0.007	0.004	-0.002	0.002	0.001***	0.000	0.001	0.001	0.001	0.001
Credit Suisse	-0.005	0.010	0.002	0.003	-0.001	0.001	0.001**	0.000	0.000	0.003	0.001	0.001
Deutsche Bank	0.042**	0.018	0.004***	0.000	0.003***	0.001	0.000	0.000	0.003	0.002	0.001	0.001
Crédit Agricole	-0.005	0.003	0.012***	0.003	0.002**	0.001	0.000	0.000	0.003***	0.001	0.003***	0.001
HSBC	0.054**	0.022	0.019***	0.004	-0.015***	0.003	-0.001	0.001	0.003	0.002	0.004***	0.001
ING Bank	0.007	0.009	-0.011**	0.005	-0.007***	0.002	0.001**	0.000	0.000	0.002	-0.001	0.001
Nordea Bank	0.005	0.015	0.030***	0.006	0.002	0.001	-0.001	0.001	0.005**	0.002	0.002	0.001
Royal Bank of Scotland	0.024***	0.007	0.010***	0.003	-0.001	0.001	0.001	0.000	0.000	0.001	0.003***	0.001
Société Générale	-0.004	0.009	0.004	0.004	-0.004	0.002	0.001**	0.000	0.002	0.002	0.001	0.001
Standard Chartered	0.012***	0.003	0.012***	0.004	0.003	0.001	0.000	0.001	0.004**	0.002	0.006***	0.001
UBS	0.004	0.007	0.008***	0.003	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.002
Unicredit Group	0.001	0.010	0.000	0.002	-0.014***	0.004	0.001***	0.000	0.005**	0.002	0.002***	0.001
Asia Banks												
Agri. Bank of China	-	-	-	-	-	-			-	-	-	-
Bank of China	0.017	0.011	0.021	0.024	-0.002	0.002	-0.001**	0.001	0.000	0.003	-0.002	0.003
China Const. Bank	0.000	0.008	0.002	0.005	0.001	0.000	0.000	0.001	0.001	0.001	0.000	0.001
I & C Bank of China	0.022***	0.008	0.007***	0.002	0.004	0.004	-0.001	0.001	0.005	0.006	0.001***	0.001
Mitsubishi UFJ FG	0.009	0.004	0.002	0.002	-0.001***	0.000	-0.002***	0.001	-0.001	0.001	-0.002***	0.001
Mizuho FG	0.000	0.007	0.005	0.003	0.000	0.001	-0.002***	0.000	-0.001	0.001	-0.002**	0.001
Sumitomo Mitsui FG	0.008	0.006	0.000	0.003	0.000	0.001	-0.002***	0.000	0.002**	0.001	0.002**	0.001

*** significance at 1%, ** significance at 5%

Table 14: Pre-Crisis & Post-Crisis Bad News Effect from G-SIBs to the Global Financial Markets (d12)

	PRE-EQU		POST-EQU		PRE-IGB		POST-IGB		PRE-HYB		POST-HYB	
	d12	S.E.	d12	S.E.	d12	S.E.	d12	S.E.	d12	S.E.	d12	S.E.
NA Banks												
Bank of America	0.001	0.011	0.008	0.014	-0.010**	0.0048	0.003**	0.001	-0.0014	0.0047	0.005	0.004
Bank of New York	-0.007	0.027	0.054***	0.019	-0.011**	0.0053	0.010***	0.002	0.019***	0.0056	0.010***	0.004
Citigroup	-0.019	0.028	0.023**	0.011	-0.014***	0.005088	0.002	0.001	0.003	0.004	0.002	0.004
Goldman Sachs	0.006	0.016	0.006	0.016	-0.015***	0.004	0.003	0.003	0.012***	0.004	-0.015***	0.004
JP Morgan Chase	0.025	0.026	0.032	0.017	-0.008	0.005	-0.006***	0.002	0.000	0.004	0.010**	0.005
Morgan Stanley	0.045***	0.017	0.057***	0.016	-0.006**	0.003	0.005***	0.002	0.008**	0.003	0.014***	0.003
Royal Bank of Canada	0.026	0.034	0.039	0.020	0.000	0.006	0.006	0.005	-0.006	0.005	-0.012	0.008
State Street	-0.102***	0.028	-0.011	0.015	-0.006***	0.001	-0.002	0.002	0.019***	0.004	-0.015***	0.003
Wells Fargo	-0.019	0.021	-0.011	0.017	-0.018***	0.006	-0.004**	0.002	0.000	0.005	0.005	0.004
Europe Banks												
Banco Santander	0.004	0.032	-0.015	0.013	-0.005	0.001	-0.006***	0.002	0.016***	0.006	0.005	0.006
Barclays	-0.014	0.011	-0.031***	0.011	-0.002	0.004	0.001	0.001	-0.011**	0.006	-0.011**	0.005
BNP Paribas	0.029	0.030	0.023	0.014	0.020***	0.006	-0.009***	0.002	0.013***	0.003	0.010***	0.004
Credit Suisse	0.023	0.020	0.017	0.010	0.012***	0.005	0.001	0.002	0.014***	0.005	0.024***	0.003
Deutsche Bank	0.040	0.028	-0.001	0.003	0.000	0.005	-0.007***	0.002	0.028***	0.006	0.022***	0.003
Crédit Agricole	0.010	0.022	-0.009	0.010	-0.009	0.005	-0.005***	0.002	-0.012***	0.004	0.007**	0.004
HSBC	-0.020	0.044	0.030**	0.016	-0.006	0.009	0.009***	0.003	-0.020**	0.010	0.019***	0.005
ING Bank	0.003	0.035	0.033**	0.013	-0.007	0.006	-0.001	0.002	0.008	0.005	0.018***	0.004
Nordea Bank	-0.007	0.033	0.020	0.017	-0.003	0.005	-0.010***	0.003	-0.008	0.006	0.022***	0.004
Royal Bank of Scotland	-0.041	0.023	0.010	0.009	-0.002	0.004	0.002**	0.001	-0.011	0.006	0.002	0.003
Société Générale	0.106***	0.029	-0.003	0.012	0.018***	0.005	-0.004	0.002	-0.013***	0.005	0.015***	0.003
Standard Chartered	-0.004	0.009	-0.001	0.010	-0.007	0.005	0.002	0.002	-0.006	0.006	-0.011***	0.003
UBS	0.026	0.020	0.030***	0.010	-0.010***	0.004	0.011***	0.002	0.005	0.004	0.015	0.010
Unicredit Group	-0.017	0.031	0.001	0.007	0.007	0.009	-0.005***	0.000	-0.021***	0.007	-0.004	0.003
Asia Banks												
Agri. Bank of China	-	-	-	-	-	-	-	-	-	-	-	-
Bank of China	0.014	0.035	0.048***	0.013	0.010	0.007	0.010***	0.003	0.028***	0.008	-0.016**	0.006
China Const. Bank	-0.076***	0.022	0.050***	0.013	-0.008***	0.002	0.008	0.006	0.006	0.004	-0.006	0.006
I & C Bank of China	-0.032	0.021	-0.015	0.015	0.007	0.006	0.009***	0.003	-0.007	0.009	0.001	0.003
Mitsubishi UFJ FG	0.037**	0.016	0.018**	0.009	0.014***	0.002	0.011***	0.002	0.012***	0.004	-0.014***	0.003
Mizuho FG	0.043**	0.018	0.018	0.010	-0.014***	0.004	0.005**	0.002	0.01***	0.003	0.014***	0.002
Sumitomo Mitsui FG	0.008	0.022	0.017	0.010	0.006	0.004	0.008***	0.003	-0.020***	0.003	-0.020***	0.003

*** significance at 1%, ** significance at 5%

Table 15: Summary of Results

	EQU			IGB			HYB		
	Total	**Pre**	**Post**	**Total**	**Pre**	**Post**	**Total**	**Pre**	**Post**
NA Banks									
Bank of America:									
a12	-	-	-	Negative	Negative	Negative	Negative	Negative	Negative
g12	Signif.	Signif.	Signif.	-	-	-	Signif.	Signif.	Signif.
d12	-	-	-	Increase	Decrease	Increase	-	-	-
Bank of New York									
a12	Negative	Positive	Negative	Positive	Negative	-	Negative	Positive	Negative
g12	-	-	-	-	-	-	-	-	-
d12	-	-	-	Increase	-	-	Increase	-	-
Citigroup									
a12	-	Positive	-	-	-	Negative	-	Negative	-
g12	Signif.	-	Signif.	-	-	-	Signif.	-	Signif.
d12	-	-	Positive	Decrease	Increase	-	-	-	Increase
Goldman Sachs									
a12	Negative	Negative	Negative	-	-	Negative	Positive	Negative	Positive
g12	Signif.	Signif.	Signif.	-	Signif.	Signif.	Signif.	-	Signif.
d12	-			Decrease		Decrease	Decrease		
JP Morgan Chase									
a12	-	-	-	Negative	-	Positive	Negative	Negative	Negative
g12	-	-	-	-	-	-	Signif.	Signif.	-
d12	-	-	-	Decrease	-	-	Increase	-	Increase
Morgan Stanley									
a12	Negative	-	Negative	-	-	-	Negative	Negative	Negative
g12	Signif.	-	-	-	-	-	-	-	-
d12	Increase	Increase	Increase	Increase	Decrease	Increase	Increase	Increase	Increase
Royal Bank of Can.									
a12	-	-	-	Positive	-	Negative	-	Negative	-
g12	-	-	-	Signif.	Signif.	Signif.	-	-	-
d12	-	-	-	Decrease	-	-	-	-	-
State Street									
a12	-	Positive	-	Negative	-	Negative	Positive	-	Negative
g12	-	Signif.	-	Signif.	Signif.	Signif.	Signif.	Signif.	Signif.
d12	-	Decrease	-	Decrease	Decrease	-	Decrease	Increase	Decrease
Wells Fargo									
a12	-	-	-	-	Negative	Positive	Negative	Positive	Negative
g12	Signif.	Signif.	Signif.	-	Signif.	-	Signif.	-	Signif.
d12	-	-	-	Decrease	Decrease	Decrease	-	-	-
Europe Banks									
Banco Santander									
a12	Positive	-	Positive	Negative	Positive	Negative	Negative	-	Negative
g12	-	-	-	Signif.	Signif.	Signif.	Signif.	-	Signif.
d12	-	-	-	Decrease	-	Decrease	-	Increase	-

Table 15 (cont'd): Summary of Results

	EQU			IGB			HYB		
	Total	**Pre**	**Post**	**Total**	**Pre**	**Post**	**Total**	**Pre**	**Post**
Barclays									
a12	Negative	Negative	Positive	Negative	Positive	Negative	-	Positive	Negative
g12	Signif.	Signif.	Signif.	-	-	-	-	-	-
d12	-	-	Decrease	-	-	-	-	Decrease	Decrease
BNP Paribas									
a12	-	Negative	Positive	-	-	-	Negative	Negative	Negative
g12	-	Signif.	-	Signif.	-	Signif.	-	-	-
d12	-	-	-	Decrease	Increase	Decrease	Increase	Increase	Increase
Credit Suisse									
a12	-	-	-	-	-	Negative	Negative	-	Negative
g12	-	-	-	-	-	Signif.	-	-	-
d12	-	-	-	Decrease	Increase	-	Increase	Increase	Increase
Deutsche Bank									
a12	Negative	-	Negative	-	-	Positive	Negative	-	Negative
g12	Signif.	Signif.	Signif.	-	Signif.	-	-	-	-
d12	-	-	-	Decrease	-	Decrease	Increase	Increase	Increase
Crédit Agricole									
a12	-	-	-	-	Negative	-	-	-	Negative
g12	Signif.	-	Signif.	-	Signif.	-	Signif.	Signif.	Signif.
d12	-	-	-	Increase	-	Decrease	Decrease	Decrease	Increase
HSBC									
a12	-	-	-	Positive	Positive	Positive	Negative	Positive	Negative
g12	Signif.	Signif.	Signif.	-	Signif.	-	Signif.	-	Signif.
d12	Increase	-	Increase	Decrease	-	Increase	Increase	Decrease	Increase
ING Bank									
a12	Positive	Negative	Positive	-	Positive	Negative	Negative	-	Negative
g12	Signif.	-	Signif.	Signif.	Signif.	Signif.	-	-	-
d12	Increase	-	Increase	Decrease	-	-	Increase	-	Increase
Nordea Bank									
a12	Negative	-	Negative	-	-	Positive	Negative	-	Negative
g12	Signif.	-	Signif.	-	-	-	-	Signif.	-
d12	-	-	-	Decrease	-	Decrease	Increase	-	Increase
RBS									
a12	-	-	-	Negative	-	Negative	-	Negative	Positive
g12	Signif.	Signif.	Signif.	-	-	-	Signif.	-	Signif.
d12	-	-	-	-	-	Increase	-	-	-
Soc. Générale									
a12	-	Positive	-	-	Positive	Negative	Negative	-	Negative
g12	-	-	-	Signif.	-	Signif.	-	-	-
d12	-	Increase	-	Decrease	Increase	-	Increase	Decrease	Increase
Stand. Chart.									
a12	-	-	-	-	Negative	Negative	-	Positive	-
g12	Signif.	Signif.	Signif.	-	-	-	Signif.	Signif.	Signif.
d12	-	-	-	-	-	-	Decrease	-	Decrease

Table 15 (cont'd): Summary of Results

	EQU			IGB			HYB		
	Total	**Pre**	**Post**	**Total**	**Pre**	**Post**	**Total**	**Pre**	**Post**
UBS									
a12	-	-	Positive	Positive	-	-	-	-	-
g12	Signif.	-	Signif.	-	-	-	-	-	-
d12	Increase	-	Increase	Decrease	Decrease	Increase	-	-	-
Unicredit Group									
a12	Positive	-	Positive	-	Positive	-	-	Positive	-
g12	-	-	-	-	Signif.	Signif.	Signif.	Signif.	Signif.
d12	-	-	-	Decrease	-	Decrease	-	Decrease	-
Asia Banks									
Agri. Bank of China									
a12	-	-	-	-	-	-	-	-	-
g12	-	-	-	-	-	-	-	-	-
d12	-	-	-	Increase	-	-	-	-	-
Bank of China									
a12	-	-	-	-	-	Positive	Positive	-	Positive
g12	-	-	-	-	-	Signif.	-	-	-
d12	-	-	Increase	Increase	-	Increase	Decrease	Increase	Decrease
China Const. Bank									
a12	-	-	-	Positive	Negative	Negative	-	-	-
g12	-	-	-	-	-	-	-	-	Signif.
d12	-	Decrease	Increase	Increase	Decrease	-	-	-	-
I & C Ban of China									
a12	Negative	Negative	Negative	-	-	-	-	Negative	-
g12	Signif.	Signif.	Signif.	-	-	-	Signif.	-	Signif.
d12	-	-	-	Increase	-	Increase	-	-	-
Mitsubishi									
a12	-	-	-	-	Positive	-	Positive	-	Positive
g12	-	-	-	Signif.	Signif.	-	Signif.	-	Signif.
d12	-	Increase	Increase	Increase	Increase	Increase	Decrease	Increase	Decrease
Mizuho									
a12	Negative	-	Negative	Positive	-	Positive	Negative	-	Negative
g12	-	-	-	Signif.	-	Signif.	Signif.	-	Signif.
d12	-	Increase	-	-	Decrease	Increase	Increase	Increase	Increase
Sumitomo									
a12	-	-	-	-	Negative	Positive	-	Positive	Positive
g12	-	-	-	-	-	Signif.	-	Signif.	Signif.
d12	-	-	-	Increase	-	Increase	Decrease	Decrease	Decrease

4.5 Weekly Data

We also estimate our asymmetric VAR(1)-BEKK-GARCH (1,1) model using weekly data to examine any differences in result due to timing differences in equity returns of G-SIBs as they are traded on exchanges located in various time zones. Empirical literature has used both daily and weekly data with no consensus on which approach is better. We report the results of the weekly model in the appendix. The weekly results reveal that some of the coefficients significant in the daily model become insignificant on a weekly basis. This shows that financial markets react extremely quickly to the arrival of new information, and weekly returns are not able to fully capture the impact of new information.

4.6 Disruptive Banks vs. Stabilizing Banks

Based on the analysis of the whole sample period above, we classify banks having overall positive volatility spillovers to all two or more financial markets as being disruptive, while banks that have negative volatility spillovers to two or more markets are said to have a stabilizing effect in the global financial markets. Over here, we look at the total spillover effect, not the asymmetric response. Since spillovers are one way of analyzing interconnectedness, we feel that banks that have positive spillovers should be judged differently than those G-SIBs that have negative volatility transmission. Table 16 gives the list of G-SIBs that play a disruptive role and stabilizing roles in the global financial market. The number in parenthesis points to the bucket number in which the G-SIB lies according to FSB criteria.

The results in the table clearly point out that there is no G-SIB that is causing disruptions in any of the global financial markets. None of the five largest banks in the world, Industrial &

Commercial Bank of China, China Construction Bank, Agricultural Bank of China, Bank of China and HSBC figure in the list of disruptive or stabilizing banks. With the exception of JP Morgan Chase and Bank of America, none of the other stabilizing banks are part of the ten largest banks. In our view, this might indicate that size should not be a criteria when judging the systemic importance of banks, and the G-SIB identifying criteria could be revised so that other factors such as interconnectedness could be given more weightage in calculation of scores.

Table 16: Disruptive Banks vs. Stabilizing Banks

Disruptive Banks	Stabilizing Banks
None!	JP Morgan Chase (4)
	Bank of America (3)
	Deutsche Bank (3)
	Goldman Sachs (2)
	Barclays (2)
	Morgan Stanley (1)
	Bank of New York (1)
	Banco Santander (1)
	Nordea Bank (1)
	Mizuho (1)

4.7 Important Banks vs. Less Important Banks

We classify banks as being systemically important versus less systemically important based on the number of markets that receive spillovers from G-SIBs. Important banks are those that transmit news shock or volatility spillovers to two or more markets while less important G-SIBs are those that impact only one market. In this case, we do not distinguish between positive and negative spillovers but focus only on transmission of shocks.

We can see from Table 17 that less than half the G-SIBs are systemically important according to our empirical analysis. Among the important banks, Bank of America, State Street and HSBC do not cause spillovers to the global equity market. The only Asian bank with systemic importance is Mizuho Bank and none of the Chinese banks affect more than one financial market. Citigroup, Crédit Agricole, Standard Chartered, Agricultural Bank of China and Sumitomo Bank do not cause any volatility spillover at all. In other words, 5 out of 30 banks classified as G-SIBs have no impact on the global financial markets and do not show evidence of interconnectedness. Citigroup and Agricultural Bank of China are among the largest in the world but do not transmit shocks globally.

We feel that the balance sheets of these banks as well as some less important banks reflect this decline in systemic importance. Citigroup has fallen from bucket 4 to bucket 3 from the G-SIB list released in 2016 to the list in 2017. BNP Paribas and Credit Suisse have fallen from bucket 3 to bucket 2, while Bank of China has fallen from bucket 2 to bucket 1. In our view, market-based measures to estimate interconnectedness have been able to capture the fall in systemic importance and regulators should consider extending their methodology of calculation of scores to include market measures as well.

Table 17: Important Banks vs. Less Important Banks

Important Banks	Less Important Banks	Banks with No Spillovers
JP Morgan (4)	Wells Fargo (2)	Citigroup (3)
Bank of America (3)	BNP Paribas (2)	Crédit Agricole (1)
Deutsche Bank (3)	Bank of China (2)	Standard Chartered (1)
HSBC (3)	China Cons. Bank (2)	Agric. Bank of China (1)
Barclays (2)	I & C Bank of China (2)	Sumitomo (1)
Goldman Sachs (2)	Mitsubishi (2)	
Bank of NY (1)	RB of Canada (1)	
ING Bank (1)	Credit Suisse (1)	
Mizuho (1)	RB of Scotland (1)	
Morgan Stanley (1)	Société Générale (1)	
Nordea Bank (1)	UBS (1)	
Banco Santander (1)	Unicredit Group (1)	
State Street (1)		

CHAPTER 5: Summary and Conclusion

The objective of our research was to analyze if G-SIBs were really interconnected with the global financial markets by being a source of volatility spillovers to these markets in the period before and after the Global Financial Crisis of 2007-09. It was our view that the current methodology of calculating systemic importance of banks by giving equal importance to size, substitutability, interconnectedness, cross-jurisdictional activities and complexity was not ideal. Some indicators like interconnectedness might be more crucial in assessing systemic importance as the more interconnected the bank, the greater the chances of it causing disruptions to the international financial system and global economic activity. We specifically feel that giving equal weightage to size and interconnectedness might not be suitable in capturing true systemic importance and we propose that an alternative approach should be considered by FSB.

An empirical analysis of volatility spillovers originating from G-SIBs to global financial market shows that only 13 out of 30 GSIBs affect two or markets. 5 G-SIBs have no spillovers to any of the global financial markets. This clearly shows that market participants and regulators view systemic importance differently. Regulators base their scores on balance sheet information and other disclosures from the banks which are usually not available on a daily basis. Market participants react to positive and negative shocks to the G-SIBs immediately and their response is visible the next trading day in the financial market. This discrepancy in available information could be one reason why we feel that only 13 out of the 30 G-SIBs identified by FSB are systemically important in the eyes of investors.

Our results also show that banks that score low on systemic importance are more integrated with the global financial markets as compared to some banks that lie in higher buckets. It has also been mentioned earlier that the lower the bucket, the lower the capital buffer required. If the goal of regulators in imposing capital surcharges is to safeguard taxpayer money in bailouts by the government by ensuring that banks have adequate capital to protect themselves in crises, then these banks will have less funding available to save themselves during instability as compared to G-SIBs in higher buckets. In other words, a bank that poses more systemic risk has a lower score according to the five criteria used by FSB and is funded less adequately due to lower capital surcharges. We feel by underestimating the systemic importance of such banks, the regulators have defeated the purpose of Basel III guidelines to a large extent and left room for future defaults. Moreover, some smaller banks might have been left unregulated since their systemic score is low due to their size and as a result, they do not qualify as G-SIBs. However, these banks might be even more highly interconnected with the global financial markets than the 30 G-SIBs and pose greater systemic risk.

We also feel that some banks will deliberately try to lower their systemic score to escape capital surcharges by reducing their profitable corporate and investment banking activities in certain areas to lower the amount of risk-weighted assets they hold. However, shrinking these activities might not reduce their interconnectedness with the global financial markets. Such banks will continue to have less shock-absorbing equity to protect themselves in times of crisis and will either default or need government support to survive. Furthermore, by consciously reducing profitable business activities to lessen the G-SIB buffer requirement, some banks will face an erosion in their return on equity. Banks like JP Morgan that do not follow this strategy have safeguarded their profitability but ended up in a higher bucket and with more surcharges. We feel that as more banks adopt this tactic to avoid higher capital requirements, their systemic importance will be masked but their interconnectedness might still remain.

The findings further show that G-SIBs are more weakly integrated with the global equity market as compared to the investment-grade and the high-yield bond market. The high-yield bond market is the most exposed to spillovers arising from the G-SIBs, and volatilities in this market can somewhat be predicted by the previous day's shocks to G-SIBs. The regulators could closely monitor this market to see signs of any impending financial instability.

Another significant finding of our research is the possibility of negative spillovers originating from G-SIBs and their stabilizing role in the global financial market. Our previous discussion shows that most of the G-SIBs have negative spillovers in one or more financial markets. We feel that GSIBs that generate negative volatility spillovers are more “important” due to their stabilizing role and that FSB should reassess capital buffer requirements accordingly. Such banks might be unfairly forced to increase Tier-1 capital and face a reduction in return on equity. If G-SIBs with negative spillovers end up consciously reducing their risk-weighted assets by rethinking their business strategies, then it might have an impact on their stabilizing role.

We also feel that if majority of the G-SIBs are not causing disruption in the global financial markets, then it might be the players in the shadow banking system that are a cause of concern. “The shadow banking system is the complex credit intermediation network operating outside of the regulated banking sector” (Lysandrou and Nesvetailova, 2015). There has been considerable growth in the shadow banking system in the last three decades. The assets of the shadow banking system just before the global financial crisis were estimated by Gorton and Metrick (2012) to be almost as large as those of commercial banks. Accordingly the FSB should also consider examining interconnectedness arising from non-bank financial intermediaries that form the shadow banking system and evaluate which participant of the global financial system is actually more “important”. The answer to the question “Are Systemically Important Banks Really ‘Important’” posed by this thesis might just lie in that evaluation.

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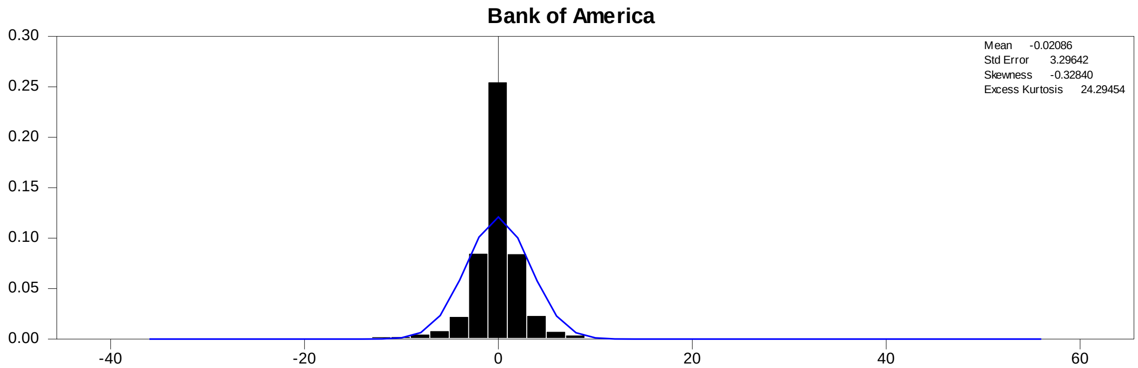
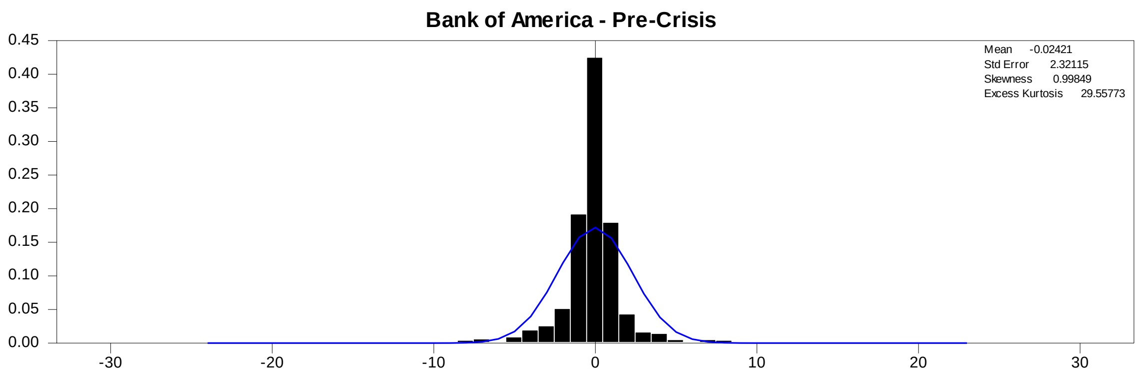
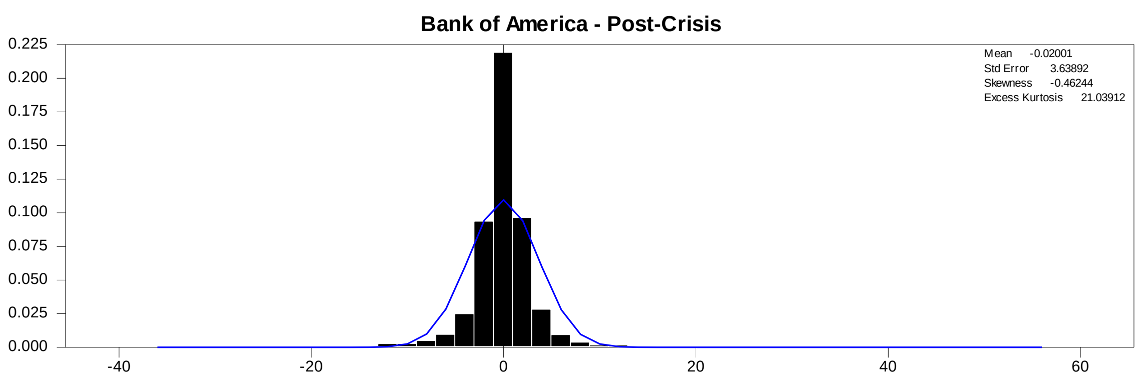
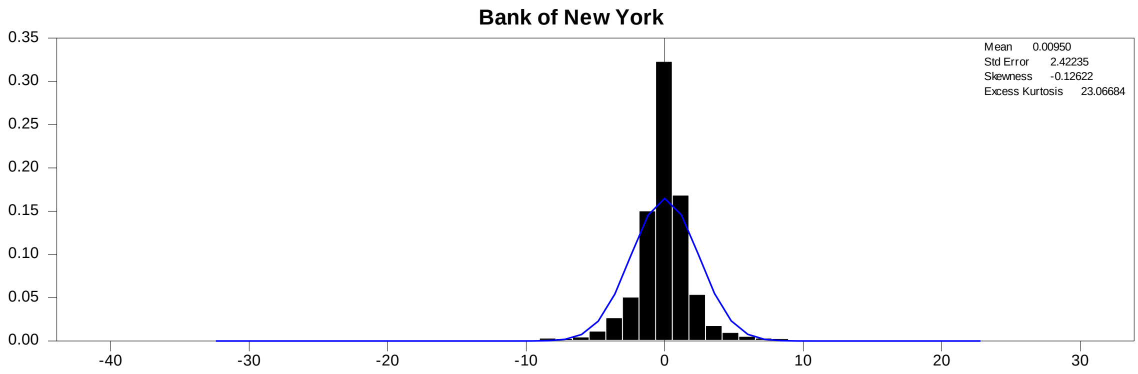
Appendix

Graphs of Descriptive Statistics:





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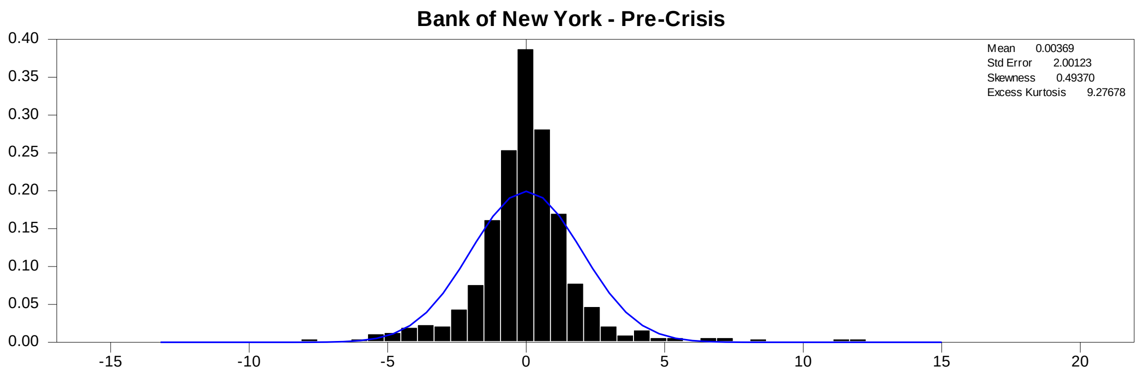
Excess Kurtosis 23.06684


Bank of New York - Pre-Crisis
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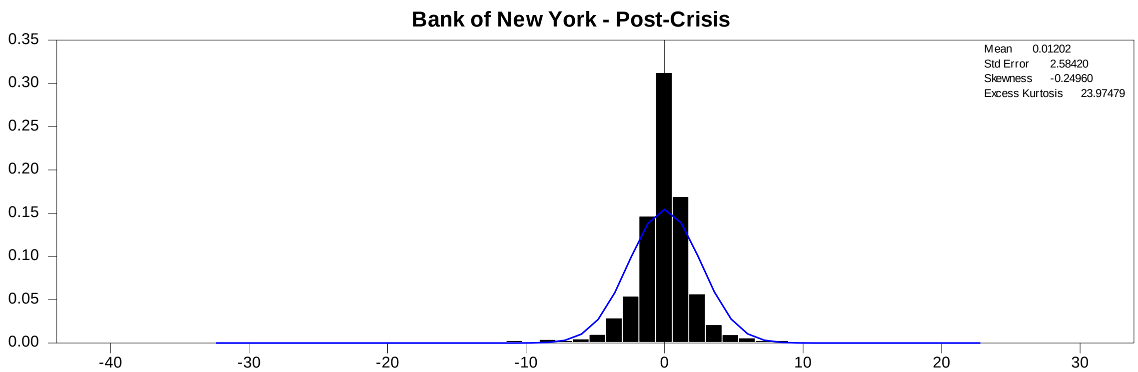
Bank of New York - Post-Crisis
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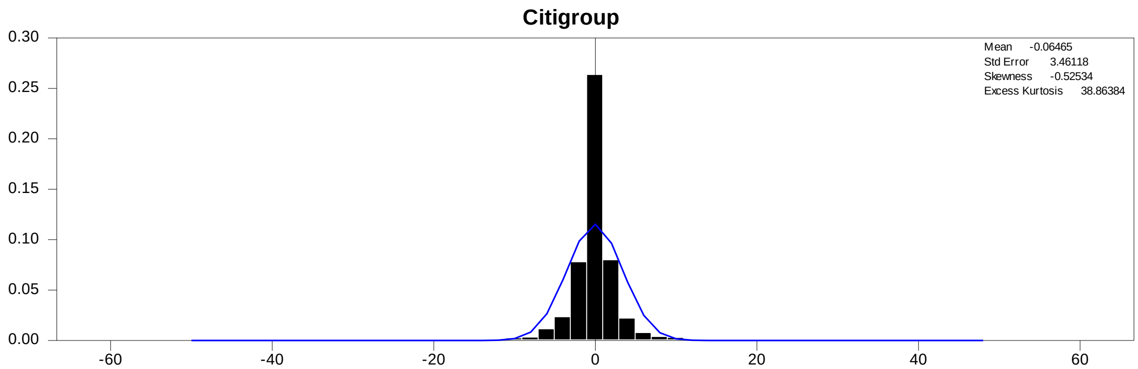
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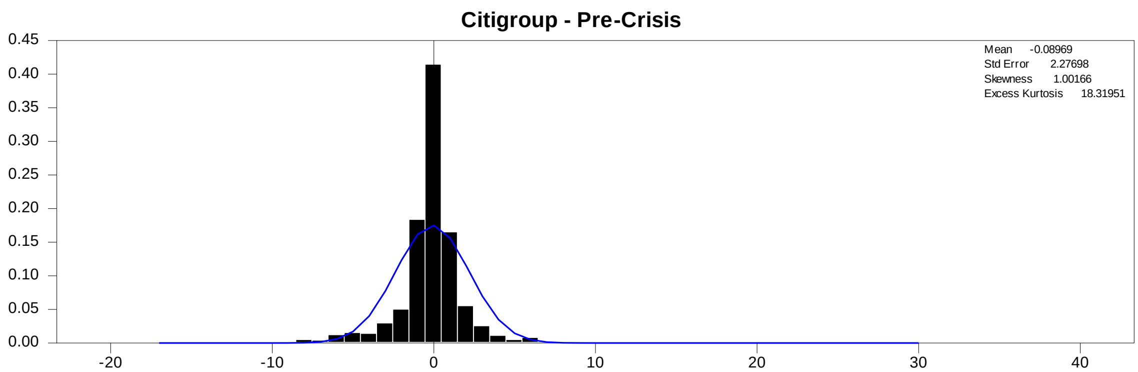
Excess Kurtosis 38.86384


Citigroup - Pre-Crisis
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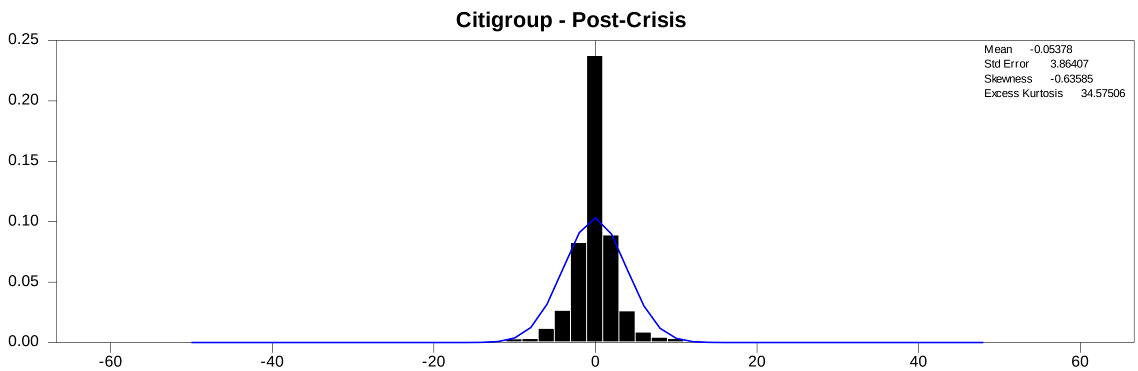
Excess Kurtosis 18.31951


Citigroup - Post-Crisis
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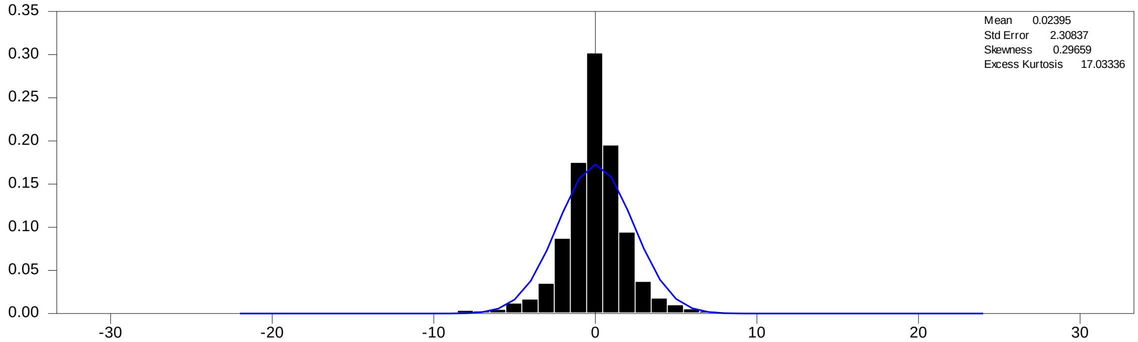
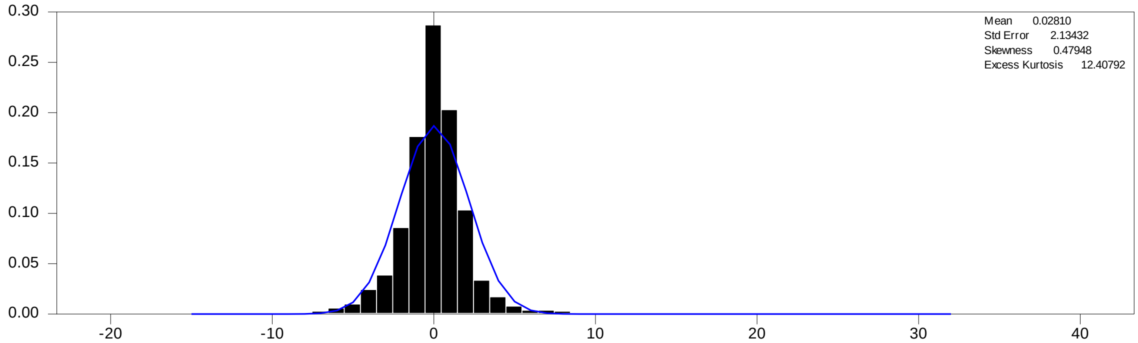
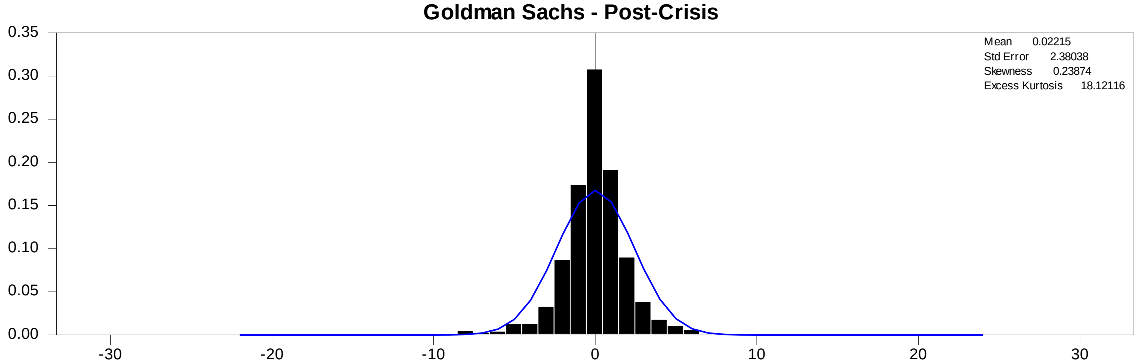
Goldman Sachs



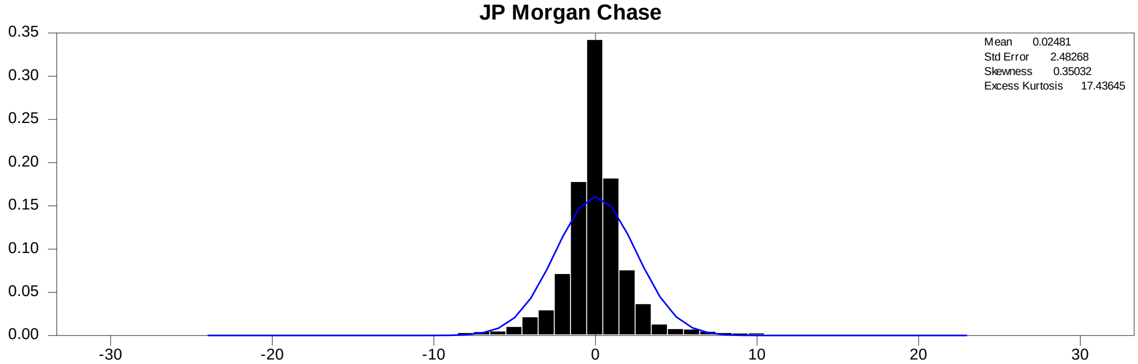
Goldman Sachs - Pre-Crisis



Goldman Sachs - Post-Crisis



JP Morgan Chase



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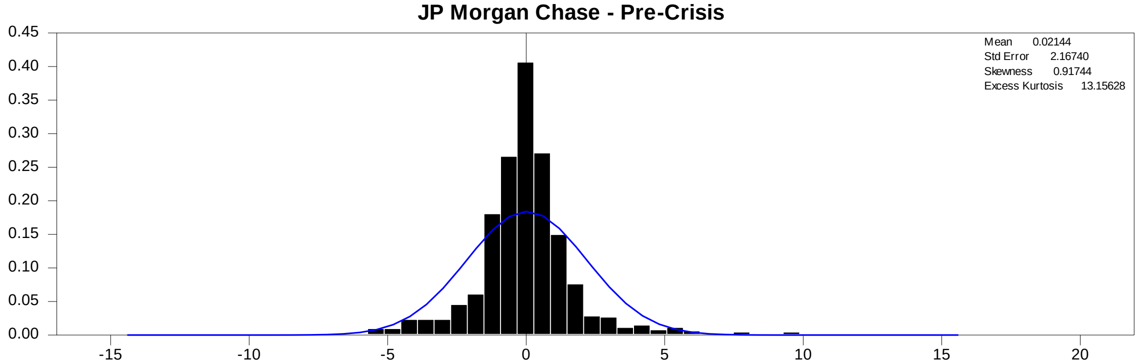

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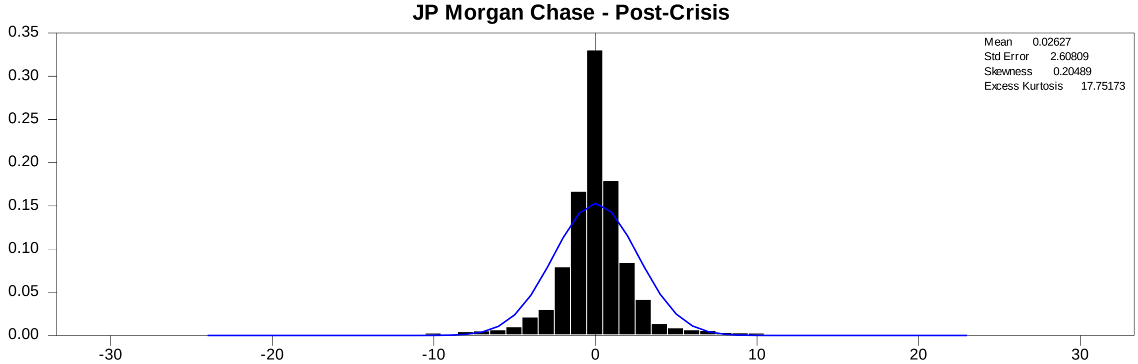
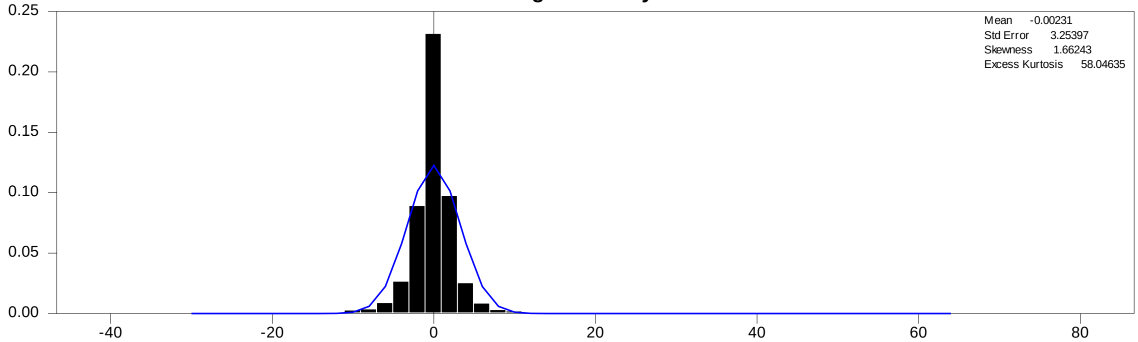


Morgan Stanley



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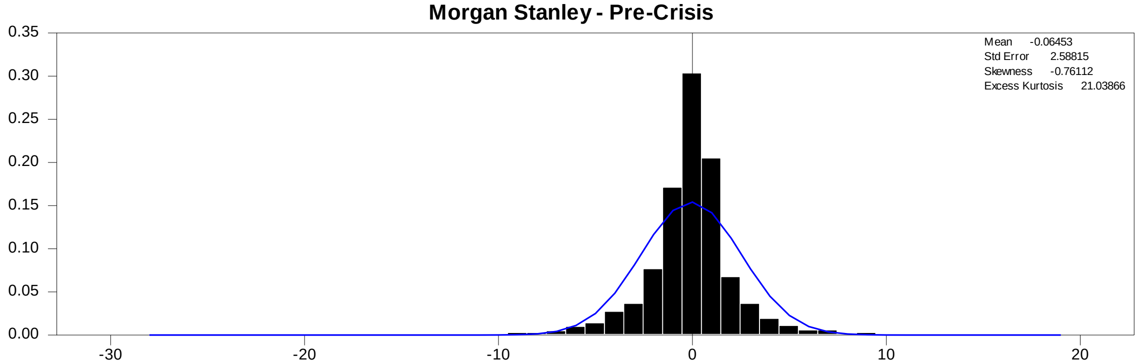

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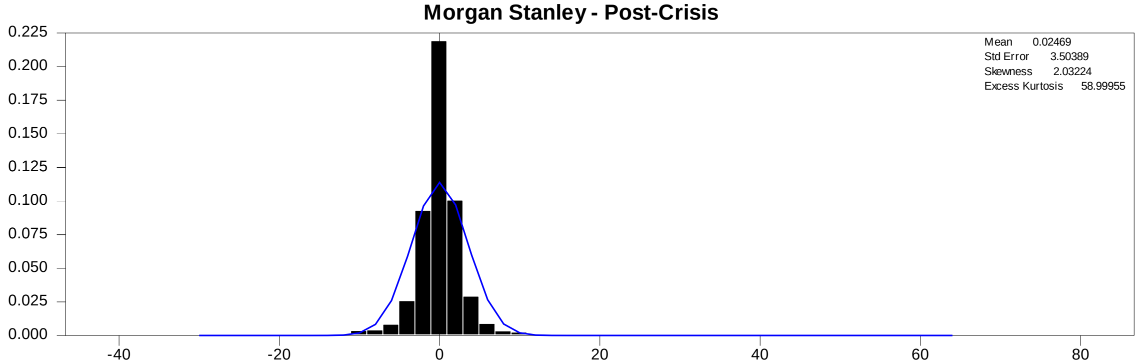

