FINANCIAL CONTAGION OF U.S. SUBPRIME CRISIS BASED ON FIRM CHARACTERISTICS

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บทวิจัยนี้ตั้งใจตรวจสอบถึงผลลุกลามทางการเงินที่เกิดจากจากวิกฤติซัพไพรม์ในประเทศสหรัฐไปยังตลาดหุ้นอื่นๆในต่างประเทศโดยเน้นศึกษาที่ข้อมูลในระดับบริษัท ที่ขึ้นอยู่กับคุณลักษณะต่างๆของบริษัทหลายๆคุณลักษณะ งานศึกษานี้ได้ใช้แบบจำลอง dynamic conditional correlation (DCC) เพื่อใช้ในการตรวจหาถึง ความสัมพันธ์ระหว่างตลาดหุ้นที่เพิ่มสูงขึ้นในช่วงปี ค.ศ. 2003 -2009 และใช้วิธีการสร้างดัชนีหุ้นขึ้นมาเพื่อใช้เป็นตัวแทนของคุณลักษณะแต่ละรูปแบบของบริษัท เพื่อใช้ในในการตรวจสอบถึง ผลลุกลามทางการเงินในตลาดหุ้นชั้นนำ 10 ตลาด ผลการศึกษาพบว่า บางคุณลักษณะของบริษัทสามารถช่วยลดผลลุกลามทางการเงินที่เกิดขึ้นมาจากวิกฤติซัพไพรม์ในประเทศสหรัฐได้ ตัวอย่างคุณลักษะ ได้แก่ หุ้นขนาดใหญ่ หรือหุ้นของบริษัทที่มีสัดส่วนรายได้ต่อทรัพย์สิน (ROA) สูง นอกจากนี้ได้ศึกษาถึงอิทธิพลของการเปลี่ยนแปลงในอัตราดอกเบี้ยนโยบายที่ไม่คาดขึ้นที่มีต่อ ความสัมพันธ์ระหว่างตลาดหุ้น ซึ่งผลการศึกษาแสดงให้เห็นว่า การเปลี่ยนแปลงในอัตราดอกเบี้ยนโยบายที่ไม่คาดคิดนั้นยังคงมีบทบาทสำคัญในการกำหนดรูปแบบ พลวัตรอย่างมีเงื่อนไขของความสัมพันธ์ระหว่างตลาดหุ้นในหลายๆตลาดหุ้น

ภาควิชา การธนาคารและการเงิน ลายมือชื่อนิสิต .....

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This paper is aimed to investigate financial contagion, incurred by U.S. Subprime crisis, to other international equity markets. Focusing on firm level data, based on several types of firm characteristics. Using the dynamic conditional correlation model (DCC) to capture the shift in the time varying correlation during 2003-2009 and construct indices, representing of each type of firm characteristic when examine financial contagion in ten major equity markets. Evidence shows that some firm characteristic can be applied to lessen contagion effect, incurred by Subprime, such as stock with large capital or stock of firms with high ROA. In addition, this paper also investigate the impact of unexpected in policy rates to stock market correlations during Subprime crisis period. The finding suggests that an unexpected change in monetary policy rates from the U.S. still performs a significant role in determining the pattern of dynamic conditional correlation in several markets.

Department: Banking and Finance Student's Signature .....
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Introduction

1.1 Background and problem reviews

Admittedly, in the last decade, we have faced with the biggest financial distress from U.S. Subprime crisis after the Great Depression in 1987. The impact of crisis, which started from U.S financial sector, rapidly spread to other international countries, causing world's economic slowdown. Many banks and financial institutions were bankrupt and must be shut down (i.e. Lehman Brothers, Paribas). Both equity markets of developed and emerging countries collapsed. The stock price fell to historically low and reached to new high volatility levels after Lehman Brothers broke down. Thus, a large number of investors lose heavily from investment in equity markets. Consequently, seeking for the safest shares, providing diversification benefits against the impact of the crisis, became one of the famous issues to study during that time.

As financial inter-linkage played a crucial role during crisis, we can find the topic about financial contagion, which emphasizes to study the transmission of shock from U.S. equity market to other international markets, turned to be a popular topic for academics in recent years. The implication for understanding financial contagion will help investors to diversify in international portfolio better since they will know which country likely to have excess co-movement in returns with returns from U.S. equity market and should be taken more consideration to invest. Indices, expressing contagion effect, can be implied that the stability of the correlation is disreputable causing an ambiguity on using the estimated correlation coefficients when optimize portfolio in long period. In addition, it also helps policy makers conduct effective plan by understanding whether markets are declining owing to contagion or come from other causes.

Most of existing evidences always use aggregate stock indices to test contagion effect, e.g. Baig and Goldfajn (1999); D. Baur (2003); G. Bekaert, R. Campbell, and H Angela Ng (2003); Chiang, Jeon, and Li (2007); Dungey and Yalama (2010); K. Forbes and R. Rigobon (2002). Studies that investigate financial contagion based on lower aggregate data are quite scarce. A few scholars examine contagion effect at sector level, e.g. D. G. Baur (2012); Phylaktis and Xia (2009). The empirical evidence from D. G. Baur (2012) demonstrated that Healthcare, Telecommunications and Technology are non-financial sectors that less likely to be detected the evidence of contagion even though, their country index was infected. Hence, investors can lessen the impact of crisis by investing in these sectors. However, to my best knowledge, none of the extant papers analyze financial contagion based on firm level data. Thus, existing evidences, let us know only which country or which sector tend to have weaker evidence suggesting the propagating of contagion.

Therefore, analyzing financial contagion at country or sector level is not enough as in practice, several investors favor to purchase individual shares of listed companies rather than invest in aggregate/sector indices. Nevertheless, evidences based on aggregate or sector level cannot provide narrow scope for selecting the proper share in order to alleviate the contagion effect, since at least each sector still has listed-companies, which can be a choice for investing, in large amount. Besides, some investors would like to hold tracking index such as. MSCI, ETF or FTSE indices which are constructed based on size, valuation or other kind of company-specific characteristic factors. Thus, it has remained a complicated task for investors when choosing the stock or tracking index so as to retain the effectiveness of diversification from various shares located in one sector or various types of provided-factor indices.

Furthermore, existing studies demonstrated the heterogeneity of contagion effect between aggregate and sector indices hence, it is interesting to analyze further by investigating

whether the results of contagion, based on firm level, also provide some rooms to investors for receiving diversification benefits similar to the evidence from sector level. If rely on traditional CAPM which assumes that all company-specific-idiosyncratic risk should be eliminated so, stock market returns should not be driven by these factors, causing we cannot earn the advantage of risk's reduction from them, several studies, however, demonstrated that some firm-specific characteristic can determine stock returns during stock market crashes date significantly - some seem to provide a less negative return than others (Jia Wang, Meric, Liu, & Meric, 2009). Yet we still lack of outstanding evidence, confirming which type of firm characteristics can be applied to lessen contagion effect precisely.

Though, stock market of each country reacted to the Subprime crisis differently by some countries have higher levels of co-movement with returns from U.S. stock than others due to trading linkage, financial linkage or investor's behavior (Didier, Love, & Pería, 2012). The relationship between the correlations across countries and firm-characteristics, during the crisis, is still ambiguous. So far, we have lacked of strong supporting evidence which can identify if considering at firm level data, stock based on which type of firm-specific characteristics large or small capital, for example, tend to be found the existence of contagion effect more than another. Put differently, which type of a firm's size can determine co-movement to increase with U.S. stock significantly during a crisis. On one hand, stocks with larger capital tend to be detected the contagion effect rather than stocks with smaller shares due to responding to market news quicker, on the other hand, smaller stocks have more probability to be affected contagion since they have weaker fundamentals to withstand the crisis and prices of smaller stocks tend to rebound harder, compared with larger shares (Jia Wang et al., 2009). From this example, investors cannot decide which type of shares, considered based on size, that should be selected in order to reduce the severely impact from U.S. financial distress.

Additionally, another issue of analyzing financial contagion is related to looking into the potential explanatory factors that can determine stock market correlations, since the occurrence of contagion always involved with the evidence, showing a dynamic increase in stock market correlations. (Chiang et al., 2007). Then, the dynamic nature of time-varying correlation should be picked out as the correlation between U.S. equity market and international stock markets, based on firm characteristic, which be used to investigate the contagion effect in this paper, may be influenced by several factors such as the conditional volatility or an alteration in some macroeconomics variable, occurring from domestic and/or foreign markets. (Hwang, In, & Kim, 2011)

Many researcher try to investigate several kinds of factors that might drive the dynamic structure of correlations to increase. Especially, the conditional volatility come from each stock market. However, almost are considered based on aggregate level data (Cappiello, Engle, & Sheppard, 2006) and (Syllignakis & Kouretas, 2011) hence, it is remain lack of consideration about an attributable of firm characteristics that may contribute an influence to this relationship, similar when examining contagion effect.

Furthermore, empirical evidences from Chiang et al. (2007) and Hwang et al. (2011) demonstrated that an announcement about sovereign credit-rating downgrade or upgrade from domestic or foreign countries become another factor that can shape the structure of dynamic correlations in Asian markets. In addition, Sovereign credit rating downgrade in one country can incur contagion effect to other countries through wake-up call hypothesis. (Ludwig, 2014) Thus, to supplement this issue, it is useful to study the spillover effect from an announcement of other macroeconomic data, apart from sovereign credit rating, that still lack of consideration, to an increment of correlation across countries.

According to survey evidence, interest rates risk is second most important risk factors of U.S. firm manager's perspective, (Pablo, 2013) so one of interesting in macroeconomic announcement is changing in interest rate policy from domestic or foreign Central bank. Clearly that, cutting policy rates became the major tool of several Central Banks used to stimulate the economy against the crisis. Hence, news about U.S. Federal Bank declared to reduce policy rate during subprime crisis: the expected as well as unexpected of change in this reduction will influence on cost of capital and the spread of country's key rate. Capital will flow out from U.S. to global markets and affect to stock returns and cross-country correlation between U.S. stock and international stocks respectively. Then, noise of correlation coefficients that I use to investigate the contagion effect might be sensitive to news from the change in this variable.

However, some recent papers argued that during global financial crisis, surprised change in policy rate are not negatively related to stock returns like traditional findings – generally, the unexpected cut in policy rate will stimulate the stock price to rise but, Kontonikas, MacDonald, and Saggu (2013) contend that during the Subprime, prices of U.S stocks did not increase when their Central Bank cut the policy rate more than market's expectation. Similarly, A Gregoriou, Kontonikas, R, and A (2009); Kontonikas et al. (2013) also found the evidence, referring that the reaction of U.K. stocks to the unexpected cut of their policy rate turned to be positively relation during this trouble. They argued that during Subprime, unexpected reduction in policy rate may be implied as a signal of worsening economy in the future, so stock prices likely to fall instead. From these arguments, some might suspect that whether during Subprime, change in policy rate during Subprime still determines correlation coefficients across country, in turn, affecting when analyzing financial contagion, and whether the relationship between them has changed similar to the evidence when consider in term of stock returns, found by these scholars

To overcome these limitations and drawbacks, this paper will analyze financial contagion, come from Subprime mortgage crisis. I will emphasize it at firm level data, based on several types of firm characteristics, that are received much consideration and still have controversial evidences in literatures. I will use a detailed dataset of firms from both major developed and major emerging market and employ dynamic conditional correlation model (Cappiello et al., 2006) to capture the shift in time-varying correlation. Additionally, this paper also concerns the impact of news about change in policy rate that might affect to the correlation coefficients. Therefore, I also investigate the influence of surprised change in monetary policy rate from domestic and U.S. Central bank to their pairs-wise correlation.

The major findings from this paper can be summarized as follows a) I find that during subprime, stocks with larger capitalization, higher cash-flow, lower debt ratio or higher ROA tend to have less evidence indicating the existence of contagion. Especially, stock of companies with high level of ROA ratio seems to be the best effective choice to lessen the impact of contagion (b) Correlations of stock market returns of firms which perform as a smaller-capped or lower ROA ratio are outstanding type of firm characteristics that likely to be strongly determined by conditional volatility from the U.S. and from its own markets. (c) Surprised changes in monetary policy rates from the U.S. and domestic country still has an influence on the correlation coefficients even though this variable did not determine stock market returns during U.S. Mortgage crisis. Additionally, I find that the unexpected change in policy rate from the U.S. Central Bank will have more pronounce effect on the correlation of firms with having higher CAPM beta, higher cash-ratio or higher ROA. Whereas, when focus on the impact of unexpected change that come from domestic Central Bank, I find that correlations of indices, constructed based on smaller capital, is only one of outstanding type that will be greatly influenced by this surprise, during the period of U.S. financial crisis.

1.2 Objectives

The ultimate purpose of this paper is to provide better understanding of financial contagion, incurred by Subprime crisis, to international equity markets (both developed and emerging) by considering contagion at firm level data, based on several types of firm characteristics. I have eight strands of firm characteristics to consider which include size, market-to-book ratio, cash-ratio, investment-ratio, debt-ratio, liquidity, CAPM beta and ROA-ratio. After that, I try to examine which type of these firm characteristics that proper to invest and can be applied to lessen this contagion effect.

Secondly, this paper will examine factors that might shape the structure of dynamic correlations. Then I will provide empirical evidence about the impact of change in interest rate policy from the U.S. and domestic Central Bank to the cross-country correlation coefficients between the U.S. and that domestic index, considered based on firm characteristic, during Subprime crisis.

1.3 Research question

Two main research questions I concern to explore in this paper are

Research question I. Does firm characteristics matter for contagion effect to existing? If so, which type of firm characteristic that should be found less evidence indicating the contagion?

Research question II. Whether an unexpected change in U.S. and domestic policy rate around the announcement date affected the cross-country correlations of returns between U.S. and stocks with different type of firm characteristics? Does the impact of unexpected (surprise) change in interest rates which can affect the correlation of stock returns, depend on firm characteristics?

1.4 Research hypothesis

Hypothesis for answer research question I:

There is heterogeneity in the contagion effect, incurred by Subprime, crisis to individual stocks in each country. Some firm characteristics tend to alleviate the contagion effect than another. Stock of companies with their firm characteristics, reflecting lower risk - For instance, lower probability to be bankruptcy, lower probability to face with the cash shortage problem or higher capacity to raise additional fund, seem to be prominent group that are weakly affected by the contagion.

Hypothesis for answer research question II:

Impact of news about the surprised change in interest rate policy from U.S. (foreign) and domestic Central Bank around the announcement date during Subprime could affect the pair-wise correlation of stock returns between U.S. and that country's stock with different firm characteristics. In addition, the magnitude of the impact of the surprised change in the policy rate on the correlation of stock returns depends on the type of firm characteristics.

1.5 Contribution

Once existing academic-literatures about financial contagion always focus financial contagion at only aggregate level or sector level, this paper will fulfil this limitation by becoming an initial paper that investigates financial contagion at firm level data, based on several types of firm characteristics. Second, most of literatures do not concern the impact of firm characteristic which can be an attributable factors when investigate the relationship between time-varying correlation and several determinant variables that can shape stock market correlations to increase. However, this paper also account the influence of firm characteristic when considers this relation.