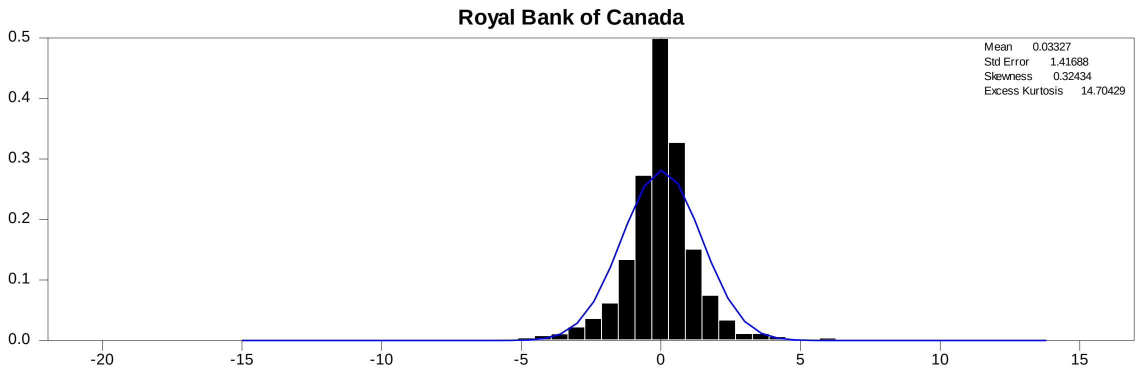
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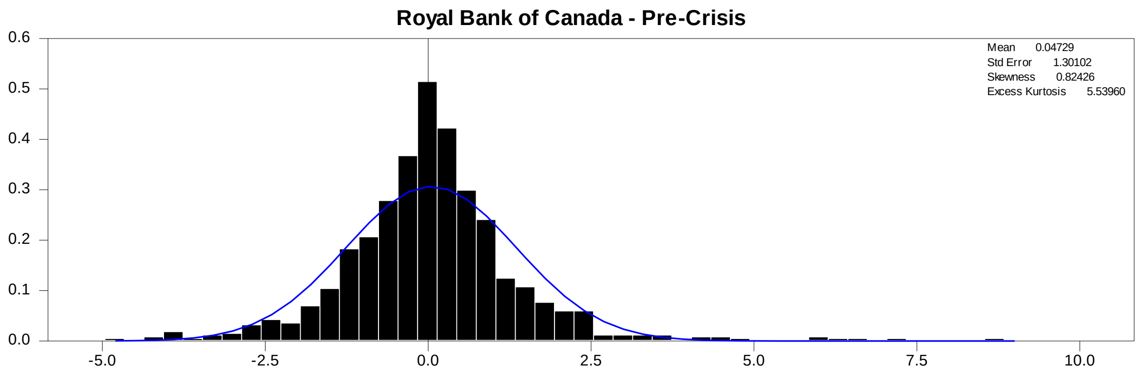
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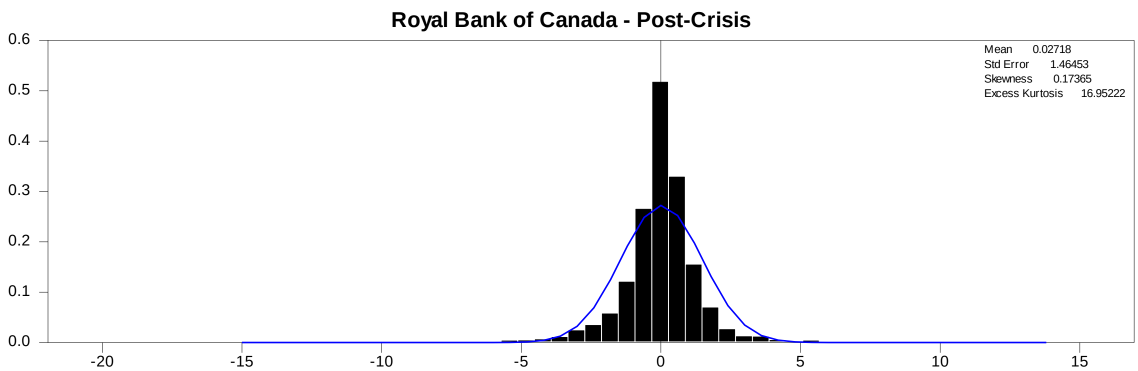
Excess Kurtosis 5.53960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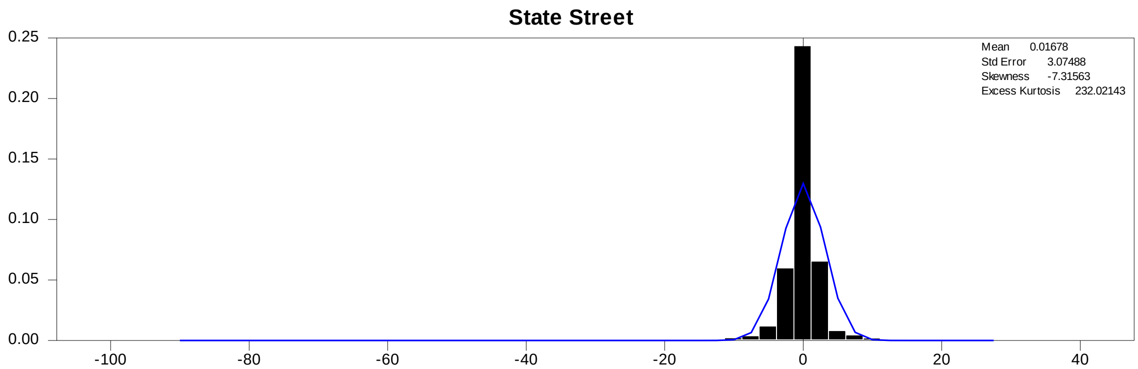
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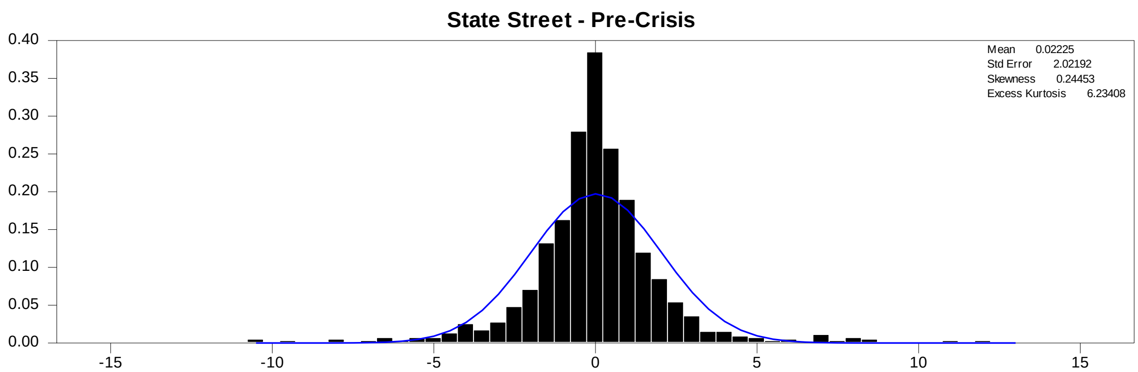
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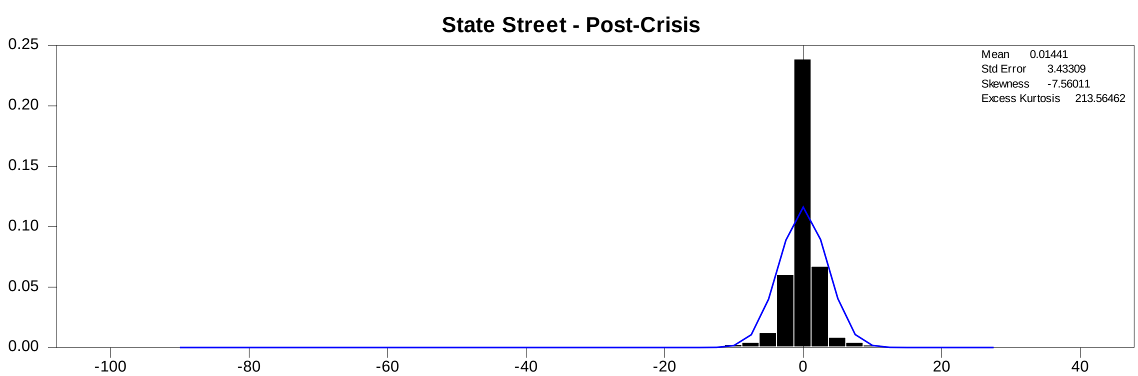
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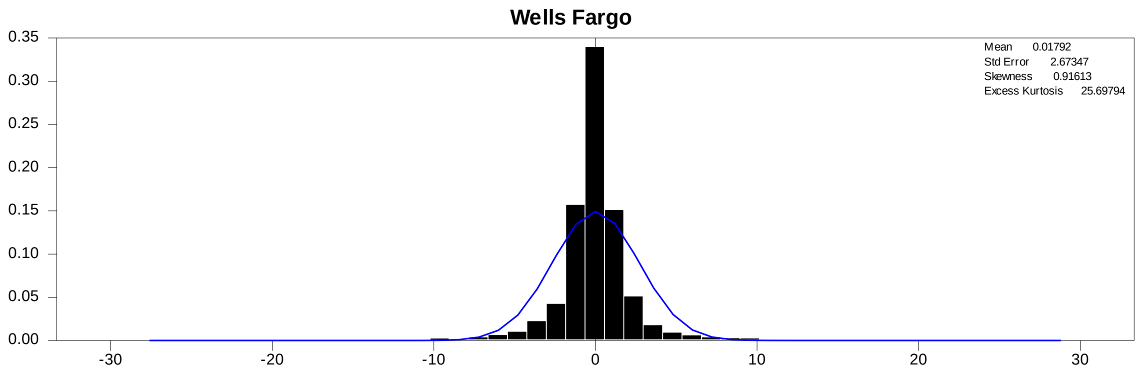
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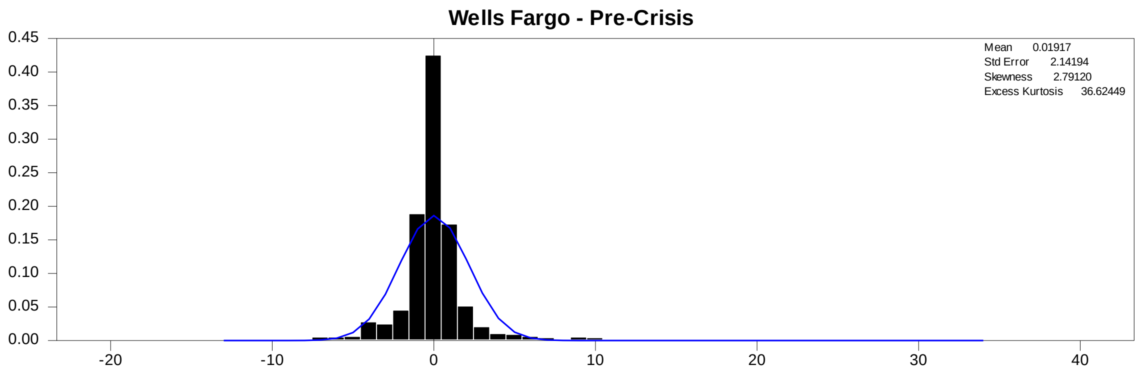
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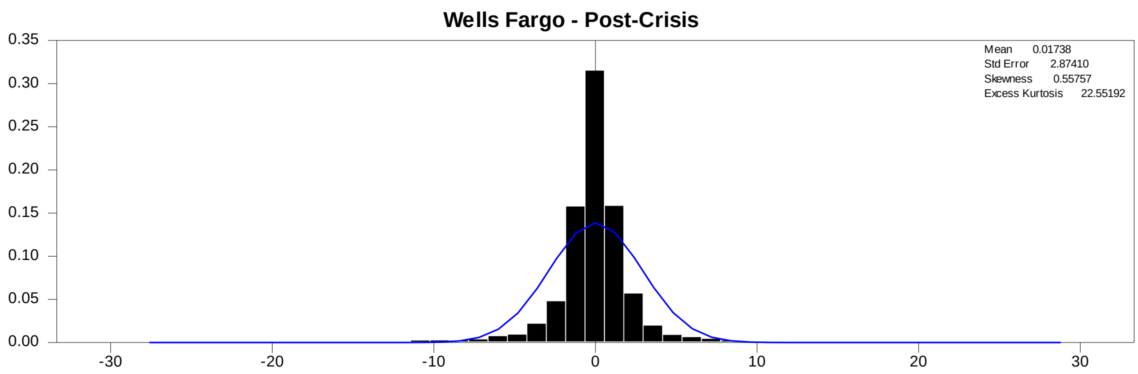
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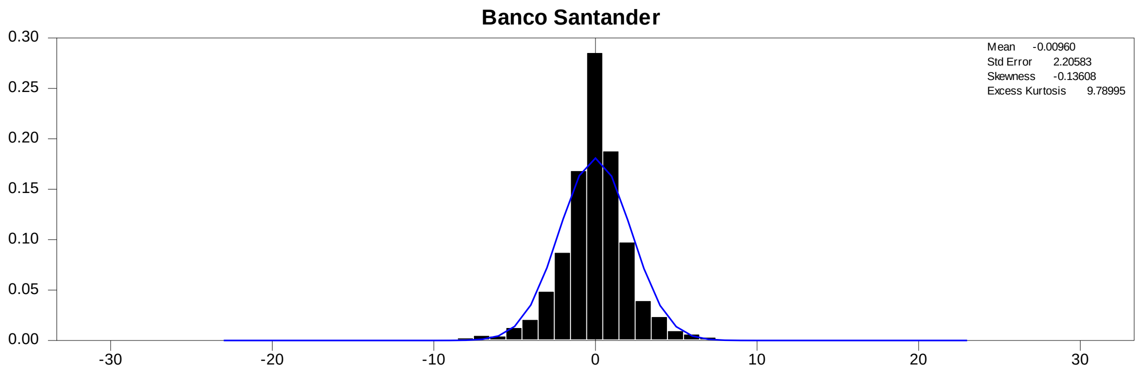
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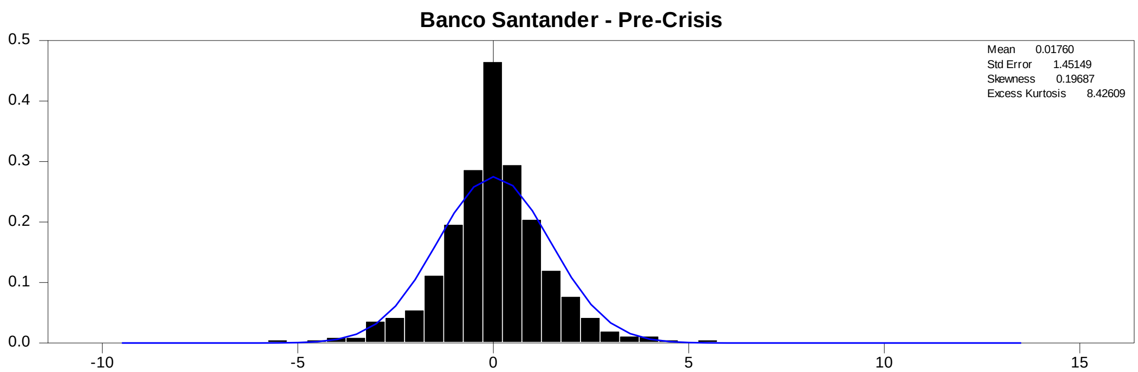
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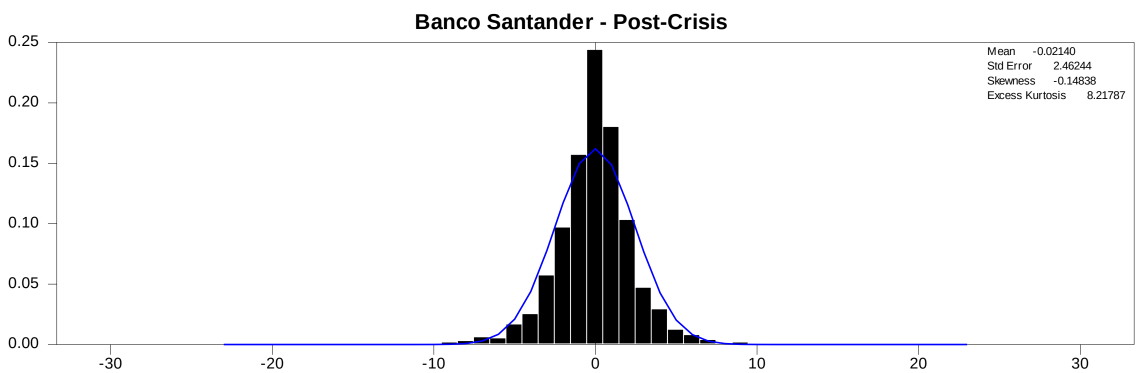
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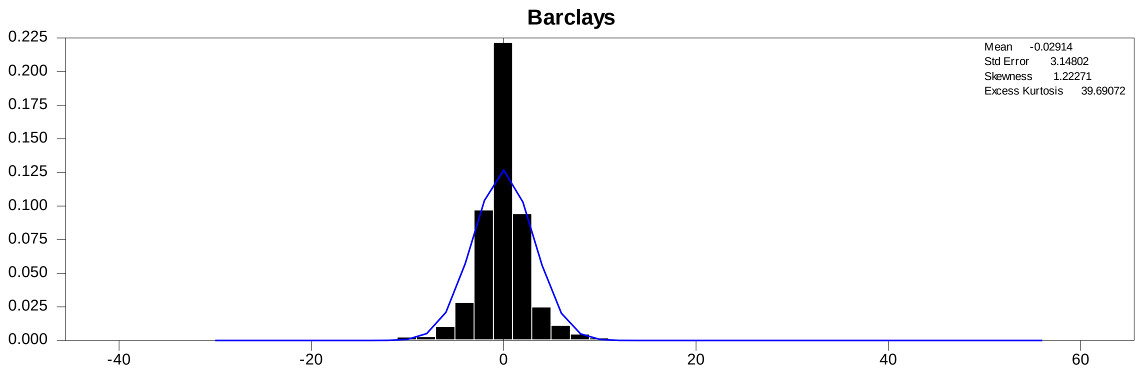
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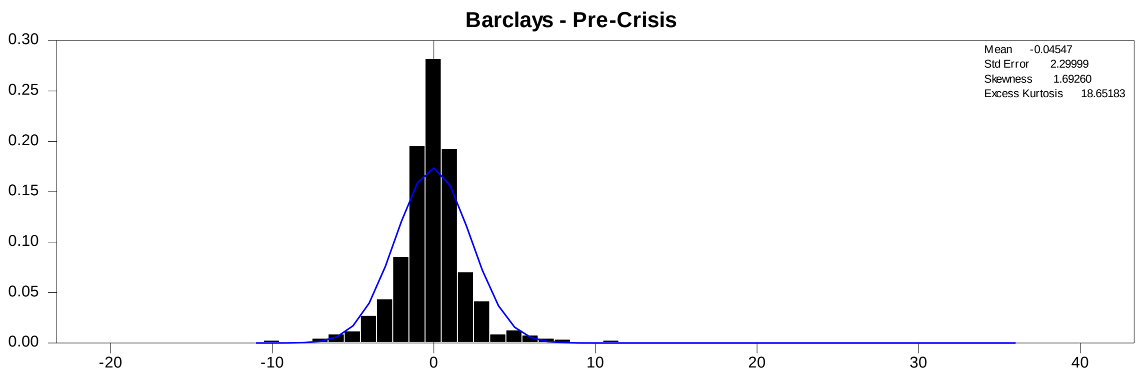
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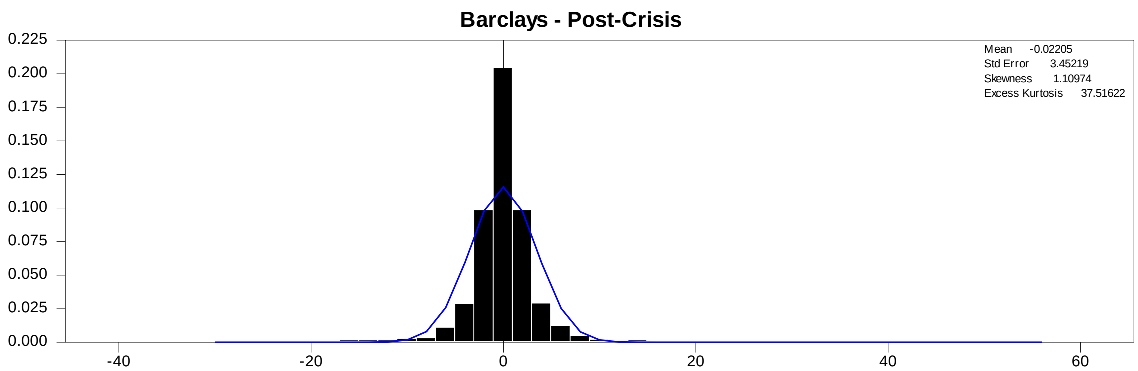
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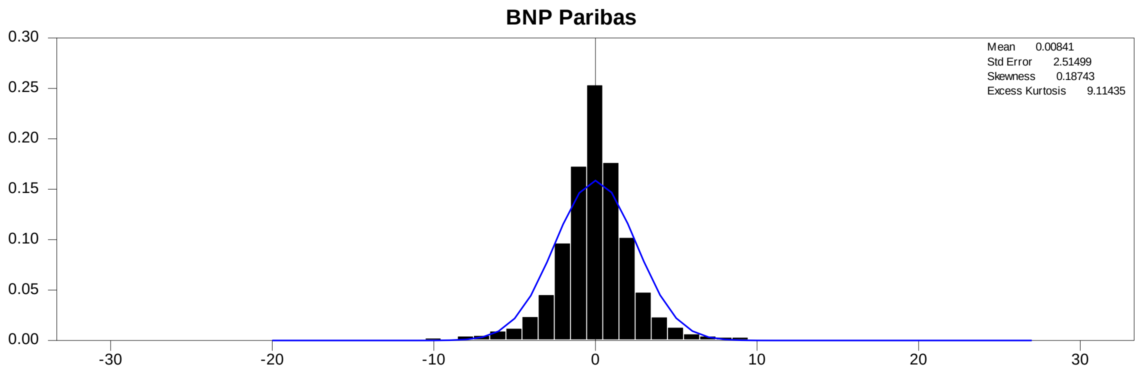
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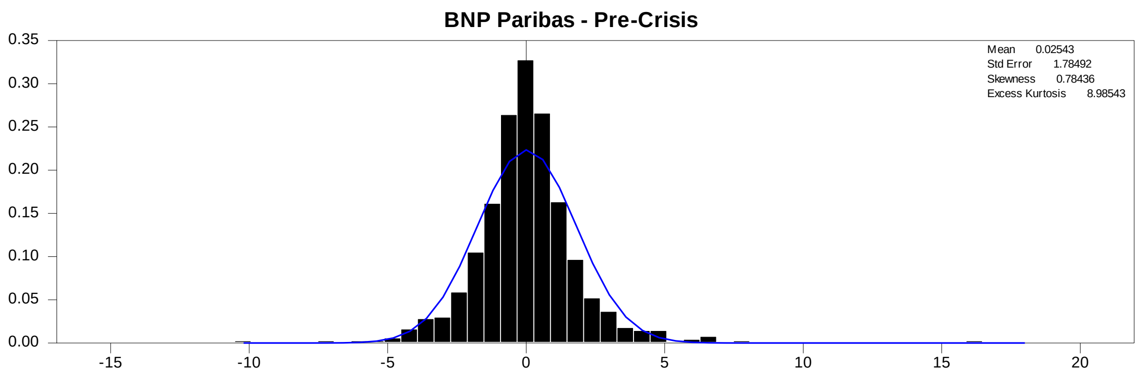
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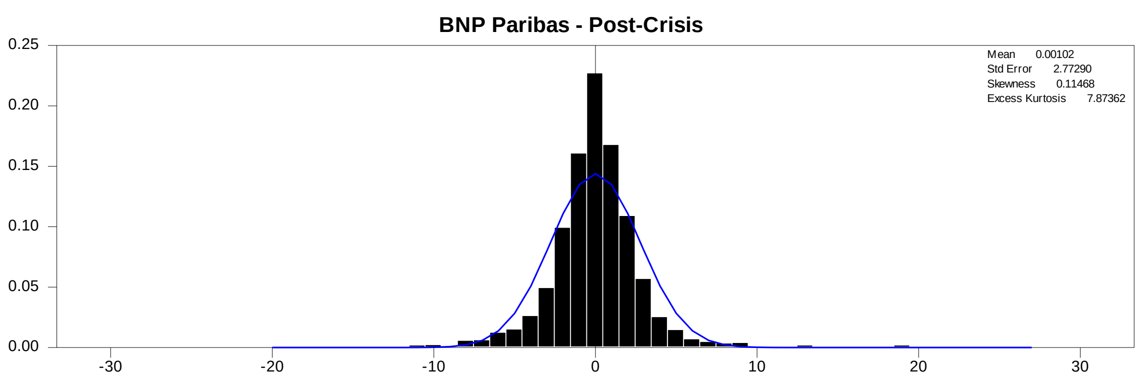
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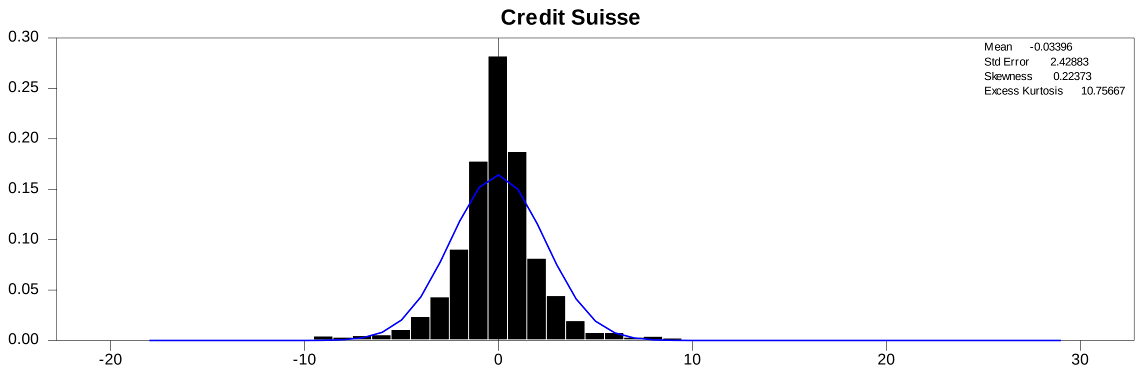
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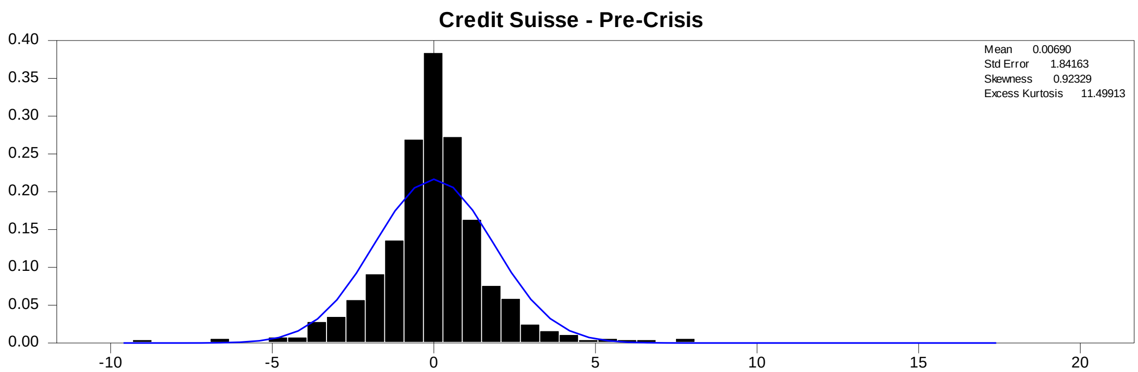
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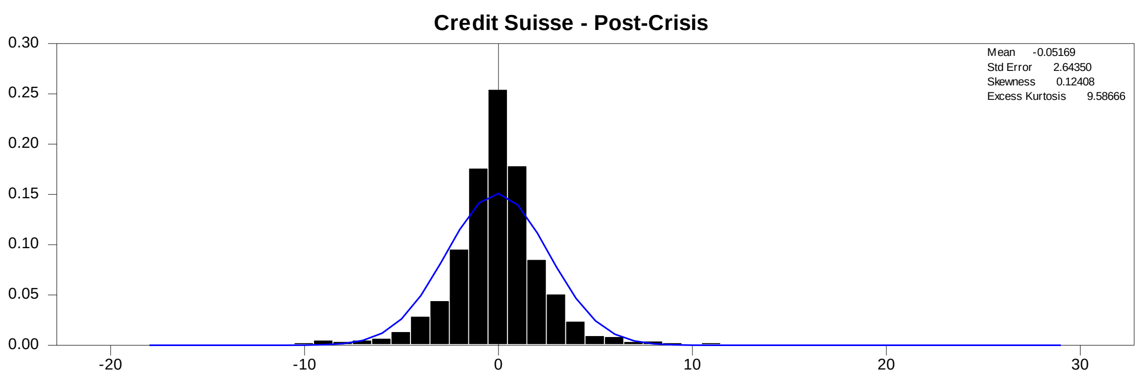
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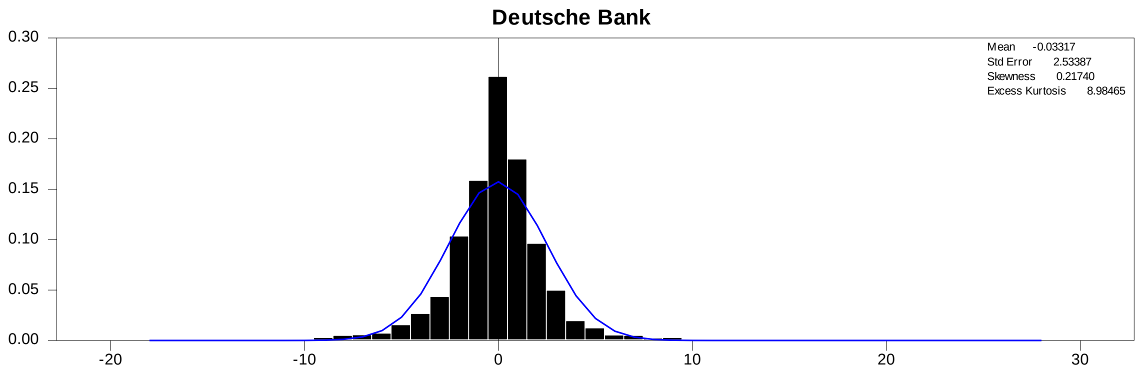
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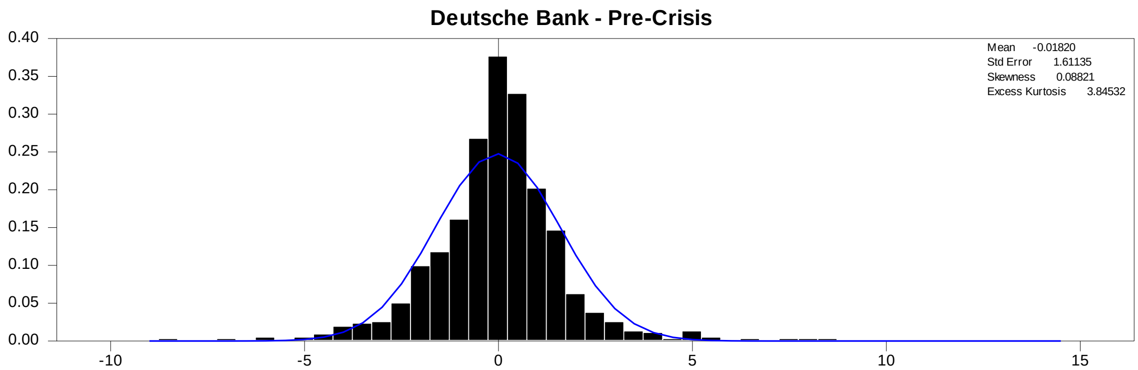
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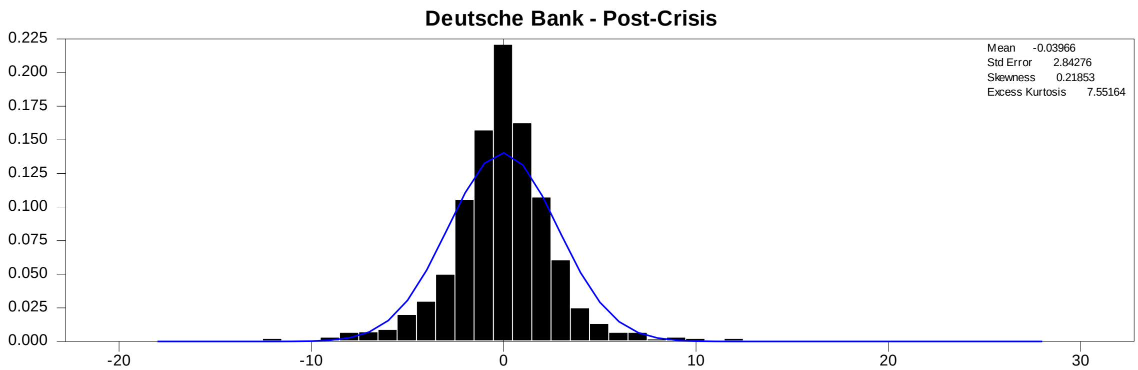
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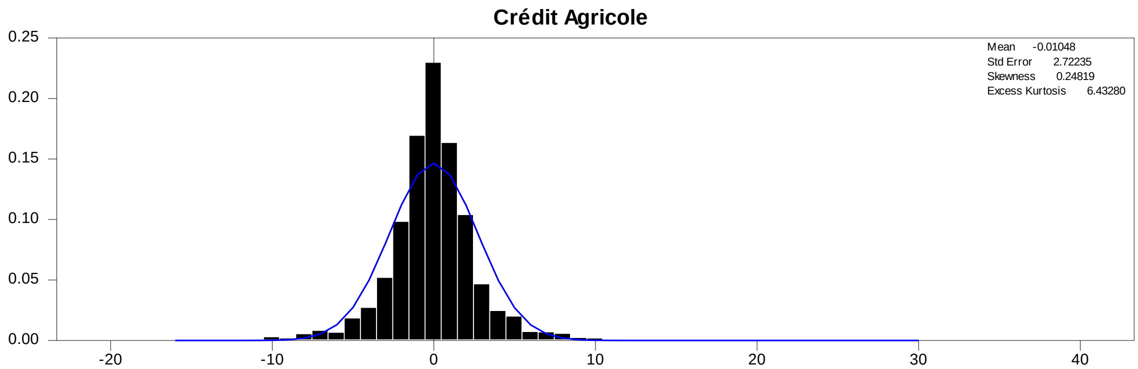
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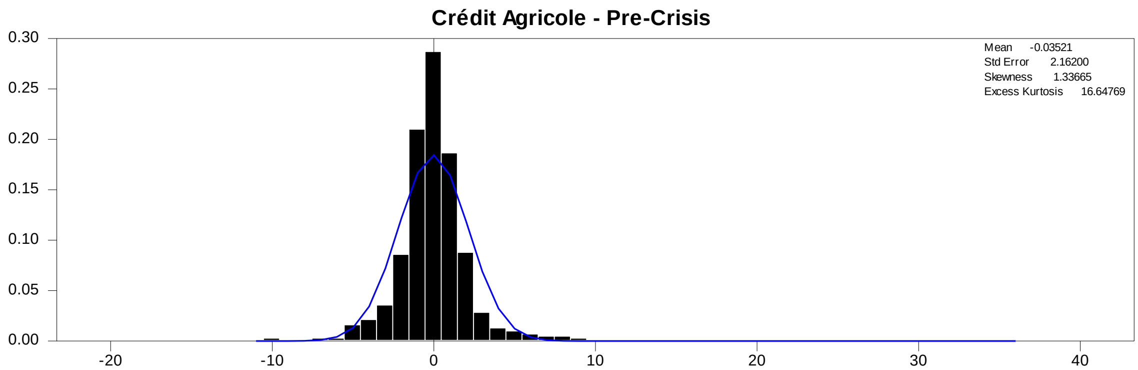
Crédit Agricole - Pre-Crisis
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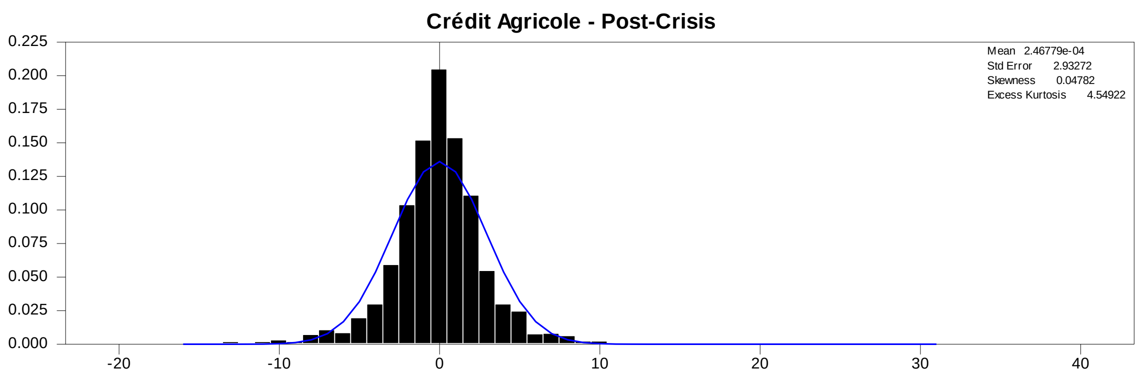
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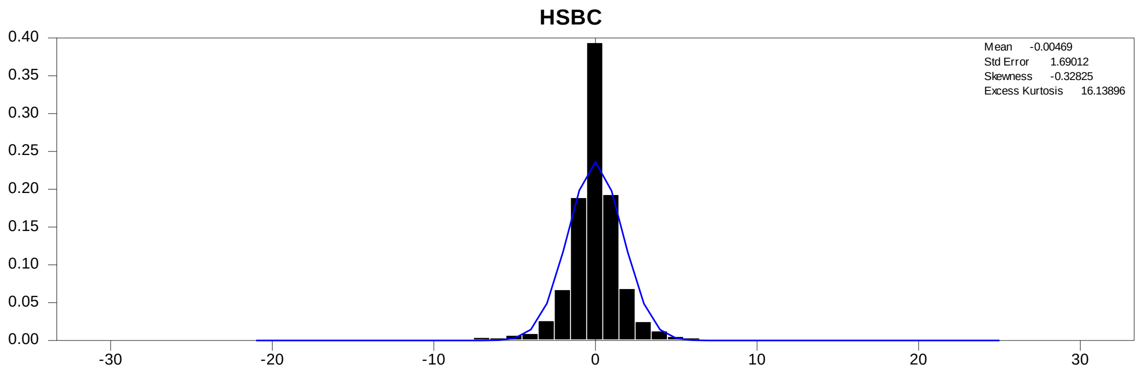
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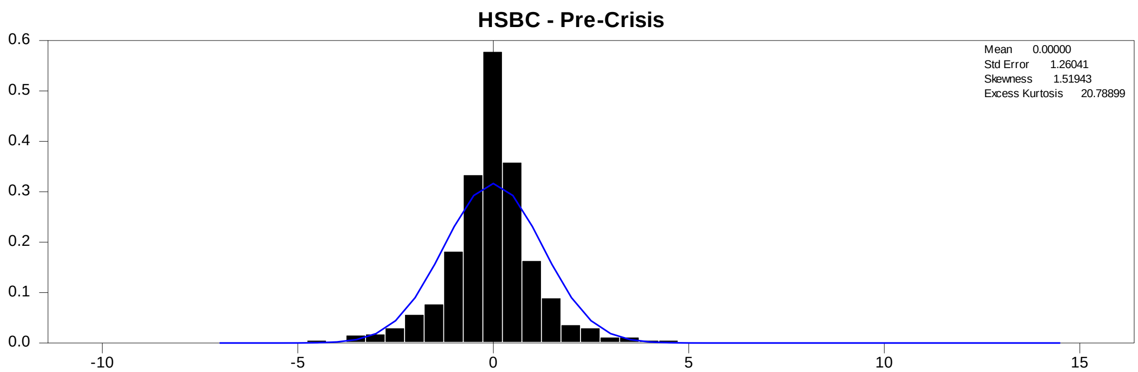
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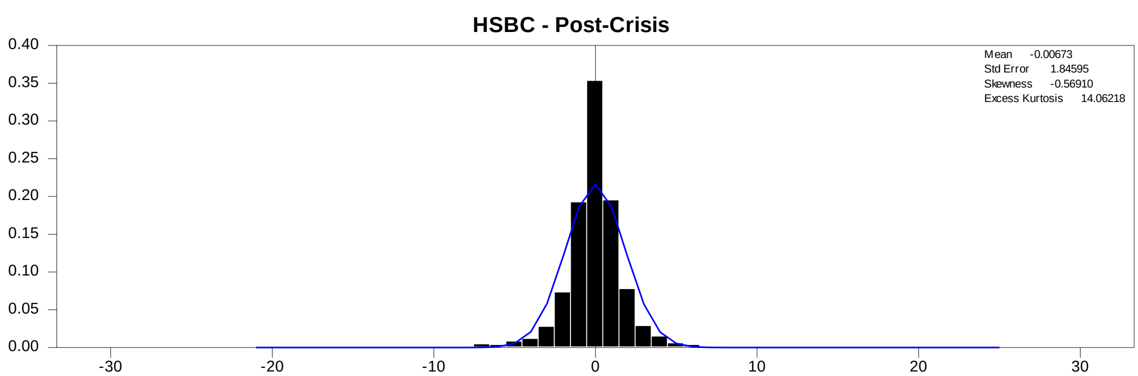
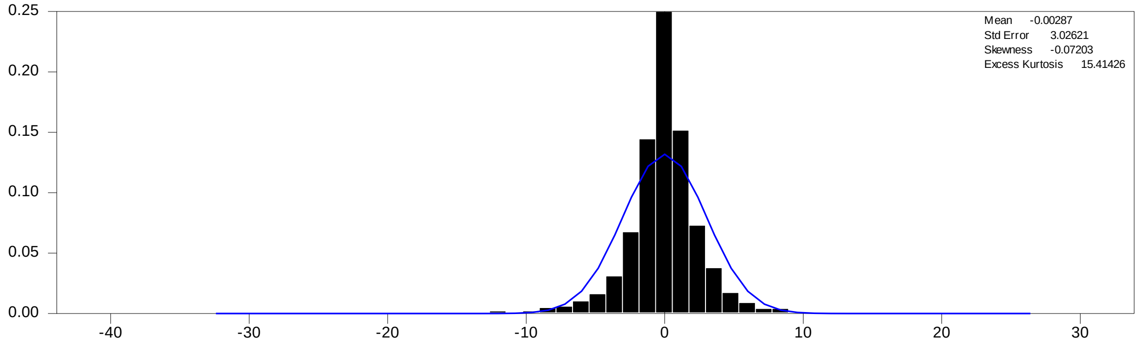
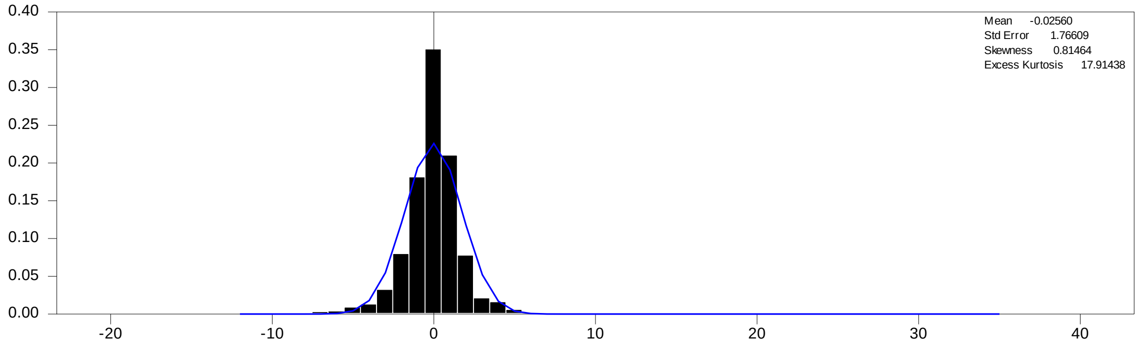

HSBC - Post-Crisis
Mean -0.00673
Std Error 1.84595
Skewness -0.56910
Excess Kurtosis 14.06218

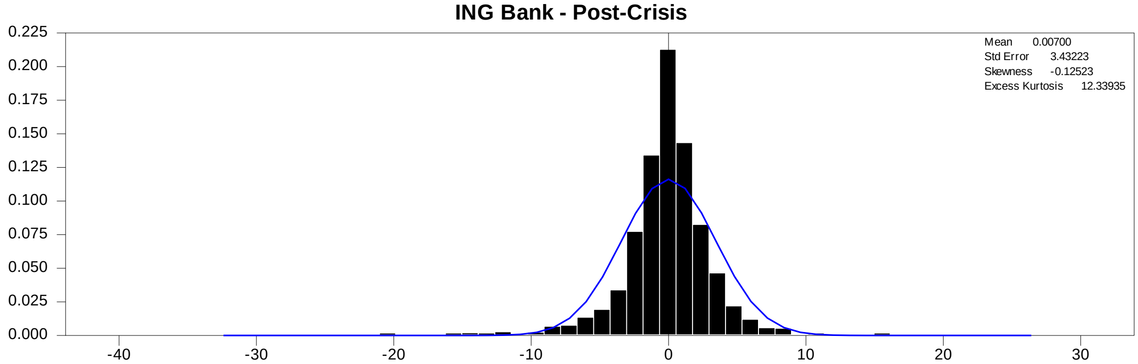
ING Bank

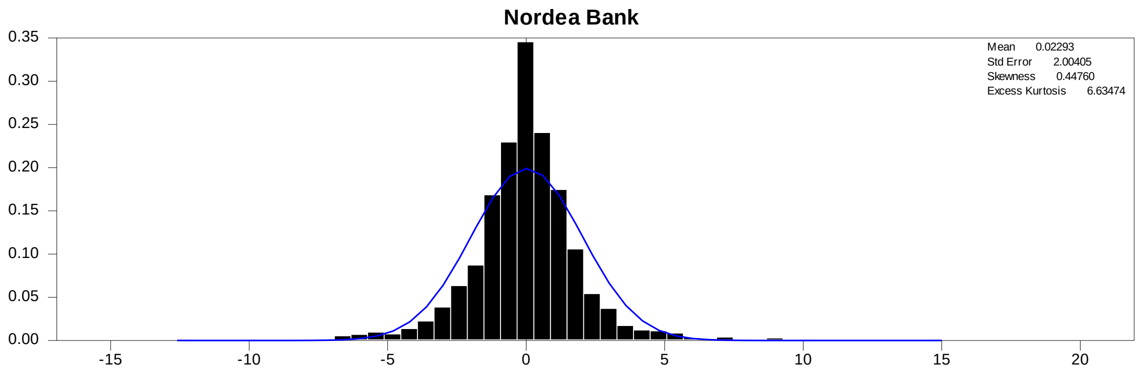


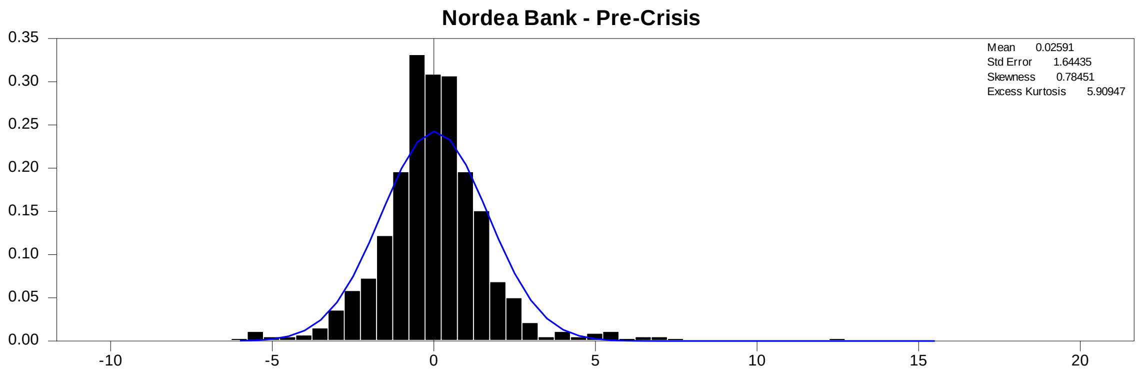
ING Bank - Pre-Crisis

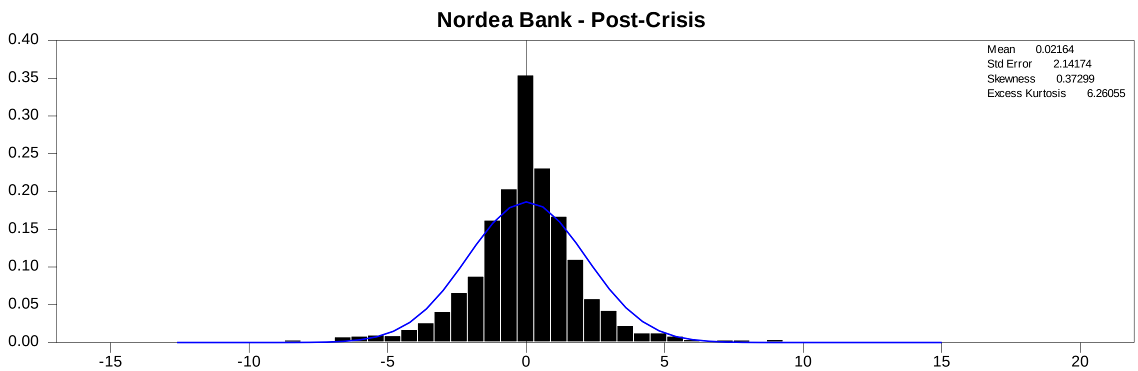


ING Bank - Post-Crisis

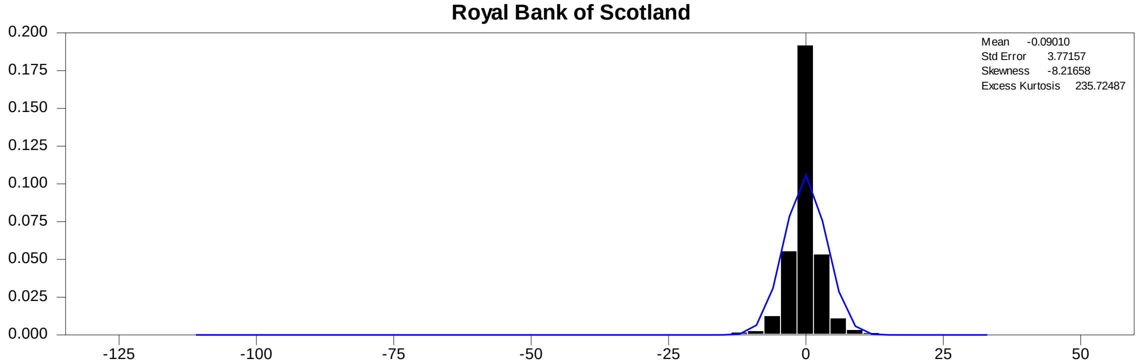



Nordea Bank
Mean 0.02293
Std Error 2.00405
Skewness 0.44760
Excess Kurtosis 6.63474

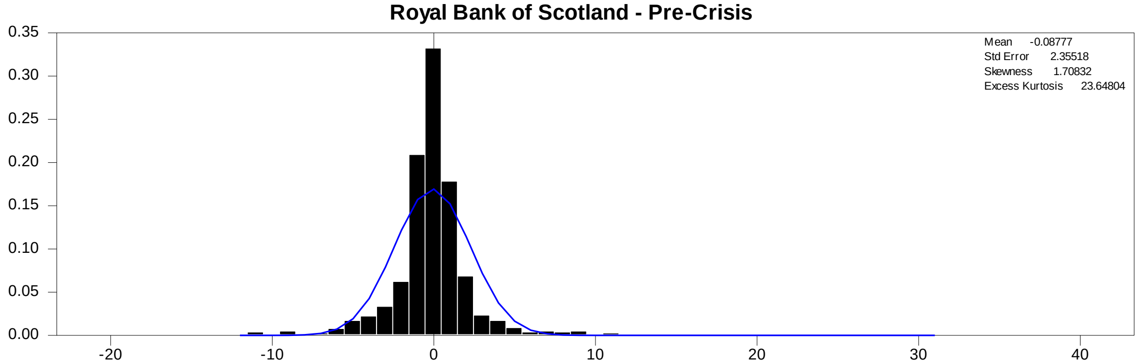

Nordea Bank - Pre-Crisis
Mean 0.02591
Std Error 1.64435
Skewness 0.78451
Excess Kurtosis 5.90947


Nordea Bank - Post-Crisis
Mean 0.02164
Std Error 2.14174
Skewness 0.37299
Excess Kurtosis 6.26055