Third, this paper will shed some light and provide new empirical evidence about the impact of surprised change in the policy interest rate during Subprime crisis to the correlation of returns between U.S. and international stocks, considered based on firm characteristic.

The new evidence, at firm level data from this paper, will grant more comprehensive views for choosing companies to invest apart from knowing contagion only country and sector data by guiding the specific type of firm characteristics that appropriate for alleviating the impact of contagion effect in each country. In addition, the result will give benefit information to risk management to allocate and diversify their portfolio during each period following a schedule of monetary meeting, announced by domestic and/or U.S. Central Bank.

1.6 Definition of terms

Announcement date – The day that Company release news information to public such as interest rate change or statement report.

Contagion - Although contagion issue has been studied for two decades, the unanimous definition of this word is still unsettled. The definition of contagion can be divided in three categories, according to World Bank First, *board definition*: Contagion is viewed as any transmission of shock across countries. By this definition shocks can spread to other countries through both fundamental and non-fundamental channel. Second, *restrictive definition*: contagion means the transmission of shock from one country to other countries which excess than common shocks. Thus, in this definition herding behavior becomes major role in explaining the co-movement beyond common linkage. **Third, *very restrictive definition***: contagion is a significant increase in correlation of the two countries during crisis period relative to stable period. Mostly, the third definition is widely used in academic studies since it can capture and explain the transmission of

shock precisely so this paper also use this definition for analyzing contagion, considered based on firm characteristics.

Constrained firm – firms with financial conditions that seem to raise additional fund to finance their company quite difficult. Normally, are those firms with having the small size, low cash flow, high debt ratio or low payout-ratio.

1.7 Organization

The rest of this paper is organized as follows. Section 2 present literature reviews. Section 3 explains the details of each hypothesis, data and methodology to investigate the contagion effect and the impact of surprise change in the policy rate to the correlation. The regression results and discussion are exhibited in Section 4. Section 5 provides a summary and conclude the finding of this paper.

Chapter 2
Literature review

2.1 Equity market contagion

Model and existing papers

Central concept methods for studying contagion which many papers used is that researchers will define a structural break date and comparing the co-movement of stock price in tranquil period relative to turmoil period. They stated that the country has been affected "pure contagion" if the correlation of return across the two markets, increase significantly, however, if the correlation increase, but insignificant, then they define it has become only "more interdependence" but do not be affected contagion.

In literatures written before 2002, unconditional correlation becomes the major variable that used to examine contagion effect. Example papers used this method as follow: King and Wadhwani (1989) constructed contagion model for studying contagion between New York, London and Tokyo equity stocks. They found that the correlation among these countries increased significantly after the U.S. crisis in 1987. S. Lee (1993) has extended King and Wadhwani's paper by adding other major twelve countries to examine and their evidences still showed contagion propagated in many stocks. Kaminsky and Reinhart (2000) focused to test contagion on equity markets of emerging countries stated in Latin America during Mexican crisis and the authors found that correlations increased significantly across weekly equity and Brady bond markets. Baig and Goldfajn (1999) test the contagion in equity, sovereign and exchange rate market during Asian financial crisis and they also found the contagion effect propagated across exchange rates and equity markets in many countries.

However, K. Forbes and R. Rigobon (2002) contend that the results indicating contagion from prior studies was inaccurate since using unadjusted correlation for investigating financial contagion lead to heteroskedasticity problem. They pointed that correlation is an increasing function of variance so if the volatility of market increase, the unadjusted correlation, estimated during crisis period, will be biased. Thereafter, many recent studies changed to follow Forbes and Rigobon methodology by using adjusted correlation model for investigating the contagion effect.

Moreover, there also have other ways to examine the market co-movement for avoiding the limitation of correlation. Some studies developed ARCH or GARCH model for examining contagion; For example, Hamao, Masulis, and Ng (1990) employed GARCH-M model to examine contagion during US 1987 crash. D. Baur (2003) created EGARCH model to test mean and volatility contagion during Asian financial crisis and he found that during the crisis, price and volatility did not be detected contagion. Chiang et al. (2007) used Dynamic correlation analysis to examine contagion from Asian crisis and the result confirmed contagion existing and continuously performed until to post-crisis period due to herding behavior. Some adopt factor model - G. Bekaert et al. (2003) adopt two factors model with time-varying beta to examine contagion in equity market during Asian and Mexican crisis. They found that there is no evidence of excess co-movement caused by the Mexican crisis. Besides, instead of building new models of asset return some studies using the copula approach for analyzing contagion. (Rodriguez, 2007)

Recently, there are many studies try to examine contagion spreading from subprime financial shock. H. Lee (2012) examined contagion in twenty international stocks during U.S mortgage distress by using adjusted correlation method and the empirical evidence showed that some stock markets such as Hong Kong Taiwan and New Zealand did suffer from contagion. Huang and Cheng (2013) investigated the contagion effect in European countries via EGARCH model. They confirmed that price spread form U.S. to E.U. countries was increased significantly. Moreover, they

found that economic fundamentals are the main factors driving contagion. Kim (2011) used multivariate GARCH model to analyze the contagion spread to five emerging Asean countries and the results showed that except Thailand, other countries has an correlation rose significantly during Lehman collapses but these high correlation coefficient occurred only short period.

Apparently, most of previous literatures studied the contagion across aggregate equity markets. However, there are some papers examined the contagion propagated at sector level. Phylaktis and Xia (2009)used asset pricing model developed by Geert Bekaert, R. Campbell, and Harvey Angela Ng (2003) to investigate contagion at sector level during 1990-2004 across Europe Asia and Latin America. The results showed that there have some sectors that still provide benefit for diversification even though the contagion was exist at the country - stock level. Moreover, the authors also found during the crisis, sectors in Asia countries changed the co-movement trend by incline to move more closely to regional-markets rather than world-markets. D. G. Baur (2012) investigated contagion effect in ten sectors indices consisting financial sector and real economy sectors of 25 major developed and developing countries. He improved two factors model to detect the contagion. The evidences show that some sectors in particular Healthcare, Telecommunications and Technology were less severely affected the impact of crisis. Grammatikos and Vermeulen (2012) also use GARCH and factors model to examine the transmission of financial and sovereign debt crisis from U.S. financial and non-financial sectors to financial and real sectors indices of European countries. They demonstrated strong evidence supporting the contagion has occurred not only financial but also real sectors in many European countries. Furthermore, they found that non-financial sectors were affected the impact of crises severely than the financial sector.

Nevertheless, existing literatures still lack the evidence of financial contagion, analyzed based on firm level data and concerning the impact of firm characteristics.

2.2 Firms characteristics and contagion

Firm characteristics have received high attention for academic research for several years. We can find bulk of researches try to identify the impact of each firm characteristics to the stock returns. The most related literature to this study is the studied from Jia Wang et al. (2009) - they demonstrated that returns of stocks which have different financial characteristics are affected differently during stock market crash date. They used firm data from U.S. market during 1962-2007 and use event study approach to find the relationship between stock returns and several firm characteristics. They found that some characteristics such as stocks with higher beta, larger capitalization, higher liquidity to trade, or stock of companies with higher debt ratio, higher level of cash-to-asset ratio, lower cash-flow per share or lower asset-profitability, likely to have lower returns during bear markets

Another related literature is the study from Didier et al. (2012) They try to examine factors which can drive co-movement of returns between US stock market and returns from other stock markets in 83 countries. The finding indicated that co-movement was driven largely by financial linkage. Some corporate sector vulnerabilities such as debt ratio also determine the excess co-movement, but trade did not explain the co-movement of stock returns.