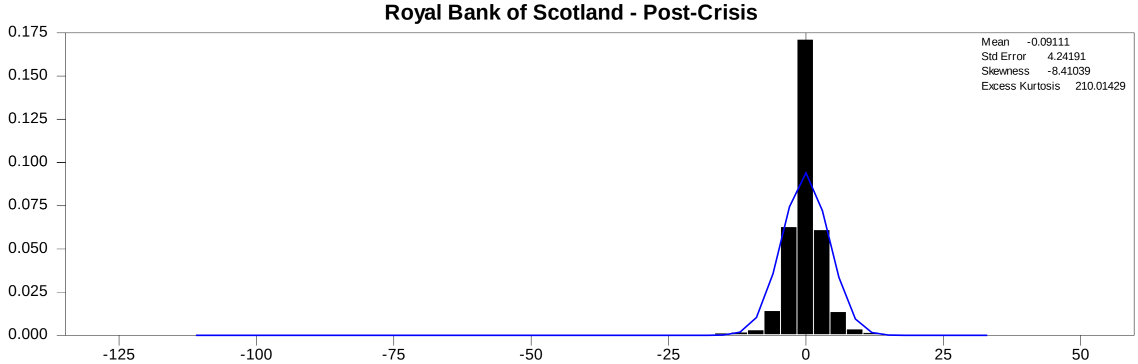
Royal Bank of Scotland

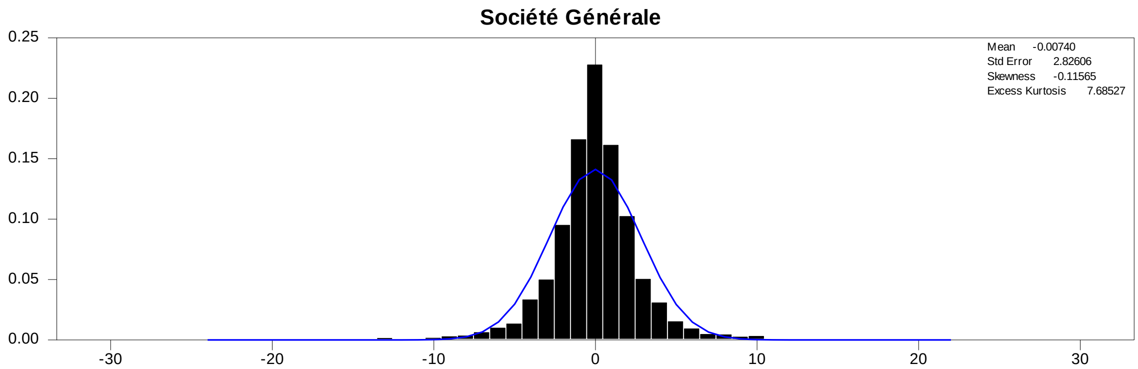


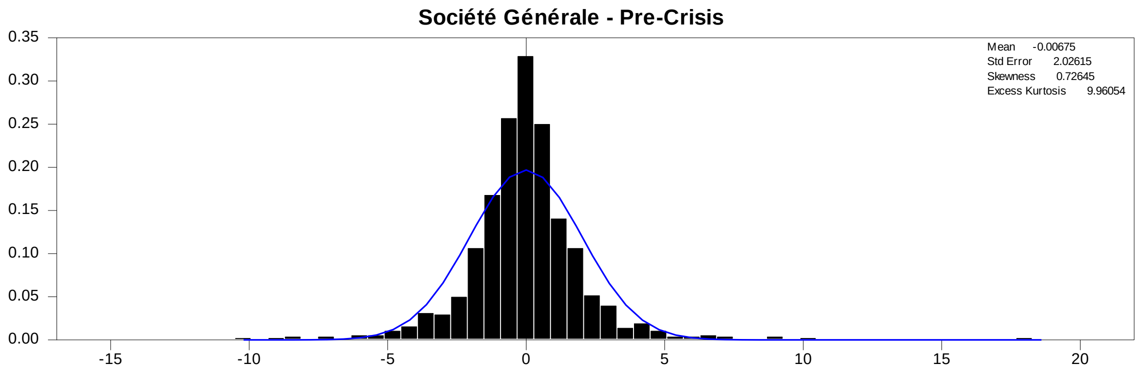
Royal Bank of Scotland - Pre-Crisis

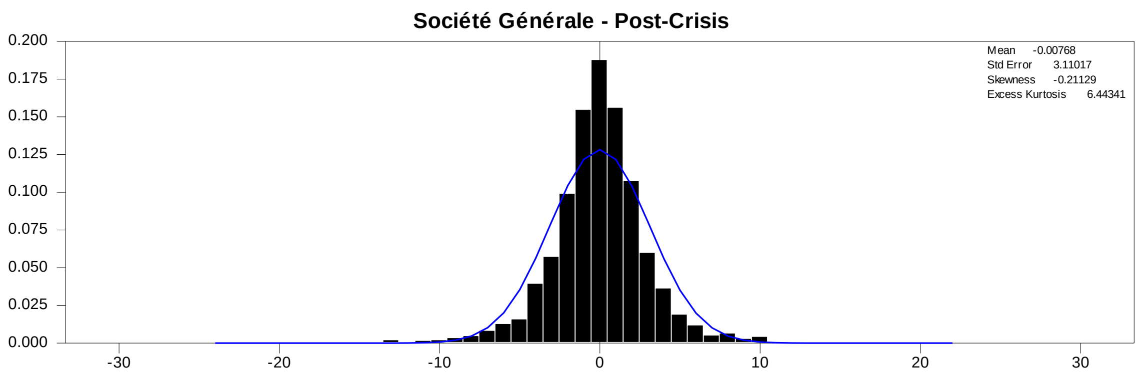


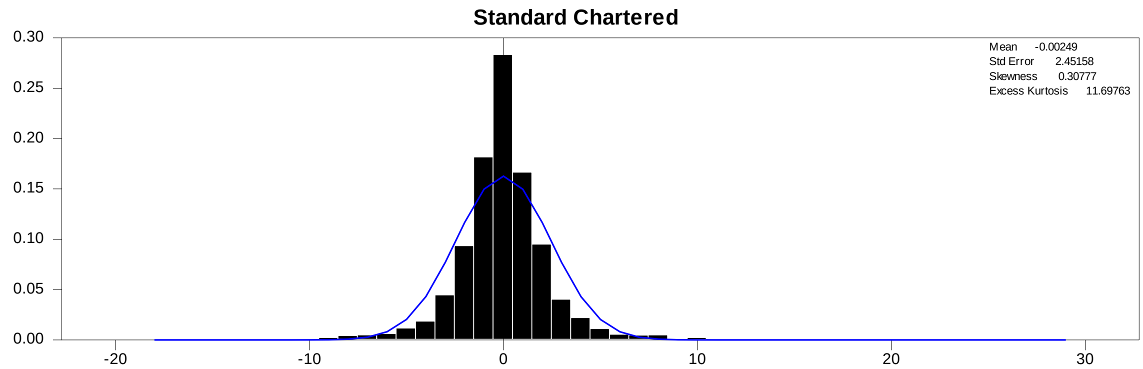
Royal Bank of Scotland - Post-Crisis

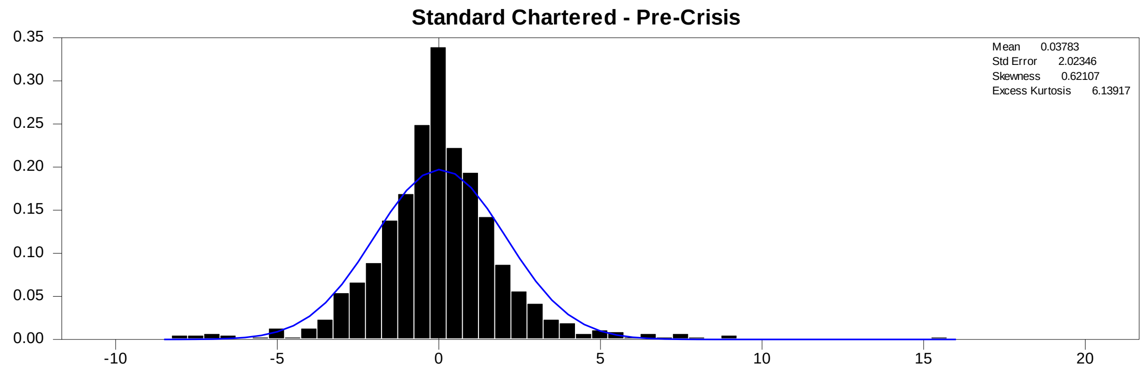


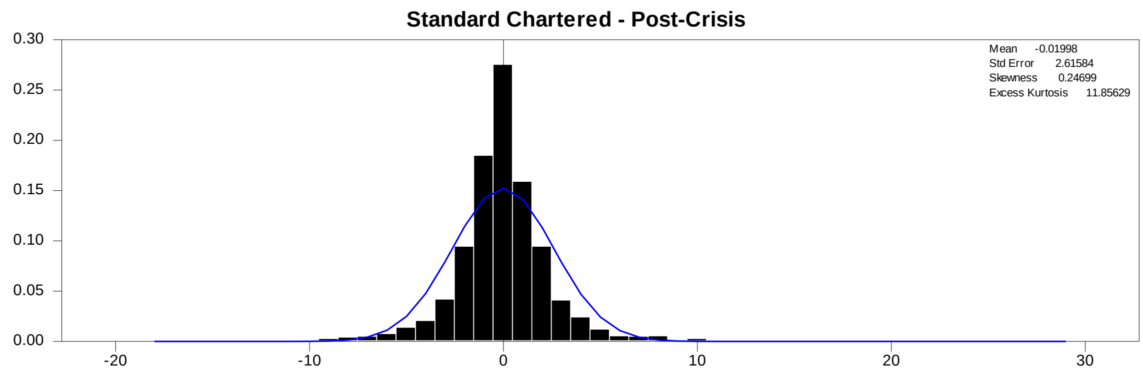

Société Générale
Mean -0.00740
Std Error 2.82606
Skewness -0.11565
Excess Kurtosis 7.68527

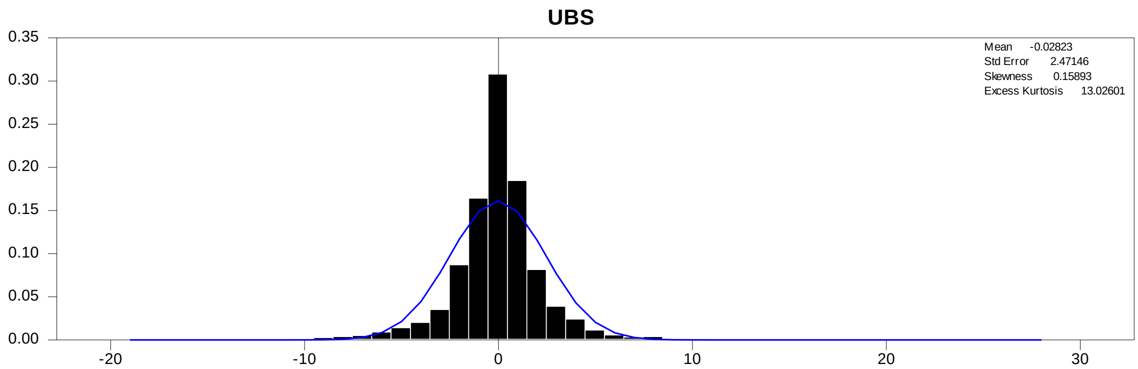

Société Générale - Pre-Crisis
Mean -0.00675
Std Error 2.02615
Skewness 0.72645
Excess Kurtosis 9.96054


Société Générale - Post-Crisis
Mean -0.00768
Std Error 3.11017
Skewness -0.21129
Excess Kurtosis 6.44341


Standard Chartered
Mean -0.00249
Std Error 2.45158
Skewness 0.30777
Excess Kurtosis 11.69763


Standard Chartered - Pre-Crisis
Mean 0.03783
Std Error 2.02346
Skewness 0.62107
Excess Kurtosis 6.13917


Standard Chartered - Post-Crisis
Mean -0.01998
Std Error 2.61584
Skewness 0.24699
Excess Kurtosis 11.85629


UBS
Mean -0.02823
Std Error 2.47146
Skewness 0.15893
Excess Kurtosis 13.02601
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0.20
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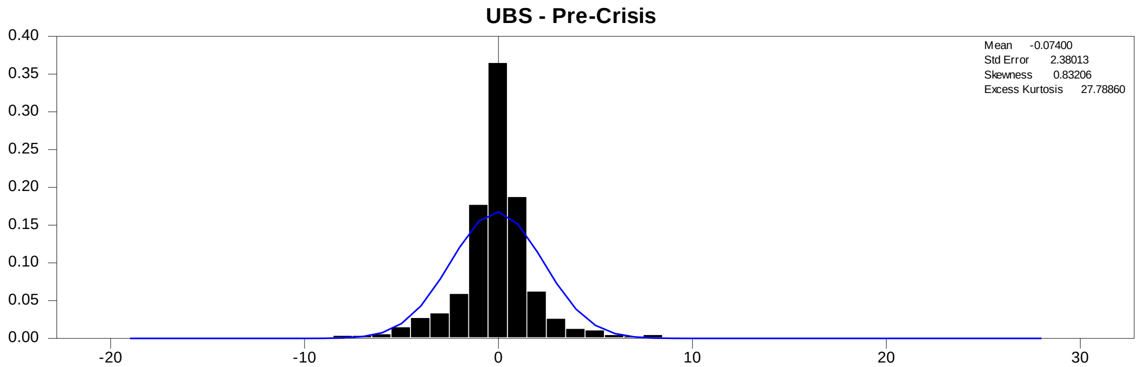
0.10
0.05
0.00
-20
-10
0
10
20
30


UBS - Pre-Crisis
Mean -0.07400
Std Error 2.38013
Skewness 0.83206
Excess Kurtosis 27.78860
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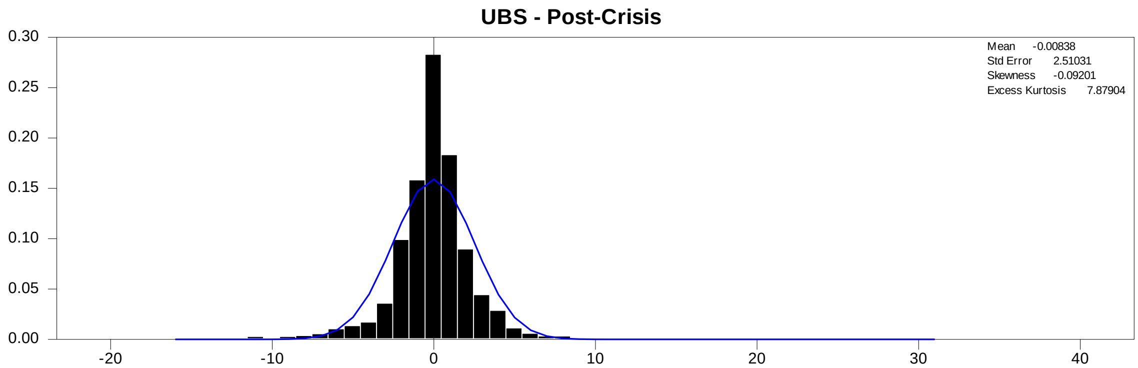
10
20
30


UBS - Post-Crisis
Mean -0.00838
Std Error 2.51031
Skewness -0.09201
Excess Kurtosis 7.87904
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30
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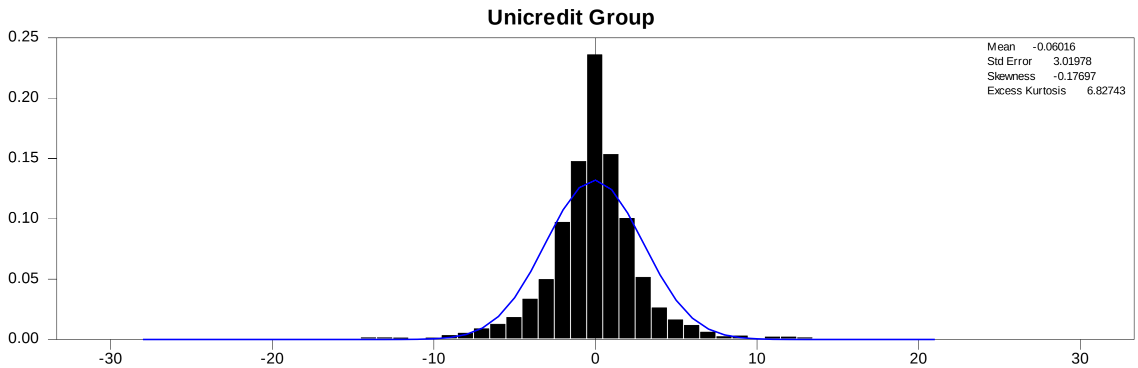
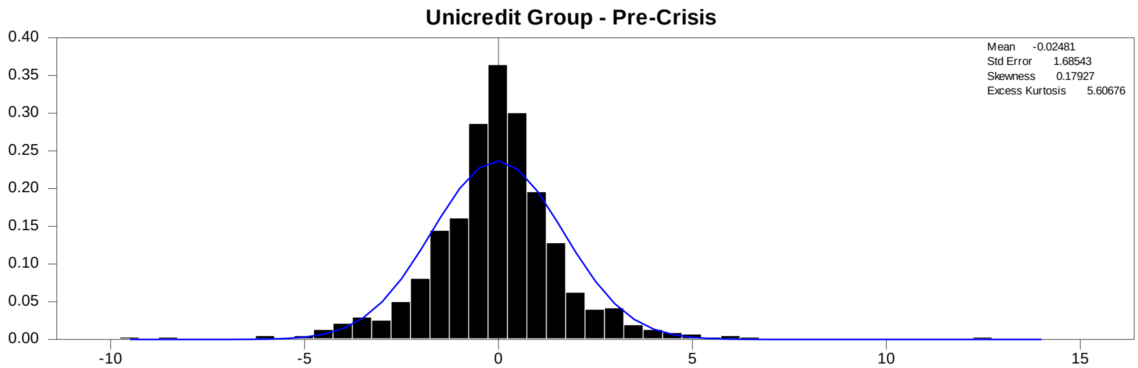
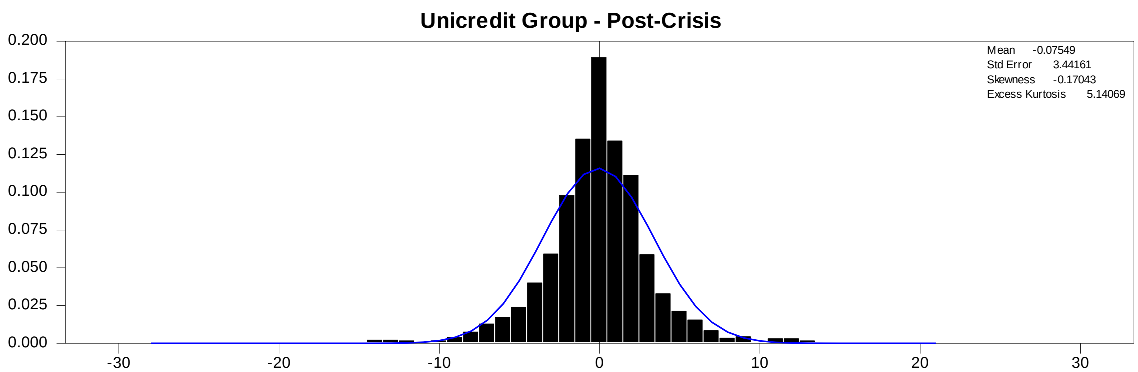
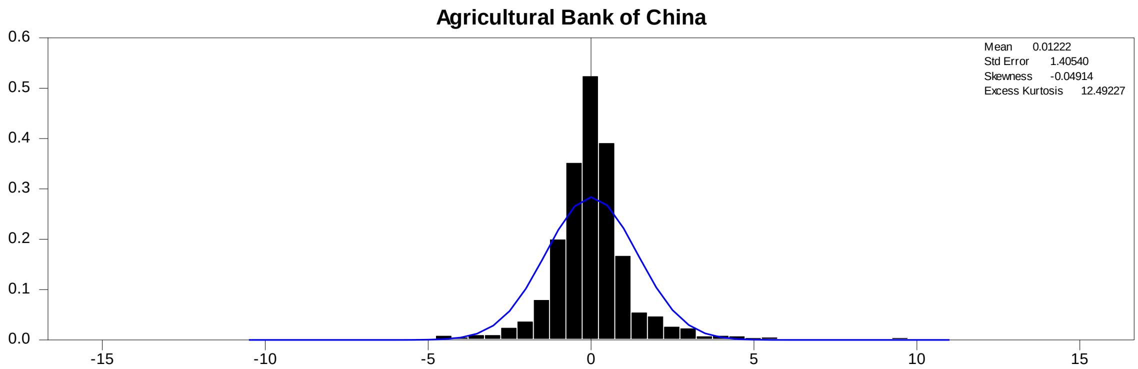

Unicredit Group
Mean -0.06016
Std Error 3.01978
Skewness -0.17697
Excess Kurtosis 6.82743


Unicredit Group - Pre-Crisis
Mean -0.02481
Std Error 1.68543
Skewness 0.17927
Excess Kurtosis 5.60676


Unicredit Group - Post-Crisis
Mean -0.07549
Std Error 3.44161
Skewness -0.17043
Excess Kurtosis 5.14069


Agricultural Bank of China
Mean 0.01222
Std Error 1.40540
Skewness -0.04914
Excess Kurtosis 12.49227
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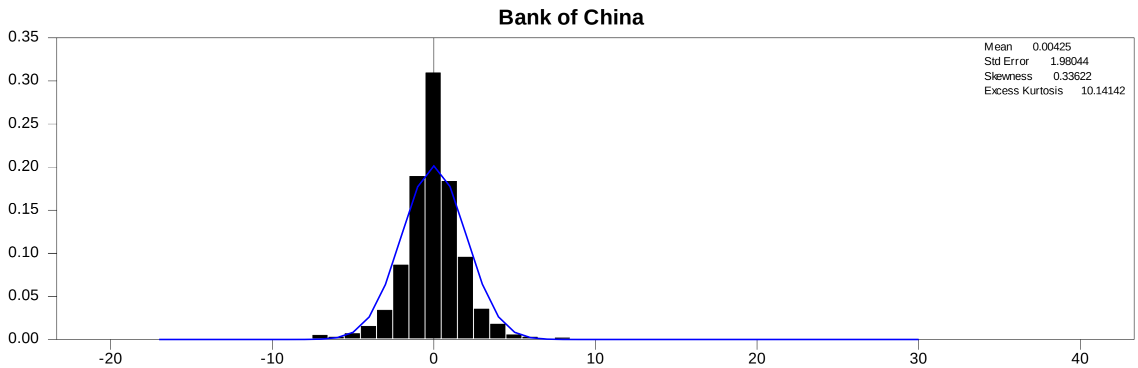
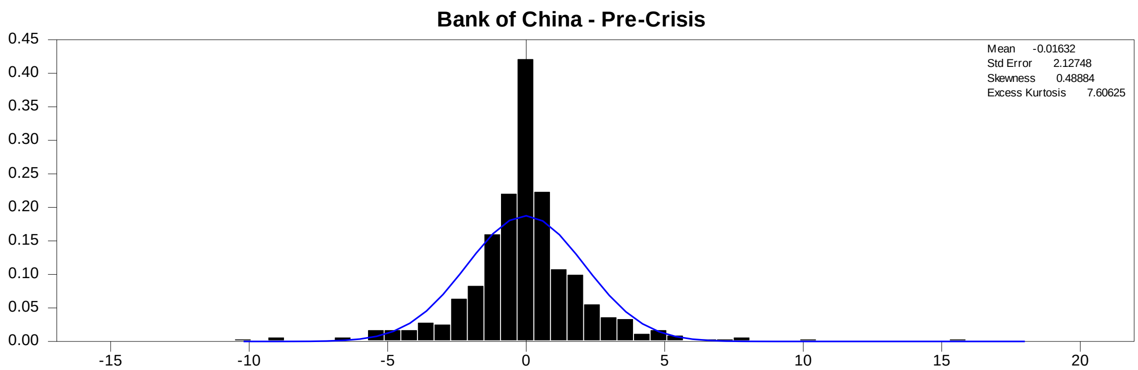
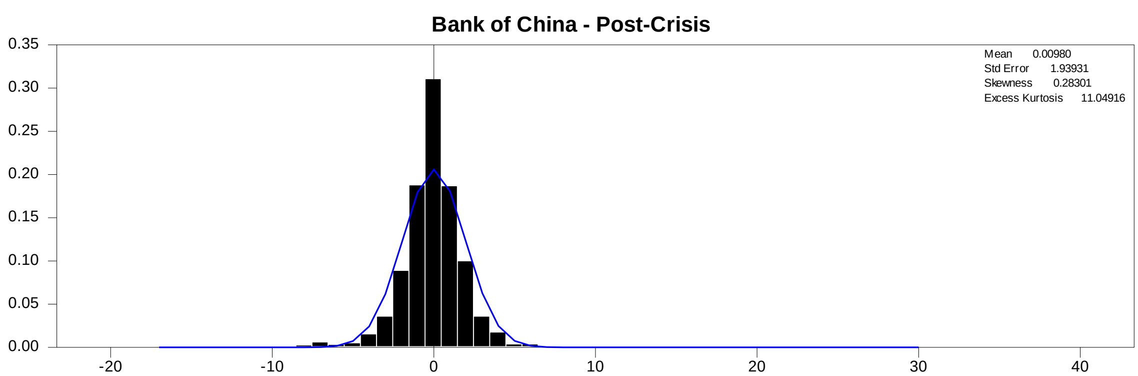
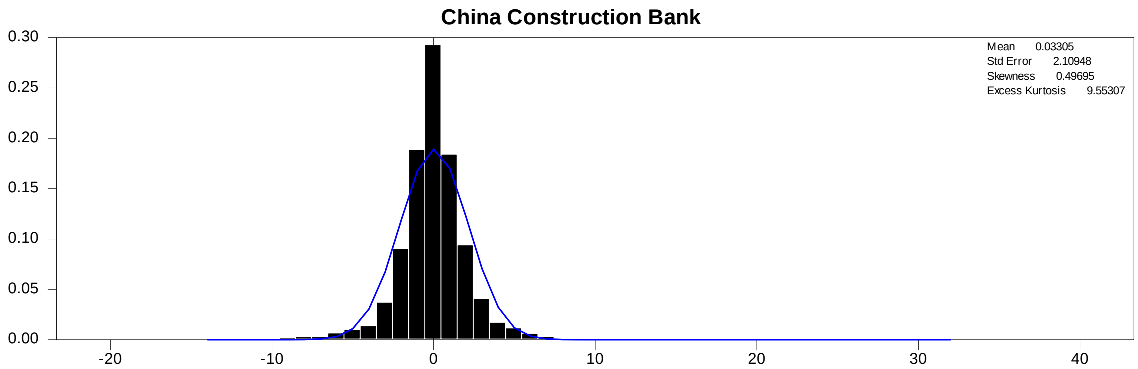
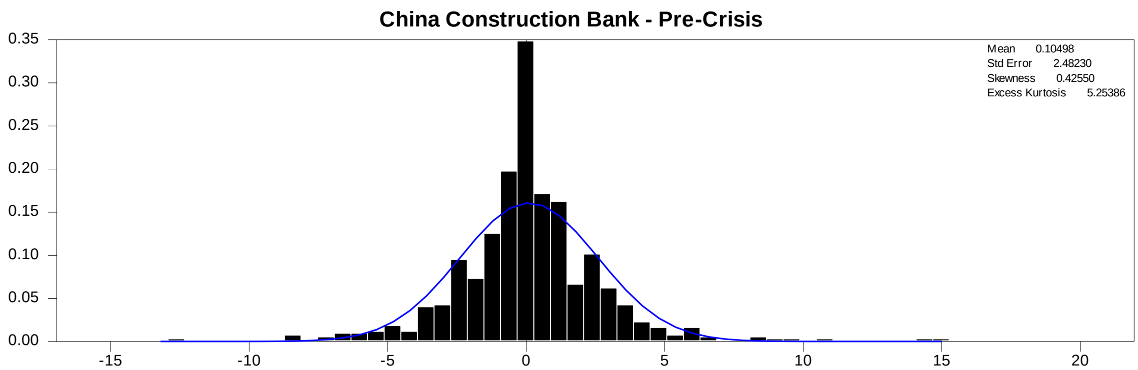
0.4
0.3
0.2
0.1
0.0
-15
-10
-5
0
5
10
15

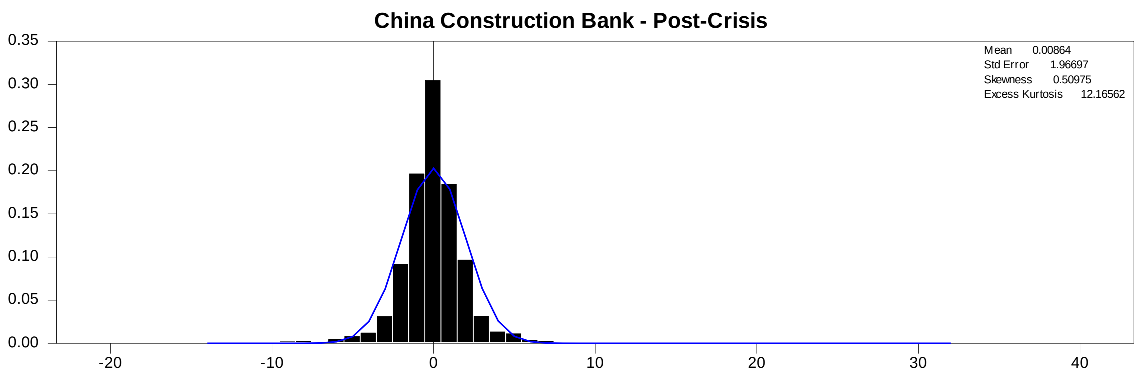

Bank of China
Mean 0.00425
Std Error 1.98044
Skewness 0.33622
Excess Kurtosis 10.14142


Bank of China - Pre-Crisis
Mean -0.01632
Std Error 2.12748
Skewness 0.48884
Excess Kurtosis 7.60625

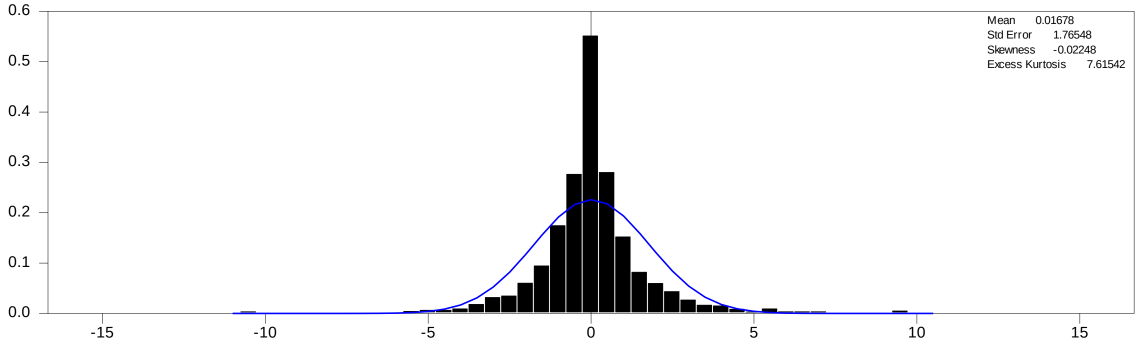

Bank of China - Post-Crisis
Mean 0.00980
Std Error 1.93931
Skewness 0.28301
Excess Kurtosis 11.04916


China Construction Bank
Mean 0.03305
Std Error 2.10948
Skewness 0.49695
Excess Kurtosis 9.55307

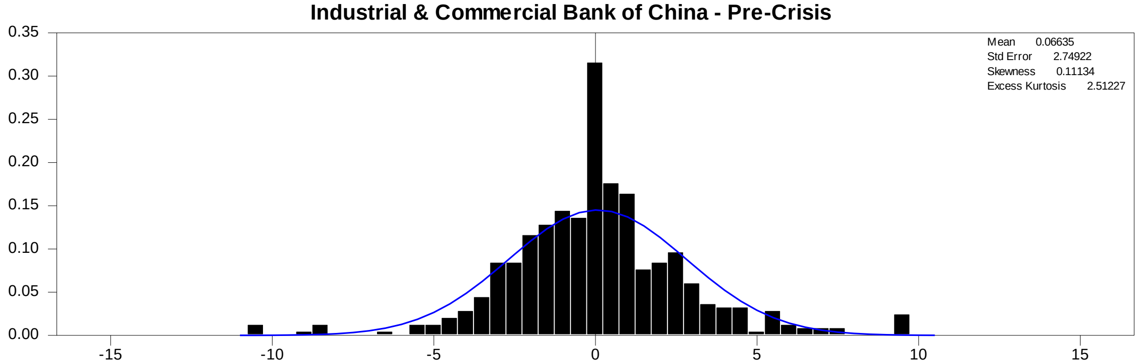

China Construction Bank - Pre-Crisis
Mean 0.10498
Std Error 2.48230
Skewness 0.42550
Excess Kurtosis 5.25386


China Construction Bank - Post-Crisis
Mean 0.00864
Std Error 1.96697
Skewness 0.50975
Excess Kurtosis 12.16562

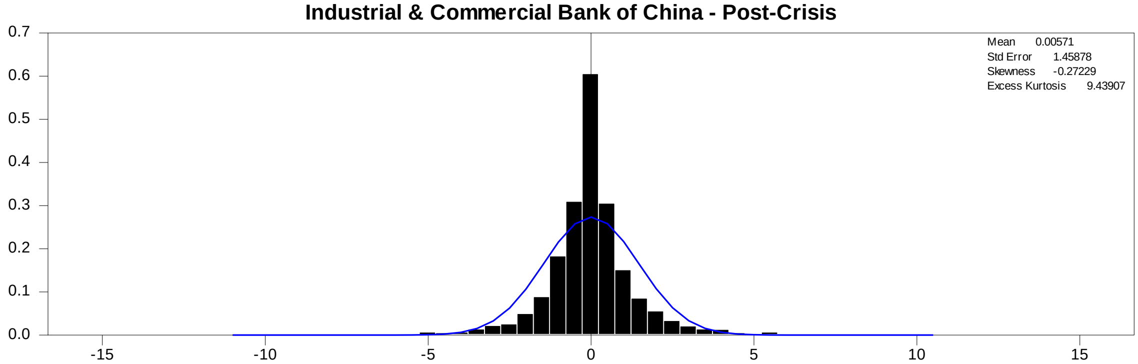
Industrial & Commercial Bank of China

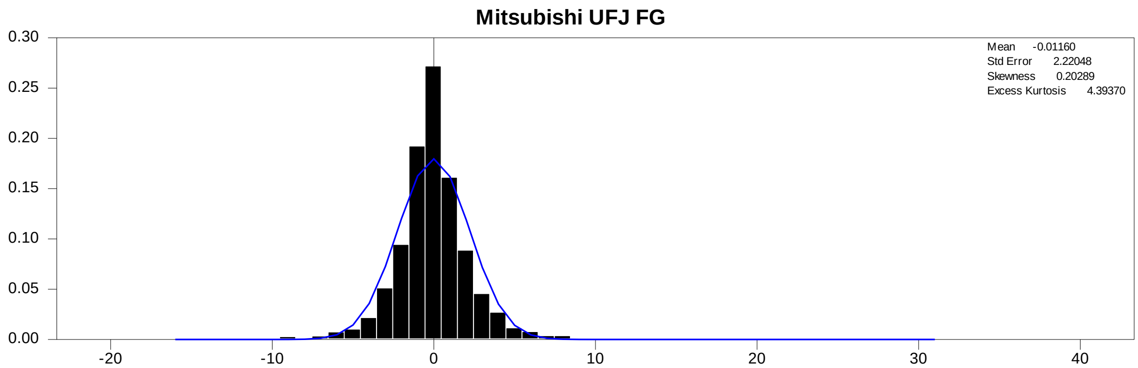


Industrial & Commercial Bank of China - Pre-Crisis



Industrial & Commercial Bank of China - Post-Crisis




Mitsubishi UFJ FG
Mean -0.01160
Std Error 2.22048
Skewness 0.20289
Excess Kurtosis 4.39370
0.30
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0.15
0.10
0.05
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-20
-10
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30
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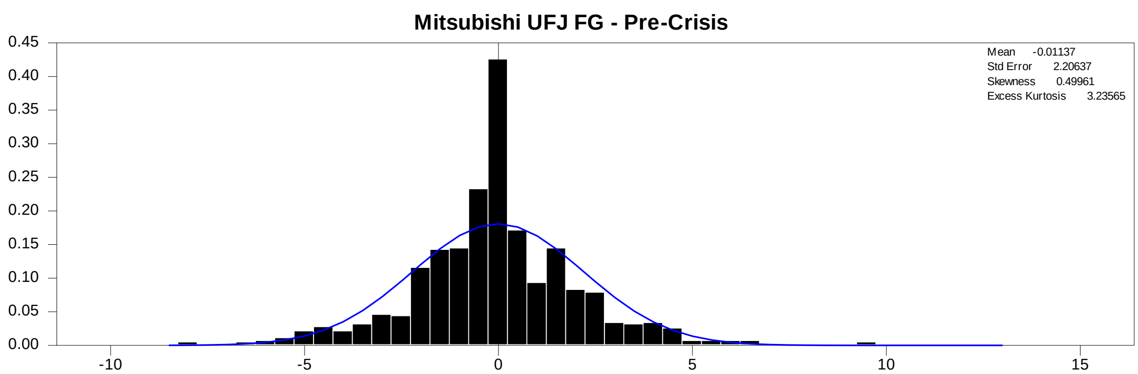
Mitsubishi UFJ FG - Pre-Crisis
Mean -0.01137
Std Error 2.20637
Skewness 0.49961
Excess Kurtosis 3.23565
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0.00
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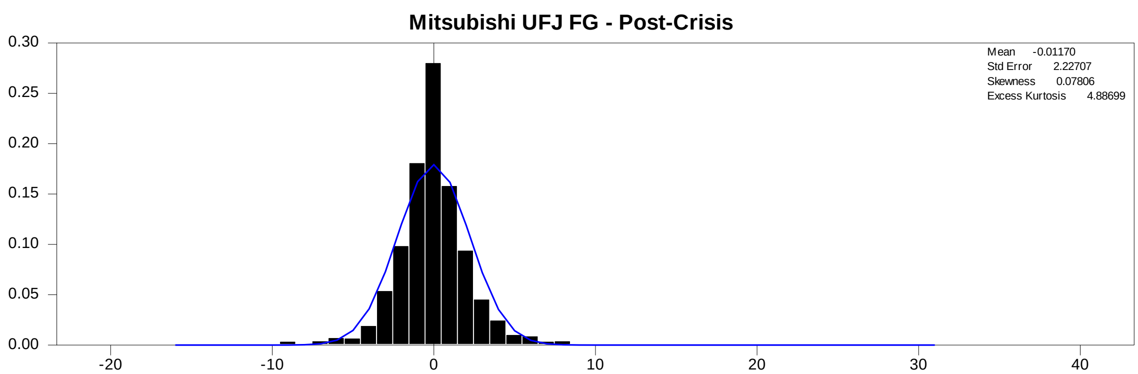
Mitsubishi UFJ FG - Post-Crisis
Mean -0.01170
Std Error 2.22707
Skewness 0.07806
Excess Kurtosis 4.88699
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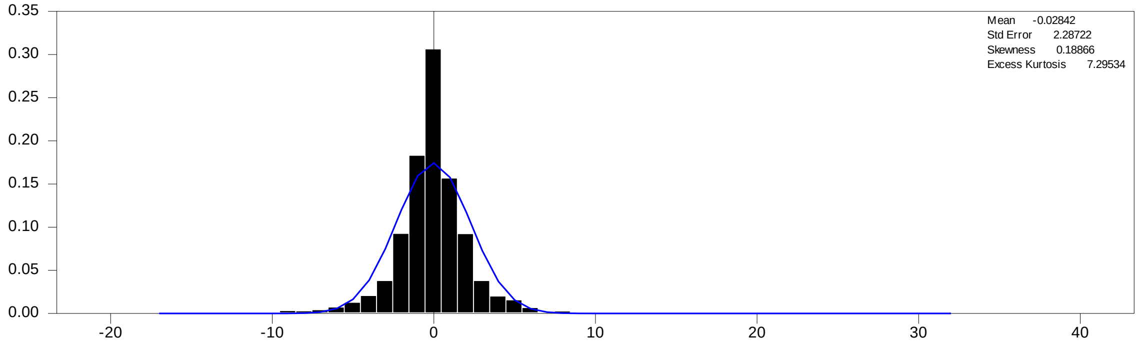
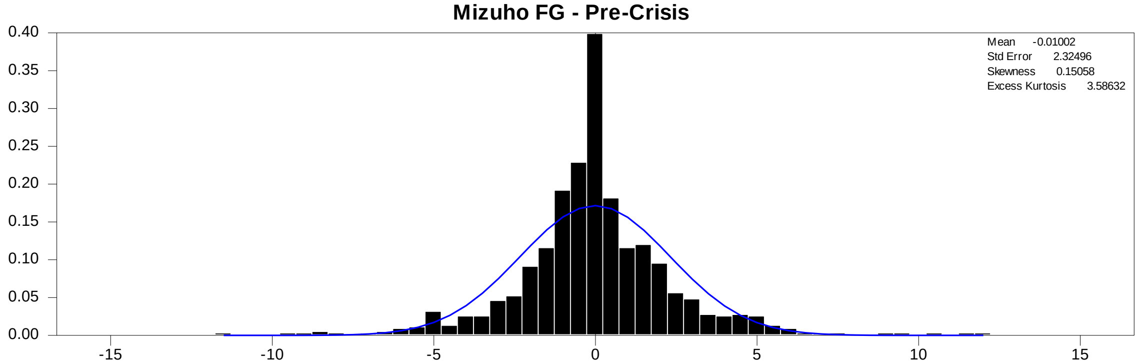
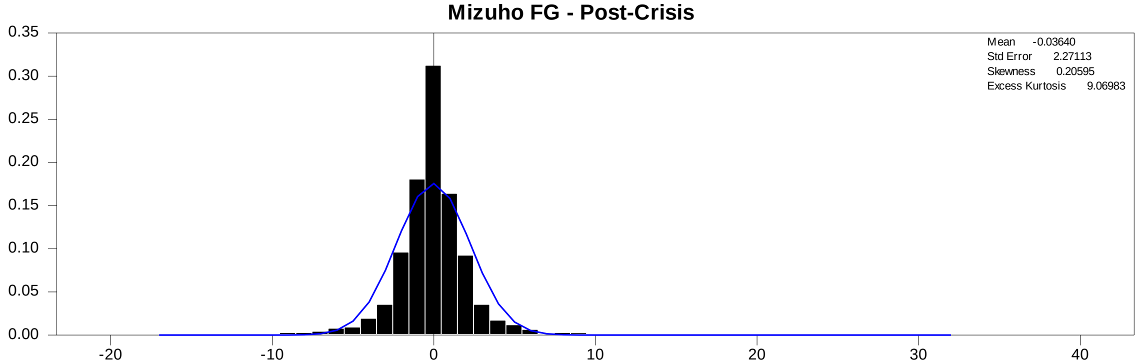
Mizuho FG



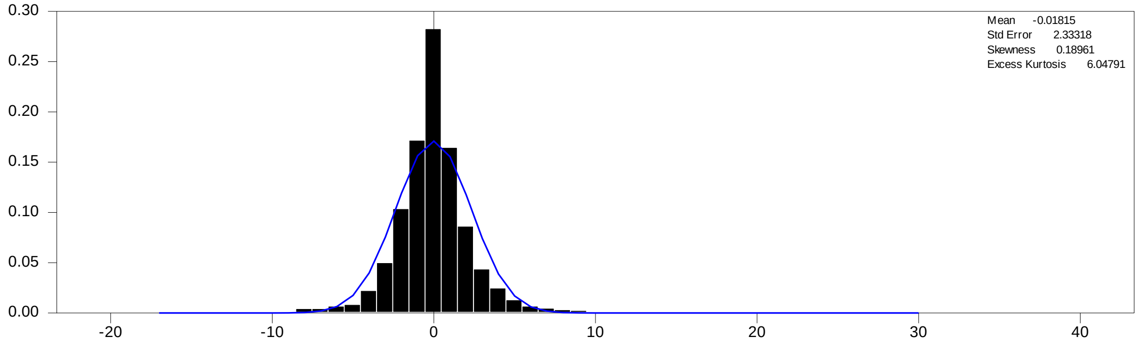
Mizuho FG - Pre-Crisis



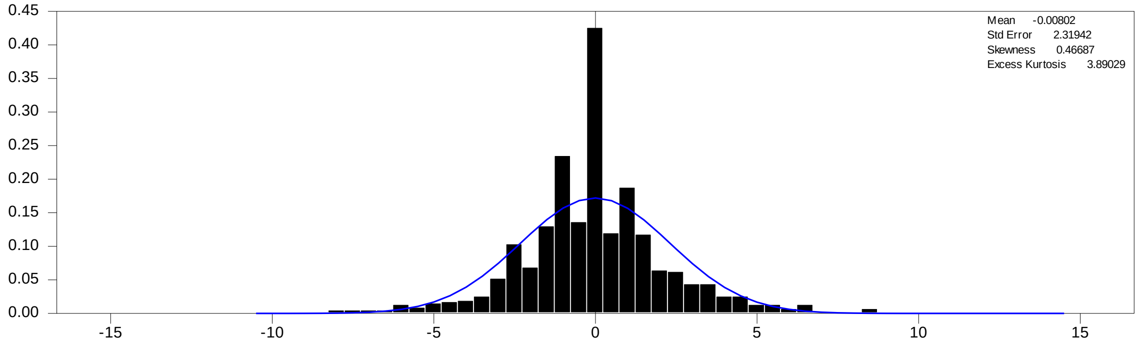
Mizuho FG - Post-Crisis



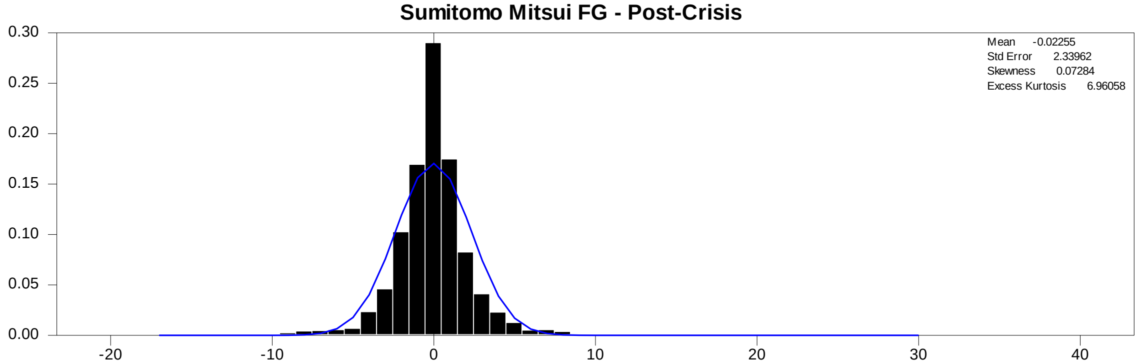
Sumitomo Mitsui FG



Sumitomo Mitsui FG - Pre-Crisis



Sumitomo Mitsui FG - Post-Crisis



Daily Data Asymmetric VAR (1) - BEKK - GARCH Model

Bank of America and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 85 Iterations.
Final criterion was 0.0000032 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -9583.101

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BOA)					
1	BOA{1}	0.024	0.020	1.215	0.224
2	EQU{1}	-0.149	0.041	-3.654	0.000
3	Constant	0.005	0.022	0.231	0.817
Mean Model(EQU)					
4	BOA{1}	0.010	0.007	1.360	0.174
5	EQU{1}	0.087	0.019	4.677	0.000
6	Constant	0.022	0.011	1.974	0.048
7	C(1,1)	-0.131	0.021	-6.279	0.000
8	C(2,1)	-0.044	0.028	-1.604	0.109
9	C(2,2)	-0.129	0.010	-13.152	0.000
10	A(1,1)	0.252	0.020	12.687	0.000
11	A(1,2)	0.004	0.006	0.546	0.585
12	A(2,1)	-0.041	0.049	-0.838	0.402
13	A(2,2)	-0.010	0.034	-0.302	0.762
14	B(1,1)	0.953	0.007	139.880	0.000
15	B(1,2)	0.008	0.002	3.681	0.000
16	B(2,1)	-0.003	0.020	-0.155	0.877
17	B(2,2)	0.932	0.008	120.342	0.000
18	D(1,1)	0.198	0.032	6.118	0.000
19	D(1,2)	0.001	0.011	0.071	0.943
20	D(2,1)	0.225	0.069	3.265	0.001
21	D(2,2)	0.392	0.028	13.941	0.000

Bank of New York and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 73 Iterations. Final criterion was 0.0000081 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -9145.759

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BNY)					
1	BNY{1}	-0.051	0.020	-2.520	0.012
2	EQU{1}	-0.067	0.041	-1.635	0.102
3	Constant	0.032	0.022	1.448	0.148
Mean Model(EQU)					
4	BNY{1}	0.025	0.009	2.822	0.005
5	EQU{1}	0.082	0.021	3.971	0.000
6	Constant	0.026	0.011	2.343	0.019
7	C(1,1)	0.198	0.025	7.860	0.000
8	C(2,1)	0.069	0.014	4.831	0.000
9	C(2,2)	0.095	0.010	9.888	0.000
10	A(1,1)	0.019	0.048	0.386	0.699
11	A(1,2)	-0.061	0.011	-5.347	0.000
12	A(2,1)	0.250	0.084	2.990	0.003
13	A(2,2)	0.159	0.036	4.395	0.000
14	B(1,1)	0.972	0.007	130.471	0.000
15	B(1,2)	0.005	0.003	1.324	0.185
16	B(2,1)	-0.059	0.017	-3.547	0.000
17	B(2,2)	0.937	0.008	122.650	0.000
18	D(1,1)	0.290	0.031	9.223	0.000
19	D(1,2)	0.013	0.017	0.725	0.469
20	D(2,1)	0.168	0.071	2.379	0.017
21	D(2,2)	0.371	0.032	11.757	0.000

Citigroup and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 73 Iterations.
Final criterion was 0.0000044 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -9532.6668

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(CITI)					
1	CITI{1}	0.043	0.019	2.281	0.023
2	EQU{1}	-0.173	0.042	-4.084	0.000
3	Constant	0.011	0.022	0.482	0.630
Mean Model(EQU)					
4	CITI{1}	0.029	0.007	4.381	0.000
5	EQU{1}	0.060	0.020	2.999	0.003
6	Constant	0.029	0.011	2.738	0.006
7	C(1,1)	0.175	0.021	8.225	0.000
8	C(2,1)	0.068	0.020	3.331	0.001
9	C(2,2)	0.125	0.011	11.442	0.000
10	A(1,1)	0.257	0.023	11.360	0.000
11	A(1,2)	-0.012	0.007	-1.728	0.084
12	A(2,1)	-0.091	0.060	-1.527	0.127
13	A(2,2)	0.057	0.027	2.072	0.038
14	B(1,1)	0.950	0.007	130.615	0.000
15	B(1,2)	0.008	0.003	3.010	0.003
16	B(2,1)	-0.030	0.023	-1.281	0.200
17	B(2,2)	0.925	0.008	109.006	0.000
18	D(1,1)	0.242	0.030	8.143	0.000
19	D(1,2)	0.023	0.011	2.036	0.042
20	D(2,1)	0.280	0.072	3.900	0.000
21	D(2,2)	0.365	0.029	12.796	0.000

Goldman Sachs and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 72 Iterations.
Final criterion was 0.0000048 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -9267.6129

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(GOLDMAN)					
1	GOLDMAN{1}	-0.040	0.022	-1.821	0.069
2	EQU{1}	0.008	0.042	0.185	0.853
3	Constant	0.035	0.022	1.629	0.103
Mean Model(EQU)					
4	GOLDMAN{1}	0.021	0.009	2.413	0.016
5	EQU{1}	0.080	0.021	3.848	0.000
6	Constant	0.021	0.011	1.882	0.060
7	C(1,1)	0.149	0.027	5.601	0.000
8	C(2,1)	0.103	0.013	7.861	0.000
9	C(2,2)	0.048	0.016	2.992	0.003
10	A(1,1)	0.128	0.029	4.390	0.000
11	A(1,2)	-0.032	0.013	-2.482	0.013
12	A(2,1)	0.036	0.077	0.473	0.636
13	A(2,2)	0.139	0.039	3.534	0.000
14	B(1,1)	0.996	0.005	193.809	0.000
15	B(1,2)	0.011	0.003	3.893	0.000
16	B(2,1)	-0.094	0.014	-6.625	0.000
17	B(2,2)	0.933	0.007	136.094	0.000
18	D(1,1)	0.089	0.031	2.867	0.004
19	D(1,2)	0.006	0.016	0.366	0.714
20	D(2,1)	0.432	0.069	6.247	0.000
21	D(2,2)	0.369	0.037	9.976	0.000

JP Morgan Chase and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 68 Iterations.
Final criterion was 0.0000072 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -9009.375

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(JPM)					
1	JPM{1}	-0.036	0.021	-1.681	0.093
2	EQU{1}	-0.066	0.039	-1.684	0.092
3	Constant	0.041	0.021	1.922	0.055
Mean Model(EQU)					
4	JPM{1}	0.039	0.009	4.283	0.000
5	EQU{1}	0.070	0.021	3.407	0.001
6	Constant	0.023	0.011	2.154	0.031
7	C(1,1)	0.184	0.022	8.378	0.000
8	C(2,1)	0.084	0.021	4.069	0.000
9	C(2,2)	0.098	0.013	7.591	0.000
10	A(1,1)	0.185	0.033	5.681	0.000
11	A(1,2)	0.000	0.017	0.028	0.977
12	A(2,1)	-0.083	0.090	-0.925	0.355
13	A(2,2)	-0.026	0.063	-0.420	0.675
14	B(1,1)	0.961	0.012	79.658	0.000
15	B(1,2)	0.002	0.005	0.425	0.671
16	B(2,1)	-0.028	0.026	-1.069	0.285
17	B(2,2)	0.941	0.009	108.291	0.000
18	D(1,1)	0.263	0.040	6.644	0.000
19	D(1,2)	0.032	0.017	1.901	0.057
20	D(2,1)	0.226	0.071	3.201	0.001
21	D(2,2)	0.357	0.029	12.531	0.000

Morgan Stanley and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 63 Iterations.
Final criterion was 0.0000081 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -9808.8707

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(MORGAN)					
1	MORGAN{1}	0.000	0.019	-0.014	0.989
2	EQU{1}	-0.110	0.042	-2.616	0.009
3	Constant	0.031	0.026	1.201	0.230
Mean Model(EQU)					
4	MORGAN{1}	0.020	0.007	2.967	0.003
5	EQU{1}	0.075	0.019	4.065	0.000
6	Constant	0.023	0.011	2.063	0.039
7	C(1,1)	0.199	0.024	8.335	0.000
8	C(2,1)	0.096	0.016	6.060	0.000
9	C(2,2)	0.079	0.014	5.791	0.000
10	A(1,1)	0.069	0.030	2.297	0.022
11	A(1,2)	-0.044	0.009	-4.689	0.000
12	A(2,1)	0.296	0.079	3.736	0.000
13	A(2,2)	0.176	0.037	4.714	0.000
14	B(1,1)	0.977	0.006	161.200	0.000
15	B(1,2)	0.005	0.002	2.149	0.032
16	B(2,1)	-0.081	0.021	-3.777	0.000
17	B(2,2)	0.931	0.008	116.135	0.000
18	D(1,1)	0.303	0.028	10.782	0.000
19	D(1,2)	0.042	0.012	3.676	0.000
20	D(2,1)	0.070	0.084	0.832	0.405
21	D(2,2)	0.300	0.032	9.351	0.000

Royal Bank of Canada and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 57 Iterations.
Final criterion was 0.0000062 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -8148.5079

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(RBC)					
1	RBC{1}	-0.002	0.019	-0.083	0.934
2	EQU{1}	0.057	0.024	2.398	0.016
3	Constant	0.034	0.017	2.043	0.041
Mean Model(EQU)					
4	RBC{1}	0.010	0.013	0.740	0.459
5	EQU{1}	0.101	0.018	5.527	0.000
6	Constant	0.021	0.012	1.706	0.088
7	C(1,1)	0.232	0.023	9.942	0.000
8	C(2,1)	-0.018	0.017	-1.097	0.273
9	C(2,2)	0.131	0.012	10.585	0.000
10	A(1,1)	0.242	0.036	6.640	0.000
11	A(1,2)	-0.021	0.020	-1.051	0.293
12	A(2,1)	0.012	0.045	0.270	0.787
13	A(2,2)	-0.024	0.044	-0.531	0.596
14	B(1,1)	0.916	0.016	58.828	0.000
15	B(1,2)	0.021	0.012	1.774	0.076
16	B(2,1)	0.017	0.020	0.860	0.390
17	B(2,2)	0.929	0.013	74.021	0.000
18	D(1,1)	0.226	0.039	5.811	0.000
19	D(1,2)	0.039	0.020	1.935	0.053
20	D(2,1)	0.170	0.050	3.371	0.001
21	D(2,2)	0.365	0.027	13.305	0.000

State Streetand Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 111 Iterations.
Final criterion was 0.0000095 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -9781.7272

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(STATE)					
1	STATE{1}	0.036	0.022	1.632	0.103
2	EQU{1}	-0.261	0.047	-5.518	0.000
3	Constant	0.018	0.026	0.687	0.492
Mean Model(EQU)					
4	STATE{1}	0.007	0.008	0.884	0.377
5	EQU{1}	0.104	0.021	5.053	0.000
6	Constant	0.021	0.011	1.827	0.068
7	C(1,1)	-0.347	0.036	-9.632	0.000
8	C(2,1)	-0.002	0.019	-0.090	0.928
9	C(2,2)	-0.117	0.012	-9.858	0.000
10	A(1,1)	0.482	0.045	10.664	0.000
11	A(1,2)	-0.002	0.010	-0.186	0.852
12	A(2,1)	-0.987	0.090	-10.992	0.000
13	A(2,2)	0.003	0.036	0.091	0.928
14	B(1,1)	0.853	0.018	47.841	0.000
15	B(1,2)	0.007	0.005	1.602	0.109
16	B(2,1)	0.118	0.037	3.231	0.001
17	B(2,2)	0.943	0.009	101.012	0.000
18	D(1,1)	0.401	0.069	5.834	0.000
19	D(1,2)	-0.011	0.015	-0.726	0.468
20	D(2,1)	0.119	0.122	0.972	0.331
21	D(2,2)	0.395	0.030	13.114	0.000

Wells Fargo and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 62 Iterations.
Final criterion was 0.0000094 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -8833.936

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(WELLS)					
1	WELLS{1}	-0.071	0.019	-3.626	0.000
2	EQU{1}	-0.070	0.035	-1.994	0.046
3	Constant	0.016	0.018	0.867	0.386
Mean Model(EQU)					
4	WELLS{1}	0.021	0.009	2.194	0.028
5	EQU{1}	0.089	0.019	4.655	0.000
6	Constant	0.019	0.011	1.768	0.077
7	C(1,1)	0.132	0.020	6.770	0.000
8	C(2,1)	0.075	0.023	3.311	0.001
9	C(2,2)	-0.112	0.011	-10.056	0.000
10	A(1,1)	0.227	0.022	10.359	0.000
11	A(1,2)	-0.013	0.009	-1.410	0.159
12	A(2,1)	-0.228	0.048	-4.779	0.000
13	A(2,2)	-0.040	0.041	-0.965	0.334
14	B(1,1)	0.958	0.007	141.579	0.000
15	B(1,2)	0.011	0.003	3.983	0.000
16	B(2,1)	-0.020	0.018	-1.140	0.254
17	B(2,2)	0.930	0.007	125.235	0.000
18	D(1,1)	0.285	0.031	9.068	0.000
19	D(1,2)	-0.011	0.017	-0.658	0.511
20	D(2,1)	0.190	0.060	3.177	0.001
21	D(2,2)	0.407	0.027	15.104	0.000

Banco Santander and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 89 Iterations.
Final criterion was 0.0000026 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -9435.2784

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(SANTANDER)					
1	SANTANDER{1}	-0.066	0.021	-3.104	0.002
2	EQU{1}	0.161	0.046	3.513	0.000
3	Constant	0.008	0.025	0.316	0.752
Mean Model(EQU)					
4	SANTANDER{1}	-0.010	0.008	-1.215	0.224
5	EQU{1}	0.116	0.021	5.409	0.000
6	Constant	0.021	0.011	1.894	0.058
7	C(1,1)	0.231	0.027	8.573	0.000
8	C(2,1)	0.037	0.014	2.678	0.007
9	C(2,2)	0.089	0.010	8.544	0.000
10	A(1,1)	0.273	0.029	9.316	0.000
11	A(1,2)	0.055	0.011	5.146	0.000
12	A(2,1)	-0.146	0.050	-2.942	0.003
13	A(2,2)	-0.122	0.030	-4.013	0.000
14	B(1,1)	0.929	0.010	92.834	0.000
15	B(1,2)	-0.008	0.004	-1.872	0.061
16	B(2,1)	0.024	0.018	1.355	0.175
17	B(2,2)	0.960	0.008	124.343	0.000
18	D(1,1)	-0.283	0.037	-7.746	0.000
19	D(1,2)	-0.015	0.013	-1.118	0.263
20	D(2,1)	-0.225	0.068	-3.311	0.001
21	D(2,2)	-0.369	0.030	-12.404	0.000

Barclays and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 65 Iterations.
Final criterion was 0.0000052 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -10219.433

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BARCLAYS)					
1	BARCLAYS{1}	-0.042	0.018	-2.367	0.018
2	EQU{1}	0.289	0.046	6.240	0.000
3	Constant	-0.035	0.025	-1.399	0.162
Mean Model(EQU)					
4	BARCLAYS{1}	-0.016	0.006	-2.749	0.006
5	EQU{1}	0.118	0.019	6.224	0.000
6	Constant	0.018	0.010	1.755	0.079
7	C(1,1)	0.166	0.030	5.487	0.000
8	C(2,1)	0.031	0.026	1.196	0.232
9	C(2,2)	0.121	0.011	11.246	0.000
10	A(1,1)	0.169	0.026	6.509	0.000
11	A(1,2)	-0.017	0.009	-1.959	0.050
12	A(2,1)	0.171	0.056	3.038	0.002
13	A(2,2)	0.048	0.032	1.490	0.136
14	B(1,1)	0.967	0.008	128.631	0.000
15	B(1,2)	0.010	0.002	4.138	0.000
16	B(2,1)	-0.048	0.027	-1.810	0.070
17	B(2,2)	0.931	0.008	113.192	0.000
18	D(1,1)	0.171	0.028	6.067	0.000
19	D(1,2)	-0.014	0.011	-1.246	0.213
20	D(2,1)	0.387	0.075	5.159	0.000
21	D(2,2)	0.412	0.027	15.070	0.000

BNP Paribas and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 65 Iterations.
Final criterion was 0.0000018 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -9738.0479

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BNP)					
1	BNP{1}	-0.057	0.021	-2.769	0.006
2	EQU{1}	0.203	0.047	4.336	0.000
3	Constant	0.008	0.026	0.307	0.759
Mean Model(EQU)					
4	BNP{1}	-0.010	0.008	-1.335	0.182
5	EQU{1}	0.119	0.020	5.887	0.000
6	Constant	0.020	0.011	1.833	0.067
7	C(1,1)	0.248	0.033	7.512	0.000
8	C(2,1)	0.040	0.016	2.560	0.010
9	C(2,2)	0.112	0.009	12.548	0.000
10	A(1,1)	0.151	0.030	5.026	0.000
11	A(1,2)	0.001	0.015	0.041	0.967
12	A(2,1)	0.235	0.067	3.493	0.000
13	A(2,2)	0.043	0.051	0.844	0.399
14	B(1,1)	0.953	0.011	83.281	0.000
15	B(1,2)	0.008	0.004	1.728	0.084
16	B(2,1)	-0.025	0.029	-0.836	0.403
17	B(2,2)	0.936	0.010	95.708	0.000
18	D(1,1)	-0.251	0.036	-6.913	0.000
19	D(1,2)	-0.003	0.012	-0.230	0.818
20	D(2,1)	-0.180	0.081	-2.235	0.025
21	D(2,2)	-0.389	0.028	-13.944	0.000

Credit Suisse and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 64 Iterations.
Final criterion was 0.0000037 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -9746.1035

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(CRESUISVX)					
1	CRESUISVX{1}	-0.025	0.022	-1.139	0.255
2	EQU{1}	0.392	0.047	8.268	0.000
3	Constant	-0.026	0.028	-0.923	0.356
Mean Model(EQU)					
4	CRESUISVX{1}	-0.005	0.007	-0.633	0.527
5	EQU{1}	0.115	0.021	5.458	0.000
6	Constant	0.021	0.011	1.871	0.061
7	C(1,1)	0.209	0.026	7.966	0.000
8	C(2,1)	0.050	0.014	3.538	0.000
9	C(2,2)	0.101	0.009	11.567	0.000
10	A(1,1)	0.169	0.023	7.379	0.000
11	A(1,2)	-0.001	0.010	-0.074	0.941
12	A(2,1)	0.146	0.058	2.500	0.012
13	A(2,2)	0.061	0.037	1.655	0.098
14	B(1,1)	0.964	0.006	159.608	0.000
15	B(1,2)	0.002	0.003	0.751	0.453
16	B(2,1)	-0.037	0.016	-2.229	0.026
17	B(2,2)	0.947	0.007	134.656	0.000
18	D(1,1)	0.179	0.033	5.393	0.000
19	D(1,2)	0.017	0.010	1.608	0.108
20	D(2,1)	0.281	0.062	4.548	0.000
21	D(2,2)	0.363	0.023	15.824	0.000

Deutsche Bank and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 71 Iterations.
Final criterion was 0.0000000 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -9604.4573

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(DEUTSCHEGR)					
1	DEUTSCHEGR{1}	0.013	0.020	0.642	0.521
2	EQU{1}	0.028	0.049	0.574	0.566
3	Constant	-0.024	0.026	-0.911	0.362
Mean Model(EQU)					
4	DEUTSCHEGR{1}	-0.005	0.007	-0.684	0.494
5	EQU{1}	0.105	0.021	4.987	0.000
6	Constant	0.017	0.011	1.540	0.124
7	C(1,1)	0.166	0.016	10.197	0.000
8	C(2,1)	0.090	0.010	9.186	0.000
9	C(2,2)	-0.066	0.007	-9.714	0.000
10	A(1,1)	0.130	0.005	26.394	0.000
11	A(1,2)	-0.009	0.002	-3.913	0.000
12	A(2,1)	0.114	0.013	8.875	0.000
13	A(2,2)	0.102	0.007	14.363	0.000
14	B(1,1)	0.983	0.002	485.455	0.000
15	B(1,2)	0.004	0.000	9.513	0.000
16	B(2,1)	-0.053	0.002	-21.203	0.000
17	B(2,2)	0.944	0.004	252.642	0.000
18	D(1,1)	0.144	0.015	9.454	0.000
19	D(1,2)	-0.001	0.003	-0.182	0.856
20	D(2,1)	0.279	0.032	8.743	0.000
21	D(2,2)	0.379	0.018	20.777	0.000

Crédit Agricole and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 67 Iterations.
Final criterion was 0.0000056 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -10257.007

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(CREAGR)					
1	CREAGR{1}	-0.042	0.019	-2.183	0.029
2	EQU{1}	0.280	0.056	5.039	0.000
3	Constant	0.014	0.027	0.508	0.611
Mean Model(EQU)					
4	CREAGR{1}	-0.011	0.006	-1.735	0.083
5	EQU{1}	0.115	0.020	5.703	0.000
6	Constant	0.023	0.010	2.468	0.014
7	C(1,1)	0.168	0.045	3.724	0.000
8	C(2,1)	0.018	0.024	0.753	0.452
9	C(2,2)	0.120	0.009	13.534	0.000
10	A(1,1)	0.106	0.027	4.004	0.000
11	A(1,2)	-0.016	0.010	-1.620	0.105
12	A(2,1)	0.205	0.072	2.853	0.004
13	A(2,2)	0.062	0.045	1.383	0.167
14	B(1,1)	0.984	0.008	130.205	0.000
15	B(1,2)	0.012	0.003	4.113	0.000
16	B(2,1)	-0.079	0.023	-3.373	0.001
17	B(2,2)	0.926	0.008	115.879	0.000
18	D(1,1)	0.173	0.029	5.875	0.000
19	D(1,2)	-0.009	0.010	-0.843	0.399
20	D(2,1)	0.344	0.076	4.499	0.000
21	D(2,2)	0.415	0.027	15.600	0.000

HSBC and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 63 Iterations.
Final criterion was 0.0000058 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -8603.0266

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(HSBC)					
1	HSBC{1}	-0.064	0.020	-3.275	0.001
2	EQU{1}	0.080	0.022	3.584	0.000
3	Constant	-0.008	0.017	-0.465	0.642
Mean Model(EQU)					
4	HSBC{1}	-0.004	0.010	-0.380	0.704
5	EQU{1}	0.099	0.018	5.499	0.000
6	Constant	0.021	0.011	1.941	0.052
7	C(1,1)	0.001	0.033	0.017	0.986
8	C(2,1)	-0.085	0.006	-13.593	0.000
9	C(2,2)	0.107	0.012	8.853	0.000
10	A(1,1)	0.156	0.021	7.413	0.000
11	A(1,2)	-0.017	0.013	-1.312	0.189
12	A(2,1)	0.002	0.038	0.056	0.955
13	A(2,2)	-0.001	0.038	-0.018	0.986
14	B(1,1)	0.987	0.004	259.140	0.000
15	B(1,2)	0.019	0.004	5.271	0.000
16	B(2,1)	-0.050	0.012	-4.343	0.000
17	B(2,2)	0.925	0.007	127.118	0.000
18	D(1,1)	0.124	0.022	5.553	0.000
19	D(1,2)	0.030	0.016	1.948	0.051
20	D(2,1)	0.284	0.033	8.511	0.000
21	D(2,2)	0.370	0.024	15.656	0.000

ING Bank and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 58 Iterations.
Final criterion was 0.0000052 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05

Usable Observations	3218
Log Likelihood	-9831.9741

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(ING)					
1	ING{1}	-0.078	0.019	-4.051	0.000
2	EQU{1}	0.343	0.050	6.810	0.000
3	Constant	0.008	0.028	0.296	0.767
Mean Model(EQU)					
4	ING{1}	-0.003	0.007	-0.476	0.634
5	EQU{1}	0.107	0.022	4.870	0.000
6	Constant	0.017	0.011	1.617	0.106
7	C(1,1)	0.240	0.029	8.240	0.000
8	C(2,1)	0.025	0.018	1.368	0.171
9	C(2,2)	0.086	0.013	6.700	0.000
10	A(1,1)	0.327	0.031	10.382	0.000
11	A(1,2)	0.058	0.018	3.324	0.001
12	A(2,1)	-0.272	0.079	-3.442	0.001
13	A(2,2)	-0.096	0.035	-2.745	0.006
14	B(1,1)	0.920	0.011	86.488	0.000
15	B(1,2)	-0.011	0.005	-2.175	0.030
16	B(2,1)	0.028	0.026	1.071	0.284
17	B(2,2)	0.969	0.008	119.105	0.000
18	D(1,1)	0.337	0.042	8.041	0.000
19	D(1,2)	0.033	0.013	2.517	0.012
20	D(2,1)	0.145	0.095	1.524	0.127
21	D(2,2)	0.324	0.030	10.892	0.000

Nordea Bank and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 68 Iterations.
Final criterion was 0.0000079 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05

Usable Observations	3218
Log Likelihood	-9227.3339

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(NORDEASS)					
1	NORDEASS{1}	-0.125	0.019	-6.627	0.000
2	EQU{1}	0.256	0.038	6.658	0.000
3	Constant	0.023	0.023	1.022	0.307
Mean Model(EQU)					
4	NORDEASS{1}	-0.002	0.010	-0.182	0.855
5	EQU{1}	0.122	0.019	6.297	0.000
6	Constant	0.021	0.012	1.783	0.075
7	C(1,1)	0.186	0.038	4.890	0.000
8	C(2,1)	-0.041	0.029	-1.405	0.160
9	C(2,2)	0.121	0.017	7.255	0.000
10	A(1,1)	0.081	0.026	3.156	0.002
11	A(1,2)	-0.075	0.011	-7.106	0.000
12	A(2,1)	0.258	0.047	5.463	0.000
13	A(2,2)	0.121	0.027	4.531	0.000
14	B(1,1)	0.975	0.011	86.779	0.000
15	B(1,2)	0.030	0.006	4.743	0.000
16	B(2,1)	-0.059	0.030	-1.964	0.050
17	B(2,2)	0.898	0.012	76.893	0.000
18	D(1,1)	0.146	0.029	5.063	0.000
19	D(1,2)	0.020	0.017	1.201	0.230
20	D(2,1)	0.298	0.068	4.368	0.000
21	D(2,2)	0.391	0.029	13.473	0.000

Royal Bank of Scotland and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 46 Iterations.
Final criterion was 0.0000060 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -10536.75

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(RBS)					
1	RBS{1}	-0.003	0.019	-0.156	0.876
2	EQU{1}	0.139	0.048	2.911	0.004
3	Constant	-0.014	0.028	-0.506	0.613
Mean Model(EQU)					
4	RBS{1}	-0.002	0.006	-0.289	0.773
5	EQU{1}	0.095	0.018	5.198	0.000
6	Constant	0.024	0.012	2.062	0.039
7	C(1,1)	0.273	0.028	9.723	0.000
8	C(2,1)	-0.031	0.020	-1.572	0.116
9	C(2,2)	0.133	0.012	11.319	0.000
10	A(1,1)	0.427	0.027	15.624	0.000
11	A(1,2)	-0.009	0.007	-1.340	0.180
12	A(2,1)	-0.144	0.060	-2.413	0.016
13	A(2,2)	0.078	0.026	3.049	0.002
14	B(1,1)	0.899	0.010	93.264	0.000
15	B(1,2)	0.010	0.003	3.450	0.001
16	B(2,1)	0.074	0.027	2.729	0.006
17	B(2,2)	0.926	0.009	105.976	0.000
18	D(1,1)	0.143	0.076	1.894	0.058
19	D(1,2)	0.010	0.009	1.189	0.234
20	D(2,1)	0.274	0.100	2.752	0.006
21	D(2,2)	0.380	0.027	13.988	0.000

Société Générale and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 66 Iterations.
Final criterion was 0.0000060 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -10184.196

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(SOCGEN)					
1	SOCGEN{1}	-0.022	0.020	-1.089	0.276
2	EQU{1}	0.255	0.050	5.127	0.000
3	Constant	0.015	0.029	0.497	0.619
Mean Model(EQU)					
4	SOCGEN{1}	-0.008	0.006	-1.279	0.201
5	EQU{1}	0.116	0.020	5.916	0.000
6	Constant	0.019	0.011	1.736	0.083
7	C(1,1)	0.217	0.031	6.994	0.000
8	C(2,1)	0.046	0.030	1.526	0.127
9	C(2,2)	0.105	0.009	11.209	0.000
10	A(1,1)	0.231	0.032	7.270	0.000
11	A(1,2)	0.008	0.013	0.633	0.527
12	A(2,1)	0.135	0.100	1.351	0.177
13	A(2,2)	0.062	0.060	1.035	0.301
14	B(1,1)	0.951	0.013	73.058	0.000
15	B(1,2)	0.004	0.004	1.046	0.296
16	B(2,1)	-0.020	0.054	-0.370	0.712
17	B(2,2)	0.943	0.011	85.099	0.000
18	D(1,1)	0.224	0.044	5.119	0.000
19	D(1,2)	-0.003	0.012	-0.208	0.835
20	D(2,1)	0.164	0.130	1.254	0.210
21	D(2,2)	0.383	0.032	11.919	0.000

Standard Chartered and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 77 Iterations.
Final criterion was 0.0000066 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -9833.6154

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(SCB)					
1	SCB{1}	-0.054	0.018	-2.966	0.003
2	EQU{1}	0.241	0.041	5.798	0.000
3	Constant	-0.011	0.026	-0.418	0.676
Mean Model(EQU)					
4	SCB{1}	0.002	0.005	0.419	0.675
5	EQU{1}	0.101	0.018	5.623	0.000
6	Constant	0.020	0.012	1.645	0.100
7	C(1,1)	0.336	0.031	10.764	0.000
8	C(2,1)	0.001	0.014	0.064	0.949
9	C(2,2)	0.120	0.010	12.586	0.000
10	A(1,1)	0.258	0.025	10.321	0.000
11	A(1,2)	-0.009	0.007	-1.205	0.228
12	A(2,1)	-0.009	0.070	-0.125	0.901
13	A(2,2)	-0.025	0.032	-0.774	0.439
14	B(1,1)	0.920	0.011	80.570	0.000
15	B(1,2)	0.012	0.003	3.519	0.000
16	B(2,1)	0.021	0.024	0.895	0.371
17	B(2,2)	0.933	0.007	127.501	0.000
18	D(1,1)	0.246	0.037	6.729	0.000
19	D(1,2)	-0.004	0.009	-0.496	0.620
20	D(2,1)	0.289	0.068	4.248	0.000
21	D(2,2)	0.395	0.023	17.110	0.000

UBS and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 65 Iterations.
Final criterion was 0.0000063 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -9636.5267

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(UBSVX)					
1	UBSVX{1}	-0.026	0.019	-1.342	0.18
2	EQU{1}	0.325	0.041	7.88	0
3	Constant	-0.01	0.024	-0.422	0.673
Mean Model(EQU)					
4	UBSVX{1}	-0.002	0.008	-0.308	0.758
5	EQU{1}	0.109	0.021	5.225	0
6	Constant	0.024	0.011	2.171	0.03
7	C(1,1)	0.195	0.022	8.773	0
8	C(2,1)	0.025	0.016	1.57	0.116
9	C(2,2)	0.117	0.008	14.399	0
10	A(1,1)	0.221	0.015	14.415	0
11	A(1,2)	-0.004	0.008	-0.5	0.617
12	A(2,1)	0.109	0.047	2.322	0.02
13	A(2,2)	0.038	0.031	1.256	0.209
14	B(1,1)	0.954	0.002	560.823	0
15	B(1,2)	0.008	0.003	2.637	0.008
16	B(2,1)	-0.022	0.014	-1.602	0.109
17	B(2,2)	0.938	0.007	143.393	0
18	D(1,1)	0.142	0.036	3.914	0
19	D(1,2)	0.03	0.01	3.095	0.002
20	D(2,1)	0.328	0.064	5.106	0
21	D(2,2)	0.344	0.022	15.421	0.000

Unicredit Group and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 83 Iterations.
Final criterion was 0.0000027 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -10519.934

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(UCG)					
1	UCG{1}	-0.053	0.019	-2.771	0.006
2	EQU{1}	0.179	0.050	3.591	0.000
3	Constant	-0.011	0.031	-0.369	0.712
Mean Model(EQU)					
4	UCG{1}	-0.003	0.005	-0.629	0.530
5	EQU{1}	0.116	0.019	5.983	0.000
6	Constant	0.024	0.011	2.208	0.027
7	C(1,1)	0.214	0.027	7.952	0.000
8	C(2,1)	0.001	0.020	0.055	0.956
9	C(2,2)	0.104	0.010	10.833	0.000
10	A(1,1)	0.260	0.025	10.584	0.000
11	A(1,2)	0.018	0.006	3.024	0.002
12	A(2,1)	-0.149	0.077	-1.936	0.053
13	A(2,2)	-0.042	0.035	-1.177	0.239
14	B(1,1)	0.937	0.007	133.604	0.000
15	B(1,2)	0.000	0.002	-0.189	0.850
16	B(2,1)	0.039	0.020	1.937	0.053
17	B(2,2)	0.954	0.006	163.626	0.000
18	D(1,1)	0.321	0.032	10.128	0.000
19	D(1,2)	0.001	0.007	0.169	0.866
20	D(2,1)	0.051	0.079	0.647	0.518
21	D(2,2)	0.385	0.024	15.905	0.000

Agricultural Bank of China and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 56 Iterations.
Final criterion was 0.0000052 <= 0.0000100
Daily(5) Data From 2010:07:16 To 2017:05:05
Usable Observations 1776
Log Likelihood -4685.252

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(ABCCH)					
1	ABCCH{1}	-0.031	0.023	-1.354	0.176
2	EQU{1}	0.130	0.025	5.284	0.000
3	Constant	0.008	0.021	0.394	0.694
Mean Model(EQU)					
4	ABCCH{1}	0.003	0.010	0.258	0.796
5	EQU{1}	0.093	0.023	4.104	0.000
6	Constant	0.025	0.014	1.766	0.077
7	C(1,1)	0.198	0.021	9.474	0.000
8	C(2,1)	0.010	0.020	0.499	0.618
9	C(2,2)	0.136	0.014	9.432	0.000
10	A(1,1)	0.289	0.021	13.942	0.000
11	A(1,2)	-0.016	0.010	-1.722	0.085
12	A(2,1)	-0.077	0.034	-2.237	0.025
13	A(2,2)	0.075	0.053	1.425	0.154
14	B(1,1)	0.946	0.007	132.109	0.000
15	B(1,2)	0.005	0.004	1.298	0.194
16	B(2,1)	0.001	0.009	0.128	0.898
17	B(2,2)	0.933	0.009	99.645	0.000
18	D(1,1)	0.044	0.043	1.032	0.302
19	D(1,2)	0.018	0.016	1.144	0.252
20	D(2,1)	0.059	0.033	1.813	0.070
21	D(2,2)	0.425	0.034	12.355	0.000

Bank of China and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 85 Iterations.
Final criterion was 0.0000022 <= 0.0000100
Daily(5) Data From 2006:06:05 To 2017:05:05
Usable Observations 2850
Log Likelihood -8774.934

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BOC)					
1	BOC{1}	-0.067	0.019	-3.535	0.000
2	EQU{1}	0.581	0.038	15.421	0.000
3	Constant	-0.025	0.028	-0.894	0.371
Mean Model(EQU)					
4	BOC{1}	0.001	0.009	0.064	0.949
5	EQU{1}	0.113	0.019	5.862	0.000
6	Constant	0.027	0.013	2.005	0.045
7	C(1,1)	0.411	0.050	8.276	0.000
8	C(2,1)	-0.001	0.032	-0.040	0.968
9	C(2,2)	0.116	0.011	10.084	0.000
10	A(1,1)	0.298	0.027	11.091	0.000
11	A(1,2)	-0.025	0.019	-1.314	0.189
12	A(2,1)	-0.597	0.070	-8.524	0.000
13	A(2,2)	-0.018	0.034	-0.534	0.593
14	B(1,1)	0.892	0.018	48.769	0.000
15	B(1,2)	0.021	0.024	0.888	0.375
16	B(2,1)	-0.044	0.060	-0.726	0.468
17	B(2,2)	0.932	0.020	46.789	0.000
18	D(1,1)	0.203	0.042	4.830	0.000
19	D(1,2)	0.048	0.013	3.619	0.000
20	D(2,1)	0.147	0.076	1.931	0.054
21	D(2,2)	0.371	0.031	12.067	0.000

China Const. Bank and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 51 Iterations.
Final criterion was 0.0000088 <= 0.0000100
Daily(5) Data From 2005:10:28 To 2017:05:05
Usable Observations 3006
Log Likelihood -9308.872

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(CCBHK)					
1	CCBHK{1}	-0.073	0.019	-3.756	0.000
2	EQU{1}	0.587	0.035	16.678	0.000
3	Constant	0.012	0.026	0.449	0.653
Mean Model(EQU)					
4	CCBHK{1}	-0.006	0.008	-0.785	0.432
5	EQU{1}	0.101	0.019	5.466	0.000
6	Constant	0.024	0.012	2.047	0.041
7	C(1,1)	0.310	0.031	10.133	0.000
8	C(2,1)	0.004	0.016	0.272	0.785
9	C(2,2)	0.114	0.010	10.927	0.000
10	A(1,1)	0.263	0.019	13.584	0.000
11	A(1,2)	0.000	0.011	0.030	0.976
12	A(2,1)	0.135	0.039	3.477	0.001
13	A(2,2)	0.082	0.037	2.245	0.025
14	B(1,1)	0.937	0.009	103.993	0.000
15	B(1,2)	0.002	0.005	0.506	0.613
16	B(2,1)	0.008	0.014	0.614	0.540
17	B(2,2)	0.943	0.007	138.985	0.000
18	D(1,1)	0.077	0.037	2.056	0.040
19	D(1,2)	0.050	0.013	3.969	0.000
20	D(2,1)	0.059	0.052	1.145	0.252
21	D(2,2)	0.358	0.023	15.611	0.000

I & C Bank of China and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 52 Iterations. Final criterion was 0.0000084 <= 0.0000100

Daily(5) Data From 2006:10:30 To 2017:05:05
Usable Observations 2745
Log Likelihood -8235.808

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(ICBCCG)					
1	ICBCCG{1}	-0.039	0.021	-1.873	0.061
2	EQU{1}	0.186	0.024	7.772	0.000
3	Constant	-0.012	0.020	-0.598	0.550
Mean Model(EQU)					
4	ICBCCG{1}	-0.003	0.009	-0.348	0.728
5	EQU{1}	0.100	0.019	5.322	0.000
6	Constant	0.013	0.013	0.972	0.331
7	C(1,1)	0.134	0.014	9.434	0.000
8	C(2,1)	0.011	0.018	0.625	0.532
9	C(2,2)	0.118	0.008	14.802	0.000
10	A(1,1)	0.294	0.015	19.662	0.000
11	A(1,2)	-0.015	0.006	-2.400	0.016
12	A(2,1)	0.066	0.023	2.876	0.004
13	A(2,2)	-0.026	0.038	-0.689	0.491
14	B(1,1)	0.953	0.004	258.876	0.000
15	B(1,2)	0.007	0.002	3.818	0.000
16	B(2,1)	-0.005	0.006	-0.802	0.423
17	B(2,2)	0.949	0.002	580.231	0.000
18	D(1,1)	0.012	0.028	0.440	0.660
19	D(1,2)	-0.015	0.015	-1.016	0.310
20	D(2,1)	0.085	0.030	2.849	0.004
21	D(2,2)	0.405	0.013	30.706	0.000

Mitsubishi Bank and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 46 Iterations.
Final criterion was 0.0000087 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -10150.52

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(MITSUBISHI)					
1	MITSUBISHI{1}	-0.006	0.016	-0.353	0.724
2	EQU{1}	0.763	0.037	20.736	0.000
3	Constant	-0.018	0.027	-0.682	0.495
Mean Model(EQU)					
4	MITSUBISHI{1}	-0.005	0.007	-0.722	0.470
5	EQU{1}	0.108	0.019	5.641	0.000
6	Constant	0.021	0.012	1.736	0.083
7	C(1,1)	0.221	0.023	9.676	0.000
8	C(2,1)	0.025	0.015	1.668	0.095
9	C(2,2)	0.108	0.009	11.720	0.000
10	A(1,1)	0.237	0.016	14.743	0.000
11	A(1,2)	-0.003	0.007	-0.460	0.645
12	A(2,1)	0.066	0.035	1.909	0.056
13	A(2,2)	-0.021	0.034	-0.602	0.547
14	B(1,1)	0.956	0.005	190.007	0.000
15	B(1,2)	0.002	0.002	0.839	0.401
16	B(2,1)	-0.015	0.010	-1.501	0.133
17	B(2,2)	0.949	0.005	191.928	0.000
18	D(1,1)	0.168	0.032	5.200	0.000
19	D(1,2)	0.018	0.009	2.025	0.043
20	D(2,1)	0.124	0.044	2.848	0.004
21	D(2,2)	0.380	0.022	17.375	0.000

Mizuho Bank and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 57 Iterations.
Final criterion was 0.0000079 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -10117.1

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(MIZUHO)					
1	MIZUHO{1}	-0.008	0.019	-0.422	0.673
2	EQU{1}	0.640	0.040	15.884	0.000
3	Constant	-0.017	0.026	-0.633	0.526
Mean Model(EQU)					
4	MIZUHO{1}	-0.014	0.007	-2.054	0.040
5	EQU{1}	0.116	0.018	6.431	0.000
6	Constant	0.022	0.011	1.968	0.049
7	C(1,1)	0.200	0.024	8.229	0.000
8	C(2,1)	0.024	0.016	1.512	0.131
9	C(2,2)	0.108	0.009	12.528	0.000
10	A(1,1)	0.202	0.016	13.042	0.000
11	A(1,2)	-0.017	0.008	-2.263	0.024
12	A(2,1)	0.155	0.042	3.696	0.000
13	A(2,2)	0.020	0.035	0.564	0.573
14	B(1,1)	0.961	0.005	176.873	0.000
15	B(1,2)	0.005	0.003	1.801	0.072
16	B(2,1)	-0.019	0.010	-1.970	0.049
17	B(2,2)	0.947	0.005	185.838	0.000
18	D(1,1)	0.185	0.030	6.221	0.000
19	D(1,2)	0.018	0.010	1.787	0.074
20	D(2,1)	0.078	0.045	1.745	0.081
21	D(2,2)	0.377	0.021	17.906	0.000

Sumitomo Bank and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 57 Iterations.
Final criterion was 0.0000075 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -10214.49

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(SUMITOMO)					
1	SUMITOMO{1}	-0.002	0.017	-0.115	0.909
2	EQU{1}	0.679	0.036	18.771	0.000
3	Constant	-0.011	0.027	-0.421	0.674
Mean Model(EQU)					
4	SUMITOMO{1}	-0.006	0.006	-0.932	0.351
5	EQU{1}	0.106	0.019	5.489	0.000
6	Constant	0.022	0.012	1.851	0.064
7	C(1,1)	0.228	0.023	10.029	0.000
8	C(2,1)	0.037	0.015	2.441	0.015
9	C(2,2)	0.104	0.010	10.364	0.000
10	A(1,1)	0.213	0.017	12.406	0.000
11	A(1,2)	-0.007	0.008	-0.844	0.399
12	A(2,1)	0.077	0.031	2.482	0.013
13	A(2,2)	-0.052	0.032	-1.600	0.110
14	B(1,1)	0.952	0.005	196.135	0.000
15	B(1,2)	0.000	0.003	-0.075	0.940
16	B(2,1)	-0.002	0.010	-0.164	0.870
17	B(2,2)	0.950	0.005	189.365	0.000
18	D(1,1)	0.260	0.028	9.366	0.000
19	D(1,2)	0.017	0.010	1.792	0.073
20	D(2,1)	0.042	0.041	1.032	0.302
21	D(2,2)	0.374	0.022	16.715	0.000

Bank of America and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 53 Iterations. Final criterion was 0.0000051 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -5821.629

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BOA)					
1	BOA{1}	0.000	0.018	-0.003	0.998
2	IGB{1}	-0.212	0.120	-1.758	0.079
3	Constant	0.013	0.025	0.533	0.594
Mean Model(IGB)					
4	BOA{1}	0.004	0.001	3.318	0.001
5	IGB{1}	-0.003	0.016	-0.213	0.832
6	Constant	0.014	0.003	4.295	0.000
7	C(1,1)	0.122	0.021	5.951	0.000
8	C(2,1)	0.000	0.006	0.026	0.979
9	C(2,2)	0.013	0.003	4.254	0.000
10	A(1,1)	0.232	0.016	14.224	0.000
11	A(1,2)	-0.003	0.001	-2.589	0.010
12	A(2,1)	-0.271	0.132	-2.057	0.040
13	A(2,2)	0.176	0.013	13.423	0.000
14	B(1,1)	0.956	0.004	240.813	0.000
15	B(1,2)	0.000	0.000	1.552	0.121
16	B(2,1)	-0.010	0.035	-0.278	0.781
17	B(2,2)	0.980	0.003	378.902	0.000
18	D(1,1)	0.238	0.022	10.755	0.000
19	D(1,2)	-0.001	0.001	-0.648	0.517
20	D(2,1)	0.130	0.213	0.609	0.543
21	D(2,2)	0.088	0.028	3.122	0.002

Bank of New York and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 62 Iterations. Final criterion was 0.0000000 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -5462.0049

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BNY)					
1	BNY{1}	-0.067	0.019	-3.610	0.000
2	IGB{1}	-0.046	0.119	-0.385	0.700
3	Constant	0.041	0.024	1.736	0.083
Mean Model(IGB)					
4	BNY{1}	0.005	0.002	3.013	0.003
5	IGB{1}	-0.011	0.017	-0.651	0.515
6	Constant	0.014	0.003	4.235	0.000
7	C(1,1)	0.265	0.023	11.530	0.000
8	C(2,1)	-0.020	0.004	-5.464	0.000
9	C(2,2)	0.012	0.004	3.229	0.001
10	A(1,1)	0.168	0.025	6.658	0.000
11	A(1,2)	0.003	0.001	1.976	0.048
12	A(2,1)	-0.310	0.162	-1.910	0.056
13	A(2,2)	0.196	0.016	12.274	0.000
14	B(1,1)	0.949	0.007	137.586	0.000
15	B(1,2)	0.001	0.000	1.885	0.059
16	B(2,1)	0.127	0.050	2.559	0.010
17	B(2,2)	0.974	0.004	258.118	0.000
18	D(1,1)	-0.335	0.027	-12.315	0.000
19	D(1,2)	0.011	0.002	6.407	0.000
20	D(2,1)	0.163	0.210	0.778	0.437
21	D(2,2)	0.055	0.040	1.384	0.166

Citigroup and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 44 Iterations. Final criterion was 0.0000067 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -5892.9092

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(CITI)					
1	CITI{1}	0.019	0.018	1.074	0.283
2	IGB{1}	-0.139	0.116	-1.194	0.232
3	Constant	0.013	0.023	0.547	0.585
Mean Model(IGB)					
4	CITI{1}	0.003	0.001	2.567	0.010
5	IGB{1}	-0.008	0.017	-0.488	0.626
6	Constant	0.013	0.003	3.862	0.000
7	C(1,1)	0.145	0.022	6.649	0.000
8	C(2,1)	-0.001	0.006	-0.147	0.883
9	C(2,2)	0.016	0.003	5.373	0.000
10	A(1,1)	0.240	0.018	13.576	0.000
11	A(1,2)	0.000	0.001	0.401	0.688
12	A(2,1)	-0.418	0.129	-3.250	0.001
13	A(2,2)	0.185	0.012	14.816	0.000
14	B(1,1)	0.947	0.004	219.567	0.000
15	B(1,2)	0.000	0.000	0.661	0.509
16	B(2,1)	0.008	0.041	0.195	0.845
17	B(2,2)	0.979	0.003	341.318	0.000
18	D(1,1)	0.277	0.022	12.375	0.000
19	D(1,2)	-0.004	0.001	-4.060	0.000
20	D(2,1)	0.289	0.169	1.709	0.087
21	D(2,2)	0.079	0.023	3.386	0.001

Goldman Sachs and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 65 Iterations. Final criterion was 0.0000000 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -5680.5683

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(GOLDMAN)					
1	GOLDMAN{1}	-0.039	0.017	-2.273	0.023
2	IGB{1}	-0.212	0.122	-1.745	0.081
3	Constant	0.049	0.025	1.948	0.051
Mean Model(IGB)					
4	GOLDMAN{1}	0.006	0.002	2.989	0.003
5	IGB{1}	0.003	0.019	0.183	0.854
6	Constant	0.013	0.004	3.674	0.000
7	C(1,1)	0.215	0.030	7.190	0.000
8	C(2,1)	-0.011	0.004	-2.910	0.004
9	C(2,2)	0.016	0.003	5.352	0.000
10	A(1,1)	0.183	0.026	7.131	0.000
11	A(1,2)	0.001	0.003	0.385	0.700
12	A(2,1)	-0.270	0.161	-1.673	0.094
13	A(2,2)	0.177	0.018	9.667	0.000
14	B(1,1)	0.963	0.007	140.462	0.000
15	B(1,2)	0.000	0.001	0.965	0.334
16	B(2,1)	0.041	0.042	0.966	0.334
17	B(2,2)	0.979	0.004	272.150	0.000
18	D(1,1)	0.226	0.024	9.335	0.000
19	D(1,2)	-0.007	0.002	-3.290	0.001
20	D(2,1)	0.039	0.266	0.145	0.885
21	D(2,2)	0.081	0.051	1.570	0.116

JP Morgan Chase and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 53 Iterations. Final criterion was 0.0000067 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -5403.695

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(JPM)					
1	JPM{1}	-0.060	0.017	-3.451	0.001
2	IGB{1}	-0.145	0.116	-1.258	0.208
3	Constant	0.040	0.022	1.809	0.070
Mean Model(IGB)					
4	JPM{1}	0.004	0.002	2.446	0.014
5	IGB{1}	-0.005	0.018	-0.278	0.781
6	Constant	0.014	0.003	4.110	0.000
7	C(1,1)	0.193	0.023	8.569	0.000
8	C(2,1)	-0.010	0.005	-2.033	0.042
9	C(2,2)	0.014	0.003	4.982	0.000
10	A(1,1)	0.198	0.020	9.786	0.000
11	A(1,2)	-0.004	0.002	-2.299	0.022
12	A(2,1)	-0.357	0.144	-2.481	0.013
13	A(2,2)	0.177	0.015	11.625	0.000
14	B(1,1)	0.946	0.006	160.677	0.000
15	B(1,2)	0.001	0.000	3.716	0.000
16	B(2,1)	0.016	0.044	0.364	0.716
17	B(2,2)	0.979	0.003	318.349	0.000
18	D(1,1)	0.329	0.024	13.839	0.000
19	D(1,2)	-0.007	0.002	-3.246	0.001
20	D(2,1)	0.069	0.173	0.401	0.689
21	D(2,2)	0.105	0.027	3.910	0.000

Morgan Stanley and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 54 Iterations. Final criterion was 0.0000000 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -6190.1383

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(MORGAN)					
1	MORGAN{1}	-0.024	0.019	-1.269	0.204
2	IGB{1}	-0.167	0.143	-1.168	0.243
3	Constant	0.034	0.028	1.219	0.223
Mean Model(IGB)					
4	MORGAN{1}	0.004	0.001	2.933	0.003
5	IGB{1}	-0.002	0.016	-0.111	0.911
6	Constant	0.014	0.003	4.048	0.000
7	C(1,1)	0.211	0.029	7.278	0.000
8	C(2,1)	-0.006	0.004	-1.489	0.137
9	C(2,2)	0.016	0.003	5.853	0.000
10	A(1,1)	0.192	0.022	8.770	0.000
11	A(1,2)	0.001	0.001	0.811	0.417
12	A(2,1)	-0.440	0.181	-2.431	0.015
13	A(2,2)	0.185	0.015	12.599	0.000
14	B(1,1)	0.955	0.005	180.694	0.000
15	B(1,2)	0.000	0.000	0.816	0.415
16	B(2,1)	0.020	0.045	0.449	0.653
17	B(2,2)	0.979	0.003	304.146	0.000
18	D(1,1)	-0.282	0.020	-14.047	0.000
19	D(1,2)	0.005	0.001	3.462	0.001
20	D(2,1)	-0.225	0.225	-0.999	0.318
21	D(2,2)	-0.081	0.031	-2.646	0.008

Royal Bank of Canada and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 89 Iterations. Final criterion was 0.0000000 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -4204.568

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(RBC)					
1	RBC{1}	0.007	0.017	0.380	0.704
2	IGB{1}	-0.210	0.080	-2.621	0.009
3	Constant	0.043	0.016	2.648	0.008
Mean Model(IGB)					
4	RBC{1}	0.012	0.003	4.363	0.000
5	IGB{1}	-0.003	0.018	-0.156	0.876
6	Constant	0.013	0.003	4.137	0.000
7	C(1,1)	0.087	0.018	4.899	0.000
8	C(2,1)	0.001	0.006	0.094	0.925
9	C(2,2)	0.020	0.003	6.395	0.000
10	A(1,1)	0.106	0.018	5.816	0.000
11	A(1,2)	0.010	0.002	4.440	0.000
12	A(2,1)	0.193	0.134	1.440	0.150
13	A(2,2)	0.174	0.017	10.038	0.000
14	B(1,1)	0.975	0.003	306.502	0.000
15	B(1,2)	0.000	0.001	0.235	0.814
16	B(2,1)	-0.062	0.031	-2.007	0.045
17	B(2,2)	0.977	0.004	269.073	0.000
18	D(1,1)	0.240	0.016	15.315	0.000
19	D(1,2)	-0.011	0.003	-3.489	0.000
20	D(2,1)	-0.223	0.231	-0.966	0.334
21	D(2,2)	-0.093	0.038	-2.478	0.013

State Streetand Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 72 Iterations. Final criterion was 0.0000079 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -5908.6551

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(STATE)					
1	STATE{1}	-0.061	0.019	-3.254	0.001
2	IGB{1}	-0.099	0.123	-0.806	0.420
3	Constant	0.032	0.023	1.387	0.166
Mean Model(IGB)					
4	STATE{1}	0.004	0.001	2.583	0.010
5	IGB{1}	-0.005	0.017	-0.270	0.787
6	Constant	0.014	0.003	4.046	0.000
7	C(1,1)	0.128	0.019	6.877	0.000
8	C(2,1)	-0.015	0.004	-3.761	0.000
9	C(2,2)	-0.013	0.004	-3.197	0.001
10	A(1,1)	0.126	0.015	8.157	0.000
11	A(1,2)	-0.003	0.001	-3.210	0.001
12	A(2,1)	-0.226	0.143	-1.582	0.114
13	A(2,2)	0.164	0.018	9.132	0.000
14	B(1,1)	0.977	0.002	558.857	0.000
15	B(1,2)	0.001	0.000	4.528	0.000
16	B(2,1)	0.028	0.032	0.883	0.377
17	B(2,2)	0.977	0.003	284.782	0.000
18	D(1,1)	0.246	0.018	13.591	0.000
19	D(1,2)	-0.005	0.001	-3.423	0.001
20	D(2,1)	-0.095	0.157	-0.604	0.546
21	D(2,2)	0.137	0.027	5.142	0.000

Wells Fargo and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 53 Iterations. Final criterion was 0.0000059 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -5217.6584

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(WELLS)					
1	WELLS{1}	-0.079	0.016	-4.906	0.000
2	IGB{1}	-0.092	0.100	-0.924	0.355
3	Constant	0.018	0.019	0.929	0.353
Mean Model(IGB)					
4	WELLS{1}	0.005	0.002	3.207	0.001
5	IGB{1}	-0.008	0.017	-0.485	0.628
6	Constant	0.014	0.003	4.232	0.000
7	C(1,1)	0.127	0.020	6.307	0.000
8	C(2,1)	-0.008	0.005	-1.512	0.131
9	C(2,2)	0.014	0.003	4.626	0.000
10	A(1,1)	0.198	0.020	10.084	0.000
11	A(1,2)	0.001	0.002	0.628	0.530
12	A(2,1)	-0.401	0.122	-3.288	0.001
13	A(2,2)	0.182	0.013	14.567	0.000
14	B(1,1)	0.951	0.005	185.830	0.000
15	B(1,2)	0.000	0.000	1.027	0.304
16	B(2,1)	0.036	0.034	1.059	0.289
17	B(2,2)	0.978	0.003	378.614	0.000
18	D(1,1)	0.324	0.022	14.649	0.000
19	D(1,2)	-0.008	0.002	-4.512	0.000
20	D(2,1)	0.126	0.200	0.629	0.529
21	D(2,2)	0.102	0.023	4.422	0.000