Other literatures of firm characteristics which relate to my study are as followings

The market-to-book ratio - Chan, Hamao, and Lakonishok (1991) and Fama and French (1992) pointed that stocks with low market to book ratio tend to provide higher returns since during distress, firms that have low market-to-book ratio may face with financial distress problem. Illiquidity ratio - Amihud (2002) showed that return of shares with high liquidity will decrease more amount during the U.S. 1987 crisis than low liquidity stocks as a of responding to the market information faster. Debt ratio – Miyajima and Yafeh (2007) found that during the Japan crisis financial

firms with higher leverage tend to lose more value than firm, with lower leverage since investors worry about the capability to repay their obligations. Size – on one hand, Fama and French (1992) indicated that stocks with small capital generate returns higher than large-capitalization stocks on the other hand, A. Lo and A. C. MacKinlay (1990) and Richardson and R. Peterson (1999) argued that large stock provide more returns than small stocks during upward market and will lose more value on stock market crash since they respond to new market information faster. Investment-to-asset-ratio – (Long Chen, Novy, & Zhang 2011) argued that stocks with low investment to asset ratio have abnormally high average returns since high investment can be implied that this firm can access the low cost of capital when they try to launch new project. Therefore, the lower risk due to low interest rate cost, lower expected returns. Beta - from the CAPM model price of stocks with high beta tend to change and volatile easier than stocks with low beta. Liquid asset ratio - Bonfim (2009) argued that liquid asset expose the negative relation to default probability thus firms with higher liquid asset should provide higher expected returns. ROA - (Long Chen et al., 2011) found that ROA should become an important variable of their three factor model to predict stock returns and they purposed that higher ROA will induce a higher expected return to the company.

2.3 Spillover effect from interest rate announcement

According to the study from Chiang et al. (2007) which argued that as investigating contagion always focus on the dynamic increase of correlations therefore the dynamic nature of correlation coefficients should be taken more consideration. They find that surprise of international sovereign credit rating change was involved to establish the structure of dynamic correlation of stock markets in Asian. They calculated the surprise by transforming S&P credit rating into a numerical value, having ranged between 0-20. Yet, there are no evidence which directly focus to study the surprise

occurring from other macro-variables, especially surprise at the fed- fund rate, to correlations like the finding from Chiang et al.

Literatures, which study in the scope about surprise changes in interest rate announcement mainly focus the impact of this change on asset returns rather than correlations. Basically, several scholars found that declaration of change in targeting rates from domestic or international Central Banks (mostly using fed-fund rates) always spend negative impact to stock returns e.g. Rigobon and Sack (2003); Bernanke and Kuttner (2005); Farka (2009); Yaowaluck (2012). Various evidences demonstrated that only unexpected change in interest rate can drive stock returns to increase or decrease, but their actual-change does not. Moreover, some studies argued that the effect of this announcement transmitting to equity returns is asymmetric - Chuliá, Martens, and Dijk (2010) found that stock prices respond to the impact of positive surprise in Fed fund rate more than the negative surprise. In contrast, there are some studies indicated that the direction of surprise in policy rate changes do not involve with the stock returns. (Bernanke & Kuttner, 2005)

Besides, the impact of interest rate announcement surprises tends to differ across sector as well. Financial and high-tech sectors demonstrate a strong response to surprises while, Energy and Health Care sectors seem to get weaker impact. (Bernanke & Kuttner, 2005; Chuliá et al., 2010) Additionally, for the impact of firm characteristic contribute to stock returns, several studies found that firm characteristic which can be defined as high constrained firms such as small size, high level of debt, firms with unrated bond or low payout ratio will react to news about monetary policy change more than unconstrained condition. (Ehrmann & Fratzscher, 2004; Thorbecke, 1997) Interestingly, some recent papers found that during global financial crisis in 2007, unexpected change in policy rate did not contribute negative influence to the returns (A. Gregoriou, Kontonikas, MacDonald, & Montagnoli, 2009; Kontonikas et al., 2013) since the unexpected reduction in policy

rate can be implied as the crisis still did not reach to the lowest point so stock price likely to decline instead.

For the methodology to evaluate unexpected of change in interest rate variable, most recent papers widely use the different between one day future rate, retrieved from future market, on the day of announcement take place and the day prior to the announcement date. Bernanke and Kuttner (2005); Chuliá et al. (2010); Kuttner (2001); Thorbecke (1997); Wongswan (2009). Yet if the future market does not provide the data, implied forward interest rate will be used instead. The implied rate can be calculated from many methods. Some scholars decide to use survey data from Bloomberg or Reuter's database. Ehrmann and Fratzscher (2004); Yaowaluck (2012). Some calculate by using another interest product such as, libor-rate or interest rate swap (IRS)

Chapter 3
Data and Methodology

3.1 Hypothesis Development

This section will provide more details of the hypothesis tested, used for answering in research question I and II.

Hypothesis I: *There is heterogeneity in the contagion effect, incurred by Subprime crisis to individual stocks in each country. Some firm characteristics tend to lessen the contagion effect than another. Stocks with following firm characteristics: larger size, higher market-to-book (growth stock), higher cash-ratio, higher investment-to-asset ratio, lower debt-ratio, lower liquidity to trade, lower CAPM beta and high ROA will have less evidence of contagion existing.*

Although, almost stocks are likely to co-move with the U.S. stock markets due to the impact of the crisis, I expect some characteristic could not drive correlation coefficient to increase significantly, meaning that no contagion. Since at least, stock of firms that characterize as low risk, when facing the trouble, their price likely to generate less negative returns and perform downward trend in shorter time, which quite contrast to the performance of U.S. stock market that always contribute large negative returns and perform downward trend continuously during whole period of crisis.

In this paper, I have eight companies-specifics characteristics[1] to be compared to finding which specific type of each firm characteristic that less likely to have an evidence indicating the existence of contagion effect. Even some variable, their characteristic may correlate with others,

[1] **Most of which are following the literatures from Wang et al. (2009)**

but using various types would give more applicable results since they are analyzed from different perspectives.

Eight strands of company-specific-characteristics, taken into account, are as follows – size, valuation (Fama & French, 1992), investment, leverage, cash flow, beta, liquidity and the company's profitability (return-on-asset. The hypothesis for each firm characteristic are as follows

1) Size

Stocks with small capital tend to have evidence of contagion effect existing rather than stocks with large capital.

Owing to three factors model, presented by Fama and French (1992) stocks with lower market capitalization will have abnormally higher average return as during the crisis, small capital stocks seem to riskier than large capital stocks. The large cap - firm can withstand the volatility of economic than small capital stock due to stronger in fundamentals. Consequently, returns of small-cap stocks should dropped more amount than large-cap stocks during the market crash.

In contrast, A. W. Lo and A. C. MacKinlay (1990) and Richardson and R. Peterson (1999) indicated that large-cap firms likely to respond to news market information faster than small-cap firms therefore, large-cap firms will lose more value than small-cap firm on market crashes date. Moreover, during crisis, foreign investors will move their capital back so they try to sell their portfolio, most of which are large-cap shares. (S. Eun, Huang , & S, 2008) Then, price of larger stocks should drop in more percentages than smaller stocks.

Although, returns of large-cap stocks may lead the returns of small-cap stocks on stock market crash date like A. Lo and A. C. MacKinlay (1990) hypothesis, recent study demonstrated that cumulative returns of stocks three days after the crash date have positively influenced by Size,

implying that large-cap stocks appear to recover faster than small-cap stocks. see Jia Wang et al. (2009) Thus, price of small-cap stocks will have the downward trend in longer period than large-cap stocks as their price are able to rebound harder. Hence, I expect, they tend to have stronger co-movement in U.S. stock market, which always performed as bear market almost the time of crisis, if compared to the large-cap.

2) Valuation

Stocks with high market-to-book ratio tends to have evidence of contagion effect existing less than stocks with low market-to-book.