Banco Santander and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 48 Iterations. Final criterion was 0.0000029 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -5864.8946

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(SANTANDER)					
1	SANTANDER{1}	-0.014	0.016	-0.868	0.385
2	IGB{1}	-0.277	0.130	-2.122	0.034
3	Constant	0.014	0.024	0.566	0.571
Mean Model(IGB)					
4	SANTANDER{1}	0.003	0.002	2.084	0.037
5	IGB{1}	-0.017	0.017	-0.985	0.325
6	Constant	0.013	0.003	3.696	0.000
7	C(1,1)	0.199	0.028	7.114	0.000
8	C(2,1)	-0.001	0.004	-0.267	0.790
9	C(2,2)	0.015	0.003	5.027	0.000
10	A(1,1)	0.150	0.025	5.931	0.000
11	A(1,2)	-0.003	0.001	-2.131	0.033
12	A(2,1)	-0.634	0.152	-4.163	0.000
13	A(2,2)	0.156	0.015	10.187	0.000
14	B(1,1)	0.948	0.006	157.310	0.000
15	B(1,2)	0.001	0.000	2.325	0.020
16	B(2,1)	0.023	0.038	0.606	0.545
17	B(2,2)	0.981	0.002	399.854	0.000
18	D(1,1)	0.362	0.022	16.535	0.000
19	D(1,2)	-0.007	0.002	-4.576	0.000
20	D(2,1)	0.107	0.186	0.576	0.565
21	D(2,2)	0.142	0.022	6.357	0.000

Barclays and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 43 Iterations. Final criterion was 0.0000000 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -6435.2842

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BARCLAYS)					
1	BARCLAYS{1}	0.017	0.016	1.120	0.263
2	IGB{1}	-0.663	0.158	-4.194	0.000
3	Constant	-0.012	0.030	-0.407	0.684
Mean Model(IGB)					
4	BARCLAYS{1}	0.003	0.001	2.465	0.014
5	IGB{1}	-0.015	0.018	-0.829	0.407
6	Constant	0.013	0.003	3.685	0.000
7	C(1,1)	0.215	0.026	8.212	0.000
8	C(2,1)	-0.003	0.004	-0.793	0.428
9	C(2,2)	0.015	0.003	5.532	0.000
10	A(1,1)	0.201	0.021	9.488	0.000
11	A(1,2)	-0.003	0.001	-3.214	0.001
12	A(2,1)	-0.455	0.170	-2.679	0.007
13	A(2,2)	0.137	0.018	7.621	0.000
14	B(1,1)	0.955	0.004	213.860	0.000
15	B(1,2)	0.000	0.000	1.481	0.139
16	B(2,1)	-0.001	0.043	-0.028	0.978
17	B(2,2)	0.982	0.003	360.576	0.000
18	D(1,1)	0.288	0.023	12.542	0.000
19	D(1,2)	-0.001	0.001	-1.018	0.309
20	D(2,1)	-0.124	0.226	-0.546	0.585
21	D(2,2)	0.150	0.024	6.392	0.000

BNP Paribas and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 48 Iterations. Final criterion was 0.0000016 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -6130.8334

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BNP)					
1	BNP{1}	-0.014	0.016	-0.872	0.383
2	IGB{1}	-0.578	0.142	-4.075	0.000
3	Constant	0.000	0.027	-0.010	0.992
Mean Model(IGB)					
4	BNP{1}	0.003	0.001	1.714	0.087
5	IGB{1}	-0.027	0.018	-1.531	0.126
6	Constant	0.014	0.003	4.392	0.000
7	C(1,1)	0.257	0.024	10.680	0.000
8	C(2,1)	-0.005	0.004	-1.365	0.172
9	C(2,2)	0.015	0.003	5.707	0.000
10	A(1,1)	0.141	0.026	5.494	0.000
11	A(1,2)	-0.001	0.002	-0.596	0.551
12	A(2,1)	-0.309	0.205	-1.502	0.133
13	A(2,2)	0.165	0.017	9.953	0.000
14	B(1,1)	0.953	0.005	187.827	0.000
15	B(1,2)	0.001	0.000	2.487	0.013
16	B(2,1)	0.011	0.046	0.244	0.807
17	B(2,2)	0.980	0.003	330.968	0.000
18	D(1,1)	0.352	0.024	14.796	0.000
19	D(1,2)	-0.008	0.002	-4.635	0.000
20	D(2,1)	-0.244	0.251	-0.972	0.331
21	D(2,2)	0.126	0.029	4.427	0.000

Credit Suisse and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 61 Iterations. Final criterion was 0.0000000 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -6009.2908

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(CRESUISVX)					
1	CRESUISVX{1}	0.077	0.016	4.808	0.000
2	IGB{1}	-0.594	0.146	-4.068	0.000
3	Constant	-0.008	0.027	-0.288	0.773
Mean Model(IGB)					
4	CRESUISVX{1}	0.003	0.002	2.127	0.033
5	IGB{1}	-0.024	0.017	-1.363	0.173
6	Constant	0.013	0.003	3.756	0.000
7	C(1,1)	0.213	0.025	8.531	0.000
8	C(2,1)	-0.006	0.004	-1.694	0.090
9	C(2,2)	0.015	0.002	8.538	0.000
10	A(1,1)	0.162	0.022	7.306	0.000
11	A(1,2)	-0.001	0.003	-0.200	0.841
12	A(2,1)	-0.550	0.133	-4.120	0.000
13	A(2,2)	0.163	0.012	13.137	0.000
14	B(1,1)	0.958	0.004	229.599	0.000
15	B(1,2)	0.001	0.000	1.730	0.084
16	B(2,1)	0.034	0.035	0.977	0.328
17	B(2,2)	0.981	0.002	564.017	0.000
18	D(1,1)	0.286	0.024	11.988	0.000
19	D(1,2)	-0.007	0.003	-2.740	0.006
20	D(2,1)	0.231	0.180	1.283	0.200
21	D(2,2)	0.123	0.024	5.169	0.000

Deutsche Bank and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 53 Iterations. Final criterion was 0.0000054 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -6098.9341

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(DEUTSCHEGR)					
1	DEUTSCHEGR{1}	0.026	0.016	1.650	0.099
2	IGB{1}	-0.280	0.139	-2.011	0.044
3	Constant	-0.018	0.029	-0.610	0.542
Mean Model(IGB)					
4	DEUTSCHEGR{1}	0.005	0.001	3.584	0.000
5	IGB{1}	-0.007	0.017	-0.400	0.689
6	Constant	0.013	0.004	3.785	0.000
7	C(1,1)	0.146	0.023	6.449	0.000
8	C(2,1)	-0.005	0.005	-1.114	0.265
9	C(2,2)	0.015	0.003	5.486	0.000
10	A(1,1)	0.131	0.023	5.762	0.000
11	A(1,2)	0.000	0.002	-0.211	0.833
12	A(2,1)	-0.426	0.147	-2.900	0.004
13	A(2,2)	0.160	0.015	10.783	0.000
14	B(1,1)	0.974	0.004	267.318	0.000
15	B(1,2)	0.000	0.000	0.990	0.322
16	B(2,1)	0.028	0.034	0.821	0.412
17	B(2,2)	0.980	0.003	360.173	0.000
18	D(1,1)	0.232	0.019	12.089	0.000
19	D(1,2)	-0.005	0.002	-3.351	0.001
20	D(2,1)	0.041	0.183	0.222	0.824
21	D(2,2)	0.138	0.024	5.763	0.000

Crédit Agricole and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 65 Iterations. Final criterion was 0.0000000 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2000.9374

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(CREAGR)					
1	CREAGR{1}	0.166	0.040	4.130	0.000
2	IGB{1}	-0.144	0.392	-0.367	0.713
3	Constant	0.037	0.130	0.283	0.777
Mean Model(IGB)					
4	CREAGR{1}	0.007	0.003	2.631	0.009
5	IGB{1}	0.308	0.038	8.150	0.000
6	Constant	0.049	0.013	3.886	0.000
7	C(1,1)	0.487	0.195	2.503	0.012
8	C(2,1)	-0.044	0.042	-1.052	0.293
9	C(2,2)	0.078	0.025	3.165	0.002
10	A(1,1)	0.088	0.050	1.766	0.077
11	A(1,2)	0.004	0.003	1.383	0.167
12	A(2,1)	-1.789	0.623	-2.873	0.004
13	A(2,2)	0.325	0.059	5.481	0.000
14	B(1,1)	0.946	0.010	92.573	0.000
15	B(1,2)	0.000	0.001	0.112	0.911
16	B(2,1)	0.404	0.355	1.137	0.256
17	B(2,2)	0.884	0.030	29.911	0.000
18	D(1,1)	-0.392	0.046	-8.461	0.000
19	D(1,2)	0.010	0.004	2.607	0.009
20	D(2,1)	-0.138	0.717	-0.192	0.848
21	D(2,2)	-0.331	0.087	-3.822	0.000

HSBC and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 52 Iterations. Final criterion was 0.0000049 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -4802.6556

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(HSBC)					
1	HSBC{1}	-0.035	0.017	-1.996	0.046
2	IGB{1}	-0.249	0.095	-2.626	0.009
3	Constant	-0.003	0.018	-0.180	0.857
Mean Model(IGB)					
4	HSBC{1}	0.004	0.003	1.516	0.129
5	IGB{1}	-0.016	0.017	-0.960	0.337
6	Constant	0.015	0.004	4.217	0.000
7	C(1,1)	0.099	0.016	6.065	0.000
8	C(2,1)	-0.002	0.006	-0.266	0.790
9	C(2,2)	0.020	0.003	5.962	0.000
10	A(1,1)	0.153	0.020	7.532	0.000
11	A(1,2)	0.006	0.002	2.931	0.003
12	A(2,1)	-0.309	0.111	-2.791	0.005
13	A(2,2)	0.176	0.020	8.911	0.000
14	B(1,1)	0.968	0.004	257.967	0.000
15	B(1,2)	0.000	0.000	-0.436	0.663
16	B(2,1)	0.006	0.033	0.175	0.861
17	B(2,2)	0.976	0.004	220.023	0.000
18	D(1,1)	0.244	0.019	12.685	0.000
19	D(1,2)	-0.011	0.003	-4.042	0.000
20	D(2,1)	0.222	0.113	1.964	0.050
21	D(2,2)	0.126	0.032	3.942	0.000

ING Bank and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 49 Iterations. Final criterion was 0.0000000 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -6286.9606

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(ING)					
1	ING{1}	0.007	0.015	0.447	0.655
2	IGB{1}	-0.567	0.142	-3.988	0.000
3	Constant	0.024	0.028	0.863	0.388
Mean Model(IGB)					
4	ING{1}	0.004	0.001	2.862	0.004
5	IGB{1}	-0.019	0.017	-1.099	0.272
6	Constant	0.013	0.004	3.746	0.000
7	C(1,1)	0.232	0.030	7.645	0.000
8	C(2,1)	-0.002	0.005	-0.484	0.628
9	C(2,2)	0.015	0.003	5.329	0.000
10	A(1,1)	0.222	0.024	9.310	0.000
11	A(1,2)	-0.003	0.001	-1.719	0.086
12	A(2,1)	-0.424	0.187	-2.265	0.024
13	A(2,2)	0.167	0.017	9.589	0.000
14	B(1,1)	0.939	0.006	147.200	0.000
15	B(1,2)	0.001	0.000	3.112	0.002
16	B(2,1)	-0.001	0.053	-0.015	0.988
17	B(2,2)	0.981	0.003	337.408	0.000
18	D(1,1)	0.350	0.025	13.714	0.000
19	D(1,2)	-0.006	0.002	-3.833	0.000
20	D(2,1)	0.164	0.236	0.695	0.487
21	D(2,2)	0.113	0.032	3.523	0.000

Nordea Bank and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 106 Iterations. Final criterion was 0.0000076 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -1749.233

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(NORDEASS)					
1	NORDEASS{1}	0.138	0.036	3.799	0.000
2	IGB{1}	-0.148	0.277	-0.534	0.593
3	Constant	0.144	0.091	1.573	0.116
Mean Model(IGB)					
4	NORDEASS{1}	0.014	0.004	3.375	0.001
5	IGB{1}	0.306	0.039	7.810	0.000
6	Constant	0.051	0.014	3.710	0.000
7	C(1,1)	0.069	0.132	0.525	0.600
8	C(2,1)	0.134	0.016	8.211	0.000
9	C(2,2)	0.000	0.822	0.000	1.000
10	A(1,1)	0.067	0.050	1.338	0.181
11	A(1,2)	0.020	0.006	3.476	0.001
12	A(2,1)	-0.739	0.443	-1.670	0.095
13	A(2,2)	0.361	0.054	6.666	0.000
14	B(1,1)	0.930	0.011	82.847	0.000
15	B(1,2)	0.004	0.003	1.406	0.160
16	B(2,1)	-0.884	0.254	-3.480	0.001
17	B(2,2)	0.781	0.036	21.569	0.000
18	D(1,1)	-0.315	0.044	-7.219	0.000
19	D(1,2)	0.031	0.008	4.000	0.000
20	D(2,1)	-1.011	0.352	-2.871	0.004
21	D(2,2)	-0.485	0.084	-5.795	0.000

Royal Bank of Scotland and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 62 Iterations. Final criterion was 0.0000056 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -6651.6539

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(RBS)					
1	RBS{1}	0.029	0.017	1.754	0.079
2	IGB{1}	-0.628	0.156	-4.017	0.000
3	Constant	-0.003	0.028	-0.090	0.928
Mean Model(IGB)					
4	RBS{1}	0.003	0.001	2.416	0.016
5	IGB{1}	-0.023	0.017	-1.393	0.164
6	Constant	0.012	0.004	3.476	0.001
7	C(1,1)	0.275	0.026	10.402	0.000
8	C(2,1)	0.017	0.003	5.779	0.000
9	C(2,2)	0.000	0.022	0.000	1.000
10	A(1,1)	0.354	0.022	16.220	0.000
11	A(1,2)	-0.003	0.001	-4.239	0.000
12	A(2,1)	-0.213	0.175	-1.215	0.224
13	A(2,2)	0.126	0.016	7.765	0.000
14	B(1,1)	0.916	0.007	131.683	0.000
15	B(1,2)	0.001	0.000	1.887	0.059
16	B(2,1)	-0.208	0.045	-4.608	0.000
17	B(2,2)	0.982	0.003	360.072	0.000
18	D(1,1)	0.281	0.033	8.521	0.000
19	D(1,2)	0.000	0.001	0.479	0.632
20	D(2,1)	0.267	0.258	1.035	0.301
21	D(2,2)	0.157	0.022	7.299	0.000

Société Générale and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 47 Iterations. Final criterion was 0.0000025 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2017.6697

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(SOCGEN)					
1	SOCGEN{1}	0.168	0.042	3.982	0.000
2	IGB{1}	-0.588	0.423	-1.389	0.165
3	Constant	0.134	0.137	0.980	0.327
Mean Model(IGB)					
4	SOCGEN{1}	0.007	0.002	2.910	0.004
5	IGB{1}	0.312	0.038	8.213	0.000
6	Constant	0.046	0.013	3.534	0.000
7	C(1,1)	0.558	0.175	3.192	0.001
8	C(2,1)	-0.046	0.027	-1.703	0.089
9	C(2,2)	0.064	0.019	3.347	0.001
10	A(1,1)	0.074	0.052	1.424	0.155
11	A(1,2)	0.004	0.003	1.378	0.168
12	A(2,1)	-1.919	0.635	-3.021	0.003
13	A(2,2)	0.298	0.052	5.723	0.000
14	B(1,1)	0.933	0.011	82.751	0.000
15	B(1,2)	-0.001	0.001	-0.718	0.473
16	B(2,1)	0.506	0.261	1.940	0.052
17	B(2,2)	0.899	0.022	40.835	0.000
18	D(1,1)	0.474	0.052	9.155	0.000
19	D(1,2)	-0.008	0.004	-2.177	0.029
20	D(2,1)	-0.039	0.710	-0.056	0.956
21	D(2,2)	0.335	0.073	4.559	0.000

Standard Chartered and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 38 Iterations. Final criterion was 0.0000022 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -1879.8514

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(SCB)					
1	SCB{1}	0.105	0.039	2.666	0.008
2	IGB{1}	0.302	0.320	0.945	0.345
3	Constant	-0.020	0.116	-0.173	0.863
Mean Model(IGB)					
4	SCB{1}	0.014	0.003	4.245	0.000
5	IGB{1}	0.302	0.037	8.220	0.000
6	Constant	0.045	0.012	3.919	0.000
7	C(1,1)	0.423	0.156	2.709	0.007
8	C(2,1)	0.014	0.047	0.289	0.773
9	C(2,2)	0.098	0.019	5.184	0.000
10	A(1,1)	0.098	0.039	2.534	0.011
11	A(1,2)	0.010	0.005	1.943	0.052
12	A(2,1)	-1.776	0.367	-4.839	0.000
13	A(2,2)	0.244	0.062	3.942	0.000
14	B(1,1)	0.937	0.012	76.655	0.000
15	B(1,2)	-0.001	0.002	-0.584	0.559
16	B(2,1)	0.026	0.370	0.071	0.943
17	B(2,2)	0.873	0.031	28.449	0.000
18	D(1,1)	0.366	0.045	8.105	0.000
19	D(1,2)	-0.009	0.006	-1.626	0.104
20	D(2,1)	0.178	0.620	0.288	0.774
21	D(2,2)	0.451	0.067	6.692	0.000

UBS and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 89 Iterations. Final criterion was 0.0000013 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -5896.007

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(UBSVX)					
1	UBSVX{1}	0.056	0.015	3.667	0
2	IGB{1}	-0.309	0.133	-2.332	0.02
3	Constant	0.011	0.026	0.43	0.667
Mean Model(IGB)					
4	UBSVX{1}	0.005	0.001	3.426	0.001
5	IGB{1}	-0.021	0.018	-1.211	0.226
6	Constant	0.014	0.003	3.969	0
7	C(1,1)	0.176	0.024	7.338	0
8	C(2,1)	-0.011	0.007	-1.627	0.104
9	C(2,2)	0.019	0.003	5.663	0
10	A(1,1)	0.128	0.025	5.164	0
11	A(1,2)	0.005	0.002	2.833	0.005
12	A(2,1)	-0.559	0.171	-3.268	0.001
13	A(2,2)	0.17	0.017	10.002	0
14	B(1,1)	0.964	0.004	238.208	0
15	B(1,2)	0	0	0.967	0.334
16	B(2,1)	0.082	0.055	1.498	0.134
17	B(2,2)	0.976	0.003	283.341	0
18	D(1,1)	0.304	0.021	14.42	0
19	D(1,2)	-0.01	0.002	-5.83	0
20	D(2,1)	-0.162	0.191	-0.847	0.397
21	D(2,2)	0.123	0.035	3.503	0.000

Unicredit Group and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 52 Iterations. Final criterion was 0.0000029 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -6726.6371

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(UCG)					
1	UCG{1}	-0.016	0.018	-0.916	0.360
2	IGB{1}	-0.386	0.163	-2.362	0.018
3	Constant	-0.008	0.031	-0.270	0.787
Mean Model(IGB)					
4	UCG{1}	0.001	0.001	1.021	0.307
5	IGB{1}	-0.023	0.019	-1.165	0.244
6	Constant	0.014	0.004	3.776	0.000
7	C(1,1)	0.195	0.032	6.117	0.000
8	C(2,1)	-0.001	0.006	-0.230	0.818
9	C(2,2)	0.014	0.003	5.696	0.000
10	A(1,1)	0.191	0.022	8.531	0.000
11	A(1,2)	-0.001	0.001	-1.049	0.294
12	A(2,1)	-0.418	0.204	-2.053	0.040
13	A(2,2)	0.161	0.014	11.288	0.000
14	B(1,1)	0.950	0.005	192.477	0.000
15	B(1,2)	0.000	0.000	1.622	0.105
16	B(2,1)	-0.021	0.047	-0.460	0.646
17	B(2,2)	0.982	0.002	393.780	0.000
18	D(1,1)	0.332	0.021	15.754	0.000
19	D(1,2)	-0.004	0.001	-3.380	0.001
20	D(2,1)	0.461	0.269	1.715	0.086
21	D(2,2)	0.105	0.029	3.590	0.000

Agricultural Bank of China and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 72 Iterations. Final criterion was 0.0000000 <= 0.0000100

Daily(5) Data From 2010:07:16 To 2017:05:05
Usable Observations 1776
Log Likelihood -2283.9552

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(ABCCH)					
1	ABCCH{1}	-0.028	0.023	-1.222	0.222
2	IGB{1}	-0.255	0.133	-1.925	0.054
3	Constant	0.002	0.020	0.113	0.910
Mean Model(IGB)					
4	ABCCH{1}	-0.004	0.003	-1.421	0.155
5	IGB{1}	-0.042	0.024	-1.730	0.084
6	Constant	0.011	0.004	2.589	0.010
7	C(1,1)	0.142	0.023	6.141	0.000
8	C(2,1)	0.018	0.008	2.160	0.031
9	C(2,2)	0.013	0.009	1.445	0.148
10	A(1,1)	0.315	0.022	14.402	0.000
11	A(1,2)	0.003	0.003	1.204	0.228
12	A(2,1)	-0.016	0.201	-0.081	0.935
13	A(2,2)	-0.104	0.027	-3.912	0.000
14	B(1,1)	0.937	0.007	137.981	0.000
15	B(1,2)	-0.001	0.001	-1.126	0.260
16	B(2,1)	-0.182	0.042	-4.299	0.000
17	B(2,2)	0.978	0.004	230.503	0.000
18	D(1,1)	0.042	0.044	0.948	0.343
19	D(1,2)	0.008	0.003	3.142	0.002
20	D(2,1)	1.118	0.136	8.199	0.000
21	D(2,2)	0.171	0.027	6.438	0.000

Bank of China and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 54 Iterations. Final criterion was 0.0000056 <= 0.0000100

Daily(5) Data From 2006:06:05 To 2017:05:05
Usable Observations 2850
Log Likelihood -5078.0177

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BOC)					
1	BOC{1}	0.011	0.019	0.566	0.571
2	IGB{1}	-0.531	0.143	-3.702	0.000
3	Constant	0.015	0.027	0.572	0.567
Mean Model(IGB)					
4	BOC{1}	-0.001	0.002	-0.259	0.796
5	IGB{1}	-0.023	0.019	-1.215	0.225
6	Constant	0.015	0.004	3.953	0.000
7	C(1,1)	0.274	0.029	9.401	0.000
8	C(2,1)	-0.001	0.004	-0.344	0.731
9	C(2,2)	0.019	0.003	6.404	0.000
10	A(1,1)	0.292	0.019	15.175	0.000
11	A(1,2)	0.004	0.002	1.805	0.071
12	A(2,1)	0.259	0.194	1.333	0.183
13	A(2,2)	0.060	0.035	1.722	0.085
14	B(1,1)	0.940	0.007	137.492	0.000
15	B(1,2)	-0.001	0.001	-0.885	0.376
16	B(2,1)	-0.020	0.041	-0.487	0.626
17	B(2,2)	0.980	0.003	344.972	0.000
18	D(1,1)	-0.162	0.042	-3.857	0.000
19	D(1,2)	0.012	0.002	5.729	0.000
20	D(2,1)	0.594	0.214	2.778	0.005
21	D(2,2)	0.182	0.022	8.367	0.000

China Const. Bank and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 69 Iterations.
Final criterion was 0.0000061 <= 0.0000100
Daily(5) Data From 2005:10:28 To 2017:05:05
Usable Observations 3006
Log Likelihood -5470.121

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(CCBHK)					
1	CCBHK{1}	0.018	0.018	1.005	0.315
2	IGB{1}	-0.293	0.137	-2.133	0.033
3	Constant	0.035	0.028	1.250	0.211
Mean Model(IGB)					
4	CCBHK{1}	0.001	0.002	0.518	0.605
5	IGB{1}	-0.026	0.018	-1.456	0.145
6	Constant	0.014	0.004	3.744	0.000
7	C(1,1)	0.259	0.031	8.338	0.000
8	C(2,1)	-0.003	0.004	-0.626	0.531
9	C(2,2)	0.017	0.003	5.575	0.000
10	A(1,1)	0.252	0.021	12.153	0.000
11	A(1,2)	0.005	0.002	2.785	0.005
12	A(2,1)	0.534	0.223	2.392	0.017
13	A(2,2)	-0.106	0.020	-5.287	0.000
14	B(1,1)	0.944	0.007	134.017	0.000
15	B(1,2)	-0.001	0.001	-1.311	0.190
16	B(2,1)	0.030	0.051	0.591	0.555
17	B(2,2)	0.980	0.003	370.734	0.000
18	D(1,1)	-0.215	0.036	-5.964	0.000
19	D(1,2)	0.010	0.003	4.082	0.000
20	D(2,1)	1.193	0.241	4.954	0.000
21	D(2,2)	0.148	0.024	6.036	0.000

I & C Bank of China and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 49 Iterations.
Final criterion was 0.0000051 <= 0.0000100
Daily(5) Data From 2006:10:30 To 2017:05:05
Usable Observations 2745
Log Likelihood -4476.792

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(ICBCCG)					
1	ICBCCG{1}	-0.035	0.019	-1.846	0.065
2	IGB{1}	-0.438	0.098	-4.488	0.000
3	Constant	0.003	0.017	0.152	0.879
Mean Model(IGB)					
4	ICBCCG{1}	-0.001	0.003	-0.547	0.585
5	IGB{1}	-0.023	0.019	-1.180	0.238
6	Constant	0.013	0.004	3.349	0.001
7	C(1,1)	0.140	0.016	8.672	0.000
8	C(2,1)	-0.004	0.005	-0.837	0.403
9	C(2,2)	0.016	0.004	4.347	0.000
10	A(1,1)	0.297	0.016	18.918	0.000
11	A(1,2)	0.002	0.002	0.951	0.342
12	A(2,1)	0.018	0.162	0.114	0.909
13	A(2,2)	-0.125	0.018	-6.860	0.000
14	B(1,1)	0.953	0.004	241.477	0.000
15	B(1,2)	-0.001	0.001	-1.659	0.097
16	B(2,1)	-0.029	0.031	-0.941	0.347
17	B(2,2)	0.980	0.003	326.561	0.000
18	D(1,1)	0.035	0.030	1.166	0.244
19	D(1,2)	0.010	0.002	4.884	0.000
20	D(2,1)	0.522	0.148	3.525	0.000
21	D(2,2)	0.156	0.024	6.363	0.000

Mitsubishi Bank and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 88 Iterations.
Final criterion was 0.0000056 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -6109.419

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(MITSUBISHI)					
1	MITSUBISHI{1}	0.095	0.018	5.295	0.000
2	IGB{1}	-1.458	0.145	-10.087	0.000
3	Constant	0.016	0.030	0.538	0.590
Mean Model(IGB)					
4	MITSUBISHI{1}	-0.001	0.002	-0.802	0.423
5	IGB{1}	-0.016	0.018	-0.914	0.361
6	Constant	0.014	0.004	3.790	0.000
7	C(1,1)	0.244	0.027	9.148	0.000
8	C(2,1)	0.000	0.004	0.050	0.960
9	C(2,2)	0.014	0.004	4.008	0.000
10	A(1,1)	0.212	0.018	11.495	0.000
11	A(1,2)	0.002	0.002	0.739	0.460
12	A(2,1)	0.149	0.197	0.752	0.452
13	A(2,2)	0.132	0.015	9.006	0.000
14	B(1,1)	0.954	0.005	207.119	0.000
15	B(1,2)	-0.001	0.001	-2.607	0.009
16	B(2,1)	-0.003	0.054	-0.049	0.961
17	B(2,2)	0.981	0.003	368.958	0.000
18	D(1,1)	0.275	0.027	10.110	0.000
19	D(1,2)	0.008	0.003	3.225	0.001
20	D(2,1)	-0.387	0.270	-1.431	0.153
21	D(2,2)	-0.174	0.021	-8.139	0.000

Mizuho Bank and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 73 Iterations.
Final criterion was 0.0000052 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -6003.362

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(MIZUHO)					
1	MIZUHO{1}	0.069	0.018	3.825	0.000
2	IGB{1}	-1.481	0.136	-10.889	0.000
3	Constant	0.015	0.028	0.558	0.577
Mean Model(IGB)					
4	MIZUHO{1}	0.000	0.002	-0.117	0.907
5	IGB{1}	-0.013	0.017	-0.808	0.419
6	Constant	0.013	0.003	3.764	0.000
7	C(1,1)	0.180	0.031	5.855	0.000
8	C(2,1)	-0.010	0.006	-1.689	0.091
9	C(2,2)	0.009	0.008	1.042	0.298
10	A(1,1)	0.197	0.016	12.113	0.000
11	A(1,2)	0.006	0.001	5.015	0.000
12	A(2,1)	-0.877	0.175	-5.006	0.000
13	A(2,2)	0.107	0.020	5.464	0.000
14	B(1,1)	0.956	0.004	213.562	0.000
15	B(1,2)	-0.001	0.000	-3.780	0.000
16	B(2,1)	0.115	0.047	2.429	0.015
17	B(2,2)	0.985	0.002	405.395	0.000
18	D(1,1)	0.251	0.026	9.568	0.000
19	D(1,2)	-0.004	0.002	-1.751	0.080
20	D(2,1)	0.401	0.203	1.977	0.048
21	D(2,2)	0.151	0.021	7.135	0.000

Sumitomo Bank and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 59 Iterations.
Final criterion was 0.0000049 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -6108.536

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(SUMITOMO)					
1	SUMITOMO{1}	0.078	0.017	4.507	0.000
2	IGB{1}	-1.451	0.146	-9.937	0.000
3	Constant	0.020	0.027	0.745	0.456
Mean Model(IGB)					
4	SUMITOMO{1}	-0.001	0.002	-0.354	0.723
5	IGB{1}	-0.013	0.017	-0.771	0.441
6	Constant	0.014	0.003	4.131	0.000
7	C(1,1)	0.235	0.025	9.478	0.000
8	C(2,1)	-0.001	0.004	-0.160	0.873
9	C(2,2)	0.014	0.003	4.864	0.000
10	A(1,1)	0.188	0.018	10.681	0.000
11	A(1,2)	-0.001	0.002	-0.549	0.583
12	A(2,1)	0.450	0.151	2.990	0.003
13	A(2,2)	0.147	0.015	10.095	0.000
14	B(1,1)	0.952	0.004	220.182	0.000
15	B(1,2)	-0.001	0.001	-1.438	0.150
16	B(2,1)	-0.036	0.047	-0.763	0.445
17	B(2,2)	0.981	0.003	361.168	0.000
18	D(1,1)	0.323	0.022	14.492	0.000
19	D(1,2)	0.008	0.002	3.898	0.000
20	D(2,1)	-0.295	0.228	-1.294	0.196
21	D(2,2)	-0.151	0.024	-6.281	0.000

Bank of America and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 52 Iterations. Final criterion was 0.0000039 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -5986.569

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BOA)					
1	BOA{1}	-0.002	0.016	-0.117	0.907
2	HYB{1}	-0.015	0.120	-0.125	0.901
3	Constant	0.017	0.024	0.724	0.469
Mean Model(HYB)					
4	BOA{1}	0.021	0.002	13.658	0.000
5	HYB{1}	0.363	0.018	20.277	0.000
6	Constant	0.023	0.003	6.653	0.000
7	C(1,1)	0.121	0.021	5.874	0.000
8	C(2,1)	0.000	0.007	0.040	0.968
9	C(2,2)	0.035	0.003	11.794	0.000
10	A(1,1)	0.242	0.018	13.705	0.000
11	A(1,2)	-0.012	0.002	-6.715	0.000
12	A(2,1)	0.558	0.115	4.864	0.000
13	A(2,2)	0.203	0.029	6.981	0.000
14	B(1,1)	0.960	0.004	235.585	0.000
15	B(1,2)	0.003	0.000	6.068	0.000
16	B(2,1)	-0.091	0.048	-1.905	0.057
17	B(2,2)	0.924	0.008	112.815	0.000
18	D(1,1)	0.191	0.034	5.609	0.000
19	D(1,2)	0.006	0.003	1.956	0.050
20	D(2,1)	-0.251	0.168	-1.490	0.136
21	D(2,2)	0.334	0.025	13.375	0.000

Bank of New York and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 53 Iterations. Final criterion was 0.0000037 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -5648.9699

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BNY)					
1	BNY{1}	-0.080	0.017	-4.562	0.000
2	HYB{1}	0.326	0.102	3.202	0.001
3	Constant	0.033	0.023	1.438	0.150
Mean Model(HYB)					
4	BNY{1}	0.024	0.002	11.238	0.000
5	HYB{1}	0.366	0.019	19.732	0.000
6	Constant	0.021	0.003	6.769	0.000
7	C(1,1)	0.205	0.021	9.869	0.000
8	C(2,1)	0.000	0.005	0.031	0.975
9	C(2,2)	0.032	0.003	9.701	0.000
10	A(1,1)	0.137	0.024	5.659	0.000
11	A(1,2)	-0.018	0.002	-7.434	0.000
12	A(2,1)	0.645	0.109	5.925	0.000
13	A(2,2)	0.264	0.023	11.454	0.000
14	B(1,1)	0.962	0.005	205.218	0.000
15	B(1,2)	0.000	0.001	0.333	0.739
16	B(2,1)	-0.086	0.043	-1.992	0.046
17	B(2,2)	0.920	0.007	126.549	0.000
18	D(1,1)	0.290	0.026	11.034	0.000
19	D(1,2)	0.014	0.004	3.938	0.000
20	D(2,1)	-0.277	0.173	-1.599	0.110
21	D(2,2)	0.301	0.025	12.234	0.000

Citigroup and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 48 Iterations. Final criterion was 0.0000029 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -6015.6915

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(CITI)					
1	CITI{1}	0.014	0.019	0.738	0.461
2	HYB{1}	0.059	0.123	0.480	0.631
3	Constant	0.013	0.025	0.544	0.586
Mean Model(HYB)					
4	CITI{1}	0.023	0.002	13.426	0.000
5	HYB{1}	0.332	0.019	17.720	0.000
6	Constant	0.027	0.003	7.787	0.000
7	C(1,1)	0.163	0.018	9.192	0.000
8	C(2,1)	-0.013	0.006	-2.042	0.041
9	C(2,2)	0.037	0.004	8.506	0.000
10	A(1,1)	0.216	0.024	9.135	0.000
11	A(1,2)	-0.003	0.004	-0.733	0.463
12	A(2,1)	0.420	0.151	2.782	0.005
13	A(2,2)	0.381	0.032	11.952	0.000
14	B(1,1)	0.956	0.004	214.132	0.000
15	B(1,2)	0.002	0.001	3.013	0.003
16	B(2,1)	-0.006	0.063	-0.090	0.928
17	B(2,2)	0.900	0.008	107.391	0.000
18	D(1,1)	-0.264	0.030	-8.902	0.000
19	D(1,2)	0.002	0.004	0.371	0.710
20	D(2,1)	0.443	0.270	1.644	0.100
21	D(2,2)	0.179	0.086	2.074	0.038

Goldman Sachs and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 48 Iterations. Final criterion was 0.0000089 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -5764.1375

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(GOLDMAN)					
1	GOLDMAN{1}	-0.043	0.018	-2.410	0.016
2	HYB{1}	0.212	0.116	1.832	0.067
3	Constant	0.030	0.026	1.156	0.247
Mean Model(HYB)					
4	GOLDMAN{1}	0.028	0.002	15.227	0.000
5	HYB{1}	0.332	0.016	20.442	0.000
6	Constant	0.023	0.003	7.209	0.000
7	C(1,1)	0.162	0.022	7.323	0.000
8	C(2,1)	-0.008	0.007	-1.204	0.229
9	C(2,2)	0.032	0.004	8.571	0.000
10	A(1,1)	0.096	0.025	3.872	0.000
11	A(1,2)	0.008	0.002	3.108	0.002
12	A(2,1)	0.084	0.126	0.666	0.505
13	A(2,2)	0.322	0.024	13.284	0.000
14	B(1,1)	0.979	0.003	302.788	0.000
15	B(1,2)	0.002	0.001	2.763	0.006
16	B(2,1)	-0.061	0.041	-1.479	0.139
17	B(2,2)	0.908	0.007	126.203	0.000
18	D(1,1)	0.209	0.022	9.391	0.000
19	D(1,2)	-0.015	0.004	-3.906	0.000
20	D(2,1)	0.382	0.139	2.740	0.006
21	D(2,2)	0.311	0.033	9.396	0.000

JP Morgan Chase and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 46 Iterations. Final criterion was 0.0000087 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -5524.866

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(JPM)					
1	JPM{1}	-0.057	0.017	-3.338	0.001
2	HYB{1}	0.233	0.107	2.166	0.030
3	Constant	0.036	0.023	1.563	0.118
Mean Model(HYB)					
4	JPM{1}	0.030	0.002	15.669	0.000
5	HYB{1}	0.362	0.017	20.785	0.000
6	Constant	0.021	0.003	6.691	0.000
7	C(1,1)	0.175	0.020	8.768	0.000
8	C(2,1)	-0.001	0.004	-0.304	0.761
9	C(2,2)	0.031	0.003	10.286	0.000
10	A(1,1)	0.179	0.019	9.667	0.000
11	A(1,2)	-0.020	0.002	-10.057	0.000
12	A(2,1)	0.608	0.112	5.422	0.000
13	A(2,2)	0.214	0.028	7.561	0.000
14	B(1,1)	0.954	0.005	174.697	0.000
15	B(1,2)	0.003	0.001	3.146	0.002
16	B(2,1)	-0.085	0.038	-2.208	0.027
17	B(2,2)	0.926	0.007	134.747	0.000
18	D(1,1)	0.312	0.030	10.542	0.000
19	D(1,2)	0.007	0.004	1.987	0.047
20	D(2,1)	-0.217	0.175	-1.241	0.215
21	D(2,2)	0.321	0.024	13.572	0.000

Morgan Stanley and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 61 Iterations. Final criterion was 0.0000075 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -6304.6476

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(MORGAN)					
1	MORGAN{1}	-0.019	0.018	-1.061	0.288
2	HYB{1}	0.210	0.145	1.454	0.146
3	Constant	0.035	0.028	1.238	0.216
Mean Model(HYB)					
4	MORGAN{1}	0.022	0.002	13.264	0.000
5	HYB{1}	0.350	0.018	19.177	0.000
6	Constant	0.023	0.003	7.083	0.000
7	C(1,1)	-0.195	0.028	-6.876	0.000
8	C(2,1)	0.000	0.005	-0.023	0.981
9	C(2,2)	-0.033	0.003	-10.451	0.000
10	A(1,1)	0.175	0.021	8.221	0.000
11	A(1,2)	-0.014	0.002	-6.506	0.000
12	A(2,1)	0.876	0.136	6.440	0.000
13	A(2,2)	0.270	0.024	11.298	0.000
14	B(1,1)	0.962	0.005	207.348	0.000
15	B(1,2)	0.001	0.001	1.801	0.072
16	B(2,1)	-0.149	0.052	-2.849	0.004
17	B(2,2)	0.918	0.008	116.668	0.000
18	D(1,1)	0.266	0.027	10.022	0.000
19	D(1,2)	0.014	0.003	4.708	0.000
20	D(2,1)	-0.373	0.204	-1.830	0.067
21	D(2,2)	0.277	0.028	9.909	0.000

Royal Bank of Canada and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 86 Iterations. Final criterion was 0.0000057 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -4308.4028

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(RBC)					
1	RBC{1}	0.004	0.018	0.213	0.831
2	HYB{1}	0.025	0.076	0.332	0.740
3	Constant	0.035	0.017	2.115	0.034
Mean Model(HYB)					
4	RBC{1}	0.023	0.003	7.140	0.000
5	HYB{1}	0.366	0.019	18.802	0.000
6	Constant	0.021	0.003	6.338	0.000
7	C(1,1)	0.076	0.016	4.744	0.000
8	C(2,1)	-0.017	0.010	-1.663	0.096
9	C(2,2)	0.032	0.006	5.605	0.000
10	A(1,1)	-0.025	0.026	-0.996	0.319
11	A(1,2)	0.010	0.008	1.248	0.212
12	A(2,1)	0.310	0.098	3.148	0.002
13	A(2,2)	0.309	0.029	10.630	0.000
14	B(1,1)	0.982	0.003	366.491	0.000
15	B(1,2)	0.003	0.002	1.840	0.066
16	B(2,1)	-0.029	0.027	-1.074	0.283
17	B(2,2)	0.910	0.009	100.924	0.000
18	D(1,1)	0.258	0.015	17.564	0.000
19	D(1,2)	-0.012	0.008	-1.601	0.109
20	D(2,1)	-0.108	0.126	-0.852	0.394
21	D(2,2)	0.315	0.030	10.420	0.000

State Streetand Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 80 Iterations. Final criterion was 0.0000042 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -6057.9266

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(STATE)					
1	STATE{1}	-0.079	0.015	-5.208	0.000
2	HYB{1}	0.119	0.133	0.893	0.372
3	Constant	0.037	0.024	1.523	0.128
Mean Model(HYB)					
4	STATE{1}	0.022	0.002	11.634	0.000
5	HYB{1}	0.359	0.018	20.391	0.000
6	Constant	0.021	0.003	6.912	0.000
7	C(1,1)	-0.115	0.016	-7.141	0.000
8	C(2,1)	0.001	0.006	0.175	0.861
9	C(2,2)	-0.034	0.003	-10.894	0.000
10	A(1,1)	0.066	0.020	3.256	0.001
11	A(1,2)	0.007	0.002	3.075	0.002
12	A(2,1)	-0.549	0.150	-3.647	0.000
13	A(2,2)	0.294	0.023	12.606	0.000
14	B(1,1)	0.976	0.002	432.419	0.000
15	B(1,2)	0.002	0.000	3.400	0.001
16	B(2,1)	0.111	0.045	2.444	0.015
17	B(2,2)	0.913	0.008	114.137	0.000
18	D(1,1)	0.242	0.021	11.685	0.000
19	D(1,2)	-0.015	0.003	-4.899	0.000
20	D(2,1)	0.288	0.158	1.822	0.068
21	D(2,2)	0.355	0.029	12.102	0.000

Wells Fargo and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 66 Iterations. Final criterion was 0.0000079 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -5350.7645

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(WELLS)					
1	WELLS{1}	-0.086	0.017	-5.111	0.000
2	HYB{1}	0.062	0.098	0.638	0.523
3	Constant	0.028	0.021	1.349	0.177
Mean Model(HYB)					
4	WELLS{1}	0.027	0.002	12.239	0.000
5	HYB{1}	0.375	0.019	20.170	0.000
6	Constant	0.020	0.003	6.084	0.000
7	C(1,1)	0.139	0.017	8.139	0.000
8	C(2,1)	0.005	0.005	1.029	0.303
9	C(2,2)	0.032	0.003	10.455	0.000
10	A(1,1)	0.208	0.021	9.801	0.000
11	A(1,2)	-0.017	0.002	-8.631	0.000
12	A(2,1)	0.405	0.107	3.783	0.000
13	A(2,2)	0.186	0.032	5.812	0.000
14	B(1,1)	0.956	0.005	190.816	0.000
15	B(1,2)	0.003	0.001	3.911	0.000
16	B(2,1)	-0.069	0.040	-1.722	0.085
17	B(2,2)	0.931	0.007	124.704	0.000
18	D(1,1)	0.287	0.029	9.799	0.000
19	D(1,2)	0.005	0.004	1.217	0.224
20	D(2,1)	-0.165	0.150	-1.101	0.271
21	D(2,2)	0.338	0.023	14.685	0.000

Banco Santander and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 102 Iterations. Final criterion was 0.0000000 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -5771.0054

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(SANTANDER)					
1	SANTANDER{1}	-0.010	0.018	-0.552	0.581
2	HYB{1}	-0.082	0.129	-0.635	0.525
3	Constant	0.023	0.026	0.858	0.391
Mean Model(HYB)					
4	SANTANDER{1}	0.007	0.002	3.594	0.000
5	HYB{1}	0.366	0.019	19.006	0.000
6	Constant	0.023	0.003	7.633	0.000
7	C(1,1)	0.170	0.038	4.505	0.000
8	C(2,1)	-0.014	0.010	-1.425	0.154
9	C(2,2)	0.033	0.005	6.148	0.000
10	A(1,1)	-0.105	0.036	-2.902	0.004
11	A(1,2)	-0.011	0.004	-2.689	0.007
12	A(2,1)	0.763	0.161	4.722	0.000
13	A(2,2)	0.365	0.026	14.044	0.000
14	B(1,1)	0.966	0.006	153.260	0.000
15	B(1,2)	0.003	0.001	2.173	0.030
16	B(2,1)	-0.188	0.083	-2.261	0.024
17	B(2,2)	0.900	0.009	97.709	0.000
18	D(1,1)	0.342	0.024	14.156	0.000
19	D(1,2)	0.008	0.004	1.923	0.054
20	D(2,1)	0.525	0.181	2.902	0.004
21	D(2,2)	0.259	0.042	6.143	0.000

Barclays and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 61 Iterations. Final criterion was 0.0000062 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -6415.095

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BARCLAYS)					
1	BARCLAYS{1}	0.034	0.017	2.001	0.045
2	HYB{1}	0.071	0.159	0.445	0.656
3	Constant	-0.012	0.029	-0.422	0.673
Mean Model(HYB)					
4	BARCLAYS{1}	0.002	0.002	1.495	0.135
5	HYB{1}	0.377	0.020	18.541	0.000
6	Constant	0.025	0.003	7.275	0.000
7	C(1,1)	-0.169	0.037	-4.592	0.000
8	C(2,1)	0.012	0.011	1.149	0.251
9	C(2,2)	0.035	0.005	7.707	0.000
10	A(1,1)	0.170	0.021	8.140	0.000
11	A(1,2)	-0.002	0.003	-0.838	0.402
12	A(2,1)	1.030	0.209	4.934	0.000
13	A(2,2)	0.360	0.027	13.174	0.000
14	B(1,1)	0.965	0.005	189.744	0.000
15	B(1,2)	0.002	0.001	1.875	0.061
16	B(2,1)	-0.173	0.116	-1.491	0.136
17	B(2,2)	0.908	0.012	77.290	0.000
18	D(1,1)	-0.276	0.029	-9.684	0.000
19	D(1,2)	-0.007	0.007	-0.981	0.326
20	D(2,1)	0.740	0.368	2.014	0.044
21	D(2,2)	0.233	0.069	3.386	0.001

BNP Paribas and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 61 Iterations. Final criterion was 0.0000074 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -6075.5857

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BNP)					
1	BNP{1}	0.026	0.018	1.456	0.146
2	HYB{1}	-0.078	0.144	-0.543	0.587
3	Constant	0.008	0.030	0.254	0.799
Mean Model(HYB)					
4	BNP{1}	0.006	0.002	3.748	0.000
5	HYB{1}	0.363	0.019	19.211	0.000
6	Constant	0.021	0.003	7.133	0.000
7	C(1,1)	0.150	0.041	3.631	0.000
8	C(2,1)	0.002	0.008	0.305	0.761
9	C(2,2)	0.028	0.003	8.663	0.000
10	A(1,1)	0.073	0.024	3.067	0.002
11	A(1,2)	-0.015	0.002	-7.086	0.000
12	A(2,1)	1.321	0.138	9.589	0.000
13	A(2,2)	0.332	0.021	15.456	0.000
14	B(1,1)	0.972	0.005	194.368	0.000
15	B(1,2)	0.001	0.001	1.194	0.233
16	B(2,1)	-0.314	0.049	-6.358	0.000
17	B(2,2)	0.917	0.007	132.151	0.000
18	D(1,1)	0.335	0.027	12.633	0.000
19	D(1,2)	0.013	0.003	3.939	0.000
20	D(2,1)	-0.496	0.220	-2.257	0.024
21	D(2,2)	0.251	0.031	8.131	0.000

Credit Suisse and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 58 Iterations. Final criterion was 0.0000052 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -5962.6413

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(CRESUISVX)					
1	CRESUISVX{1}	0.081	0.018	4.488	0.000
2	HYB{1}	0.141	0.141	1.001	0.317
3	Constant	0.011	0.027	0.396	0.692
Mean Model(HYB)					
4	CRESUISVX{1}	0.007	0.002	4.062	0.000
5	HYB{1}	0.377	0.018	21.198	0.000
6	Constant	0.024	0.003	7.889	0.000
7	C(1,1)	0.188	0.032	5.872	0.000
8	C(2,1)	-0.001	0.007	-0.108	0.914
9	C(2,2)	0.033	0.003	9.654	0.000
10	A(1,1)	0.184	0.019	9.715	0.000
11	A(1,2)	-0.007	0.003	-2.654	0.008
12	A(2,1)	0.926	0.164	5.645	0.000
13	A(2,2)	0.332	0.025	13.237	0.000
14	B(1,1)	0.967	0.005	178.807	0.000
15	B(1,2)	0.001	0.001	0.593	0.553
16	B(2,1)	-0.137	0.080	-1.725	0.084
17	B(2,2)	0.908	0.010	92.838	0.000
18	D(1,1)	0.175	0.042	4.120	0.000
19	D(1,2)	0.024	0.003	7.474	0.000
20	D(2,1)	-0.422	0.259	-1.629	0.103
21	D(2,2)	0.190	0.041	4.655	0.000

Deutsche Bank and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 65 Iterations. Final criterion was 0.0000034 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -6130.1875

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(DEUTSCHEGR)					
1	DEUTSCHEGR{1}	0.035	0.018	1.983	0.047
2	HYB{1}	-0.033	0.141	-0.233	0.816
3	Constant	0.001	0.029	0.041	0.967
Mean Model(HYB)					
4	DEUTSCHEGR{1}	0.011	0.002	6.252	0.000
5	HYB{1}	0.355	0.018	20.211	0.000
6	Constant	0.024	0.003	7.600	0.000
7	C(1,1)	0.130	0.023	5.550	0.000
8	C(2,1)	0.004	0.008	0.561	0.575
9	C(2,2)	-0.030	0.003	-8.637	0.000
10	A(1,1)	0.133	0.019	6.843	0.000
11	A(1,2)	-0.012	0.003	-3.715	0.000
12	A(2,1)	0.885	0.149	5.946	0.000
13	A(2,2)	0.336	0.022	15.016	0.000
14	B(1,1)	0.979	0.003	318.549	0.000
15	B(1,2)	0.001	0.001	0.913	0.361
16	B(2,1)	-0.158	0.059	-2.684	0.007
17	B(2,2)	0.909	0.008	111.025	0.000
18	D(1,1)	0.199	0.027	7.486	0.000
19	D(1,2)	0.022	0.003	6.804	0.000
20	D(2,1)	-0.382	0.208	-1.832	0.067
21	D(2,2)	0.211	0.037	5.676	0.000

Crédit Agricole and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 64 Iterations. Final criterion was 0.0000085 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -6474.0993