Several multiples can be used to discriminate stocks as either value or growth stocks, one of the most frequently used by scholars, is market-to-book ratio (M/B). As pointed by Fama and French (2007) valuation, categorized based on market-to-book ratio, can influence the returns with higher level of significance and more consistency than classified by other multiples. In addition, market-to-book ratio become an important specific-characteristic to study because this multiple provide information to investors for analyzing how much the market price of the stock is higher/lower than book price. Basically, stocks of companies with lower market-to book will be defined as value stocks whereas, stocks of companies with high market-to book ratio will be interpreted as growth stocks.

Some scholars find that during 2008 meltdown, value stocks still perform better than growth stocks in many international equity markets. They found that value stock, considered in term of M/B, provided higher returns, less sensitive to market perils and have lower responding to the recession than growth stocks (Athanassakos, 2009). The evidence from Hoekjan (2012) has shown a positive value of value-growth spread variable implying that value stocks provide a higher total return than growth stocks during the collapse 2007-2010.

Moreover, generally value stocks tend to provide a higher amount of dividend than growth stocks so when prices fall due to crisis, some people think that it's a good opportunity to buy these shares because these shares are viewed as a safer asset since at least investors can earn the dividend return from them. Thus value shares were less likely to be affected the impact of the subprime crisis than shares classified as growth stocks.

However, many prior studies have empirically evidences, indicating that stocks with lower market-to-book will have abnormally higher returns. Rosenberg, Reid, and Lanstein (1985), Fama and French (1992); Griffin and Lemmon (2002) They pointed that investors become more risk-averse and urge the risk premium for stocks with lower market-to-book due to concerning that during the crisis, they may sell their stock lower than book price and may face with the financial distress problem. Therefore, during a turmoil period, valuation of stocks with lower market-to-book ratio are likely to drop in larger amount.

Thus, according to these evidences, value stocks (lower market-to-book ratio) seem to have more chance to be detected the contagion existing than stocks classified as a growth.

3) Cash-Flow

Stock with lower liquid asset ratio tends to have evidence of contagion effect existing than stocks with higher liquid asset ratio.

Investors favor to purchase stocks of firms with large proportion of cash-holdings because it implies that these firms have a better chance to afford money on maturity date. In addition, firms with higher liquid assets are safer against bankruptcy risk since these firms have low probability to face with cash shortage problem. (Bonfim, 2009) However Hillegeist, Keating, Cram, and Lundstedt (2004) contend that cash-liquidity does not reduce the probability to default over the period which is greater than one year. Acharya, Davydenko, and Strebulaev (2008) argued that riskier firms tend

to hold higher cash reserves. They found that in short term period, high cash reserves can reduce the probability to default, but in long terms, high cash reserves lead to cash-shortage, contributing more probability to default. Moreover, Jensen (1986) and other contend that high level of cash holding implies these firms lack of investment profitability and may lead their manager to manage this resource in wrong decision by investing in negative net present value projects. This sound seems to convince that stocks of companies with higher liquid-ratio incline to be affected the contagion problem more than the lower one.

Nevertheless, the evidence from Jia Wang et al. (2009) indicated that in many crises before the subprime (e.g. Great depression 1980, Asian crisis 1997, Dot-com bubble 2001) stocks of firms with higher levels of liquid asset tend to lose more value on crash date. Nevertheless, the recent evidence of them in 2010 show that during the subprime crisis, firms with higher liquid-asset favored to lose less value since they have lower financial constraints. Thus, according to the latest finding, I still expect that return of stocks with lower liquid asset tend to co-move and should be detected contagion effect rather than stocks with higher liquid asset.

4) Investment

Stocks with higher investment-to-asset ratio tend to have evidence of contagion effect existing less than stocks with lower investment-to-asset ratio

Various studies such as studies L Chen, Novy-Marx , and Zhang (2001); Lyandres, Sun, and Zhang (2008) and Cooper, Gulen, and Schill (2008) argued that stocks with low investment-to-asset ratio have abnormally high average returns and the relationship between returns and investment should become negative association since firms will invest more when they can access to many low risk projects, causing lowers the firm's risk level, in turn, their expected returns.

V Gala (2006) also supported this hypothesis by giving the reason that in bad times, low investment firms have more constraint to disinvest and sell off their capital. High investment firms, however, can reduce their positive investment easily as they do not have strict constraints to disinvest like those with low investment-to-asset. They can transform positive investment project to be the cash which can be the buffer asset, lessen the impact of crisis. Then, firms with higher investment-ratio should earn lower expected returns. From this view, during the distress stocks of firms with lower investment-to-asset seem to provide negative return more than stocks of firms with higher investment-ratio. Consequently, I expect to observe that returns of stocks with higher investment-to-asset have more likely to co-move with U.S stocks than stocks of firms with lower investment-to-asset.

5) Leverage

Stock with higher debt ratio tends to have evidence of contagion effect existing more than stocks with lower debt ratio

Modigliani and Miller (1958) stated that returns of stock should be an increasing function of leverage since debt increases the bankruptcy risk hence, shareholders will demand a premium to compensate. However, empirical evidences of the relationship between returns and leverage are mixed and inconclusive. Some studies showed that returns increase with leverage Hamada (1972), Bhandari (1988) but other contends that it contribute negative impact to returns (Dimitrov & Jain, 2008)

Many scholars acknowledged that bankruptcy risk is a significant determinant of stock returns during crisis period. Miyajima and Yafeh (2007) found that companies with higher levels of leverage (high debt ratio) tend to have severely affected to impact of credit-crunch crisis in Japan during 1995-2000 than the lower.

In addition, the recent evidence from J. Wang, Meric, Liu, and Meric (2010) and Hillegeist et al. (2004) demonstrated that firms with a higher debt - ratio will loss more value on stock market crash date during the 2008 meltdown since they have more financial constraint to raise funds due to fearing that, high leverage firms may unable to pay interest and loan payment, leading to bankruptcy risk.

Thus, I expect returns of stocks with low debt-to-asset ratio did not perform reconcile with the returns from U.S. stock market. Therefore, they are less likely to found the evidence of contagion effect existing.

6) Liquidity

Stocks with higher liquidity tend to have evidence of contagion effect existing than stocks with lower liquidity.

Generally, investors prefer to invest in stocks with high liquid to illiquid as during uncertainty, almost investors attempt to hold in more liquid assets (flight to liquidity), making high liquidity stocks become more valuable. Thus, the relationship between returns and liquidity should be a negative influence. Stocks with lower liquidity should provide higher expected returns to compensate this illiquid (Amihud, 2002).

Jia Wang et al. (2009); (J. Wang et al., 2010) asserted that low liquid stocks lost less value than stocks with high liquid on many crashes date, occurring before 2008 meltdown, since stocks with lower liquidity appear to respond to new market information slower. The bad news from the crisis will contribute less negative impact to stocks with low liquidity to trade than liquid stocks. Yet, they found that the liquidity was not a significant determinant of stock returns during subprime, That is, prices of either liquid or illiquid stocks were affected to the impact of this financial crisis similarly.

However, Didier et al. (2012) contend that higher liquid share still be affected by to the spread of U.S. financial crisis more than illiquidity shares. They used turnover-ratio to be a proxy of liquidity and found that liquidity became strongly factors that can determine the degree of co-movement in returns between international and U.S stock markets in both turmoil and tranquil periods. Additionally, liquidity factor has more influence on the co-movement in returns of U.S. and developed countries than the impact of size.

Thus, form these empirical evidences, I expect the price of higher liquidity stocks tend to move consistent with U.S stock market easier than lower liquidity stocks and also more likely to be found the evidence indicating contagion.

7) Beta

Stocks with higher beta tend to have evidence of contagion effect existing than stocks with lower beta.