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(CREAGR)					
1	CREAGR{1}	0.027	0.019	1.451	0.147
2	HYB{1}	0.170	0.154	1.103	0.270
3	Constant	0.015	0.033	0.457	0.647
Mean Model(HYB)					
4	CREAGR{1}	0.004	0.001	3.391	0.001
5	HYB{1}	0.370	0.018	20.156	0.000
6	Constant	0.024	0.002	9.565	0.000
7	C(1,1)	0.157	0.051	3.096	0.002
8	C(2,1)	-0.025	0.013	-1.858	0.063
9	C(2,2)	0.027	0.012	2.144	0.032
10	A(1,1)	0.132	0.018	7.242	0.000
11	A(1,2)	-0.005	0.003	-1.763	0.078
12	A(2,1)	1.017	0.139	7.298	0.000
13	A(2,2)	0.350	0.023	15.225	0.000
14	B(1,1)	0.979	0.005	183.798	0.000
15	B(1,2)	0.003	0.001	3.879	0.000
16	B(2,1)	-0.282	0.064	-4.396	0.000
17	B(2,2)	0.901	0.009	102.830	0.000
18	D(1,1)	-0.253	0.025	-10.202	0.000
19	D(1,2)	-0.012	0.004	-3.091	0.002
20	D(2,1)	0.933	0.223	4.177	0.000
21	D(2,2)	0.300	0.035	8.473	0.000

HSBC and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 70 Iterations. Final criterion was 0.0000084 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -4782.1149

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(HSBC)					
1	HSBC{1}	-0.022	0.019	-1.192	0.233
2	HYB{1}	0.020	0.085	0.230	0.818
3	Constant	0.002	0.018	0.113	0.910
Mean Model(HYB)					
4	HSBC{1}	0.011	0.003	4.274	0.000
5	HYB{1}	0.380	0.020	19.438	0.000
6	Constant	0.022	0.003	6.896	0.000
7	C(1,1)	-0.045	0.022	-2.054	0.040
8	C(2,1)	0.030	0.003	9.637	0.000
9	C(2,2)	0.000	0.039	0.000	1.000
10	A(1,1)	0.179	0.016	10.894	0.000
11	A(1,2)	-0.018	0.004	-4.532	0.000
12	A(2,1)	0.437	0.088	4.970	0.000
13	A(2,2)	0.284	0.024	11.982	0.000
14	B(1,1)	0.978	0.003	369.649	0.000
15	B(1,2)	0.004	0.001	4.324	0.000
16	B(2,1)	-0.137	0.037	-3.650	0.000
17	B(2,2)	0.916	0.007	125.673	0.000
18	D(1,1)	0.162	0.028	5.735	0.000
19	D(1,2)	0.019	0.005	3.768	0.000
20	D(2,1)	0.101	0.112	0.895	0.371
21	D(2,2)	0.281	0.028	9.907	0.000

ING Bank and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 48 Iterations. Final criterion was 0.0000053 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -6199.3321

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(ING)					
1	ING{1}	0.034	0.017	2.080	0.038
2	HYB{1}	0.164	0.138	1.191	0.234
3	Constant	0.038	0.027	1.432	0.152
Mean Model(HYB)					
4	ING{1}	0.006	0.002	4.126	0.000
5	HYB{1}	0.376	0.019	20.289	0.000
6	Constant	0.022	0.003	7.420	0.000
7	C(1,1)	0.197	0.033	6.051	0.000
8	C(2,1)	0.016	0.005	3.007	0.003
9	C(2,2)	0.031	0.003	10.661	0.000
10	A(1,1)	0.189	0.024	7.995	0.000
11	A(1,2)	-0.008	0.003	-2.741	0.006
12	A(2,1)	1.075	0.143	7.537	0.000
13	A(2,2)	0.309	0.023	13.528	0.000
14	B(1,1)	0.952	0.007	141.382	0.000
15	B(1,2)	0.000	0.001	-0.278	0.781
16	B(2,1)	-0.287	0.063	-4.594	0.000
17	B(2,2)	0.916	0.008	110.216	0.000
18	D(1,1)	0.345	0.030	11.499	0.000
19	D(1,2)	0.014	0.003	5.252	0.000
20	D(2,1)	-0.286	0.226	-1.264	0.206
21	D(2,2)	0.264	0.027	9.844	0.000

Nordea Bank and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 58 Iterations. Final criterion was 0.0000062 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -5487.0744

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(NORDEASS)					
1	NORDEASS{1}	-0.065	0.017	-3.791	0.000
2	HYB{1}	-0.019	0.116	-0.160	0.873
3	Constant	0.052	0.019	2.660	0.008
Mean Model(HYB)					
4	NORDEASS{1}	0.005	0.002	2.613	0.009
5	HYB{1}	0.382	0.018	20.869	0.000
6	Constant	0.022	0.003	6.831	0.000
7	C(1,1)	0.186	0.026	7.110	0.000
8	C(2,1)	0.003	0.008	0.409	0.682
9	C(2,2)	0.035	0.004	9.332	0.000
10	A(1,1)	0.162	0.019	8.305	0.000
11	A(1,2)	-0.012	0.003	-3.929	0.000
12	A(2,1)	0.772	0.122	6.307	0.000
13	A(2,2)	0.340	0.026	13.072	0.000
14	B(1,1)	0.970	0.006	175.145	0.000
15	B(1,2)	0.002	0.001	1.414	0.157
16	B(2,1)	-0.168	0.056	-2.994	0.003
17	B(2,2)	0.902	0.010	86.748	0.000
18	D(1,1)	0.192	0.034	5.680	0.000
19	D(1,2)	0.022	0.004	4.997	0.000
20	D(2,1)	-0.310	0.203	-1.531	0.126
21	D(2,2)	0.245	0.038	6.498	0.000

Royal Bank of Scotland and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 55 Iterations. Final criterion was 0.0000090 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -6623.0142

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(RBS)					
1	RBS{1}	0.053	0.019	2.812	0.005
2	HYB{1}	-0.097	0.128	-0.759	0.448
3	Constant	0.000	0.025	0.011	0.991
Mean Model(HYB)					
4	RBS{1}	0.004	0.001	2.540	0.011
5	HYB{1}	0.382	0.020	19.171	0.000
6	Constant	0.024	0.003	7.717	0.000
7	C(1,1)	0.281	0.029	9.603	0.000
8	C(2,1)	-0.014	0.005	-2.895	0.004
9	C(2,2)	0.036	0.004	9.716	0.000
10	A(1,1)	0.360	0.027	13.490	0.000
11	A(1,2)	-0.002	0.002	-1.013	0.311
12	A(2,1)	0.174	0.191	0.910	0.363
13	A(2,2)	0.297	0.026	11.568	0.000
14	B(1,1)	0.918	0.008	111.862	0.000
15	B(1,2)	0.003	0.001	4.123	0.000
16	B(2,1)	0.161	0.087	1.841	0.066
17	B(2,2)	0.909	0.009	101.044	0.000
18	D(1,1)	-0.259	0.046	-5.668	0.000
19	D(1,2)	0.002	0.003	0.732	0.464
20	D(2,1)	1.014	0.229	4.438	0.000
21	D(2,2)	0.285	0.027	10.538	0.000

Société Générale and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 70 Iterations. Final criterion was 0.0000078 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -6469.8981

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(SOCGEN)					
1	SOCGEN{1}	0.053	0.019	2.861	0.004
2	HYB{1}	0.069	0.156	0.442	0.658
3	Constant	0.035	0.031	1.134	0.257
Mean Model(HYB)					
4	SOCGEN{1}	0.004	0.002	2.849	0.004
5	HYB{1}	0.372	0.020	19.084	0.000
6	Constant	0.022	0.003	7.087	0.000
7	C(1,1)	0.140	0.047	2.992	0.003
8	C(2,1)	0.010	0.008	1.211	0.226
9	C(2,2)	0.032	0.003	9.849	0.000
10	A(1,1)	0.169	0.019	8.782	0.000
11	A(1,2)	-0.009	0.002	-4.677	0.000
12	A(2,1)	1.218	0.135	9.031	0.000
13	A(2,2)	0.331	0.022	14.838	0.000
14	B(1,1)	0.969	0.005	212.482	0.000
15	B(1,2)	0.001	0.001	1.831	0.067
16	B(2,1)	-0.374	0.065	-5.768	0.000
17	B(2,2)	0.908	0.008	108.843	0.000
18	D(1,1)	0.291	0.028	10.448	0.000
19	D(1,2)	0.015	0.003	5.623	0.000
20	D(2,1)	-0.498	0.256	-1.943	0.052
21	D(2,2)	0.238	0.035	6.831	0.000

Standard Chartered and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 70 Iterations. Final criterion was 0.0000069 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -5991.5856

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(SCB)					
1	SCB{1}	0.007	0.017	0.389	0.698
2	HYB{1}	0.105	0.133	0.793	0.428
3	Constant	-0.016	0.027	-0.611	0.541
Mean Model(HYB)					
4	SCB{1}	0.006	0.002	2.967	0.003
5	HYB{1}	0.378	0.017	22.501	0.000
6	Constant	0.021	0.003	6.613	0.000
7	C(1,1)	0.290	0.034	8.650	0.000
8	C(2,1)	-0.025	0.005	-5.014	0.000
9	C(2,2)	0.026	0.006	4.534	0.000
10	A(1,1)	-0.084	0.044	-1.903	0.057
11	A(1,2)	0.000	0.002	-0.034	0.973
12	A(2,1)	0.117	0.187	0.625	0.532
13	A(2,2)	0.302	0.029	10.428	0.000
14	B(1,1)	0.950	0.009	106.301	0.000
15	B(1,2)	0.006	0.001	5.951	0.000
16	B(2,1)	0.112	0.091	1.225	0.221
17	B(2,2)	0.902	0.009	103.283	0.000
18	D(1,1)	0.319	0.031	10.361	0.000
19	D(1,2)	-0.011	0.003	-4.019	0.000
20	D(2,1)	0.622	0.179	3.480	0.001
21	D(2,2)	0.314	0.038	8.332	0.000

UBS and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 55 Iterations. Final criterion was 0.0000041 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -5874.4172

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(UBSVX)					
1	UBSVX{1}	0.055	0.018	3.03	0.002
2	HYB{1}	0.274	0.123	2.226	0.026
3	Constant	-0.004	0.026	-0.141	0.888
Mean Model(HYB)					
4	UBSVX{1}	0.009	0.002	5.059	0
5	HYB{1}	0.362	0.019	18.731	0
6	Constant	0.025	0.003	7.184	0
7	C(1,1)	0.228	0.024	9.718	0
8	C(2,1)	-0.013	0.008	-1.626	0.104
9	C(2,2)	0.034	0.004	8.872	0
10	A(1,1)	0.169	0.021	7.993	0
11	A(1,2)	-0.001	0.003	-0.375	0.707
12	A(2,1)	0.448	0.151	2.974	0.003
13	A(2,2)	0.376	0.023	16.122	0
14	B(1,1)	0.949	0.006	166.635	0
15	B(1,2)	0.001	0.002	0.352	0.725
16	B(2,1)	0.085	0.071	1.193	0.233
17	B(2,2)	0.909	0.01	93.704	0
18	D(1,1)	0.333	0.028	11.741	0
19	D(1,2)	0.015	0.01	1.45	0.147
20	D(2,1)	-0.648	0.189	-3.427	0.001
21	D(2,2)	-0.228	0.074	-3.082	0.002

Unicredit Group and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 60 Iterations. Final criterion was 0.0000034 <= 0.0000100

Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -6733.1658

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(UCG)					
1	UCG{1}	-0.008	0.018	-0.454	0.650
2	HYB{1}	-0.033	0.160	-0.206	0.836
3	Constant	-0.005	0.031	-0.149	0.882
Mean Model(HYB)					
4	UCG{1}	0.003	0.001	1.948	0.051
5	HYB{1}	0.375	0.020	18.906	0.000
6	Constant	0.023	0.003	7.247	0.000
7	C(1,1)	0.164	0.032	5.185	0.000
8	C(2,1)	-0.005	0.008	-0.625	0.532
9	C(2,2)	0.039	0.004	11.078	0.000
10	A(1,1)	0.124	0.029	4.226	0.000
11	A(1,2)	0.003	0.002	1.176	0.240
12	A(2,1)	0.096	0.229	0.418	0.676
13	A(2,2)	0.332	0.027	12.411	0.000
14	B(1,1)	0.968	0.005	191.605	0.000
15	B(1,2)	0.002	0.001	3.177	0.001
16	B(2,1)	-0.156	0.090	-1.725	0.085
17	B(2,2)	0.900	0.010	93.731	0.000
18	D(1,1)	0.305	0.025	12.015	0.000
19	D(1,2)	-0.004	0.003	-1.552	0.121
20	D(2,1)	0.716	0.217	3.296	0.001
21	D(2,2)	0.292	0.041	7.147	0.000

Agricultural Bank of China and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 52 Iterations.
Final criterion was 0.0000063 <= 0.0000100
Daily(5) Data From 2010:07:16 To 2017:05:05
Usable Observations 1776
Log Likelihood -2480.3734

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(ABCCH)					
1	ABCCH{1}	-0.024	0.024	-0.992	0.321
2	HYB{1}	0.159	0.095	1.678	0.093
3	Constant	-0.003	0.023	-0.128	0.898
Mean Model(HYB)					
4	ABCCH{1}	0.000	0.003	0.094	0.925
5	HYB{1}	0.360	0.026	13.859	0.000
6	Constant	0.021	0.005	4.624	0.000
7	C(1,1)	0.183	0.022	8.467	0.000
8	C(2,1)	0.007	0.006	1.206	0.228
9	C(2,2)	0.043	0.004	9.976	0.000
10	A(1,1)	0.270	0.020	13.411	0.000
11	A(1,2)	-0.004	0.003	-1.397	0.162
12	A(2,1)	-0.248	0.087	-2.847	0.004
13	A(2,2)	0.232	0.029	7.929	0.000
14	B(1,1)	0.952	0.007	142.347	0.000
15	B(1,2)	0.001	0.001	1.115	0.265
16	B(2,1)	0.023	0.031	0.728	0.467
17	B(2,2)	0.921	0.009	100.308	0.000
18	D(1,1)	-0.044	0.042	-1.049	0.294
19	D(1,2)	0.001	0.005	0.238	0.812
20	D(2,1)	0.269	0.108	2.486	0.013
21	D(2,2)	0.362	0.035	10.473	0.000

Bank of China and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 60 Iterations. Final criterion was 0.0000034 <= 0.0000100

Daily(5) Data From 2006:06:05 To 2017:05:05
Usable Observations 2850
Log Likelihood -5118.443

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BOC)					
1	BOC{1}	-0.009	0.020	-0.428	0.669
2	HYB{1}	0.705	0.126	5.591	0.000
3	Constant	-0.025	0.028	-0.869	0.385
Mean Model(HYB)					
4	BOC{1}	-0.001	0.002	-0.260	0.795
5	HYB{1}	0.383	0.019	20.460	0.000
6	Constant	0.027	0.003	8.009	0.000
7	C(1,1)	0.353	0.054	6.546	0.000
8	C(2,1)	0.001	0.007	0.114	0.909
9	C(2,2)	0.033	0.004	7.232	0.000
10	A(1,1)	0.304	0.024	12.656	0.000
11	A(1,2)	0.009	0.004	2.340	0.019
12	A(2,1)	-0.800	0.280	-2.852	0.004
13	A(2,2)	0.334	0.038	8.755	0.000
14	B(1,1)	0.905	0.020	45.172	0.000
15	B(1,2)	-0.002	0.003	-0.551	0.581
16	B(2,1)	0.253	0.102	2.491	0.013
17	B(2,2)	0.924	0.013	68.822	0.000
18	D(1,1)	0.109	0.057	1.910	0.056
19	D(1,2)	-0.016	0.006	-2.494	0.013
20	D(2,1)	1.440	0.216	6.681	0.000
21	D(2,2)	0.228	0.051	4.471	0.000

China Construction Bank and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 54 Iterations.
Final criterion was 0.0000012 <= 0.0000100
Daily(5) Data From 2005:10:28 To 2017:05:05
Usable Observations 3006
Log Likelihood -5452.048

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(CCBHK)					
1	CCBHK{1}	-0.003	0.018	-0.156	0.876
2	HYB{1}	0.715	0.122	5.863	0.000
3	Constant	0.002	0.027	0.085	0.932
Mean Model(HYB)					
4	CCBHK{1}	0.000	0.002	0.241	0.809
5	HYB{1}	0.384	0.018	21.446	0.000
6	Constant	0.024	0.003	7.720	0.000
7	C(1,1)	0.272	0.027	10.146	0.000
8	C(2,1)	0.008	0.006	1.412	0.158
9	C(2,2)	0.037	0.003	11.936	0.000
10	A(1,1)	0.227	0.018	12.577	0.000
11	A(1,2)	0.002	0.002	0.733	0.464
12	A(2,1)	0.483	0.144	3.345	0.001
13	A(2,2)	0.328	0.023	14.001	0.000
14	B(1,1)	0.953	0.007	143.776	0.000
15	B(1,2)	0.000	0.001	0.174	0.862
16	B(2,1)	-0.052	0.056	-0.917	0.359
17	B(2,2)	0.913	0.008	113.483	0.000
18	D(1,1)	-0.171	0.043	-4.013	0.000
19	D(1,2)	-0.006	0.006	-1.053	0.292
20	D(2,1)	0.385	0.217	1.777	0.076
21	D(2,2)	0.308	0.035	8.907	0.000

I & C Bank of Chinaand Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 38 Iterations.
Final criterion was 0.0000057 <= 0.0000100
Daily(5) Data From 2006:10:30 To 2017:05:05
Usable Observations 2745
Log Likelihood -4703.385

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(ICBCCG)					
1	ICBCCG{1}	-0.022	0.018	-1.260	0.208
2	HYB{1}	0.200	0.075	2.662	0.008
3	Constant	-0.020	0.019	-1.055	0.291
Mean Model(HYB)					
4	ICBCCG{1}	-0.002	0.002	-0.894	0.371
5	HYB{1}	0.407	0.022	18.663	0.000
6	Constant	0.021	0.004	5.190	0.000
7	C(1,1)	0.137	0.015	9.082	0.000
8	C(2,1)	0.009	0.006	1.524	0.128
9	C(2,2)	0.041	0.003	12.318	0.000
10	A(1,1)	0.277	0.015	18.506	0.000
11	A(1,2)	-0.003	0.002	-1.895	0.058
12	A(2,1)	0.304	0.062	4.880	0.000
13	A(2,2)	0.309	0.023	13.308	0.000
14	B(1,1)	0.958	0.004	243.468	0.000
15	B(1,2)	0.001	0.001	2.631	0.009
16	B(2,1)	-0.075	0.029	-2.606	0.009
17	B(2,2)	0.909	0.009	102.050	0.000
18	D(1,1)	-0.038	0.030	-1.263	0.207
19	D(1,2)	0.001	0.003	0.213	0.832
20	D(2,1)	-0.004	0.092	-0.047	0.962
21	D(2,2)	0.352	0.025	14.264	0.000

Mitsubishi Bank and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 58 Iterations.
Final criterion was 0.0000063 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -6164.458

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(MITSUBISHI)					
1	MITSUBISHI{1}	0.067	0.019	3.606	0.000
2	HYB{1}	1.056	0.122	8.630	0.000
3	Constant	-0.036	0.032	-1.124	0.261
Mean Model(HYB)					
4	MITSUBISHI{1}	0.002	0.002	1.117	0.264
5	HYB{1}	0.389	0.019	20.042	0.000
6	Constant	0.022	0.003	6.867	0.000
7	C(1,1)	0.279	0.029	9.757	0.000
8	C(2,1)	0.011	0.006	1.921	0.055
9	C(2,2)	-0.034	0.004	-8.975	0.000
10	A(1,1)	0.222	0.018	12.467	0.000
11	A(1,2)	0.005	0.002	2.355	0.019
12	A(2,1)	0.395	0.151	2.614	0.009
13	A(2,2)	0.315	0.021	15.263	0.000
14	B(1,1)	0.946	0.006	159.586	0.000
15	B(1,2)	-0.002	0.001	-2.812	0.005
16	B(2,1)	-0.025	0.061	-0.403	0.687
17	B(2,2)	0.917	0.008	120.235	0.000
18	D(1,1)	-0.300	0.028	-10.860	0.000
19	D(1,2)	-0.014	0.003	-4.550	0.000
20	D(2,1)	0.797	0.172	4.620	0.000
21	D(2,2)	0.339	0.029	11.676	0.000

Mizuho Bank and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 47 Iterations.
Final criterion was 0.0000083 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -6091.51

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(MIZUHO)					
1	MIZUHO{1}	0.055	0.018	2.994	0.003
2	HYB{1}	0.905	0.105	8.617	0.000
3	Constant	-0.027	0.030	-0.880	0.379
Mean Model(HYB)					
4	MIZUHO{1}	0.002	0.002	1.203	0.229
5	HYB{1}	0.389	0.016	24.488	0.000
6	Constant	0.020	0.003	6.557	0.000
7	C(1,1)	0.221	0.023	9.619	0.000
8	C(2,1)	0.014	0.004	3.083	0.002
9	C(2,2)	0.031	0.003	9.659	0.000
10	A(1,1)	0.202	0.017	12.133	0.000
11	A(1,2)	-0.005	0.002	-2.799	0.005
12	A(2,1)	0.652	0.097	6.729	0.000
13	A(2,2)	0.296	0.022	13.515	0.000
14	B(1,1)	0.957	0.004	213.529	0.000
15	B(1,2)	-0.002	0.001	-2.323	0.020
16	B(2,1)	-0.095	0.034	-2.754	0.006
17	B(2,2)	0.920	0.007	131.037	0.000
18	D(1,1)	0.252	0.029	8.631	0.000
19	D(1,2)	0.014	0.002	7.829	0.000
20	D(2,1)	-0.487	0.153	-3.174	0.002
21	D(2,2)	0.293	0.027	10.671	0.000

Sumitomo Bank and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 52 Iterations.
Final criterion was 0.0000024 <= 0.0000100
Daily(5) Data From 2005:01:05 To 2017:05:05
Usable Observations 3218
Log Likelihood -6188.375

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(SUMITOMO)					
1	SUMITOMO{1}	0.059	0.019	3.087	0.002
2	HYB{1}	0.940	0.121	7.786	0.000
3	Constant	-0.022	0.031	-0.719	0.472
Mean Model(HYB)					
4	SUMITOMO{1}	0.002	0.002	1.061	0.289
5	HYB{1}	0.388	0.019	20.127	0.000
6	Constant	0.023	0.003	7.172	0.000
7	C(1,1)	0.249	0.022	11.389	0.000
8	C(2,1)	0.001	0.006	0.195	0.845
9	C(2,2)	0.037	0.003	11.822	0.000
10	A(1,1)	0.191	0.017	11.222	0.000
11	A(1,2)	0.003	0.002	1.373	0.170
12	A(2,1)	0.493	0.133	3.700	0.000
13	A(2,2)	0.327	0.023	14.445	0.000
14	B(1,1)	0.952	0.005	208.869	0.000
15	B(1,2)	0.000	0.001	-0.248	0.805
16	B(2,1)	-0.056	0.054	-1.037	0.300
17	B(2,2)	0.914	0.008	118.258	0.000
18	D(1,1)	-0.320	0.023	-14.064	0.000
19	D(1,2)	-0.008	0.004	-2.076	0.038
20	D(2,1)	0.634	0.162	3.921	0.000
21	D(2,2)	0.300	0.028	10.691	0.000

Weekly Data Asymmetric VAR (1) - BEKK - GARCH Model

Bank of America and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 80 Iterations. Final criterion was 0.0000069 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2772.269

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BOA)					
1	BOA{1}	0.330	0.042	7.787	0.000
2	EQU{1}	-0.212	0.080	-2.641	0.008
3	Constant	0.053	0.091	0.585	0.558
Mean Model(EQU)					
4	BOA{1}	0.008	0.015	0.531	0.595
5	EQU{1}	0.165	0.042	3.946	0.000
6	Constant	0.104	0.049	2.122	0.034
7	C(1,1)	-0.508	0.096	-5.267	0.000
8	C(2,1)	-0.470	0.142	-3.312	0.001
9	C(2,2)	0.353	0.127	2.784	0.005
10	A(1,1)	0.310	0.062	5.006	0.000
11	A(1,2)	0.003	0.029	0.112	0.911
12	A(2,1)	0.020	0.142	0.138	0.891
13	A(2,2)	-0.060	0.102	-0.593	0.553
14	B(1,1)	0.936	0.028	33.763	0.000
15	B(1,2)	0.032	0.015	2.151	0.032
16	B(2,1)	-0.185	0.099	-1.859	0.063
17	B(2,2)	0.763	0.047	16.264	0.000
18	D(1,1)	0.269	0.121	2.230	0.026
19	D(1,2)	0.015	0.052	0.277	0.782
20	D(2,1)	0.566	0.164	3.455	0.001
21	D(2,2)	0.622	0.082	7.549	0.000

Bank of New York and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 87 Iterations. Final criterion was 0.0000055 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2593.5297

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BNY)					
1	BNY{1}	0.178	0.045	3.974	0.000
2	EQU{1}	0.011	0.070	0.150	0.881
3	Constant	0.144	0.090	1.588	0.112
Mean Model(EQU)					
4	BNY{1}	-0.022	0.025	-0.858	0.391
5	EQU{1}	0.182	0.044	4.111	0.000
6	Constant	0.112	0.053	2.107	0.035
7	C(1,1)	0.584	0.156	3.734	0.000
8	C(2,1)	0.384	0.096	4.001	0.000
9	C(2,2)	0.229	0.076	3.016	0.003
10	A(1,1)	0.127	0.090	1.404	0.160
11	A(1,2)	-0.095	0.050	-1.882	0.060
12	A(2,1)	0.198	0.124	1.591	0.112
13	A(2,2)	0.245	0.085	2.876	0.004
14	B(1,1)	0.994	0.032	30.924	0.000
15	B(1,2)	0.046	0.020	2.348	0.019
16	B(2,1)	-0.288	0.061	-4.753	0.000
17	B(2,2)	0.797	0.033	24.258	0.000
18	D(1,1)	0.120	0.115	1.041	0.298
19	D(1,2)	0.051	0.075	0.680	0.496
20	D(2,1)	0.663	0.155	4.280	0.000
21	D(2,2)	0.536	0.101	5.286	0.000

Citigroup and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 58 Iterations. Final criterion was 0.0000059 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2740.1977

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(CITI)					
1	CITI{1}	0.261	0.044	5.993	0.000
2	EQU{1}	0.005	0.091	0.057	0.955
3	Constant	-0.052	0.099	-0.529	0.597
Mean Model(EQU)					
4	CITI{1}	0.034	0.017	1.961	0.050
5	EQU{1}	0.133	0.047	2.844	0.004
6	Constant	0.106	0.050	2.102	0.036
7	C(1,1)	0.635	0.088	7.257	0.000
8	C(2,1)	0.470	0.095	4.934	0.000
9	C(2,2)	0.303	0.070	4.328	0.000
10	A(1,1)	0.236	0.071	3.317	0.001
11	A(1,2)	-0.024	0.033	-0.717	0.473
12	A(2,1)	-0.140	0.193	-0.727	0.467
13	A(2,2)	0.021	0.109	0.190	0.849
14	B(1,1)	0.937	0.022	42.482	0.000
15	B(1,2)	0.012	0.014	0.857	0.391
16	B(2,1)	-0.191	0.089	-2.148	0.032
17	B(2,2)	0.792	0.050	15.788	0.000
18	D(1,1)	0.401	0.068	5.910	0.000
19	D(1,2)	0.054	0.038	1.427	0.153
20	D(2,1)	0.490	0.152	3.233	0.001
21	D(2,2)	0.576	0.084	6.827	0.000

Goldman Sachs and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 69 Iterations. Final criterion was 0.0000036 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2626.3098

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(GOLDMAN)					
1	GOLDMAN{1}	0.289	0.048	6.034	0.000
2	EQU{1}	-0.107	0.092	-1.172	0.241
3	Constant	0.093	0.096	0.970	0.332
Mean Model(EQU)					
4	GOLDMAN{1}	0.003	0.022	0.153	0.879
5	EQU{1}	0.196	0.049	3.989	0.000
6	Constant	0.075	0.051	1.484	0.138
7	C(1,1)	0.525	0.131	4.010	0.000
8	C(2,1)	0.355	0.086	4.132	0.000
9	C(2,2)	0.306	0.075	4.073	0.000
10	A(1,1)	0.436	0.065	6.682	0.000
11	A(1,2)	0.039	0.050	0.780	0.435
12	A(2,1)	-0.595	0.173	-3.443	0.001
13	A(2,2)	-0.048	0.145	-0.331	0.740
14	B(1,1)	0.934	0.030	31.323	0.000
15	B(1,2)	0.018	0.023	0.788	0.431
16	B(2,1)	-0.088	0.079	-1.106	0.269
17	B(2,2)	0.819	0.048	17.139	0.000
18	D(1,1)	-0.223	0.109	-2.047	0.041
19	D(1,2)	-0.135	0.048	-2.820	0.005
20	D(2,1)	-0.382	0.189	-2.019	0.044
21	D(2,2)	-0.460	0.079	-5.795	0.000

JP Morgan Chase and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 86 Iterations. Final criterion was 0.0000065 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2556.939

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(JPM)					
1	JPM{1}	0.352	0.033	10.796	0.000
2	EQU{1}	-0.221	0.081	-2.745	0.006
3	Constant	0.113	0.083	1.365	0.172
Mean Model(EQU)					
4	JPM{1}	0.080	0.023	3.541	0.000
5	EQU{1}	0.057	0.041	1.387	0.165
6	Constant	0.108	0.050	2.154	0.031
7	C(1,1)	0.532	0.127	4.195	0.000
8	C(2,1)	0.476	0.097	4.907	0.000
9	C(2,2)	0.143	0.181	0.789	0.430
10	A(1,1)	0.069	0.086	0.801	0.423
11	A(1,2)	-0.116	0.045	-2.569	0.010
12	A(2,1)	-0.531	0.114	-4.646	0.000
13	A(2,2)	-0.097	0.085	-1.130	0.258
14	B(1,1)	1.036	0.032	32.370	0.000
15	B(1,2)	0.083	0.021	3.891	0.000
16	B(2,1)	-0.369	0.089	-4.135	0.000
17	B(2,2)	0.725	0.049	14.848	0.000
18	D(1,1)	-0.019	0.121	-0.156	0.876
19	D(1,2)	-0.276	0.092	-2.998	0.003
20	D(2,1)	0.681	0.178	3.832	0.000
21	D(2,2)	0.831	0.119	7.004	0.000

Morgan Stanley and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 66 Iterations. Final criterion was 0.0000061 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2754.6212

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(MORGAN)					
1	MORGAN{1}	0.273	0.050	5.453	0.000
2	EQU{1}	-0.138	0.105	-1.314	0.189
3	Constant	0.024	0.115	0.209	0.835
Mean Model(EQU)					
4	MORGAN{1}	0.015	0.020	0.755	0.451
5	EQU{1}	0.158	0.049	3.191	0.001
6	Constant	0.090	0.052	1.734	0.083
7	C(1,1)	0.729	0.111	6.596	0.000
8	C(2,1)	0.495	0.068	7.313	0.000
9	C(2,2)	0.177	0.087	2.037	0.042
10	A(1,1)	0.224	0.083	2.681	0.007
11	A(1,2)	-0.043	0.041	-1.041	0.298
12	A(2,1)	-0.010	0.222	-0.043	0.966
13	A(2,2)	0.128	0.121	1.058	0.290
14	B(1,1)	0.994	0.025	39.680	0.000
15	B(1,2)	0.037	0.014	2.716	0.007
16	B(2,1)	-0.329	0.086	-3.835	0.000
17	B(2,2)	0.760	0.040	18.920	0.000
18	D(1,1)	0.348	0.092	3.803	0.000
19	D(1,2)	0.071	0.036	1.951	0.051
20	D(2,1)	0.357	0.177	2.010	0.044
21	D(2,2)	0.528	0.083	6.363	0.000

Royal Bank of Canada and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 100 Iterations. Final criterion was 0.0000000 <= 0.0000100

Weekly Data From 2005:01:17 To 2017:05:08
Usable Observations 643
Log Likelihood -2437.7819

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(RBC)					
1	RBC{1}	0.179	0.041	4.412	0.000
2	EQU{1}	-0.081	0.053	-1.530	0.126
3	Constant	0.186	0.065	2.881	0.004
Mean Model(EQU)					
4	RBC{1}	0.003	0.033	0.103	0.918
5	EQU{1}	0.150	0.045	3.369	0.001
6	Constant	0.114	0.054	2.123	0.034
7	C(1,1)	0.211	0.132	1.605	0.109
8	C(2,1)	-0.515	0.067	-7.655	0.000
9	C(2,2)	0.000	2.928	0.000	1.000
10	A(1,1)	-0.009	0.058	-0.149	0.882
11	A(1,2)	-0.253	0.052	-4.825	0.000
12	A(2,1)	0.272	0.060	4.501	0.000
13	A(2,2)	0.202	0.087	2.329	0.020
14	B(1,1)	0.975	0.029	33.286	0.000
15	B(1,2)	0.142	0.034	4.224	0.000
16	B(2,1)	-0.098	0.066	-1.481	0.139
17	B(2,2)	0.695	0.045	15.412	0.000
18	D(1,1)	0.273	0.069	3.971	0.000
19	D(1,2)	0.040	0.075	0.528	0.597
20	D(2,1)	0.195	0.110	1.782	0.075
21	D(2,2)	0.590	0.084	7.045	0.000

State Streetand Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 69 Iterations. Final criterion was 0.0000094 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2695.6252

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(STATE)					
1	STATE{1}	0.253	0.042	5.973	0.000
2	EQU{1}	-0.154	0.072	-2.132	0.033
3	Constant	0.179	0.095	1.887	0.059
Mean Model(EQU)					
4	STATE{1}	-0.003	0.022	-0.153	0.878
5	EQU{1}	0.167	0.040	4.158	0.000
6	Constant	0.108	0.049	2.194	0.028
7	C(1,1)	0.660	0.118	5.603	0.000
8	C(2,1)	0.440	0.078	5.630	0.000
9	C(2,2)	0.181	0.109	1.662	0.097
10	A(1,1)	0.242	0.070	3.449	0.001
11	A(1,2)	0.069	0.047	1.479	0.139
12	A(2,1)	-0.066	0.171	-0.387	0.699
13	A(2,2)	-0.180	0.102	-1.764	0.078
14	B(1,1)	0.964	0.024	40.946	0.000
15	B(1,2)	0.028	0.015	1.900	0.057
16	B(2,1)	-0.289	0.058	-4.982	0.000
17	B(2,2)	0.817	0.030	27.483	0.000
18	D(1,1)	0.171	0.118	1.446	0.148
19	D(1,2)	-0.069	0.058	-1.177	0.239
20	D(2,1)	0.732	0.161	4.559	0.000
21	D(2,2)	0.682	0.089	7.639	0.000

Wells Fargo and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 76 Iterations. Final criterion was 0.0000029 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2520.5815

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(WELLS)					
1	WELLS{1}	0.262	0.046	5.739	0.000
2	EQU{1}	-0.163	0.067	-2.437	0.015
3	Constant	0.090	0.075	1.197	0.231
Mean Model(EQU)					
4	WELLS{1}	0.052	0.024	2.192	0.028
5	EQU{1}	0.111	0.046	2.443	0.015
6	Constant	0.108	0.053	2.038	0.042
7	C(1,1)	0.243	0.085	2.869	0.004
8	C(2,1)	0.544	0.069	7.844	0.000
9	C(2,2)	0.000	0.374	0.000	1.000
10	A(1,1)	0.323	0.056	5.800	0.000
11	A(1,2)	0.001	0.042	0.012	0.990
12	A(2,1)	-0.526	0.090	-5.868	0.000
13	A(2,2)	-0.089	0.115	-0.775	0.438
14	B(1,1)	0.944	0.015	61.238	0.000
15	B(1,2)	0.027	0.015	1.802	0.072
16	B(2,1)	-0.060	0.049	-1.238	0.216
17	B(2,2)	0.791	0.043	18.443	0.000
18	D(1,1)	0.193	0.088	2.201	0.028
19	D(1,2)	-0.054	0.049	-1.092	0.275
20	D(2,1)	0.379	0.141	2.689	0.007
21	D(2,2)	0.737	0.095	7.748	0.000

Banco Santander and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 57 Iterations. Final criterion was 0.0000017 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2678.1512

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(SANTANDER)					
1	SANTANDER{1}	0.203	0.045	4.475	0.000
2	EQU{1}	-0.026	0.082	-0.315	0.753
3	Constant	0.055	0.095	0.576	0.565
Mean Model(EQU)					
4	SANTANDER{1}	-0.015	0.020	-0.731	0.464
5	EQU{1}	0.202	0.047	4.267	0.000
6	Constant	0.100	0.049	2.030	0.042
7	C(1,1)	0.612	0.089	6.853	0.000
8	C(2,1)	0.242	0.082	2.959	0.003
9	C(2,2)	0.338	0.050	6.770	0.000
10	A(1,1)	-0.228	0.074	-3.083	0.002
11	A(1,2)	-0.069	0.039	-1.775	0.076
12	A(2,1)	0.423	0.103	4.121	0.000
13	A(2,2)	0.340	0.080	4.228	0.000
14	B(1,1)	0.908	0.021	42.478	0.000
15	B(1,2)	-0.007	0.014	-0.521	0.603
16	B(2,1)	-0.003	0.055	-0.052	0.959
17	B(2,2)	0.861	0.031	27.869	0.000
18	D(1,1)	0.502	0.061	8.237	0.000
19	D(1,2)	0.058	0.036	1.602	0.109
20	D(2,1)	-0.028	0.128	-0.219	0.827
21	D(2,2)	0.476	0.085	5.568	0.000

Barclays and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 63 Iterations. Final criterion was 0.0000000 <= 0.0000100

Weekly Data From 2005:01:17 To 2017:05:08
Usable Observations 643
Log Likelihood -2873.219

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BARCLAYS)					
1	BARCLAYS{1}	0.142	0.047	3.031	0.002
2	EQU{1}	-0.014	0.112	-0.124	0.901
3	Constant	-0.148	0.124	-1.191	0.234
Mean Model(EQU)					
4	BARCLAYS{1}	-0.019	0.015	-1.208	0.227
5	EQU{1}	0.212	0.048	4.463	0.000
6	Constant	0.081	0.052	1.559	0.119
7	C(1,1)	0.592	0.146	4.069	0.000
8	C(2,1)	0.397	0.122	3.265	0.001
9	C(2,2)	0.358	0.087	4.111	0.000
10	A(1,1)	0.196	0.098	2.003	0.045
11	A(1,2)	-0.005	0.030	-0.155	0.877
12	A(2,1)	-0.030	0.199	-0.153	0.879
13	A(2,2)	-0.125	0.092	-1.365	0.172
14	B(1,1)	0.945	0.022	42.874	0.000
15	B(1,2)	0.017	0.010	1.675	0.094
16	B(2,1)	-0.050	0.102	-0.489	0.625
17	B(2,2)	0.811	0.041	19.702	0.000
18	D(1,1)	0.217	0.078	2.772	0.006
19	D(1,2)	-0.009	0.038	-0.246	0.806
20	D(2,1)	0.568	0.173	3.284	0.001
21	D(2,2)	0.625	0.098	6.379	0.000

BNP Paribas and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 69 Iterations. Final criterion was 0.0000053 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2733.8178

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BNP)					
1	BNP{1}	0.096	0.047	2.043	0.041
2	EQU{1}	-0.008	0.099	-0.079	0.937
3	Constant	0.109	0.111	0.983	0.325
Mean Model(EQU)					
4	BNP{1}	-0.060	0.021	-2.795	0.005
5	EQU{1}	0.289	0.048	6.069	0.000
6	Constant	0.083	0.053	1.583	0.113
7	C(1,1)	0.855	0.165	5.185	0.000
8	C(2,1)	0.096	0.103	0.929	0.353
9	C(2,2)	0.463	0.063	7.393	0.000
10	A(1,1)	0.056	0.075	0.743	0.457
11	A(1,2)	0.130	0.035	3.675	0.000
12	A(2,1)	-0.448	0.130	-3.435	0.001
13	A(2,2)	-0.089	0.082	-1.093	0.274
14	B(1,1)	0.826	0.079	10.448	0.000
15	B(1,2)	0.014	0.033	0.414	0.679
16	B(2,1)	0.215	0.205	1.051	0.293
17	B(2,2)	0.807	0.066	12.300	0.000
18	D(1,1)	0.485	0.078	6.199	0.000
19	D(1,2)	0.033	0.042	0.780	0.436
20	D(2,1)	0.049	0.178	0.274	0.784
21	D(2,2)	0.562	0.081	6.941	0.000

Credit Suisse and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 57 Iterations. Final criterion was 0.0000017 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2731.0262

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(CRESUISVX)					
1	CRESUISVX{1}	0.247	0.046	5.360	0.000
2	EQU{1}	-0.185	0.100	-1.846	0.065
3	Constant	-0.092	0.122	-0.756	0.450
Mean Model(EQU)					
4	CRESUISVX{1}	-0.023	0.019	-1.213	0.225
5	EQU{1}	0.203	0.049	4.177	0.000
6	Constant	0.087	0.053	1.641	0.101
7	C(1,1)	0.825	0.120	6.894	0.000
8	C(2,1)	0.402	0.068	5.879	0.000
9	C(2,2)	0.203	0.063	3.233	0.001
10	A(1,1)	0.156	0.068	2.292	0.022
11	A(1,2)	-0.017	0.034	-0.497	0.619
12	A(2,1)	-0.040	0.160	-0.252	0.801
13	A(2,2)	-0.075	0.102	-0.737	0.461
14	B(1,1)	0.917	0.020	45.514	0.000
15	B(1,2)	-0.007	0.013	-0.534	0.593
16	B(2,1)	-0.014	0.053	-0.257	0.797
17	B(2,2)	0.870	0.029	29.811	0.000
18	D(1,1)	0.316	0.072	4.401	0.000
19	D(1,2)	0.008	0.038	0.215	0.830
20	D(2,1)	0.364	0.156	2.337	0.019
21	D(2,2)	0.605	0.074	8.146	0.000

Deutsche Bank and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 64 Iterations. Final criterion was 0.0000031 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2770.4484

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(DEUTSCHEGR)					
1	DEUTSCHEGR{1}	0.270	0.047	5.790	0.000
2	EQU{1}	-0.219	0.105	-2.079	0.038
3	Constant	-0.026	0.129	-0.204	0.838
Mean Model(EQU)					
4	DEUTSCHEGR{1}	0.004	0.016	0.277	0.782
5	EQU{1}	0.150	0.048	3.152	0.002
6	Constant	0.120	0.053	2.242	0.025
7	C(1,1)	0.774	0.118	6.541	0.000
8	C(2,1)	0.374	0.069	5.383	0.000
9	C(2,2)	0.228	0.049	4.667	0.000
10	A(1,1)	0.262	0.072	3.668	0.000
11	A(1,2)	0.007	0.026	0.273	0.785
12	A(2,1)	0.118	0.237	0.499	0.618
13	A(2,2)	0.168	0.129	1.305	0.192
14	B(1,1)	0.964	0.022	43.881	0.000
15	B(1,2)	0.016	0.009	1.673	0.094
16	B(2,1)	-0.221	0.079	-2.790	0.005
17	B(2,2)	0.829	0.032	25.944	0.000
18	D(1,1)	0.136	0.186	0.730	0.465
19	D(1,2)	-0.020	0.048	-0.414	0.679
20	D(2,1)	-1.042	0.256	-4.068	0.000
21	D(2,2)	-0.565	0.087	-6.481	0.000

Crédit Agricole and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 66 Iterations. Final criterion was 0.0000059 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2842.9059

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(CREAGR)					
1	CREAGR{1}	0.210	0.041	5.113	0.000
2	EQU{1}	-0.096	0.103	-0.928	0.353
3	Constant	0.012	0.113	0.106	0.916
Mean Model(EQU)					
4	CREAGR{1}	-0.008	0.016	-0.489	0.625
5	EQU{1}	0.191	0.044	4.332	0.000
6	Constant	0.097	0.047	2.069	0.039
7	C(1,1)	0.572	0.153	3.747	0.000
8	C(2,1)	0.375	0.089	4.211	0.000
9	C(2,2)	0.312	0.072	4.300	0.000
10	A(1,1)	0.071	0.108	0.661	0.509
11	A(1,2)	-0.075	0.046	-1.619	0.105
12	A(2,1)	-0.178	0.499	-0.357	0.721
13	A(2,2)	0.038	0.200	0.188	0.851
14	B(1,1)	0.986	0.017	57.642	0.000
15	B(1,2)	0.022	0.008	2.791	0.005
16	B(2,1)	-0.204	0.081	-2.521	0.012
17	B(2,2)	0.798	0.030	26.465	0.000
18	D(1,1)	0.351	0.062	5.684	0.000
19	D(1,2)	0.049	0.033	1.473	0.141
20	D(2,1)	0.427	0.166	2.570	0.010
21	D(2,2)	0.525	0.071	7.364	0.000

HSBC and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 67 Iterations. Final criterion was 0.0000069 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2506.1731

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(HSBC)					
1	HSBC{1}	0.174	0.043	4.040	0.000
2	EQU{1}	0.036	0.056	0.644	0.520
3	Constant	-0.027	0.069	-0.385	0.700
Mean Model(EQU)					
4	HSBC{1}	0.002	0.029	0.065	0.948
5	EQU{1}	0.151	0.045	3.341	0.001
6	Constant	0.097	0.050	1.943	0.052
7	C(1,1)	0.153	0.282	0.541	0.588
8	C(2,1)	0.023	0.289	0.079	0.937
9	C(2,2)	0.447	0.058	7.657	0.000
10	A(1,1)	0.122	0.067	1.830	0.067
11	A(1,2)	-0.116	0.050	-2.312	0.021
12	A(2,1)	0.217	0.081	2.661	0.008
13	A(2,2)	0.193	0.095	2.037	0.042
14	B(1,1)	0.991	0.034	29.388	0.000
15	B(1,2)	0.078	0.027	2.948	0.003
16	B(2,1)	-0.142	0.072	-1.973	0.048
17	B(2,2)	0.775	0.040	19.224	0.000
18	D(1,1)	0.239	0.067	3.570	0.000
19	D(1,2)	0.151	0.053	2.840	0.005
20	D(2,1)	0.227	0.093	2.439	0.015
21	D(2,2)	0.463	0.074	6.248	0.000

ING Bank and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 61 Iterations. Final criterion was 0.0000000 <= 0.0000100

Weekly Data From 2005:01:17 To 2017:05:08
Usable Observations 643
Log Likelihood -2759.2865

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(ING)					
1	ING{1}	0.269	0.044	6.105	0.000
2	EQU{1}	-0.202	0.102	-1.989	0.047
3	Constant	0.099	0.117	0.848	0.396
Mean Model(EQU)					
4	ING{1}	0.027	0.017	1.566	0.117
5	EQU{1}	0.120	0.047	2.541	0.011
6	Constant	0.087	0.052	1.666	0.096
7	C(1,1)	0.684	0.124	5.535	0.000
8	C(2,1)	0.440	0.097	4.560	0.000
9	C(2,2)	0.322	0.090	3.579	0.000
10	A(1,1)	0.129	0.103	1.253	0.210
11	A(1,2)	-0.027	0.044	-0.620	0.535
12	A(2,1)	0.152	0.260	0.586	0.558
13	A(2,2)	0.050	0.131	0.384	0.701
14	B(1,1)	0.964	0.029	33.738	0.000
15	B(1,2)	0.025	0.012	2.065	0.039
16	B(2,1)	-0.208	0.098	-2.132	0.033
17	B(2,2)	0.794	0.039	20.265	0.000
18	D(1,1)	0.361	0.091	3.960	0.000
19	D(1,2)	0.037	0.035	1.057	0.291
20	D(2,1)	0.446	0.204	2.184	0.029
21	D(2,2)	0.553	0.078	7.094	0.000

Nordea Bank and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 70 Iterations. Final criterion was 0.0000000 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2588.4714

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(NORDEASS)					
1	NORDEASS{1}	0.161	0.043	3.764	0.000
2	EQU{1}	-0.031	0.079	-0.399	0.690
3	Constant	0.111	0.095	1.161	0.246
Mean Model(EQU)					
4	NORDEASS{1}	0.000	0.023	-0.017	0.986
5	EQU{1}	0.167	0.043	3.868	0.000
6	Constant	0.086	0.052	1.644	0.100
7	C(1,1)	0.640	0.123	5.203	0.000
8	C(2,1)	0.254	0.076	3.358	0.001
9	C(2,2)	-0.326	0.075	-4.364	0.000
10	A(1,1)	0.160	0.102	1.572	0.116
11	A(1,2)	0.027	0.074	0.362	0.718
12	A(2,1)	-0.002	0.197	-0.011	0.992
13	A(2,2)	-0.108	0.151	-0.711	0.477
14	B(1,1)	0.915	0.035	25.846	0.000
15	B(1,2)	-0.017	0.030	-0.580	0.562
16	B(2,1)	0.006	0.072	0.089	0.929
17	B(2,2)	0.883	0.046	19.218	0.000
18	D(1,1)	0.132	0.106	1.246	0.213
19	D(1,2)	0.128	0.049	2.642	0.008
20	D(2,1)	0.501	0.146	3.422	0.001
21	D(2,2)	0.455	0.078	5.814	0.000

Royal Bank of Scotland and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 99 Iterations. Final criterion was 0.0000082 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2979.4109

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(RBS)					
1	RBS{1}	0.153	0.045	3.375	0.001
2	EQU{1}	0.065	0.094	0.696	0.486
3	Constant	-0.059	0.118	-0.499	0.618
Mean Model(EQU)					
4	RBS{1}	-0.013	0.014	-0.893	0.372
5	EQU{1}	0.191	0.042	4.498	0.000
6	Constant	0.112	0.052	2.145	0.032
7	C(1,1)	-0.029	0.228	-0.126	0.899
8	C(2,1)	-0.296	0.070	-4.198	0.000
9	C(2,2)	0.363	0.051	7.056	0.000
10	A(1,1)	0.510	0.058	8.836	0.000
11	A(1,2)	0.100	0.023	4.362	0.000
12	A(2,1)	-0.298	0.113	-2.642	0.008
13	A(2,2)	-0.150	0.069	-2.182	0.029
14	B(1,1)	0.870	0.016	54.477	0.000
15	B(1,2)	-0.016	0.006	-2.863	0.004
16	B(2,1)	0.163	0.067	2.456	0.014
17	B(2,2)	0.857	0.030	28.787	0.000
18	D(1,1)	0.241	0.117	2.061	0.039
19	D(1,2)	0.071	0.028	2.536	0.011
20	D(2,1)	0.084	0.196	0.430	0.667
21	D(2,2)	0.460	0.075	6.101	0.000

Société Générale and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 95 Iterations. Final criterion was 0.0000034 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2857.9187