Beta is a measure the volatility of individual security return relative to market portfolio. Stocks with low beta reflect that these shares are determined by aggregate stock in a lower proportion. According to CAPM model, returns of higher beta stocks will move faster than the returns of lower beta stocks in both bull and bear markets since lower beta stocks weakly react to the change from broader market and always have lower volatility than the whole market. Consequently, when aggregate stock dramatically declined due to the impact of crisis, price of shares with low beta will decline slightly. Jia Wang et al. (2009) also have empirical evidence supporting this argument by showing that returns of higher beta stocks loss more value, on many market crashes date, than lower beta stocks.

Therefore returns of low beta stocks inclined not to move companion with returns from the U.S. stock market, implying lower chance to be detected contagion existing

8) Return-on-Asset (ROA)

Stocks with lower ROA tend to have evidence of contagion effect existing than stocks with higher ROA.

The evidence from Jia Wang et al. (2009) purposed that firms with a higher ROA ratio will lose less negative value during the market crash date on 2008 meltdown. As these firms have less likely to face the bankruptcy problem, for the stock market crash in 1987 (generally, called it as the great depression crisis) they found that, however, the coefficient of ROA is not statistically significant to determine the stock returns in the U.S. or it's never significant higher than the benchmark at 10% level.

In contradict, the finding from Didier et al. (2012) indicated that ROA ratio is not one of significant firm characteristics to determine the co-movement of returns between each international country to move along with the returns of U.S. equity market during 2007-2009.

However, many studies purposed that stock with higher returns-on-asset (ROA) will provide abnormally higher average returns. Stock of firms with high ROA can be implied that this company can manage their assets to generate income quite effective. Therefore, firms with high ROA seem to lessen the contagion impact from U.S. market more than those firms with low ROA as they can bring their profit to finance cash' payment on maturity date. Then, I still believe that Stocks with lower ROA tend to have evidence of contagion effect existing than stocks with higher ROA.

Hypothesis II: *Impact of news about the surprised change in interest rate policy from U.S. (foreign) and domestic Central Bank around the announcement date could affect the pair-wise correlation of stock returns between U.S. and that country stocks with different firm characteristics. In addition, the magnitude of the impact of the surprise change in the policy rate on the correlation of stock returns depends on the type of firm characteristics.*

Numerous existing literatures demonstrated that an unexpected change in policy rates, can influence stock returns, but the actual change do not since due to semi-strong form perspective, prices of asset react when the market receives only unanticipated information. An unexpected change in fed-fund rates typically affects stock returns in both U.S. and global markets in negative relationships. In details, an unexpected tightening of fed-fund rates have an influence on discount rate and investors' expected inflation, causing firm value and household's consumption decrease. Consequently, prices of U.S. stocks fall and provide negative returns.

Moreover, as U.S. is the biggest world's economy the effect can transmits to international equity markets through 3 channels – trading, financial-linkage and capital market adjustment Ehrmann and Fratzscher (2004) Thus, unexpected tightening (viewed it as positive surprise) in fed-funds rate, causing real foreign exchange rates and world's interest rate increase but decrease capital flow out from U.S. to global equity markets, also reduce price of global equity market as well causing cross-country correlations performs the positive relationship Therefore, I expect the correlations of returns between U.S. and stocks with different firm characteristics from international countries should have negative relationship to the impact of surprise in fed-fund rate policy.

Considering whether this impact is attributed to firm characteristics, I expect that firm characteristics also have an influence on the response of correlation coefficients to the announcement of the change in interest rate policy. The correlation of some firm characteristics may absorb intense impact from this monetary action, especially, firms that encounter with higher global funding exposure. Stocks with large size, could receive stronger impact from an unexpected changes in U.S. policy rate since large-cap firms can access and raise funds from the global resource easier than small-cap firms. (Ehrmann & Fratzscher, 2004)

Besides, Karim (2009) stated that less financially constrained firms seem to face more negative impact from the surprise change in international monetary policy than highly constrained firms since only less constrained firms have potential to obtain fund from international markets. Thus, if the surprise matter, e.g. unexpected tightening in fed fun rate, it should have emphatically negative effect to returns leading more positive impact to the correlations between U.S. stocks and stocks which have firm characteristic defined as less constrained. (Value stock, low debt-ratio, high investment, high cash-holding or high return-on-asset) For example, large cash-holding firms have more sensitivity to the change in global discounted rates, due to holding much cash that could be the source of global funds.

For beta, I expect an unexpected change in fed-fund rates have pronounced positive impact to correlations of returns between U.S. stock and stock with high beta in more magnitude than stocks with low beta since if price of whole stocks decline owing to the unexpected change in U.S. interest rates, price of low beta stocks volatile and change by lower amount if compared to high beta stocks. For those stocks with high liquidity, they are likely to respond to unexpected change in U.S. policy rates more than stocks with low liquidity as high liquidity stocks respond to markets news information quicker (Amihud, 2002), thus news about surprise change in U.S. policy rates which contribute negative effect to returns of both domestic and U.S. stocks, will negatively affect correlations of high liquidity stocks in more amount than illiquid stocks.

Turning to consider the impact of unexpected change in domestic interest rates to the correlation coefficient between U.S. and domestic stocks with different firm characteristics, the impact of change in each domestic key-rates inclines to differ from the impact of surprise change in fed-fund rates (foreign) since the degree of transmission depends on the level of financial integration and size of economy. As pointed by Li, İşcan, and Xu (2010) an announcement of change in domestic interest rates may provide less impact to U.S. equity market if the announcement

comes from the country which their economy is quite small to determine world's interest rates and/or have low financial-integration with U.S. market (e.g. Emerging markets) However, if the declaration of changing in key-interest rates come from countries which have high financial integration with U.S. market and/or their economy can influence world's interest rates with highly proportion (major developed country), we should observe a positive correlation between US stock return and domestic stock return.

However, if a surprise change in policy rate announcement come from a small country's economy or from a country that has low financial linkage with the U.S., even though the capital may flow out of the U.S after the domestic's central bank decides to tighten the domestic policy rate, the effect might not strong enough to influence the U.S. stock price to fall significantly. Therefore, a surprise change in domestic policy rate is not likely to contribute much to the correlations between the U.S. and domestic stock return since that announcement is likely to affect only the domestic stock return.

Likewise, when we try to identify the effect of the surprise change in US policy rate on the correlations between the US stock returns and domestic stock returns with different firm characteristics, I will also identify the impact of the surprise change in domestic policy rate on the correlations between the US stock return and domestic stock return with different firm characteristics. I expect the surprise change in the domestic policy rate will result in the positive correlations of the US stock returns and domestic stock returns of the financial constrained firms (small, growth, high debt-ratio, high level of investment or low cash-holding) rather than the unconstrained firms. This is due to have evidences support that firms which have inconvenient to raise additional funds become more sensitive to surprise change of domestic's interest rates than firms that have low limitation to raise additional fund. Thorbecke (1997) argued that the unexpected change in domestic interest policy causes more negative effect on the return of small

firm than large firms. Ehrmann and Fratzscher (2004) found that the effect of monetary policy decision influences the financial constrained firms more degree than the less constrained firms. Bougheas, Mizen, and Yalcin (2006) asserted that small size, high risk and young firms are intensely affected by the tightening monetary policy since these characteristics cause the limitation of firms to connect the external financing.

In sum, unexpected change in domestic policy rates will affect the correlation of returns between U.S. stocks and stocks which characterize as constrained firms more magnitude than less constrained firms, however, if the surprise of interest rate change come from the U.S. Central Bank, correlation of less constrained firms will be affected by this announcement greater than highly constrained firms.