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(SOCGEN)					
1	SOCGEN{1}	0.218	0.046	4.772	0.000
2	EQU{1}	-0.112	0.124	-0.902	0.367
3	Constant	0.159	0.134	1.188	0.235
Mean Model(EQU)					
4	SOCGEN{1}	-0.012	0.016	-0.717	0.473
5	EQU{1}	0.195	0.051	3.848	0.000
6	Constant	0.109	0.050	2.186	0.029
7	C(1,1)	0.544	0.160	3.397	0.001
8	C(2,1)	0.390	0.084	4.659	0.000
9	C(2,2)	0.203	0.098	2.073	0.038
10	A(1,1)	0.036	0.074	0.483	0.629
11	A(1,2)	0.089	0.030	3.005	0.003
12	A(2,1)	-0.609	0.163	-3.740	0.000
13	A(2,2)	-0.241	0.093	-2.576	0.010
14	B(1,1)	0.956	0.017	55.430	0.000
15	B(1,2)	0.006	0.009	0.700	0.484
16	B(2,1)	-0.173	0.079	-2.186	0.029
17	B(2,2)	0.826	0.031	26.415	0.000
18	D(1,1)	0.444	0.060	7.453	0.000
19	D(1,2)	0.085	0.029	2.953	0.003
20	D(2,1)	0.226	0.181	1.251	0.211
21	D(2,2)	0.459	0.072	6.361	0.000

Standard Chartered and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 62 Iterations. Final criterion was 0.0000000 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2720.585

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(SCB)					
1	SCB{1}	0.129	0.045	2.857	0.004
2	EQU{1}	-0.078	0.087	-0.894	0.371
3	Constant	-0.038	0.112	-0.340	0.734
Mean Model(EQU)					
4	SCB{1}	-0.010	0.020	-0.494	0.621
5	EQU{1}	0.199	0.043	4.682	0.000
6	Constant	0.070	0.048	1.468	0.142
7	C(1,1)	0.716	0.119	6.012	0.000
8	C(2,1)	0.051	0.105	0.481	0.631
9	C(2,2)	0.474	0.059	7.996	0.000
10	A(1,1)	0.175	0.063	2.766	0.006
11	A(1,2)	0.046	0.031	1.498	0.134
12	A(2,1)	-0.034	0.111	-0.305	0.760
13	A(2,2)	-0.286	0.072	-3.960	0.000
14	B(1,1)	0.907	0.033	27.086	0.000
15	B(1,2)	0.032	0.025	1.292	0.196
16	B(2,1)	0.048	0.082	0.589	0.556
17	B(2,2)	0.782	0.054	14.587	0.000
18	D(1,1)	0.253	0.070	3.607	0.000
19	D(1,2)	0.059	0.035	1.693	0.090
20	D(2,1)	0.378	0.131	2.885	0.004
21	D(2,2)	0.550	0.079	6.961	0.000

UBS and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 67 Iterations. Final criterion was 0.0000000 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2718.7284

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(UBSVX)					
1	UBSVX{1}	0.274	0.047	5.763	0.000
2	EQU{1}	-0.125	0.088	-1.414	0.157
3	Constant	-0.035	0.114	-0.308	0.758
Mean Model(EQU)					
4	UBSVX{1}	-0.007	0.020	-0.338	0.736
5	EQU{1}	0.219	0.045	4.832	0.000
6	Constant	0.081	0.053	1.532	0.125
7	C(1,1)	0.573	0.118	4.842	0.000
8	C(2,1)	0.403	0.084	4.782	0.000
9	C(2,2)	-0.303	0.076	-4.007	0.000
10	A(1,1)	0.159	0.088	1.796	0.073
11	A(1,2)	-0.060	0.042	-1.417	0.156
12	A(2,1)	-0.054	0.284	-0.190	0.849
13	A(2,2)	0.083	0.160	0.520	0.603
14	B(1,1)	0.913	0.021	42.837	0.000
15	B(1,2)	-0.003	0.016	-0.156	0.876
16	B(2,1)	0.078	0.093	0.835	0.404
17	B(2,2)	0.841	0.045	18.567	0.000
18	D(1,1)	0.397	0.076	5.250	0.000
19	D(1,2)	0.113	0.046	2.430	0.015
20	D(2,1)	0.038	0.211	0.178	0.859
21	D(2,2)	0.451	0.105	4.312	0.000

Unicredit Group and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 50 Iterations. Final criterion was 0.0000000 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2929.5424

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(UCG)					
1	UCG{1}	0.197	0.039	5.092	0.000
2	EQU{1}	-0.075	0.102	-0.738	0.461
3	Constant	-0.010	0.126	-0.083	0.934
Mean Model(EQU)					
4	UCG{1}	-0.013	0.011	-1.133	0.257
5	EQU{1}	0.201	0.042	4.731	0.000
6	Constant	0.109	0.050	2.189	0.029
7	C(1,1)	0.606	0.106	5.691	0.000
8	C(2,1)	0.239	0.103	2.316	0.021
9	C(2,2)	0.388	0.056	6.950	0.000
10	A(1,1)	-0.189	0.065	-2.887	0.004
11	A(1,2)	-0.027	0.020	-1.349	0.177
12	A(2,1)	0.238	0.176	1.354	0.176
13	A(2,2)	0.242	0.092	2.621	0.009
14	B(1,1)	0.941	0.016	58.410	0.000
15	B(1,2)	0.005	0.007	0.814	0.416
16	B(2,1)	-0.060	0.070	-0.859	0.391
17	B(2,2)	0.836	0.030	28.050	0.000
18	D(1,1)	0.384	0.063	6.059	0.000
19	D(1,2)	0.034	0.022	1.552	0.121
20	D(2,1)	0.271	0.172	1.575	0.115
21	D(2,2)	0.536	0.078	6.847	0.000

Agricultural Bank of China and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 39 Iterations. Final criterion was 0.0000083 <= 0.0000100

Weekly Data From 2010:07:30 To 2017:05:05
Usable Observations 354
Log Likelihood -1358.708

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(ABCCH)					
1	ABCCH{1}	0.193	0.053	3.603	0.000
2	EQU{1}	-0.004	0.056	-0.066	0.948
3	Constant	0.038	0.091	0.424	0.672
Mean Model(EQU)					
4	ABCCH{1}	-0.026	0.033	-0.784	0.433
5	EQU{1}	0.160	0.057	2.812	0.005
6	Constant	0.110	0.070	1.562	0.118
7	C(1,1)	0.437	0.112	3.909	0.000
8	C(2,1)	0.100	0.109	0.919	0.358
9	C(2,2)	0.223	0.120	1.852	0.064
10	A(1,1)	0.380	0.046	8.183	0.000
11	A(1,2)	-0.046	0.032	-1.423	0.155
12	A(2,1)	-0.108	0.056	-1.940	0.052
13	A(2,2)	-0.035	0.078	-0.446	0.655
14	B(1,1)	0.904	0.025	35.525	0.000
15	B(1,2)	0.010	0.019	0.518	0.604
16	B(2,1)	0.013	0.022	0.575	0.565
17	B(2,2)	0.900	0.029	31.286	0.000
18	D(1,1)	0.093	0.096	0.972	0.331
19	D(1,2)	0.113	0.042	2.680	0.007
20	D(2,1)	0.079	0.072	1.099	0.272
21	D(2,2)	0.477	0.085	5.628	0.000

Bank of China and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 54 Iterations. Final criterion was 0.0000035 <= 0.0000100

Weekly Data From 2006:06:16 To 2017:05:05
Usable Observations 569
Log Likelihood -2427.2505

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BOC)					
1	BOC{1}	0.182	0.045	3.999	0.000
2	EQU{1}	0.128	0.070	1.833	0.067
3	Constant	0.070	0.109	0.641	0.522
Mean Model(EQU)					
4	BOC{1}	-0.041	0.018	-2.193	0.028
5	EQU{1}	0.214	0.034	6.335	0.000
6	Constant	0.111	0.054	2.048	0.041
7	C(1,1)	1.061	0.212	5.010	0.000
8	C(2,1)	-0.164	0.152	-1.086	0.278
9	C(2,2)	0.238	0.205	1.159	0.246
10	A(1,1)	0.321	0.076	4.250	0.000
11	A(1,2)	-0.015	0.037	-0.415	0.678
12	A(2,1)	0.164	0.082	2.001	0.045
13	A(2,2)	0.111	0.083	1.336	0.182
14	B(1,1)	0.844	0.066	12.851	0.000
15	B(1,2)	0.088	0.033	2.656	0.008
16	B(2,1)	0.019	0.081	0.230	0.818
17	B(2,2)	0.772	0.047	16.586	0.000
18	D(1,1)	0.166	0.083	2.002	0.045
19	D(1,2)	0.052	0.044	1.185	0.236
20	D(2,1)	0.186	0.126	1.483	0.138
21	D(2,2)	0.604	0.079	7.632	0.000

China Const. Bank and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 60 Iterations. Final criterion was 0.0000006 <= 0.0000100

Weekly Data From 2005:11:11 To 2017:05:05
Usable Observations 600
Log Likelihood -2590.9501

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(CCBHK)					
1	CCBHK{1}	0.228	0.039	5.855	0.000
2	EQU{1}	0.134	0.075	1.802	0.072
3	Constant	0.115	0.100	1.146	0.252
Mean Model(EQU)					
4	CCBHK{1}	-0.025	0.017	-1.420	0.155
5	EQU{1}	0.214	0.040	5.365	0.000
6	Constant	0.083	0.043	1.901	0.057
7	C(1,1)	0.551	0.275	2.000	0.045
8	C(2,1)	-0.097	0.234	-0.416	0.678
9	C(2,2)	0.378	0.104	3.628	0.000
10	A(1,1)	0.280	0.062	4.488	0.000
11	A(1,2)	0.023	0.032	0.732	0.464
12	A(2,1)	-0.114	0.103	-1.107	0.268
13	A(2,2)	-0.041	0.095	-0.435	0.663
14	B(1,1)	0.944	0.041	23.307	0.000
15	B(1,2)	0.027	0.023	1.161	0.246
16	B(2,1)	-0.051	0.069	-0.738	0.460
17	B(2,2)	0.841	0.036	23.115	0.000
18	D(1,1)	0.157	0.089	1.761	0.078
19	D(1,2)	0.114	0.035	3.238	0.001
20	D(2,1)	0.366	0.128	2.864	0.004
21	D(2,2)	0.476	0.067	7.074	0.000

I & C Bank of China and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 38 Iterations. Final criterion was 0.0000070 <= 0.0000100

Weekly Data From 2006:11:10 To 2017:05:05
Usable Observations 548
Log Likelihood -2335.937

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(ICBCCG)					
1	ICBCCG{1}	0.162	0.046	3.508	0.000
2	EQU{1}	0.064	0.049	1.314	0.189
3	Constant	-0.042	0.079	-0.534	0.594
Mean Model(EQU)					
4	ICBCCG{1}	-0.045	0.021	-2.186	0.029
5	EQU{1}	0.198	0.040	4.932	0.000
6	Constant	0.070	0.061	1.137	0.256
7	C(1,1)	0.425	0.079	5.353	0.000
8	C(2,1)	0.017	0.094	0.182	0.856
9	C(2,2)	0.387	0.068	5.655	0.000
10	A(1,1)	0.443	0.050	8.780	0.000
11	A(1,2)	-0.030	0.022	-1.375	0.169
12	A(2,1)	-0.058	0.052	-1.132	0.258
13	A(2,2)	-0.052	0.064	-0.817	0.414
14	B(1,1)	0.893	0.024	37.804	0.000
15	B(1,2)	0.024	0.010	2.442	0.015
16	B(2,1)	0.017	0.020	0.842	0.400
17	B(2,2)	0.859	0.022	39.069	0.000
18	D(1,1)	0.094	0.068	1.384	0.166
19	D(1,2)	0.066	0.033	2.013	0.044
20	D(2,1)	0.075	0.059	1.263	0.207
21	D(2,2)	0.581	0.062	9.335	0.000

Mitsubishi Bank and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 57 Iterations. Final criterion was 0.0000014 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2871.953

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(MITSUBISHI)					
1	MITSUBISHI{1}	0.126	0.046	2.745	0.006
2	EQU{1}	0.361	0.092	3.937	0.000
3	Constant	-0.005	0.127	-0.036	0.971
Mean Model(EQU)					
4	MITSUBISHI{1}	-0.036	0.015	-2.492	0.013
5	EQU{1}	0.233	0.042	5.565	0.000
6	Constant	0.105	0.052	2.021	0.043
7	C(1,1)	0.836	0.232	3.609	0.000
8	C(2,1)	0.247	0.119	2.069	0.039
9	C(2,2)	0.356	0.077	4.645	0.000
10	A(1,1)	0.332	0.050	6.571	0.000
11	A(1,2)	0.035	0.028	1.259	0.208
12	A(2,1)	-0.220	0.132	-1.667	0.096
13	A(2,2)	0.145	0.081	1.783	0.075
14	B(1,1)	0.938	0.028	34.006	0.000
15	B(1,2)	0.002	0.018	0.090	0.928
16	B(2,1)	-0.090	0.052	-1.726	0.084
17	B(2,2)	0.854	0.032	26.983	0.000
18	D(1,1)	-0.194	0.132	-1.462	0.144
19	D(1,2)	-0.107	0.053	-2.027	0.043
20	D(2,1)	0.800	0.184	4.341	0.000
21	D(2,2)	0.704	0.095	7.390	0.000

Mizuho Bank and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 58 Iterations. Final criterion was 0.0000016 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2865.058

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(MIZUHO)					
1	MIZUHO{1}	0.209	0.044	4.743	0.000
2	EQU{1}	0.257	0.095	2.700	0.007
3	Constant	-0.019	0.133	-0.142	0.887
Mean Model(EQU)					
4	MIZUHO{1}	-0.031	0.017	-1.821	0.069
5	EQU{1}	0.214	0.044	4.875	0.000
6	Constant	0.093	0.056	1.649	0.099
7	C(1,1)	0.792	0.169	4.698	0.000
8	C(2,1)	0.382	0.069	5.564	0.000
9	C(2,2)	0.193	0.070	2.752	0.006
10	A(1,1)	0.386	0.049	7.798	0.000
11	A(1,2)	0.072	0.027	2.627	0.009
12	A(2,1)	-0.033	0.119	-0.280	0.779
13	A(2,2)	0.075	0.090	0.841	0.400
14	B(1,1)	0.919	0.023	39.707	0.000
15	B(1,2)	-0.019	0.012	-1.569	0.117
16	B(2,1)	-0.138	0.042	-3.265	0.001
17	B(2,2)	0.883	0.023	38.351	0.000
18	D(1,1)	-0.088	0.174	-0.502	0.615
19	D(1,2)	-0.066	0.069	-0.950	0.342
20	D(2,1)	0.711	0.194	3.663	0.000
21	D(2,2)	0.625	0.097	6.437	0.000

Sumitomo Bank and Global Equity Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 60 Iterations. Final criterion was 0.0000015 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2883.7775

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(SUMITOMO)					
1	SUMITOMO{1}	0.245	0.045	5.512	0.000
2	EQU{1}	0.155	0.090	1.721	0.085
3	Constant	0.051	0.134	0.382	0.703
Mean Model(EQU)					
4	SUMITOMO{1}	-0.016	0.015	-1.062	0.288
5	EQU{1}	0.201	0.044	4.559	0.000
6	Constant	0.103	0.054	1.895	0.058
7	C(1,1)	0.973	0.149	6.528	0.000
8	C(2,1)	0.315	0.072	4.367	0.000
9	C(2,2)	0.285	0.070	4.062	0.000
10	A(1,1)	0.400	0.059	6.807	0.000
11	A(1,2)	0.086	0.023	3.756	0.000
12	A(2,1)	-0.080	0.107	-0.746	0.456
13	A(2,2)	-0.038	0.125	-0.302	0.762
14	B(1,1)	0.888	0.022	39.615	0.000
15	B(1,2)	-0.029	0.012	-2.468	0.014
16	B(2,1)	-0.066	0.051	-1.273	0.203
17	B(2,2)	0.882	0.026	34.221	0.000
18	D(1,1)	0.062	0.172	0.363	0.716
19	D(1,2)	-0.022	0.056	-0.394	0.694
20	D(2,1)	0.592	0.188	3.143	0.002
21	D(2,2)	0.640	0.092	6.937	0.000

Bank of America and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 47 Iterations. Final criterion was 0.0000047 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -1895.970

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BOA)					
1	BOA{1}	0.234	0.042	5.640	0.000
2	IGB{1}	-0.842	0.308	-2.732	0.006
3	Constant	0.098	0.105	0.925	0.355
Mean Model(IGB)					
4	BOA{1}	0.009	0.003	3.690	0.000
5	IGB{1}	0.282	0.037	7.656	0.000
6	Constant	0.050	0.012	4.188	0.000
7	C(1,1)	0.532	0.100	5.347	0.000
8	C(2,1)	-0.071	0.039	-1.816	0.069
9	C(2,2)	0.052	0.047	1.102	0.270
10	A(1,1)	0.309	0.046	6.779	0.000
11	A(1,2)	0.004	0.002	1.537	0.124
12	A(2,1)	-1.002	0.540	-1.857	0.063
13	A(2,2)	0.354	0.049	7.254	0.000
14	B(1,1)	0.907	0.016	56.330	0.000
15	B(1,2)	-0.001	0.001	-1.137	0.256
16	B(2,1)	0.490	0.346	1.417	0.157
17	B(2,2)	0.880	0.029	30.525	0.000
18	D(1,1)	-0.405	0.067	-6.080	0.000
19	D(1,2)	-0.002	0.003	-0.561	0.575
20	D(2,1)	0.413	0.680	0.608	0.543
21	D(2,2)	0.275	0.096	2.864	0.004

Bank of New York and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 51 Iterations. Final criterion was 0.0000000 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -1734.312

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BNY)					
1	BNY{1}	0.128	0.042	3.021	0.003
2	IGB{1}	-0.575	0.279	-2.061	0.039
3	Constant	0.123	0.095	1.288	0.198
Mean Model(IGB)					
4	BNY{1}	0.011	0.004	2.503	0.012
5	IGB{1}	0.269	0.040	6.712	0.000
6	Constant	0.058	0.013	4.321	0.000
7	C(1,1)	0.870	0.133	6.567	0.000
8	C(2,1)	-0.091	0.020	-4.511	0.000
9	C(2,2)	0.054	0.022	2.413	0.016
10	A(1,1)	0.153	0.061	2.507	0.012
11	A(1,2)	0.010	0.007	1.492	0.136
12	A(2,1)	0.056	0.677	0.083	0.934
13	A(2,2)	0.319	0.082	3.906	0.000
14	B(1,1)	0.892	0.027	32.636	0.000
15	B(1,2)	0.002	0.002	0.628	0.530
16	B(2,1)	0.535	0.278	1.925	0.054
17	B(2,2)	0.878	0.029	30.710	0.000
18	D(1,1)	0.489	0.062	7.877	0.000
19	D(1,2)	-0.019	0.007	-2.606	0.009
20	D(2,1)	-0.796	0.680	-1.171	0.242
21	D(2,2)	0.269	0.155	1.736	0.083

Citigroup and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 58 Iterations. Final criterion was 0.0000047 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -1901.4157

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(CITI)					
1	CITI{1}	0.187	0.041	4.528	0.000
2	IGB{1}	-0.724	0.310	-2.336	0.019
3	Constant	0.036	0.106	0.340	0.734
Mean Model(IGB)					
4	CITI{1}	0.007	0.002	2.958	0.003
5	IGB{1}	0.295	0.040	7.389	0.000
6	Constant	0.042	0.013	3.181	0.001
7	C(1,1)	0.246	0.271	0.906	0.365
8	C(2,1)	-0.070	0.078	-0.897	0.370
9	C(2,2)	0.040	0.129	0.308	0.758
10	A(1,1)	0.212	0.044	4.860	0.000
11	A(1,2)	0.002	0.002	0.854	0.393
12	A(2,1)	-2.066	0.458	-4.512	0.000
13	A(2,2)	0.325	0.054	6.022	0.000
14	B(1,1)	0.917	0.012	77.895	0.000
15	B(1,2)	0.000	0.001	-0.667	0.505
16	B(2,1)	0.447	0.248	1.801	0.072
17	B(2,2)	0.900	0.026	34.070	0.000
18	D(1,1)	0.406	0.060	6.795	0.000
19	D(1,2)	-0.001	0.003	-0.175	0.861
20	D(2,1)	-0.030	0.527	-0.057	0.955
21	D(2,2)	0.274	0.073	3.770	0.000

Goldman Sachs and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 71 Iterations. Final criterion was 0.0000036 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -1824.6212

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(GOLDMAN)					
1	GOLDMAN{1}	0.179	0.040	4.472	0.000
2	IGB{1}	-1.159	0.350	-3.313	0.001
3	Constant	0.251	0.116	2.168	0.030
Mean Model(IGB)					
4	GOLDMAN{1}	0.003	0.004	0.621	0.535
5	IGB{1}	0.284	0.040	7.083	0.000
6	Constant	0.040	0.014	2.899	0.004
7	C(1,1)	0.403	0.213	1.890	0.059
8	C(2,1)	-0.123	0.018	-6.834	0.000
9	C(2,2)	0.000	0.071	0.000	1.000
10	A(1,1)	0.100	0.061	1.650	0.099
11	A(1,2)	-0.018	0.005	-3.578	0.000
12	A(2,1)	2.691	0.430	6.259	0.000
13	A(2,2)	-0.156	0.075	-2.087	0.037
14	B(1,1)	0.911	0.014	67.117	0.000
15	B(1,2)	0.012	0.004	3.354	0.001
16	B(2,1)	-0.436	0.449	-0.972	0.331
17	B(2,2)	0.865	0.031	28.145	0.000
18	D(1,1)	0.344	0.046	7.399	0.000
19	D(1,2)	-0.014	0.009	-1.524	0.128
20	D(2,1)	-0.841	0.544	-1.545	0.122
21	D(2,2)	0.496	0.067	7.371	0.000

JP Morgan Chase and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 43 Iterations. Final criterion was 0.0000062 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -1742.206

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(JPM)					
1	JPM{1}	0.179	0.039	4.573	0.000
2	IGB{1}	-0.878	0.277	-3.169	0.002
3	Constant	0.129	0.097	1.325	0.185
Mean Model(IGB)					
4	JPM{1}	0.007	0.002	3.929	0.000
5	IGB{1}	0.296	0.038	7.719	0.000
6	Constant	0.047	0.013	3.597	0.000
7	C(1,1)	0.444	0.128	3.454	0.001
8	C(2,1)	-0.071	0.028	-2.559	0.010
9	C(2,2)	0.070	0.022	3.246	0.001
10	A(1,1)	0.080	0.053	1.509	0.131
11	A(1,2)	0.010	0.005	2.158	0.031
12	A(2,1)	-1.693	0.329	-5.149	0.000
13	A(2,2)	0.275	0.053	5.213	0.000
14	B(1,1)	0.935	0.012	80.543	0.000
15	B(1,2)	-0.002	0.002	-1.199	0.231
16	B(2,1)	0.287	0.228	1.260	0.208
17	B(2,2)	0.872	0.025	35.232	0.000
18	D(1,1)	0.356	0.046	7.655	0.000
19	D(1,2)	0.007	0.006	1.122	0.262
20	D(2,1)	0.065	0.454	0.142	0.887
21	D(2,2)	0.383	0.069	5.585	0.000

Morgan Stanley and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 84 Iterations. Final criterion was 0.0000000 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -1929.1565

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(MORGAN)					
1	MORGAN{1}	0.152	0.041	3.748	0.000
2	IGB{1}	-1.244	0.349	-3.565	0.000
3	Constant	0.128	0.108	1.183	0.237
Mean Model(IGB)					
4	MORGAN{1}	0.005	0.003	1.694	0.090
5	IGB{1}	0.305	0.040	7.535	0.000
6	Constant	0.047	0.013	3.701	0.000
7	C(1,1)	0.803	0.120	6.687	0.000
8	C(2,1)	-0.094	0.014	-6.590	0.000
9	C(2,2)	0.000	0.055	0.000	1.000
10	A(1,1)	-0.098	0.057	-1.717	0.086
11	A(1,2)	-0.011	0.003	-3.261	0.001
12	A(2,1)	1.220	0.534	2.284	0.022
13	A(2,2)	-0.255	0.061	-4.171	0.000
14	B(1,1)	0.931	0.012	76.560	0.000
15	B(1,2)	-0.001	0.001	-0.992	0.321
16	B(2,1)	0.828	0.188	4.412	0.000
17	B(2,2)	0.889	0.019	46.172	0.000
18	D(1,1)	0.441	0.054	8.184	0.000
19	D(1,2)	-0.006	0.004	-1.449	0.147
20	D(2,1)	-0.970	0.568	-1.707	0.088
21	D(2,2)	0.364	0.067	5.447	0.000

Royal Bank of Canada and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 46 Iterations. Final criterion was 0.0000063 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -1524.607

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(RBC)					
1	RBC{1}	0.178	0.041	4.349	0.000
2	IGB{1}	0.120	0.200	0.600	0.549
3	Constant	0.136	0.071	1.916	0.055
Mean Model(IGB)					
4	RBC{1}	0.016	0.007	2.383	0.017
5	IGB{1}	0.278	0.038	7.237	0.000
6	Constant	0.053	0.013	4.185	0.000
7	C(1,1)	0.254	0.106	2.409	0.016
8	C(2,1)	-0.090	0.035	-2.587	0.010
9	C(2,2)	0.053	0.048	1.102	0.270
10	A(1,1)	0.121	0.047	2.577	0.010
11	A(1,2)	0.013	0.008	1.517	0.129
12	A(2,1)	0.879	0.409	2.148	0.032
13	A(2,2)	0.259	0.089	2.917	0.004
14	B(1,1)	0.942	0.012	80.581	0.000
15	B(1,2)	0.001	0.003	0.441	0.659
16	B(2,1)	0.145	0.204	0.712	0.477
17	B(2,2)	0.872	0.030	28.902	0.000
18	D(1,1)	-0.328	0.048	-6.854	0.000
19	D(1,2)	0.024	0.008	2.901	0.004
20	D(2,1)	-0.596	0.369	-1.617	0.106
21	D(2,2)	0.351	0.086	4.082	0.000

State Streetand Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 67 Iterations. Final criterion was 0.0000000 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -1809.725

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(STATE)					
1	STATE{1}	0.195	0.004	53.155	0.000
2	IGB{1}	-0.290	0.002	-122.076	0.000
3	Constant	0.134	0.003	50.134	0.000
Mean Model(IGB)					
4	STATE{1}	0.003	0.004	0.822	0.411
5	IGB{1}	0.258	0.037	6.906	0.000
6	Constant	0.057	0.013	4.303	0.000
7	C(1,1)	0.910	0.100	9.127	0.000
8	C(2,1)	-0.102	0.014	-7.487	0.000
9	C(2,2)	0.000	0.071	0.000	1.000
10	A(1,1)	0.228	0.062	3.668	0.000
11	A(1,2)	0.000	0.005	0.007	0.994
12	A(2,1)	-0.071	0.455	-0.156	0.876
13	A(2,2)	0.299	0.047	6.318	0.000
14	B(1,1)	0.875	0.022	39.073	0.000
15	B(1,2)	0.002	0.002	1.083	0.279
16	B(2,1)	0.707	0.193	3.670	0.000
17	B(2,2)	0.877	0.021	41.308	0.000
18	D(1,1)	0.531	0.066	8.077	0.000
19	D(1,2)	-0.007	0.005	-1.322	0.186
20	D(2,1)	-0.306	0.489	-0.625	0.532
21	D(2,2)	-0.332	0.072	-4.606	0.000

Wells Fargo and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 64 Iterations. Final criterion was 0.0000037 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -1684.8223

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(WELLS)					
1	WELLS{1}	0.098	0.039	2.492	0.013
2	IGB{1}	-0.753	0.235	-3.206	0.001
3	Constant	0.159	0.078	2.033	0.042
Mean Model(IGB)					
4	WELLS{1}	0.012	0.004	3.174	0.002
5	IGB{1}	0.311	0.038	8.189	0.000
6	Constant	0.043	0.013	3.180	0.001
7	C(1,1)	0.192	0.109	1.772	0.076
8	C(2,1)	-0.091	0.015	-6.243	0.000
9	C(2,2)	0.000	0.123	0.000	1.000
10	A(1,1)	0.232	0.046	4.988	0.000
11	A(1,2)	0.007	0.004	1.923	0.054
12	A(2,1)	-1.411	0.230	-6.135	0.000
13	A(2,2)	0.312	0.048	6.443	0.000
14	B(1,1)	0.936	0.008	111.988	0.000
15	B(1,2)	-0.003	0.001	-2.635	0.008
16	B(2,1)	0.433	0.151	2.858	0.004
17	B(2,2)	0.875	0.025	35.212	0.000
18	D(1,1)	0.298	0.062	4.806	0.000
19	D(1,2)	0.001	0.005	0.307	0.759
20	D(2,1)	0.022	0.397	0.055	0.956
21	D(2,2)	0.356	0.073	4.877	0.000

Banco Santander and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 36 Iterations. Final criterion was 0.0000099 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -1836.6676

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(SANTANDER)					
1	SANTANDER{1}	0.171	0.040	4.331	0.000
2	IGB{1}	0.127	0.306	0.415	0.678
3	Constant	0.002	0.113	0.022	0.983
Mean Model(IGB)					
4	SANTANDER{1}	0.007	0.003	2.076	0.038
5	IGB{1}	0.304	0.040	7.686	0.000
6	Constant	0.047	0.013	3.701	0.000
7	C(1,1)	0.510	0.147	3.463	0.001
8	C(2,1)	-0.051	0.025	-2.016	0.044
9	C(2,2)	0.065	0.017	3.895	0.000
10	A(1,1)	0.070	0.067	1.054	0.292
11	A(1,2)	-0.008	0.005	-1.792	0.073
12	A(2,1)	1.839	0.407	4.518	0.000
13	A(2,2)	-0.278	0.043	-6.428	0.000
14	B(1,1)	0.920	0.016	57.237	0.000
15	B(1,2)	0.001	0.002	0.521	0.603
16	B(2,1)	0.425	0.208	2.045	0.041
17	B(2,2)	0.894	0.020	43.776	0.000
18	D(1,1)	0.487	0.049	9.877	0.000
19	D(1,2)	-0.015	0.005	-3.154	0.002
20	D(2,1)	-0.030	0.533	-0.056	0.955
21	D(2,2)	0.395	0.068	5.806	0.000

Barclays and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 47 Iterations. Final criterion was 0.0000020 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -1992.1335

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BARCLAYS)					
1	BARCLAYS{1}	0.137	0.039	3.521	0.000
2	IGB{1}	-0.611	0.416	-1.468	0.142
3	Constant	-0.110	0.128	-0.859	0.390
Mean Model(IGB)					
4	BARCLAYS{1}	0.007	0.003	2.528	0.011
5	IGB{1}	0.310	0.039	7.878	0.000
6	Constant	0.044	0.014	3.164	0.002
7	C(1,1)	0.504	0.213	2.371	0.018
8	C(2,1)	-0.068	0.034	-2.014	0.044
9	C(2,2)	0.049	0.044	1.111	0.266
10	A(1,1)	0.145	0.055	2.656	0.008
11	A(1,2)	0.000	0.003	-0.031	0.975
12	A(2,1)	-2.554	0.546	-4.675	0.000
13	A(2,2)	0.274	0.053	5.143	0.000
14	B(1,1)	0.909	0.016	56.083	0.000
15	B(1,2)	-0.001	0.001	-0.657	0.511
16	B(2,1)	0.472	0.305	1.548	0.122
17	B(2,2)	0.893	0.030	30.164	0.000
18	D(1,1)	0.493	0.062	7.917	0.000
19	D(1,2)	0.000	0.004	0.049	0.961
20	D(2,1)	0.050	0.729	0.069	0.945
21	D(2,2)	0.377	0.069	5.468	0.000

BNP Paribas and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 43 Iterations. Final criterion was 0.0000010 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -1893.8789

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BNP)					
1	BNP{1}	0.089	0.037	2.387	0.017
2	IGB{1}	-0.269	0.343	-0.785	0.432
3	Constant	0.068	0.121	0.563	0.573
Mean Model(IGB)					
4	BNP{1}	0.010	0.003	3.177	0.001
5	IGB{1}	0.316	0.042	7.531	0.000
6	Constant	0.044	0.013	3.270	0.001
7	C(1,1)	0.767	0.162	4.738	0.000
8	C(2,1)	-0.055	0.020	-2.754	0.006
9	C(2,2)	0.063	0.016	3.924	0.000
10	A(1,1)	-0.014	0.074	-0.194	0.847
11	A(1,2)	0.005	0.004	1.374	0.169
12	A(2,1)	-1.942	0.533	-3.641	0.000
13	A(2,2)	0.290	0.057	5.084	0.000
14	B(1,1)	0.909	0.018	51.363	0.000
15	B(1,2)	0.001	0.001	0.512	0.609
16	B(2,1)	0.624	0.235	2.651	0.008
17	B(2,2)	0.899	0.022	40.361	0.000
18	D(1,1)	0.520	0.055	9.505	0.000
19	D(1,2)	-0.012	0.004	-3.019	0.003
20	D(2,1)	-0.543	0.668	-0.813	0.416
21	D(2,2)	0.351	0.080	4.397	0.000

Credit Suisse and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 41 Iterations. Final criterion was 0.0000026 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -1909.9625

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(CRESUISVX)					
1	CRESUISVX{1}	0.180	0.041	4.386	0.000
2	IGB{1}	-0.837	0.373	-2.241	0.025
3	Constant	-0.058	0.134	-0.431	0.667
Mean Model(IGB)					
4	CRESUISVX{1}	0.008	0.003	2.465	0.014
5	IGB{1}	0.306	0.040	7.658	0.000
6	Constant	0.046	0.013	3.497	0.000
7	C(1,1)	0.754	0.178	4.236	0.000
8	C(2,1)	-0.040	0.026	-1.551	0.121
9	C(2,2)	0.077	0.011	6.704	0.000
10	A(1,1)	0.041	0.063	0.650	0.516
11	A(1,2)	0.011	0.006	1.992	0.046
12	A(2,1)	-2.097	0.553	-3.791	0.000
13	A(2,2)	0.302	0.050	6.008	0.000
14	B(1,1)	0.919	0.019	49.166	0.000
15	B(1,2)	-0.001	0.002	-0.775	0.439
16	B(2,1)	0.602	0.239	2.522	0.012
17	B(2,2)	0.882	0.021	42.321	0.000
18	D(1,1)	0.457	0.061	7.436	0.000
19	D(1,2)	-0.010	0.004	-2.199	0.028
20	D(2,1)	-0.324	0.652	-0.497	0.619
21	D(2,2)	0.373	0.073	5.121	0.000

Deutsche Bank and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 43 Iterations. Final criterion was 0.0000096 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -1947.9513

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(DEUTSCHEGR)					
1	DEUTSCHEGR{1}	0.187	0.037	5.020	0.000
2	IGB{1}	-0.429	0.346	-1.239	0.215
3	Constant	-0.127	0.128	-0.989	0.323
Mean Model(IGB)					
4	DEUTSCHEGR{1}	0.007	0.003	2.420	0.016
5	IGB{1}	0.298	0.041	7.336	0.000
6	Constant	0.051	0.013	3.979	0.000
7	C(1,1)	0.508	0.163	3.105	0.002
8	C(2,1)	-0.045	0.030	-1.492	0.136
9	C(2,2)	0.069	0.018	3.773	0.000
10	A(1,1)	-0.002	0.053	-0.044	0.965
11	A(1,2)	0.008	0.004	2.208	0.027
12	A(2,1)	-1.527	0.482	-3.166	0.002
13	A(2,2)	0.292	0.056	5.221	0.000
14	B(1,1)	0.951	0.009	100.822	0.000
15	B(1,2)	-0.002	0.001	-1.419	0.156
16	B(2,1)	0.597	0.242	2.468	0.014
17	B(2,2)	0.893	0.027	33.355	0.000
18	D(1,1)	0.422	0.040	10.633	0.000
19	D(1,2)	-0.009	0.004	-2.275	0.023
20	D(2,1)	-0.209	0.601	-0.348	0.728
21	D(2,2)	0.340	0.074	4.610	0.000

Crédit Agricole and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 65 Iterations. Final criterion was 0.0000000 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2000.9374

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(CREAGR)					
1	CREAGR{1}	0.166	0.040	4.130	0.000
2	IGB{1}	-0.144	0.392	-0.367	0.713
3	Constant	0.037	0.130	0.283	0.777
Mean Model(IGB)					
4	CREAGR{1}	0.007	0.003	2.631	0.009
5	IGB{1}	0.308	0.038	8.150	0.000
6	Constant	0.049	0.013	3.886	0.000
7	C(1,1)	0.487	0.195	2.503	0.012
8	C(2,1)	-0.044	0.042	-1.052	0.293
9	C(2,2)	0.078	0.025	3.165	0.002
10	A(1,1)	0.088	0.050	1.766	0.077
11	A(1,2)	0.004	0.003	1.383	0.167
12	A(2,1)	-1.789	0.623	-2.873	0.004
13	A(2,2)	0.325	0.059	5.481	0.000
14	B(1,1)	0.946	0.010	92.573	0.000
15	B(1,2)	0.000	0.001	0.112	0.911
16	B(2,1)	0.404	0.355	1.137	0.256
17	B(2,2)	0.884	0.030	29.911	0.000
18	D(1,1)	-0.392	0.046	-8.461	0.000
19	D(1,2)	0.010	0.004	2.607	0.009
20	D(2,1)	-0.138	0.717	-0.192	0.848
21	D(2,2)	-0.331	0.087	-3.822	0.000

HSBC and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 62 Iterations. Final criterion was 0.0000011 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -1619.4006

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(HSBC)					
1	HSBC{1}	0.173	0.038	4.597	0.000
2	IGB{1}	-0.290	0.217	-1.337	0.181
3	Constant	0.028	0.070	0.401	0.689
Mean Model(IGB)					
4	HSBC{1}	0.020	0.005	4.081	0.000
5	IGB{1}	0.313	0.038	8.288	0.000
6	Constant	0.047	0.012	3.920	0.000
7	C(1,1)	0.207	0.100	2.074	0.038
8	C(2,1)	-0.109	0.016	-6.662	0.000
9	C(2,2)	0.000	0.079	0.000	1.000
10	A(1,1)	0.116	0.047	2.469	0.014
11	A(1,2)	0.016	0.008	2.096	0.036
12	A(2,1)	-1.371	0.196	-6.976	0.000
13	A(2,2)	0.255	0.055	4.669	0.000
14	B(1,1)	0.951	0.009	102.647	0.000
15	B(1,2)	-0.003	0.002	-1.320	0.187
16	B(2,1)	0.291	0.175	1.668	0.095
17	B(2,2)	0.860	0.030	28.437	0.000
18	D(1,1)	0.278	0.050	5.518	0.000
19	D(1,2)	-0.004	0.009	-0.432	0.666
20	D(2,1)	0.175	0.345	0.508	0.611
21	D(2,2)	0.430	0.063	6.832	0.000

ING Bank and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 58 Iterations. Final criterion was 0.0000000 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -1961.7528

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(ING)					
1	ING{1}	0.165	0.040	4.086	0.000
2	IGB{1}	-0.405	0.395	-1.026	0.305
3	Constant	0.109	0.119	0.918	0.359
Mean Model(IGB)					
4	ING{1}	0.006	0.003	2.296	0.022
5	IGB{1}	0.297	0.040	7.432	0.000
6	Constant	0.047	0.013	3.584	0.000
7	C(1,1)	0.526	0.147	3.591	0.000
8	C(2,1)	-0.098	0.017	-5.679	0.000
9	C(2,2)	0.000	0.062	0.000	1.000
10	A(1,1)	0.085	0.051	1.669	0.095
11	A(1,2)	0.005	0.003	1.608	0.108
12	A(2,1)	-1.894	0.456	-4.155	0.000
13	A(2,2)	0.346	0.053	6.467	0.000
14	B(1,1)	0.942	0.011	85.304	0.000
15	B(1,2)	0.000	0.001	0.489	0.625
16	B(2,1)	0.615	0.235	2.615	0.009
17	B(2,2)	0.875	0.029	29.704	0.000
18	D(1,1)	0.398	0.052	7.716	0.000
19	D(1,2)	-0.008	0.004	-1.888	0.059
20	D(2,1)	0.332	0.642	0.517	0.605
21	D(2,2)	0.306	0.089	3.440	0.001

Nordea Bank and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 106 Iterations. Final criterion was 0.0000076 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -1749.233

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(NORDEASS)					
1	NORDEASS{1}	0.138	0.036	3.799	0.000
2	IGB{1}	-0.148	0.277	-0.534	0.593
3	Constant	0.144	0.091	1.573	0.116
Mean Model(IGB)					
4	NORDEASS{1}	0.014	0.004	3.375	0.001
5	IGB{1}	0.306	0.039	7.810	0.000
6	Constant	0.051	0.014	3.710	0.000
7	C(1,1)	0.069	0.132	0.525	0.600
8	C(2,1)	0.134	0.016	8.211	0.000
9	C(2,2)	0.000	0.822	0.000	1.000
10	A(1,1)	0.067	0.050	1.338	0.181
11	A(1,2)	0.020	0.006	3.476	0.001
12	A(2,1)	-0.739	0.443	-1.670	0.095
13	A(2,2)	0.361	0.054	6.666	0.000
14	B(1,1)	0.930	0.011	82.847	0.000
15	B(1,2)	0.004	0.003	1.406	0.160
16	B(2,1)	-0.884	0.254	-3.480	0.001
17	B(2,2)	0.781	0.036	21.569	0.000
18	D(1,1)	-0.315	0.044	-7.219	0.000
19	D(1,2)	0.031	0.008	4.000	0.000
20	D(2,1)	-1.011	0.352	-2.871	0.004
21	D(2,2)	-0.485	0.084	-5.795	0.000

Royal Bank of Scotland and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 60 Iterations. Final criterion was 0.0000046 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2087.1564

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(RBS)					
1	RBS{1}	0.124	0.039	3.182	0.001
2	IGB{1}	-0.172	0.386	-0.445	0.656
3	Constant	-0.029	0.132	-0.219	0.827
Mean Model(IGB)					
4	RBS{1}	0.007	0.002	2.751	0.006
5	IGB{1}	0.295	0.042	7.111	0.000
6	Constant	0.044	0.013	3.327	0.001
7	C(1,1)	0.538	0.127	4.230	0.000
8	C(2,1)	-0.052	0.046	-1.130	0.259
9	C(2,2)	0.063	0.036	1.742	0.082
10	A(1,1)	0.395	0.051	7.795	0.000
11	A(1,2)	-0.002	0.003	-0.839	0.401
12	A(2,1)	-0.294	0.716	-0.411	0.681
13	A(2,2)	0.166	0.068	2.453	0.014
14	B(1,1)	0.909	0.013	71.953	0.000
15	B(1,2)	0.000	0.001	-0.048	0.962
16	B(2,1)	0.271	0.409	0.663	0.508
17	B(2,2)	0.913	0.020	45.001	0.000
18	D(1,1)	0.302	0.098	3.072	0.002
19	D(1,2)	0.002	0.003	0.871	0.384
20	D(2,1)	-1.281	0.742	-1.726	0.084
21	D(2,2)	0.397	0.063	6.302	0.000

Société Générale and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 47 Iterations. Final criterion was 0.0000025 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2017.6697

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(SOCGEN)					
1	SOCGEN{1}	0.168	0.042	3.982	0.000
2	IGB{1}	-0.588	0.423	-1.389	0.165
3	Constant	0.134	0.137	0.980	0.327
Mean Model(IGB)					
4	SOCGEN{1}	0.007	0.002	2.910	0.004
5	IGB{1}	0.312	0.038	8.213	0.000
6	Constant	0.046	0.013	3.534	0.000
7	C(1,1)	0.558	0.175	3.192	0.001
8	C(2,1)	-0.046	0.027	-1.703	0.089
9	C(2,2)	0.064	0.019	3.347	0.001
10	A(1,1)	0.074	0.052	1.424	0.155
11	A(1,2)	0.004	0.003	1.378	0.168
12	A(2,1)	-1.919	0.635	-3.021	0.003
13	A(2,2)	0.298	0.052	5.723	0.000
14	B(1,1)	0.933	0.011	82.751	0.000
15	B(1,2)	-0.001	0.001	-0.718	0.473
16	B(2,1)	0.506	0.261	1.940	0.052
17	B(2,2)	0.899	0.022	40.835	0.000
18	D(1,1)	0.474	0.052	9.155	0.000
19	D(1,2)	-0.008	0.004	-2.177	0.029
20	D(2,1)	-0.039	0.710	-0.056	0.956
21	D(2,2)	0.335	0.073	4.559	0.000

Standard Chartered and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 38 Iterations. Final criterion was 0.0000022 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -1879.8514

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(SCB)					
1	SCB{1}	0.105	0.039	2.666	0.008
2	IGB{1}	0.302	0.320	0.945	0.345
3	Constant	-0.020	0.116	-0.173	0.862
Mean Model(IGB)					
4	SCB{1}	0.014	0.003	4.245	0.000
5	IGB{1}	0.302	0.037	8.220	0.000
6	Constant	0.045	0.012	3.919	0.000
7	C(1,1)	0.423	0.156	2.709	0.007
8	C(2,1)	0.014	0.047	0.289	0.773
9	C(2,2)	0.098	0.019	5.184	0.000
10	A(1,1)	0.098	0.039	2.533	0.011
11	A(1,2)	0.010	0.005	1.943	0.052
12	A(2,1)	-1.776	0.367	-4.838	0.000
13	A(2,2)	0.243	0.062	3.941	0.000
14	B(1,1)	0.937	0.012	76.655	0.000
15	B(1,2)	-0.001	0.002	-0.584	0.559
16	B(2,1)	0.026	0.369	0.071	0.943
17	B(2,2)	0.873	0.031	28.449	0.000
18	D(1,1)	0.366	0.045	8.105	0.000
19	D(1,2)	-0.009	0.006	-1.626	0.104
20	D(2,1)	0.178	0.620	0.288	0.774
21	D(2,2)	0.451	0.067	6.692	0.000

UBS and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 187 Iterations. Final criterion was 0.0000095 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -1904.2013

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(UBSVX)					
1	UBSVX{1}	0.192	0.04	4.788	0
2	IGB{1}	-0.584	0.337	-1.729	0.084
3	Constant	0.044	0.118	0.374	0.709
Mean Model(IGB)					
4	UBSVX{1}	0.007	0.003	1.937	0.053
5	IGB{1}	0.306	0.041	7.487	0
6	Constant	0.053	0.013	4.063	0
7	C(1,1)	0.011	0.182	0.06	0.952
8	C(2,1)	-0.124	0.138	-0.901	0.368
9	C(2,2)	0.015	1.052	0.015	0.988
10	A(1,1)	0.276	0.051	5.43	0
11	A(1,2)	0.002	0.006	0.392	0.695
12	A(2,1)	-0.272	0.485	-0.561	0.575
13	A(2,2)	0.348	0.071	4.922	0
14	B(1,1)	0.905	0.014	66.447	0
15	B(1,2)	0.009	0.002	3.751	0
16	B(2,1)	-1.3	0.275	-4.737	0
17	B(2,2)	0.837	0.035	23.925	0
18	D(1,1)	-0.301	0.081	-3.719	0
19	D(1,2)	0.024	0.007	3.666	0
20	D(2,1)	0.71	0.675	1.052	0.293
21	D(2,2)	0.252	0.105	2.410	0.016

Unicredit Group and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 43 Iterations. Final criterion was 0.0000000 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2048.5706

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(UCG)					
1	UCG{1}	0.171	0.040	4.305	0.000
2	IGB{1}	0.213	0.423	0.503	0.615
3	Constant	-0.065	0.146	-0.444	0.657
Mean Model(IGB)					
4	UCG{1}	0.004	0.002	1.718	0.086
5	IGB{1}	0.292	0.037	7.860	0.000
6	Constant	0.050	0.013	3.874	0.000
7	C(1,1)	0.567	0.147	3.843	0.000
8	C(2,1)	-0.041	0.025	-1.617	0.106
9	C(2,2)	0.071	0.018	3.935	0.000
10	A(1,1)	0.062	0.056	1.108	0.268
11	A(1,2)	0.004	0.003	1.232	0.218
12	A(2,1)	-1.372	0.512	-2.678	0.007
13	A(2,2)	0.330	0.056	5.896	0.000
14	B(1,1)	0.940	0.012	77.841	0.000
15	B(1,2)	-0.001	0.001	-1.134	0.257
16	B(2,1)	0.427	0.218	1.958	0.050
17	B(2,2)	0.899	0.024	38.000	0.000
18	D(1,1)	0.432	0.046	9.334	0.000
19	D(1,2)	-0.006	0.003	-2.206	0.027
20	D(2,1)	0.681	0.869	0.783	0.433
21	D(2,2)	0.243	0.116	2.102	0.036

Agricultural Bank of China and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 50 Iterations. Final criterion was 0.0000071 <= 0.0000100

Weekly Data From 2010:07:30 To 2017:05:05
Usable Observations 354
Log Likelihood -999.355

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(ABCCH)					
1	ABCCH{1}	0.187	0.044	4.271	0.000
2	GBMI{1}	-0.133	0.139	-0.957	0.339
3	Constant	0.036	0.068	0.531	0.596
Mean Model(GBMI)					
4	ABCCH{1}	0.004	0.011	0.424	0.672
5	GBMI{1}	0.283	0.050	5.657	0.000
6	Constant	0.037	0.025	1.446	0.148
7	C(1,1)	0.594	0.105	5.648	0.000
8	C(2,1)	0.013	0.041	0.302	0.762
9	C(2,2)	0.085	0.040	2.111	0.035
10	A(1,1)	0.466	0.058	8.053	0.000
11	A(1,2)	-0.004	0.011	-0.373	0.709
12	A(2,1)	0.100	0.282	0.353	0.724
13	A(2,2)	0.290	0.059	4.896	0.000
14	B(1,1)	0.812	0.034	24.093	0.000
15	B(1,2)	-0.004	0.007	-0.557	0.577
16	B(2,1)	-0.068	0.162	-0.421	0.674
17	B(2,2)	0.933	0.026	35.618	0.000
18	D(1,1)	-0.342	0.146	-2.338	0.019
19	D(1,2)	-0.002	0.021	-0.112	0.911
20	D(2,1)	1.329	0.307	4.335	0.000
21	D(2,2)	0.199	0.093	2.142	0.032

Bank of China and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 40 Iterations. Final criterion was 0.0000000 <= 0.0000100

Weekly Data From 2006:06:16 To 2017:05:05
Usable Observations 569
Log Likelihood -1648.3696

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BOC)					
1	BOC{1}	0.236	0.039	6.046	0.000
2	IGB{1}	-0.668	0.317	-2.111	0.035
3	Constant	0.176	0.120	1.465	0.143
Mean Model(IGB)					
4	BOC{1}	0.011	0.004	2.460	0.014
5	IGB{1}	0.252	0.039	6.461	0.000
6	Constant	0.064	0.013	4.724	0.000
7	C(1,1)	1.155	0.316	3.660	0.000
8	C(2,1)	0.016	0.037	0.429	0.668
9	C(2,2)	0.089	0.025	3.571	0.000
10	A(1,1)	0.417	0.083	4.999	0.000
11	A(1,2)	0.014	0.006	2.272	0.023
12	A(2,1)	-0.631	0.522	-1.210	0.226
13	A(2,2)	0.262	0.060	4.406	0.000
14	B(1,1)	0.800	0.071	11.315	0.000
15	B(1,2)	-0.001	0.005	-0.175	0.861
16	B(2,1)	-0.727	0.603	-1.206	0.228
17	B(2,2)	0.893	0.034	25.889	0.000
18	D(1,1)	0.190	0.157	1.207	0.227
19	D(1,2)	-0.026	0.009	-2.937	0.003
20	D(2,1)	1.804	0.923	1.954	0.051
21	D(2,2)	0.316	0.089	3.534	0.000

China Const. Bank and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 48 Iterations. Final criterion was 0.0000070 <= 0.0000100

Weekly Data From 2005:11:11 To 2017:05:05
Usable Observations 600
Log Likelihood -2036.9592

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(CCBHK)					
1	CCBHK{1}	0.219	0.042	5.266	0.000
2	GBMI{1}	-0.030	0.215	-0.140	0.888
3	Constant	0.126	0.119	1.064	0.287
Mean Model(GBMI)					
4	CCBHK{1}	0.021	0.006	3.537	0.000
5	GBMI{1}	0.305	0.037	8.350	0.000
6	Constant	0.035	0.022	1.607	0.108
7	C(1,1)	0.628	0.162	3.876	0.000
8	C(2,1)	-0.103	0.032	-3.243	0.001
9	C(2,2)	0.000	0.082	0.000	1.000
10	A(1,1)	0.208	0.065	3.184	0.001
11	A(1,2)	0.031	0.006	4.970	0.000
12	A(2,1)	-1.755	0.316	-5.555	0.000
13	A(2,2)	0.029	0.054	0.533	0.594
14	B(1,1)	0.871	0.020	43.155	0.000
15	B(1,2)	-0.021	0.004	-4.842	0.000
16	B(2,1)	0.683	0.156	4.387	0.000
17	B(2,2)	0.947	0.017	55.230	0.000
18	D(1,1)	0.366	0.071	5.185	0.000
19	D(1,2)	0.009	0.012	0.731	0.465
20	D(2,1)	0.550	0.470	1.171	0.241
21	D(2,2)	0.202	0.061	3.326	0.001

I & C Bank of China and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 43 Iterations. Final criterion was 0.0000087 <= 0.0000100

Weekly Data From 2006:11:10 To 2017:05:05
Usable Observations 548
Log Likelihood -1486.8034

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(ICBCCG)					
1	ICBCCG{1}	0.210	0.048	4.394	0.000
2	IGB{1}	-0.341	0.232	-1.471	0.141
3	Constant	0.013	0.085	0.151	0.880
Mean Model(IGB)					
4	ICBCCG{1}	0.012	0.005	2.354	0.019
5	IGB{1}	0.268	0.044	6.124	0.000
6	Constant	0.051	0.014	3.593	0.000
7	C(1,1)	0.301	0.188	1.604	0.109
8	C(2,1)	-0.021	0.039	-0.529	0.597
9	C(2,2)	0.090	0.016	5.476	0.000
10	A(1,1)	0.424	0.079	5.340	0.000
11	A(1,2)	0.001	0.006	0.113	0.910
12	A(2,1)	0.548	0.309	1.776	0.076
13	A(2,2)	0.127	0.084	1.514	0.130
14	B(1,1)	0.905	0.034	26.267	0.000
15	B(1,2)	-0.001	0.003	-0.432	0.666
16	B(2,1)	-0.238	0.153	-1.562	0.118
17	B(2,2)	0.896	0.023	38.554	0.000
18	D(1,1)	0.052	0.101	0.514	0.607
19	D(1,2)	0.014	0.007	1.950	0.051
20	D(2,1)	0.810	0.416	1.949	0.051
21	D(2,2)	0.441	0.064	6.865	0.000

Mitsubishi Bank and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 54 Iterations. Final criterion was 0.0000039 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -1943.686

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(MITSUBISHI)					
1	MITSUBISHI{1}	0.146	0.041	3.529	0.000
2	IGB{1}	-2.131	0.423	-5.034	0.000
3	Constant	0.207	0.143	1.449	0.147
Mean Model(IGB)					
4	MITSUBISHI{1}	0.005	0.003	1.656	0.098
5	IGB{1}	0.303	0.035	8.633	0.000
6	Constant	0.057	0.012	4.891	0.000
7	C(1,1)	1.249	0.197	6.352	0.000
8	C(2,1)	-0.100	0.021	-4.852	0.000
9	C(2,2)	0.045	0.025	1.767	0.077
10	A(1,1)	0.125	0.066	1.900	0.057
11	A(1,2)	0.019	0.004	4.169	0.000
12	A(2,1)	-2.723	0.595	-4.575	0.000
13	A(2,2)	0.374	0.071	5.247	0.000
14	B(1,1)	0.883	0.028	31.897	0.000
15	B(1,2)	0.002	0.003	0.633	0.527
16	B(2,1)	1.212	0.356	3.410	0.001
17	B(2,2)	0.848	0.028	30.663	0.000
18	D(1,1)	-0.386	0.083	-4.624	0.000
19	D(1,2)	0.014	0.005	2.643	0.008
20	D(2,1)	2.033	1.646	1.235	0.217
21	D(2,2)	0.211	0.146	1.445	0.148

Mizuho Bank and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 54 Iterations. Final criterion was 0.0000082 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -1914.5006

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(MIZUHO)					
1	MIZUHO{1}	0.194	0.041	4.707	0.000
2	IGB{1}	-2.112	0.388	-5.442	0.000
3	Constant	0.128	0.127	1.013	0.311
Mean Model(IGB)					
4	MIZUHO{1}	0.001	0.003	0.321	0.748
5	IGB{1}	0.271	0.039	6.917	0.000
6	Constant	0.052	0.013	4.150	0.000
7	C(1,1)	1.006	0.153	6.582	0.000
8	C(2,1)	-0.079	0.022	-3.559	0.000
9	C(2,2)	0.000	0.029	0.000	1.000
10	A(1,1)	0.173	0.061	2.816	0.005
11	A(1,2)	0.018	0.004	5.085	0.000
12	A(2,1)	-1.398	0.620	-2.255	0.024
13	A(2,2)	0.253	0.057	4.436	0.000
14	B(1,1)	0.922	0.019	47.574	0.000
15	B(1,2)	-0.005	0.002	-2.467	0.014
16	B(2,1)	1.169	0.307	3.811	0.000
17	B(2,2)	0.885	0.026	33.514	0.000
18	D(1,1)	-0.340	0.065	-5.204	0.000
19	D(1,2)	0.007	0.005	1.385	0.166
20	D(2,1)	0.312	0.864	0.362	0.718
21	D(2,2)	0.312	0.071	4.401	0.000

Sumitomo Bank and Global Investment-Grade Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 57 Iterations. Final criterion was 0.0000000 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -1939.0915

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(SUMITOMO)					
1	SUMITOMO{1}	0.191	0.041	4.608	0.000
2	IGB{1}	-2.088	0.374	-5.590	0.000
3	Constant	0.180	0.128	1.408	0.159
Mean Model(IGB)					
4	SUMITOMO{1}	0.004	0.003	1.111	0.267
5	IGB{1}	0.284	0.038	7.520	0.000
6	Constant	0.052	0.012	4.265	0.000
7	C(1,1)	1.127	0.156	7.220	0.000
8	C(2,1)	-0.084	0.020	-4.179	0.000
9	C(2,2)	0.000	0.067	0.000	1.000
10	A(1,1)	0.234	0.068	3.448	0.001
11	A(1,2)	0.014	0.004	3.310	0.001
12	A(2,1)	-1.151	0.654	-1.759	0.079
13	A(2,2)	0.201	0.060	3.330	0.001
14	B(1,1)	0.898	0.024	36.795	0.000
15	B(1,2)	-0.003	0.002	-1.317	0.188
16	B(2,1)	1.205	0.271	4.447	0.000
17	B(2,2)	0.887	0.023	39.155	0.000
18	D(1,1)	0.368	0.066	5.541	0.000
19	D(1,2)	-0.010	0.005	-1.870	0.062
20	D(2,1)	0.959	0.645	1.488	0.137
21	D(2,2)	-0.376	0.063	-6.007	0.000

Bank of America and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 53 Iterations. Final criterion was 0.0000000 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2244.480

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BOA)					
1	BOA{1}	0.297	0.041	7.205	0.000
2	HYB{1}	-0.483	0.203	-2.382	0.017
3	Constant	0.047	0.104	0.456	0.648
Mean Model(HYB)					
4	BOA{1}	0.007	0.006	1.189	0.235
5	HYB{1}	0.447	0.039	11.531	0.000
6	Constant	0.065	0.022	2.962	0.003
7	C(1,1)	0.261	0.161	1.622	0.105
8	C(2,1)	0.092	0.078	1.178	0.239
9	C(2,2)	0.093	0.066	1.399	0.162
10	A(1,1)	0.226	0.052	4.347	0.000
11	A(1,2)	-0.023	0.008	-2.790	0.005
12	A(2,1)	0.729	0.257	2.835	0.005
13	A(2,2)	0.122	0.065	1.865	0.062
14	B(1,1)	0.942	0.019	50.562	0.000
15	B(1,2)	0.012	0.004	2.801	0.005
16	B(2,1)	-0.458	0.154	-2.979	0.003
17	B(2,2)	0.865	0.028	31.041	0.000
18	D(1,1)	0.378	0.073	5.202	0.000
19	D(1,2)	0.010	0.011	0.871	0.384
20	D(2,1)	0.635	0.350	1.813	0.070
21	D(2,2)	0.493	0.059	8.373	0.000

Bank of New York and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 69 Iterations. Final criterion was 0.0000000 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2086.9779

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BNY)					
1	BNY{1}	0.134	0.044	3.034	0.002
2	HYB{1}	0.106	0.140	0.757	0.449
3	Constant	0.125	0.097	1.288	0.198
Mean Model(HYB)					
4	BNY{1}	-0.009	0.009	-1.031	0.302
5	HYB{1}	0.451	0.036	12.456	0.000
6	Constant	0.066	0.022	3.081	0.002
7	C(1,1)	0.982	0.135	7.259	0.000
8	C(2,1)	0.086	0.024	3.632	0.000
9	C(2,2)	0.000	0.038	0.000	1.000
10	A(1,1)	0.279	0.060	4.630	0.000
11	A(1,2)	0.026	0.014	1.810	0.070
12	A(2,1)	0.436	0.346	1.262	0.207
13	A(2,2)	-0.038	0.099	-0.385	0.700
14	B(1,1)	0.824	0.043	19.043	0.000
15	B(1,2)	-0.026	0.007	-3.669	0.000
16	B(2,1)	0.083	0.096	0.862	0.389
17	B(2,2)	0.950	0.012	82.485	0.000
18	D(1,1)	0.263	0.107	2.450	0.014
19	D(1,2)	0.044	0.014	3.165	0.002
20	D(2,1)	0.783	0.310	2.524	0.012
21	D(2,2)	0.453	0.052	8.804	0.000

Citigroup and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 51 Iterations. Final criterion was 0.0000058 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2240.2631

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(CITI)					
1	CITI{1}	0.244	0.037	6.513	0.000
2	HYB{1}	-0.193	0.175	-1.099	0.272
3	Constant	-0.022	0.099	-0.222	0.824
Mean Model(HYB)					
4	CITI{1}	0.014	0.005	2.467	0.014
5	HYB{1}	0.426	0.033	12.791	0.000
6	Constant	0.076	0.021	3.676	0.000
7	C(1,1)	0.443	0.129	3.431	0.001
8	C(2,1)	0.044	0.046	0.951	0.342
9	C(2,2)	0.134	0.026	5.195	0.000
10	A(1,1)	0.181	0.051	3.579	0.000
11	A(1,2)	-0.036	0.009	-4.122	0.000
12	A(2,1)	0.766	0.306	2.502	0.012
13	A(2,2)	0.210	0.059	3.530	0.000
14	B(1,1)	0.928	0.021	44.679	0.000
15	B(1,2)	0.008	0.006	1.292	0.196
16	B(2,1)	-0.379	0.215	-1.761	0.078
17	B(2,2)	0.840	0.036	23.563	0.000
18	D(1,1)	0.429	0.063	6.795	0.000
19	D(1,2)	0.022	0.012	1.827	0.068
20	D(2,1)	0.584	0.369	1.583	0.113
21	D(2,2)	0.488	0.063	7.724	0.000

Goldman Sachs and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 67 Iterations. Final criterion was 0.0000000 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2153.4892

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(GOLDMAN)					
1	GOLDMAN{1}	0.235	0.040	5.849	0.000
2	HYB{1}	-0.201	0.167	-1.206	0.228
3	Constant	0.072	0.105	0.690	0.491
Mean Model(HYB)					
4	GOLDMAN{1}	0.007	0.007	0.923	0.356
5	HYB{1}	0.466	0.029	15.906	0.000
6	Constant	0.057	0.019	2.944	0.003
7	C(1,1)	0.526	0.154	3.403	0.001
8	C(2,1)	-0.123	0.028	-4.445	0.000
9	C(2,2)	0.000	0.079	0.000	1.000
10	A(1,1)	0.229	0.048	4.730	0.000
11	A(1,2)	-0.035	0.011	-3.079	0.002
12	A(2,1)	-0.149	0.230	-0.651	0.515
13	A(2,2)	-0.012	0.085	-0.140	0.889
14	B(1,1)	0.943	0.025	38.133	0.000
15	B(1,2)	0.024	0.006	4.079	0.000
16	B(2,1)	0.004	0.138	0.027	0.978
17	B(2,2)	0.827	0.038	21.617	0.000
18	D(1,1)	-0.242	0.067	-3.627	0.000
19	D(1,2)	-0.025	0.013	-1.908	0.056
20	D(2,1)	-0.329	0.307	-1.069	0.285
21	D(2,2)	-0.478	0.069	-6.915	0.000

JP Morgan Chase and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 60 Iterations. Final criterion was 0.0000000 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2085.812

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(JPM)					
1	JPM{1}	0.268	0.037	7.262	0.000
2	HYB{1}	-0.321	0.155	-2.069	0.039
3	Constant	0.119	0.086	1.381	0.167
Mean Model(HYB)					
4	JPM{1}	0.021	0.008	2.636	0.008
5	HYB{1}	0.433	0.036	12.039	0.000
6	Constant	0.060	0.019	3.121	0.002
7	C(1,1)	0.511	0.112	4.583	0.000
8	C(2,1)	-0.015	0.037	-0.390	0.696
9	C(2,2)	0.086	0.025	3.384	0.001
10	A(1,1)	0.081	0.045	1.808	0.071
11	A(1,2)	-0.049	0.012	-4.049	0.000
12	A(2,1)	0.862	0.157	5.497	0.000
13	A(2,2)	0.208	0.068	3.053	0.002
14	B(1,1)	0.936	0.028	33.192	0.000
15	B(1,2)	0.017	0.007	2.446	0.014
16	B(2,1)	-0.168	0.119	-1.412	0.158
17	B(2,2)	0.869	0.026	33.876	0.000
18	D(1,1)	0.415	0.075	5.514	0.000
19	D(1,2)	0.008	0.020	0.417	0.677
20	D(2,1)	-0.382	0.333	-1.150	0.250
21	D(2,2)	0.477	0.086	5.576	0.000

Morgan Stanley and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 63 Iterations. Final criterion was 0.0000000 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2260.5879

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(MORGAN)					
1	MORGAN{1}	0.258	0.041	6.314	0.000
2	HYB{1}	-0.421	0.192	-2.192	0.028
3	Constant	0.033	0.121	0.276	0.782
Mean Model(HYB)					
4	MORGAN{1}	0.014	0.007	2.038	0.042
5	HYB{1}	0.436	0.037	11.677	0.000
6	Constant	0.074	0.022	3.416	0.001
7	C(1,1)	0.514	0.164	3.135	0.002
8	C(2,1)	-0.044	0.051	-0.863	0.388
9	C(2,2)	-0.149	0.030	-5.024	0.000
10	A(1,1)	0.144	0.058	2.456	0.014
11	A(1,2)	-0.048	0.011	-4.592	0.000
12	A(2,1)	0.419	0.339	1.236	0.216
13	A(2,2)	0.210	0.076	2.772	0.006
14	B(1,1)	0.955	0.024	39.803	0.000
15	B(1,2)	0.019	0.005	3.653	0.000
16	B(2,1)	-0.281	0.204	-1.380	0.167
17	B(2,2)	0.776	0.039	19.924	0.000
18	D(1,1)	0.425	0.077	5.508	0.000
19	D(1,2)	0.024	0.014	1.663	0.096
20	D(2,1)	-0.047	0.457	-0.103	0.918
21	D(2,2)	0.520	0.084	6.229	0.000

Royal Bank of Canada and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 81 Iterations. Final criterion was 0.0000018 <= 0.0000100

Weekly Data From 2005:01:17 To 2017:05:08
Usable Observations 643
Log Likelihood -1880.563

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(RBC)					
1	RBC{1}	0.142	0.036	3.920	0.000
2	HYB{1}	-0.133	0.107	-1.250	0.211
3	Constant	0.162	0.069	2.351	0.019
Mean Model(HYB)					
4	RBC{1}	0.007	0.012	0.628	0.530
5	HYB{1}	0.454	0.036	12.705	0.000
6	Constant	0.061	0.020	3.112	0.002
7	C(1,1)	0.551	0.145	3.804	0.000
8	C(2,1)	-0.072	0.032	-2.273	0.023
9	C(2,2)	0.000	0.043	0.000	1.000
10	A(1,1)	0.078	0.065	1.188	0.235
11	A(1,2)	-0.087	0.012	-7.255	0.000
12	A(2,1)	0.665	0.099	6.701	0.000
13	A(2,2)	0.205	0.067	3.056	0.002
14	B(1,1)	0.881	0.053	16.566	0.000
15	B(1,2)	0.021	0.013	1.601	0.109
16	B(2,1)	0.092	0.158	0.587	0.557
17	B(2,2)	0.877	0.027	32.960	0.000
18	D(1,1)	0.395	0.069	5.708	0.000
19	D(1,2)	0.015	0.032	0.486	0.627
20	D(2,1)	-0.267	0.283	-0.945	0.345
21	D(2,2)	0.431	0.079	5.427	0.000

State Streetand Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 63 Iterations. Final criterion was 0.0000100 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2162.1196

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(STATE)					
1	STATE{1}	0.207	0.038	5.455	0.000
2	HYB{1}	-0.191	0.176	-1.084	0.278
3	Constant	0.162	0.092	1.771	0.077
Mean Model(HYB)					
4	STATE{1}	0.000	0.007	-0.020	0.984
5	HYB{1}	0.435	0.039	11.111	0.000
6	Constant	0.067	0.021	3.152	0.002
7	C(1,1)	0.773	0.087	8.902	0.000
8	C(2,1)	0.048	0.026	1.853	0.064
9	C(2,2)	0.000	0.072	0.000	1.000
10	A(1,1)	0.010	0.058	0.176	0.861
11	A(1,2)	-0.040	0.011	-3.657	0.000
12	A(2,1)	1.379	0.217	6.351	0.000
13	A(2,2)	0.113	0.065	1.728	0.084
14	B(1,1)	0.836	0.026	31.782	0.000
15	B(1,2)	-0.030	0.005	-5.775	0.000
16	B(2,1)	0.572	0.193	2.959	0.003
17	B(2,2)	0.950	0.016	58.290	0.000
18	D(1,1)	0.324	0.076	4.287	0.000
19	D(1,2)	0.039	0.013	3.077	0.002
20	D(2,1)	0.110	0.304	0.361	0.718
21	D(2,2)	0.472	0.056	8.442	0.000

Wells Fargo and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 65 Iterations. Final criterion was 0.0000034 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2044.0998

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(WELLS)					
1	WELLS{1}	0.158	0.039	4.036	0.000
2	HYB{1}	-0.307	0.130	-2.361	0.018
3	Constant	0.104	0.075	1.379	0.168
Mean Model(HYB)					
4	WELLS{1}	0.014	0.008	1.638	0.102
5	HYB{1}	0.449	0.038	11.758	0.000
6	Constant	0.059	0.019	3.037	0.002
7	C(1,1)	0.327	0.090	3.623	0.000
8	C(2,1)	-0.048	0.053	-0.893	0.372
9	C(2,2)	0.137	0.032	4.214	0.000
10	A(1,1)	0.268	0.074	3.628	0.000
11	A(1,2)	-0.049	0.015	-3.214	0.001
12	A(2,1)	-0.807	0.169	-4.779	0.000
13	A(2,2)	0.075	0.093	0.810	0.418
14	B(1,1)	0.927	0.026	35.971	0.000
15	B(1,2)	0.016	0.008	1.993	0.046
16	B(2,1)	0.060	0.140	0.428	0.669
17	B(2,2)	0.845	0.048	17.762	0.000
18	D(1,1)	0.300	0.057	5.287	0.000
19	D(1,2)	0.008	0.014	0.582	0.560
20	D(2,1)	0.221	0.277	0.797	0.425
21	D(2,2)	0.568	0.079	7.176	0.000

Banco Santander and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 56 Iterations. Final criterion was 0.0000094 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2185.3863

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(SANTANDER)					
1	SANTANDER{1}	0.199	0.040	4.915	0.000
2	HYB{1}	-0.212	0.186	-1.141	0.254
3	Constant	0.055	0.106	0.519	0.604
Mean Model(HYB)					
4	SANTANDER{1}	0.016	0.007	2.309	0.021
5	HYB{1}	0.434	0.040	10.817	0.000
6	Constant	0.079	0.020	3.908	0.000
7	C(1,1)	0.581	0.140	4.159	0.000
8	C(2,1)	-0.044	0.043	-1.021	0.307
9	C(2,2)	0.037	0.073	0.502	0.616
10	A(1,1)	-0.027	0.078	-0.351	0.726
11	A(1,2)	0.032	0.008	3.779	0.000
12	A(2,1)	0.827	0.211	3.920	0.000
13	A(2,2)	0.187	0.057	3.260	0.001
14	B(1,1)	0.927	0.021	45.207	0.000
15	B(1,2)	0.005	0.007	0.683	0.494
16	B(2,1)	0.015	0.109	0.137	0.891
17	B(2,2)	0.886	0.031	28.577	0.000
18	D(1,1)	-0.509	0.051	-10.082	0.000
19	D(1,2)	-0.072	0.015	-4.681	0.000
20	D(2,1)	1.111	0.274	4.058	0.000
21	D(2,2)	0.607	0.067	9.097	0.000

Barclays and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 78 Iterations. Final criterion was 0.0000000 <= 0.0000100

Weekly Data From 2005:01:17 To 2017:05:08
Usable Observations 643
Log Likelihood -2336.826

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BARCLAYS)					
1	BARCLAYS{1}	0.128	0.039	3.249	0.001
2	HYB{1}	-0.421	0.230	-1.829	0.067
3	Constant	-0.125	0.139	-0.902	0.367
Mean Model(HYB)					
4	BARCLAYS{1}	-0.001	0.006	-0.108	0.914
5	HYB{1}	0.454	0.034	13.491	0.000
6	Constant	0.061	0.020	3.082	0.002
7	C(1,1)	0.738	0.181	4.073	0.000
8	C(2,1)	-0.075	0.040	-1.854	0.064
9	C(2,2)	-0.112	0.032	-3.545	0.000
10	A(1,1)	-0.191	0.059	-3.247	0.001
11	A(1,2)	0.009	0.009	1.068	0.285
12	A(2,1)	-1.200	0.237	-5.063	0.000
13	A(2,2)	-0.007	0.068	-0.106	0.916
14	B(1,1)	0.923	0.030	31.121	0.000
15	B(1,2)	0.018	0.005	3.775	0.000
16	B(2,1)	-0.132	0.227	-0.580	0.562
17	B(2,2)	0.838	0.032	26.158	0.000
18	D(1,1)	0.236	0.071	3.322	0.001
19	D(1,2)	-0.012	0.010	-1.207	0.228
20	D(2,1)	0.528	0.367	1.440	0.150
21	D(2,2)	0.586	0.066	8.843	0.000

BNP Paribas and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 55 Iterations. Final criterion was 0.0000000 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2236.4488

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BNP)					
1	BNP{1}	0.095	0.044	2.165	0.030
2	HYB{1}	-0.374	0.120	-3.126	0.002
3	Constant	0.165	0.129	1.283	0.199
Mean Model(HYB)					
4	BNP{1}	-0.004	0.007	-0.632	0.528
5	HYB{1}	0.467	0.036	13.137	0.000
6	Constant	0.068	0.021	3.238	0.001
7	C(1,1)	0.619	0.161	3.844	0.000
8	C(2,1)	-0.106	0.024	-4.401	0.000
9	C(2,2)	0.000	0.078	0.000	1.000
10	A(1,1)	0.197	0.059	3.375	0.001
11	A(1,2)	-0.027	0.014	-1.966	0.049
12	A(2,1)	1.023	0.259	3.949	0.000
13	A(2,2)	0.144	0.096	1.498	0.134
14	B(1,1)	0.942	0.034	27.646	0.000
15	B(1,2)	0.029	0.007	4.151	0.000
16	B(2,1)	-0.325	0.313	-1.039	0.299
17	B(2,2)	0.804	0.044	18.348	0.000
18	D(1,1)	0.243	0.095	2.559	0.010
19	D(1,2)	0.002	0.013	0.143	0.886
20	D(2,1)	0.194	0.400	0.484	0.629
21	D(2,2)	0.560	0.072	7.732	0.000

Credit Suisse and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 52 Iterations. Final criterion was 0.0000000 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2242.8367

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(CRESUISVX)					
1	CRESUISVX{1}	0.213	0.038	5.677	0.000
2	HYB{1}	-0.247	0.162	-1.519	0.129
3	Constant	-0.081	0.097	-0.828	0.408
Mean Model(HYB)					
4	CRESUISVX{1}	0.005	0.000	52.594	0.000
5	HYB{1}	0.469	0.009	51.864	0.000
6	Constant	0.058	0.006	9.705	0.000
7	C(1,1)	0.831	0.101	8.217	0.000
8	C(2,1)	0.105	0.019	5.573	0.000
9	C(2,2)	0.000	0.029	0.000	1.000
10	A(1,1)	0.072	0.047	1.540	0.124
11	A(1,2)	-0.009	0.008	-1.144	0.252
12	A(2,1)	1.117	0.220	5.075	0.000
13	A(2,2)	0.182	0.091	2.008	0.045
14	B(1,1)	0.898	0.011	82.562	0.000
15	B(1,2)	-0.016	0.000	-34.870	0.000
16	B(2,1)	0.140	0.088	1.584	0.113
17	B(2,2)	0.943	0.016	57.975	0.000
18	D(1,1)	0.392	0.056	6.998	0.000
19	D(1,2)	0.035	0.009	3.894	0.000
20	D(2,1)	-0.284	0.413	-0.688	0.491
21	D(2,2)	0.419	0.060	6.979	0.000

Deutsche Bank and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 52 Iterations. Final criterion was 0.0000082 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2285.1722

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(DEUTSCHEGR)					
1	DEUTSCHEGR{1}	0.228	0.038	6.053	0.000
2	HYB{1}	-0.230	0.185	-1.244	0.213
3	Constant	-0.069	0.113	-0.611	0.541
Mean Model(HYB)					
4	DEUTSCHEGR{1}	0.002	0.006	0.363	0.716
5	HYB{1}	0.467	0.034	13.882	0.000
6	Constant	0.060	0.020	3.070	0.002
7	C(1,1)	0.697	0.095	7.340	0.000
8	C(2,1)	0.063	0.018	3.586	0.000
9	C(2,2)	0.000	0.025	0.000	1.000
10	A(1,1)	-0.017	0.069	-0.251	0.801
11	A(1,2)	0.010	0.012	0.824	0.410
12	A(2,1)	-0.862	0.281	-3.072	0.002
13	A(2,2)	0.011	0.074	0.146	0.884
14	B(1,1)	0.916	0.010	89.763	0.000
15	B(1,2)	-0.013	0.002	-6.514	0.000
16	B(2,1)	0.292	0.079	3.691	0.000
17	B(2,2)	0.954	0.010	96.101	0.000
18	D(1,1)	0.368	0.046	7.927	0.000
19	D(1,2)	0.048	0.008	6.206	0.000
20	D(2,1)	-0.092	0.249	-0.369	0.712
21	D(2,2)	0.352	0.045	7.871	0.000

Crédit Agricole and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 67 Iterations. Final criterion was 0.0000085 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2326.531

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(CREAGR)					
1	CREAGR{1}	0.176	0.041	4.343	0.000
2	HYB{1}	-0.204	0.232	-0.877	0.381
3	Constant	0.111	0.138	0.801	0.423
Mean Model(HYB)					
4	CREAGR{1}	0.005	0.005	0.954	0.340
5	HYB{1}	0.467	0.037	12.585	0.000
6	Constant	0.074	0.019	3.996	0.000
7	C(1,1)	0.518	0.163	3.170	0.002
8	C(2,1)	-0.066	0.033	-2.001	0.045
9	C(2,2)	0.000	0.110	0.000	1.000
10	A(1,1)	0.062	0.057	1.080	0.280
11	A(1,2)	-0.039	0.007	-5.364	0.000
12	A(2,1)	0.575	0.251	2.292	0.022
13	A(2,2)	0.070	0.101	0.686	0.493
14	B(1,1)	0.965	0.017	56.865	0.000
15	B(1,2)	0.012	0.005	2.378	0.017
16	B(2,1)	-0.231	0.158	-1.462	0.144
17	B(2,2)	0.849	0.031	27.429	0.000
18	D(1,1)	0.362	0.045	8.031	0.000
19	D(1,2)	0.014	0.011	1.222	0.222
20	D(2,1)	0.306	0.339	0.902	0.367
21	D(2,2)	0.521	0.061	8.546	0.000

HSBC and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 57 Iterations. Final criterion was 0.0000061 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -1963.318

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(HSBC)					
1	HSBC{1}	0.193	0.036	5.349	0.000
2	HYB{1}	-0.140	0.119	-1.173	0.241
3	Constant	-0.016	0.070	-0.222	0.824
Mean Model(HYB)					
4	HSBC{1}	0.007	0.009	0.713	0.476
5	HYB{1}	0.449	0.035	12.909	0.000
6	Constant	0.063	0.019	3.266	0.001
7	C(1,1)	0.243	0.088	2.743	0.006
8	C(2,1)	-0.128	0.022	-5.668	0.000
9	C(2,2)	0.000	0.077	0.000	1.000
10	A(1,1)	0.214	0.051	4.164	0.000
11	A(1,2)	-0.030	0.016	-1.864	0.062
12	A(2,1)	0.342	0.135	2.535	0.011
13	A(2,2)	0.068	0.054	1.267	0.205
14	B(1,1)	0.960	0.018	53.423	0.000
15	B(1,2)	0.027	0.007	4.074	0.000
16	B(2,1)	-0.172	0.108	-1.594	0.111
17	B(2,2)	0.848	0.025	33.473	0.000
18	D(1,1)	0.178	0.060	2.982	0.003
19	D(1,2)	0.029	0.015	1.885	0.059
20	D(2,1)	0.490	0.169	2.906	0.004
21	D(2,2)	0.509	0.051	9.930	0.000

ING Bank and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 77 Iterations. Final criterion was 0.0000065 <= 0.0000100

Weekly Data From 2005:01:17 To 2017:05:08
Usable Observations 643
Log Likelihood -2265.3948

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(ING)					
1	ING{1}	0.203	0.039	5.183	0.000
2	HYB{1}	-0.263	0.221	-1.189	0.234
3	Constant	0.187	0.121	1.546	0.122
Mean Model(HYB)					
4	ING{1}	0.011	0.006	1.985	0.047
5	HYB{1}	0.422	0.034	12.370	0.000
6	Constant	0.071	0.019	3.702	0.000
7	C(1,1)	0.705	0.175	4.032	0.000
8	C(2,1)	-0.042	0.031	-1.327	0.185
9	C(2,2)	0.114	0.020	5.768	0.000
10	A(1,1)	0.116	0.079	1.469	0.142
11	A(1,2)	-0.011	0.009	-1.264	0.206
12	A(2,1)	0.818	0.240	3.401	0.001
13	A(2,2)	-0.024	0.068	-0.354	0.724
14	B(1,1)	0.915	0.032	28.271	0.000
15	B(1,2)	0.010	0.005	2.183	0.029
16	B(2,1)	-0.021	0.179	-0.116	0.907
17	B(2,2)	0.869	0.028	30.669	0.000
18	D(1,1)	0.432	0.069	6.282	0.000
19	D(1,2)	0.013	0.011	1.229	0.219
20	D(2,1)	0.011	0.439	0.025	0.980
21	D(2,2)	0.493	0.067	7.352	0.000

Nordea Bank and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 62 Iterations. Final criterion was 0.0000083 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2085.1466

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(NORDEASS)					
1	NORDEASS{1}	0.135	0.040	3.355	0.001
2	HYB{1}	-0.096	0.159	-0.602	0.547
3	Constant	0.163	0.099	1.648	0.099
Mean Model(HYB)					
4	NORDEASS{1}	0.004	0.009	0.471	0.637
5	HYB{1}	0.464	0.037	12.717	0.000
6	Constant	0.057	0.021	2.755	0.006
7	C(1,1)	0.722	0.092	7.877	0.000
8	C(2,1)	0.064	0.022	2.873	0.004
9	C(2,2)	0.000	0.034	0.000	1.000
10	A(1,1)	0.020	0.056	0.353	0.724
11	A(1,2)	-0.003	0.012	-0.256	0.798
12	A(2,1)	1.086	0.184	5.887	0.000
13	A(2,2)	0.115	0.076	1.512	0.131
14	B(1,1)	0.886	0.023	38.986	0.000
15	B(1,2)	-0.022	0.006	-3.743	0.000
16	B(2,1)	0.180	0.106	1.700	0.089
17	B(2,2)	0.953	0.012	76.706	0.000
18	D(1,1)	0.291	0.059	4.918	0.000
19	D(1,2)	0.060	0.012	4.953	0.000
20	D(2,1)	-0.070	0.292	-0.241	0.810
21	D(2,2)	0.372	0.049	7.593	0.000

Royal Bank of Scotland and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 63 Iterations. Final criterion was 0.0000055 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05	
Usable Observations	642
Log Likelihood	-2421.5583

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(RBS)					
1	RBS{1}	0.129	0.041	3.174	0.002
2	HYB{1}	0.266	0.252	1.057	0.291
3	Constant	-0.112	0.126	-0.890	0.373
Mean Model(HYB)					
4	RBS{1}	0.004	0.006	0.702	0.483
5	HYB{1}	0.452	0.039	11.651	0.000
6	Constant	0.068	0.022	3.084	0.002
7	C(1,1)	0.245	0.149	1.649	0.099
8	C(2,1)	0.140	0.018	7.923	0.000
9	C(2,2)	0.000	0.211	0.000	1.000
10	A(1,1)	0.335	0.066	5.103	0.000
11	A(1,2)	-0.017	0.009	-1.882	0.060
12	A(2,1)	-0.179	0.327	-0.547	0.585
13	A(2,2)	0.044	0.055	0.796	0.426
14	B(1,1)	0.964	0.015	62.745	0.000
15	B(1,2)	0.013	0.003	5.309	0.000
16	B(2,1)	-0.739	0.150	-4.928	0.000
17	B(2,2)	0.835	0.023	36.603	0.000
18	D(1,1)	0.165	0.096	1.719	0.086
19	D(1,2)	0.009	0.008	1.191	0.234
20	D(2,1)	1.579	0.386	4.090	0.000
21	D(2,2)	0.537	0.063	8.463	0.000

Société Générale and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 64 Iterations. Final criterion was 0.0000072 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05	
Usable Observations	642
Log Likelihood	-2362.1995

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(SOCGEN)					
1	SOCGEN{1}	0.229	0.040	5.790	0.000
2	HYB{1}	-0.446	0.213	-2.091	0.037
3	Constant	0.213	0.129	1.645	0.100
Mean Model(HYB)					
4	SOCGEN{1}	0.004	0.005	0.754	0.451
5	HYB{1}	0.456	0.037	12.454	0.000
6	Constant	0.069	0.020	3.356	0.001
7	C(1,1)	1.010	0.136	7.417	0.000
8	C(2,1)	0.060	0.025	2.352	0.019
9	C(2,2)	0.000	0.039	0.000	1.000
10	A(1,1)	-0.085	0.058	-1.484	0.138
11	A(1,2)	0.008	0.010	0.787	0.431
12	A(2,1)	-1.489	0.368	-4.049	0.000
13	A(2,2)	-0.104	0.092	-1.137	0.255
14	B(1,1)	0.861	0.023	36.900	0.000
15	B(1,2)	-0.017	0.004	-4.448	0.000
16	B(2,1)	0.507	0.184	2.748	0.006
17	B(2,2)	0.968	0.013	71.769	0.000
18	D(1,1)	0.409	0.069	5.897	0.000
19	D(1,2)	0.045	0.008	5.513	0.000
20	D(2,1)	-0.260	0.509	-0.511	0.609
21	D(2,2)	0.341	0.054	6.345	0.000

Standard Chartered and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 63 Iterations. Final criterion was 0.0000000 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2195.4049

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(SCB)					
1	SCB{1}	0.113	0.040	2.818	0.005
2	HYB{1}	-0.382	0.178	-2.149	0.032
3	Constant	0.031	0.113	0.277	0.782
Mean Model(HYB)					
4	SCB{1}	0.010	0.007	1.405	0.160
5	HYB{1}	0.457	0.035	13.047	0.000
6	Constant	0.063	0.021	2.946	0.003
7	C(1,1)	0.814	0.153	5.329	0.000
8	C(2,1)	-0.167	0.024	-6.913	0.000
9	C(2,2)	0.000	0.075	0.000	1.000
10	A(1,1)	0.170	0.054	3.156	0.002
11	A(1,2)	-0.004	0.013	-0.321	0.748
12	A(2,1)	0.624	0.260	2.401	0.016
13	A(2,2)	-0.068	0.112	-0.609	0.543
14	B(1,1)	0.901	0.030	30.367	0.000
15	B(1,2)	0.030	0.006	5.158	0.000
16	B(2,1)	0.129	0.165	0.778	0.437
17	B(2,2)	0.790	0.036	21.766	0.000
18	D(1,1)	0.232	0.061	3.781	0.000
19	D(1,2)	-0.001	0.013	-0.080	0.936
20	D(2,1)	0.545	0.337	1.618	0.106
21	D(2,2)	0.605	0.067	8.999	0.000

UBS and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 69 Iterations. Final criterion was 0.0000049 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2248.8533

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(UBSVX)					
1	UBSVX{1}	0.219	0.04	5.513	0
2	HYB{1}	-0.258	0.205	-1.259	0.208
3	Constant	0.034	0.122	0.284	0.777
Mean Model(HYB)					
4	UBSVX{1}	0.007	0.008	0.941	0.347
5	HYB{1}	0.455	0.038	11.848	0
6	Constant	0.072	0.021	3.498	0
7	C(1,1)	0.938	0.129	7.267	0
8	C(2,1)	0.033	0.036	0.918	0.359
9	C(2,2)	0	0.036	0	1
10	A(1,1)	0.213	0.05	4.23	0
11	A(1,2)	-0.012	0.012	-1.03	0.303
12	A(2,1)	0.469	0.338	1.388	0.165
13	A(2,2)	0.061	0.089	0.686	0.493
14	B(1,1)	0.699	0.03	23.242	0
15	B(1,2)	-0.055	0.006	-9.85	0
16	B(2,1)	2.037	0.224	9.113	0
17	B(2,2)	1.046	0.02	51.766	0
18	D(1,1)	0.203	0.096	2.127	0.033
19	D(1,2)	0.047	0.009	5.284	0
20	D(2,1)	-0.409	0.366	-1.12	0.263
21	D(2,2)	0.292	0.054	5.440	0.000

Unicredit Group and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 56 Iterations. Final criterion was 0.0000034 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2407.6706

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(UCG)					
1	UCG{1}	0.163	0.040	4.113	0.000
2	HYB{1}	0.061	0.227	0.271	0.786
3	Constant	0.035	0.138	0.254	0.799
Mean Model(HYB)					
4	UCG{1}	0.001	0.005	0.114	0.909
5	HYB{1}	0.469	0.034	13.805	0.000
6	Constant	0.073	0.021	3.520	0.000
7	C(1,1)	0.625	0.138	4.520	0.000
8	C(2,1)	-0.014	0.028	-0.492	0.623
9	C(2,2)	0.087	0.022	3.916	0.000
10	A(1,1)	0.144	0.063	2.289	0.022
11	A(1,2)	-0.006	0.007	-0.917	0.359
12	A(2,1)	0.324	0.310	1.046	0.296
13	A(2,2)	-0.112	0.069	-1.626	0.104
14	B(1,1)	0.933	0.019	49.042	0.000
15	B(1,2)	0.001	0.003	0.436	0.663
16	B(2,1)	0.015	0.121	0.123	0.902
17	B(2,2)	0.914	0.020	44.952	0.000
18	D(1,1)	0.393	0.065	6.024	0.000
19	D(1,2)	0.018	0.010	1.764	0.078
20	D(2,1)	0.178	0.370	0.481	0.631
21	D(2,2)	0.436	0.060	7.312	0.000

Agricultural Bank of China and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 38 Iterations. Final criterion was 0.0000067 <= 0.0000100

Weekly Data From 2010:07:30 To 2017:05:05
Usable Observations 354
Log Likelihood -1029.830

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(ABCCH)					
1	ABCCH{1}	0.206	0.049	4.180	0.000
2	HYB{1}	-0.036	0.115	-0.308	0.758
3	Constant	0.004	0.090	0.049	0.961
Mean Model(HYB)					
4	ABCCH{1}	-0.002	0.011	-0.149	0.881
5	HYB{1}	0.453	0.048	9.403	0.000
6	Constant	0.056	0.031	1.820	0.069
7	C(1,1)	0.449	0.102	4.404	0.000
8	C(2,1)	0.080	0.053	1.494	0.135
9	C(2,2)	0.170	0.043	3.945	0.000
10	A(1,1)	0.385	0.050	7.780	0.000
11	A(1,2)	-0.017	0.013	-1.308	0.191
12	A(2,1)	-0.409	0.115	-3.574	0.000
13	A(2,2)	-0.227	0.113	-2.000	0.046
14	B(1,1)	0.893	0.027	33.136	0.000
15	B(1,2)	-0.007	0.007	-0.924	0.355
16	B(2,1)	0.015	0.076	0.195	0.845
17	B(2,2)	0.815	0.046	17.559	0.000
18	D(1,1)	0.187	0.102	1.838	0.066
19	D(1,2)	0.027	0.019	1.438	0.150
20	D(2,1)	0.209	0.192	1.090	0.276
21	D(2,2)	0.615	0.096	6.393	0.000

Bank of China and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 53 Iterations. Final criterion was 0.0000062 <= 0.0000100

Weekly Data From 2006:06:16 To 2017:05:05
Usable Observations 569
Log Likelihood -1946.4021

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(BOC)					
1	BOC{1}	0.231	0.043	5.401	0.000
2	HYB{1}	-0.117	0.153	-0.763	0.446
3	Constant	0.056	0.122	0.459	0.646
Mean Model(HYB)					
4	BOC{1}	0.006	0.007	0.796	0.426
5	HYB{1}	0.456	0.041	11.232	0.000
6	Constant	0.077	0.024	3.148	0.002
7	C(1,1)	1.016	0.167	6.068	0.000
8	C(2,1)	-0.020	0.030	-0.657	0.511
9	C(2,2)	0.000	0.092	0.000	1.000
10	A(1,1)	0.290	0.061	4.767	0.000
11	A(1,2)	-0.015	0.010	-1.512	0.131
12	A(2,1)	0.516	0.201	2.571	0.010
13	A(2,2)	0.290	0.067	4.362	0.000
14	B(1,1)	0.869	0.041	21.017	0.000
15	B(1,2)	0.009	0.007	1.262	0.207
16	B(2,1)	0.036	0.114	0.314	0.753
17	B(2,2)	0.885	0.024	37.564	0.000
18	D(1,1)	0.214	0.075	2.834	0.005
19	D(1,2)	0.054	0.015	3.674	0.000
20	D(2,1)	-0.235	0.301	-0.779	0.436
21	D(2,2)	0.330	0.075	4.409	0.000

China Const. Bank and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 53 Iterations. Final criterion was 0.0000061 <= 0.0000100

Weekly Data From 2005:11:11 To 2017:05:05
Usable Observations 600
Log Likelihood -2058.3581

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(CCBHK)					
1	CCBHK{1}	0.262	0.039	6.671	0.000
2	HYB{1}	-0.031	0.163	-0.190	0.849
3	Constant	0.104	0.114	0.911	0.362
Mean Model(HYB)					
4	CCBHK{1}	0.007	0.006	1.170	0.242
5	HYB{1}	0.459	0.041	11.143	0.000
6	Constant	0.068	0.022	3.116	0.002
7	C(1,1)	0.474	0.161	2.945	0.003
8	C(2,1)	-0.020	0.051	-0.397	0.691
9	C(2,2)	0.039	0.077	0.511	0.609
10	A(1,1)	0.264	0.052	5.120	0.000
11	A(1,2)	-0.012	0.009	-1.358	0.174
12	A(2,1)	-0.011	0.280	-0.041	0.968
13	A(2,2)	0.240	0.076	3.165	0.002
14	B(1,1)	0.953	0.021	46.226	0.000
15	B(1,2)	0.005	0.004	1.333	0.183
16	B(2,1)	-0.103	0.090	-1.148	0.251
17	B(2,2)	0.896	0.024	37.793	0.000
18	D(1,1)	0.139	0.074	1.887	0.059
19	D(1,2)	0.049	0.014	3.385	0.001
20	D(2,1)	0.658	0.298	2.206	0.027
21	D(2,2)	0.371	0.055	6.689	0.000

I & C Bank of China and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 41 Iterations. Final criterion was 0.0000039 <= 0.0000100

Weekly Data From 2006:11:10 To 2017:05:05
Usable Observations 548
Log Likelihood -1843.269

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(ICBCCG)					
1	ICBCCG{1}	0.171	0.045	3.827	0.000
2	HYB{1}	0.108	0.097	1.114	0.265
3	Constant	-0.071	0.078	-0.906	0.365
Mean Model(HYB)					
4	ICBCCG{1}	-0.005	0.008	-0.543	0.587
5	HYB{1}	0.493	0.035	14.063	0.000
6	Constant	0.051	0.023	2.182	0.029
7	C(1,1)	0.368	0.089	4.119	0.000
8	C(2,1)	0.016	0.033	0.496	0.620
9	C(2,2)	0.110	0.034	3.269	0.001
10	A(1,1)	0.410	0.054	7.605	0.000
11	A(1,2)	-0.011	0.008	-1.270	0.204
12	A(2,1)	-0.369	0.118	-3.120	0.002
13	A(2,2)	-0.235	0.062	-3.814	0.000
14	B(1,1)	0.910	0.022	41.020	0.000
15	B(1,2)	0.003	0.003	0.999	0.318
16	B(2,1)	0.001	0.046	0.024	0.981
17	B(2,2)	0.888	0.026	34.165	0.000
18	D(1,1)	0.092	0.070	1.324	0.185
19	D(1,2)	0.039	0.011	3.621	0.000
20	D(2,1)	0.174	0.136	1.275	0.202
21	D(2,2)	0.465	0.049	9.401	0.000

Mitsubishi Bank and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 58 Iterations. Final criterion was 0.0000043 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2344.9474

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(MITSUBISHI)					
1	MITSUBISHI{1}	0.187	0.043	4.341	0.000
2	HYB{1}	0.201	0.182	1.104	0.270
3	Constant	-0.070	0.140	-0.504	0.614
Mean Model(HYB)					
4	MITSUBISHI{1}	-0.011	0.006	-1.865	0.062
5	HYB{1}	0.489	0.039	12.605	0.000
6	Constant	0.065	0.022	2.944	0.003
7	C(1,1)	0.918	0.268	3.428	0.001
8	C(2,1)	-0.112	0.024	-4.734	0.000
9	C(2,2)	0.000	0.082	0.000	1.000
10	A(1,1)	0.261	0.046	5.654	0.000
11	A(1,2)	-0.010	0.008	-1.224	0.221
12	A(2,1)	-0.757	0.263	-2.874	0.004
13	A(2,2)	0.198	0.085	2.336	0.020
14	B(1,1)	0.927	0.028	32.609	0.000
15	B(1,2)	0.012	0.004	3.139	0.002
16	B(2,1)	0.064	0.126	0.509	0.611
17	B(2,2)	0.875	0.027	32.761	0.000
18	D(1,1)	0.121	0.083	1.460	0.144
19	D(1,2)	0.008	0.009	0.868	0.385
20	D(2,1)	0.738	0.299	2.467	0.014
21	D(2,2)	0.510	0.053	9.555	0.000

Mizuho Bank and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 66 Iterations. Final criterion was 0.0000000 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2322.7022

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(MIZUHO)					
1	MIZUHO{1}	0.263	0.038	6.886	0.000
2	HYB{1}	-0.015	0.166	-0.091	0.927
3	Constant	-0.020	0.128	-0.156	0.876
Mean Model(HYB)					
4	MIZUHO{1}	-0.012	0.006	-2.197	0.028
5	HYB{1}	0.480	0.032	14.916	0.000
6	Constant	0.053	0.020	2.664	0.008
7	C(1,1)	0.943	0.155	6.099	0.000
8	C(2,1)	0.054	0.022	2.471	0.013
9	C(2,2)	0.000	0.056	0.000	1.000
10	A(1,1)	0.321	0.052	6.188	0.000
11	A(1,2)	0.013	0.010	1.356	0.175
12	A(2,1)	-0.015	0.241	-0.061	0.951
13	A(2,2)	-0.034	0.061	-0.556	0.578
14	B(1,1)	0.897	0.021	43.463	0.000
15	B(1,2)	-0.012	0.003	-4.058	0.000
16	B(2,1)	0.069	0.078	0.895	0.371
17	B(2,2)	0.943	0.009	106.389	0.000
18	D(1,1)	-0.184	0.106	-1.736	0.083
19	D(1,2)	-0.030	0.010	-2.888	0.004
20	D(2,1)	-0.681	0.280	-2.434	0.015
21	D(2,2)	-0.443	0.046	-9.699	0.000

Sumitomo Bank and Global High-Yield Bond Market

MV-GARCH, BEKK - Estimation by BFGS
Convergence in 62 Iterations. Final criterion was 0.0000038 <= 0.0000100

Weekly Data From 2005:01:21 To 2017:05:05
Usable Observations 642
Log Likelihood -2338.4504

	Variable	Coeff	Std Error	T-Stat	Signif
Mean Model(SUMITOMO)					
1	SUMITOMO{1}	0.286	0.040	7.220	0.000
2	HYB{1}	-0.063	0.181	-0.350	0.726
3	Constant	0.023	0.152	0.154	0.877
Mean Model(HYB)					
4	SUMITOMO{1}	-0.008	0.005	-1.699	0.089
5	HYB{1}	0.492	0.034	14.385	0.000
6	Constant	0.053	0.021	2.561	0.010
7	C(1,1)	1.021	0.136	7.526	0.000
8	C(2,1)	0.056	0.022	2.535	0.011
9	C(2,2)	0.000	0.039	0.000	1.000
10	A(1,1)	0.315	0.052	6.064	0.000
11	A(1,2)	0.006	0.008	0.705	0.481
12	A(2,1)	-0.064	0.241	-0.264	0.792
13	A(2,2)	-0.057	0.055	-1.032	0.302
14	B(1,1)	0.878	0.020	43.726	0.000
15	B(1,2)	-0.013	0.003	-3.896	0.000
16	B(2,1)	0.187	0.093	2.009	0.044
17	B(2,2)	0.945	0.009	101.325	0.000
18	D(1,1)	0.321	0.077	4.152	0.000
19	D(1,2)	0.032	0.007	4.442	0.000
20	D(2,1)	0.275	0.287	0.959	0.338
21	D(2,2)	0.433	0.044	9.869	0.000