3.2 Data

This paper investigates the contagion effect transmitting from U.S stock market to international equity markets based on firm characteristics. Hence, I use New York stock exchange (NYSE) as a proxy of U.S equity market. In international equity markets I use the daily stock price of listed companies from five major developed and five major emerging countries. The sample includes England (the FTSE 100 Index), Germany (the CDAX Performance Index), Japan (the Tokyo Stock Price Index), Hong Kong (the Hang Seng Index), Canada (the Toronto stock index**),** Thailand (the Stock Exchange of Thailand Index), Brazil (the Bovespa Index), Korea (the Korea Composite Index), Mexico (the Bolsa Index) and China (Shanghai composite index). All stock indices are collected in closing prices, unadjusted dividend and dominated in local currency in each market. All of stock data obtained from Datastream.

Following the methodology from Chiang et al. (2007), Returns of stock are calculated as continuous compounding (log of first difference) and expressed it in percentage form. I use one day return and do not employ moving-average returns, two-day returns[2], since this method may cause a serial correlation problem and does not appropriate for investigating an announcement effect which are defined as daily basis, though it can reduce the asynchronous in trading hours effect.

According to Figure 1, in each day, Asian stocks (Japan, Korea and Hong Kong) markets open earlier than others and European markets (England and Germany) will open 7-8 hours later than Hong Kong respectively. Lastly U.S. stock market will open 13 hours later than Hong Kong. Thus, in order to investigate the contagion effect, spread from U.S. markets, in those countries which open and close correspond with the trading hours at the U.S. market. I will match their stock return at time *t* with the U.S. returns at time *t* (same time) whereas, in countries which their trading hour does not match to U.S. stock. I will match the return at time *t+1* with the U.S stock returns at time *t*.[3]

---- Insert Figure 1 about here-----

2 Purposed by Forbes and Rigobon (2002)

3 According to this point, I will match returns of Asian stocks and European stocks (Japan, Hong Kong, Korea, China and Thailand) at time t+1 with U.S. stock returns at time *t*. However for the rest countries (Brazil, Mexico, England, Germany and Canada) I will match the returns of these markets at the same time with U.S. stock (time t)

3.3 Methodology

3.3.1 Identify Key dates

The stock price data covers the period from January 2003 to October 2009 due to avoiding the impact of Dot.com crisis, occurring before 2003, and impact of the European debt crisis, occurring in 2010. To examine the possible change in the correlation of returns between U.S. stock and international stock, I must separate the data into two main periods. Since the results from investigating financial contagion tend to be affected by the determination of crisis period (Dungey & Yalama, 2010) hence, to account this problem, I combine the information from Federal Reserve Bank of St. Louis' crisis timeline, plotting the stock volatility to find the movement of stock prices and estimating Bai-Perron structural break date to obtain the exact crisis period. The results are shown in Figure 2 and Table 1

---- Insert Table 1, Figure 2 about here-----

Owing to the results from Table1 and Figure 2, I determine the tranquil period cover the stock price data from January 2003 through 20 July 2007 (1180 observations) While for the turmoil period, the starting point of U.S. financial crisis is on 21 July 2007 and ending point at 30 October 2009 (594 observations). However, the difference in the time that we focus to examine contagion could express the different results - as during before the date of Lehman's collapse, the impact of Subprime may spread to other international markets in lower magnitude, especially the emerging market, located in Asia. Consequently when analyzing contagion, the results of these countries may not reveal the trace indicating the existence of contagion. In contrast, during the Lehman broke down period, the impact of crisis transmitted to global equity market with wildly and severely

degree, almost investors could recognize the spreading of the crisis and will react follow the herding behavior, then we might observe the evidence demonstrating the existence of contagion in several countries and several firm characteristics during that time. Hence, for better understanding, I also divide turmoil period into 3 sub periods using the event of bankruptcy of Lehman to be a threshold so, I have 3 stages of crisis to consider - pre-Lehman (21 July 2007 – 14 September 2008, 300 observations), Lehman (15 September 2008 - March 2009, 140 observations) and post crisis sub period. (April 2009 – October 2009, 153 observations)

3.3.2 Constructed indices

As analyzing contagion effect, basically we investigate it by comparing whether the correlation coefficient increases significantly if compared the results between tranquil and turmoil period. However, firm characteristics can change over time, relying on the firm's performance in each period, for instance, one firm may be classified as a large-cap firm during the tranquil period, but two years later, this firm's performance may change and switch to characterize as small-cap stocks. That contrast to analyzing financial contagion at aggregate or sector level, which almost of data, located in one sector, do not change to be a member in another sector despite considering in different period. Owing to this point, provided factor indices from institutions such as, a FTSE-large-cap or MSCI with low-beta, should have become the proper that used to analyze contagion however, this institution does not generate any firm characteristic, in all countries. Hence, I try to construct indices, using closely the way for calculating the index similar to this standard.

I will rank stocks with respect to each firm characteristic every year for capturing each firm characteristic precisely despite I will have different firms to compare the correlation between these two periods. The constructed indices in each year are coming from the multiple in previous year like when form portfolio to analyze factors model (normally using fiscal year end data provided in

31 December). I consider eight characteristics for investigating contagion effect. The definition and the way to calculate these variables are provided in Table 2

---- Insert Table 2 about here-----

I also exclude utilities firms from this sample since some financial decision are affected by laws and also exclude financial firms since some financial ratio are unusual and cannot be compared with industrial firms. Besides, firms with missing financial data or their price less than 1 (in term of their local currency) are also terminated to avoid the discrepant results.

I find that cross-correlations [4] between one firm characteristics to the rest are basically not too high, indicating each firm characteristic that I choose to study in this paper are not being heavily driven by other characteristics which may lead to a missing interpretation from each result.

I use long only portfolio instead of long-short and use cutoff rate at 25 percent[5] to be benchmarked. For example, stocks which are sorted by size, the 25 percent of stocks with the lowest (highest) multiples are characterized as small (large) capital stocks. For calculating the weight of stocks, I choose equally-weighted approach[6] since each stock can contribute equal exposure to influence the portfolio, which also helps reduce the effect of issuing new shares or split stock.

[4] The Pearson correlation coefficients between firm characteristic of each country are available upon request..

[5] the methodology from Fama & French (1997), Bird & Casavecchia (2007)

[6] Basic formula for calculating equally weighted Index (Assume that every stock in the index has the same weight, regardless how large or small the company) is $\boldsymbol{EW} = \frac{1}{n}\sum_i^n \boldsymbol{R_i}$ where, n = number of shares in constructed index, $\boldsymbol{R_i}$ returns of each stock located in the indice.

In contrast, in value-weighted method, portfolio index may be dominated by some firms (e.g. Blue–chip) which can give a wrong explanation of results (Black & McMillan, 2006)

In additions, after selecting every the first and the last-quartile of listed firms in every firm characteristic for generating indices, I also provide the proportion of each firm characteristic that has same listed shares locating in both of the their indices and indices, calculated based on size characteristic. I do it because normally size become the strongest firm characteristic that likely to determine other company idiosyncratic risk. I find that the correlation between size and other firm characteristic indicating the value around 0.2- 0.4 in almost countries except the correlations between size and liquidity, which their correlations are somewhat high (0.3-0.6). This evidence might be owing to the fact that smaller company incline to have lower liquidity to trade. Accordingly, the results between these variables seem to go in the same direction when analyzes financial contagion.[7]

---- Insert Table 3 about here -----

The summary statistics of a U.S. and constructed index-return in 10 international countries is presented in Table 4.

---- Insert Table 4 about here-----

[7] Actually, I can drop one of them due to high correlation but each characteristic still does not capture the net effect of another which it might give more illustration to understand. Therefore, I decide to use both of them to analyze financial contagion which it might help

According to Table 4, I can summarize that during pre-crisis periods, stock of all countries and all firm characteristics contribute positive returns to investors, whereas most of them turning to provide negative returns during the crisis period. Variances also dramatically increase during that trouble. The excess of Kurtosis ($\neq \mathbf{3}$) and Skewness ($\neq \mathbf{0}$) in all markets suggests that these series are not normally distributed which is known as a remarkable feature of stock returns. Correlations seem to increase during distress time in almost markets and several firm characteristics.[8] Nevertheless, in China, the difference of correlation coefficients between pre and post-crisis did not vary in large amount since China's market has the specific characteristic due to having a high constraint on economic policy, causing low linkage with international market. In addition, during the post - crisis the correlation coefficients between U.S. and South Korea markets of several firm characteristics (notably, valuation, cash, and investment) seem to decrease a lot from the pre-crisis period. The possible reason to describe this phenomenon may come from the effect of non-synchronous trading between Korea and U.S market and the impact of using the daily data to analyze contagion than jumping to conclude it as these firm characteristics can lessen the impact of contagion in Korea market.

The correlation from Table 4 also suggest guideline, indicating stock with small capital tend to be detected contagion effect more than stocks with large capital since their correlation likely to increase from pre to post-crisis period in larger proportion than firm with large capital. Especially, the results from developed countries (Canada, German, Hong Kong or Japan) - For instance, in Hong Kong, obviously that the correlation of firm with small-cap increase from 0.269 to 0.476 during Subprime while the correlation of firm with large-cap increase relatively small if compared to the small one (from 0.397 to 0.457) However, in emerging markets, I cannot find the

[8] These simple correlations do not be addressed for heteroskedasticity problem so they are used to only be a primary check for analyzing contagion.

outstanding trend that can identify the type of firm's size that likely to be found contagion propagating like the evidence from developed countries. Furthermore, I find that firm with lower cash-flow, larger investment-ratio, higher debt-ratio and lower beta are another additional firm characteristic that their correlation coefficients incline to increase dramatically during turmoil – notably, in developed market, implying that they are likely to have more chance to be found contagion appearing than those indices which constructed as opposite characteristic (lower investment-ratio, lower debt-ratio, higher cash-flow or higher beta, respectively). However, for the rest, the result is ambiguous since their correlation coefficient of both developed and emerging markets show such a conflict trend against each other that I cannot conclude the type of them, which likely to be observed contagion than another from this primary-check or the difference of correlations between each pair of firm characteristics still insignificant.

To refine this analysis, next, I will analyze the co-movement of the U.S. equity market and formed indices, based on each characteristic, by using a contagion model from Chiang et al. (2007) Finally, after getting the correlation from model, I will compare the results by focusing on which characteristic contributes significant increase in correlation than another.

3.3.3 The model for testing financial contagion

Since I would like to obtain the series of time-varying correlation to analyze contagion effect. Then, I employ DCC-GARCH approach proposed by Engle (2002) for capturing the co-movement in returns between U.S stock index and international stock indices, constructed based on each firm characteristic because this model can avoid heteroskedasticity problem and can include additional explanatory variable to measure common factors. In this paper I use EGARCH framework, developed by Nelson (1991), to obtain standardized residuals as this model can capture

the asymmetric response in the conditional variance. Then, return the model can be written as follows:

$$\boldsymbol{r_{i,t} = a_0 + a_1 r_{us,t-1} + \sum_{k=1}^{n} b_k r_{i,t-k} + e_{i,t}} \quad \textbf{(e.q. 1)}$$

$$\boldsymbol{e_{i,t} | \varepsilon_{t-1} \sim N(0, H_t)}$$

$$\boldsymbol{\sigma_{i,t}^2 = exp[\alpha_{i,0} + \delta_i g(Z_{t-1}) + \gamma_1 ln(\sigma_{i,t-1}^2)]}$$

$$\boldsymbol{g(Z_t) = \theta Z_t + \varphi(|Z_t| - E|Z_t|))}$$

where

$\boldsymbol{r_{i,t}}$ = The current equity return, sorted by firm characteristic of country i

$\boldsymbol{r_{i,t-k}}$ = Lagged of equity returns, sorted by firm characteristic of country i

$\boldsymbol{r_{us,t}}$ = One day lagged return of U.S. stock market

$\boldsymbol{\sigma_{i,t}^2}$ = Conditional variance

$\boldsymbol{g(Z_{t-1})}$ = Function of the lagged standardized error term

$\boldsymbol{\sigma_{i,t-1}^2}$ = Lagged of conditional variance.

The AR terms used to account for autocorrelation and lagged return of the U.S. represents as exogenous global factor.

Next I specify a time-varying correlation matrix as:

$$\boldsymbol{H_t = D_t R_t D_t} \quad \textbf{(e.q. 2)}$$

where

$\boldsymbol{H_t}$ = Time Varying Conditional Variance-covariance Matrix of $\boldsymbol{Y_t}$

$\boldsymbol{R_t}$ = Time Varying Correlation Matrix

$\boldsymbol{D_t} =$ Diagonal Matrix, which has N*N vectors and consists of time varying standard deviations from univariate GARCH model $\sqrt{\boldsymbol{h_{ii,t}}}$

The Elements of $\boldsymbol{H_t} = \boldsymbol{D_t R_t D_t}$ is

$$[\boldsymbol{H_t}]_{\boldsymbol{ij}} = \sqrt{\boldsymbol{h_{it} h_{jt}}}\boldsymbol{\rho_{ij}}$$

$$\boldsymbol{H_t} \equiv \begin{bmatrix} \sqrt{\boldsymbol{h_{11,t}}} & \boldsymbol{0} \\ \boldsymbol{0} & \sqrt{\boldsymbol{h_{22,t}}} \end{bmatrix} \begin{bmatrix} \boldsymbol{1} & \boldsymbol{\rho_{12,t}} \\ \boldsymbol{\rho_{12,t}} & \boldsymbol{1} \end{bmatrix} \begin{bmatrix} \sqrt{\boldsymbol{h_{11,t}}} & \boldsymbol{0} \\ \boldsymbol{0} & \sqrt{\boldsymbol{h_{22,t}}} \end{bmatrix}$$

The DCC-GARCH models use two-stage of estimation of conditional covariance matrix. $(\boldsymbol{H_t})$ In the first stage, univariate volatility models are fitted to each of stock returns and estimated of $\sqrt{\boldsymbol{h_{ii,t}}}$ are obtained. In second stage residuals are transformed by their estimated standard deviations from the first stage. That is $\boldsymbol{u_{i,t}} = \frac{\boldsymbol{e_{i,t}}}{\sqrt{\boldsymbol{h_{ii,t}}}}$ and it used to estimate the correlation parameters.

In DCC GARCH model $\boldsymbol{R_t}$ has two requirements to be considered:

1) $\boldsymbol{R_t}$ is positive definite

2) All elements in the correlation matrix $\boldsymbol{R_t}$ is equal or less than one.

Then $\boldsymbol{R_t}$ is decomposed into:

$$\boldsymbol{R_t} = \boldsymbol{Q_t^{*-1} Q_t Q_t^{*-1}} \quad \textbf{(e.q. 3)}$$

$$\boldsymbol{Q_t} = (\boldsymbol{1 - a - b})\bar{\boldsymbol{Q}} + \boldsymbol{a u_{t-1} u_{t-1}'} + \boldsymbol{b Q_{t-1}} \quad \textbf{(e.q. 4)}$$

where

$\boldsymbol{Q_t} =$ The n*n time-varying covariance matrix of $\mathbf{u_t}$

$\bar{\boldsymbol{Q}} =$ Unconditional Covariance of Standardize Disturbances which can be estimated as

$$\bar{\boldsymbol{Q}} = \frac{1}{T}\sum_{t=1}^{T} u_t u_t'$$

$\boldsymbol{Q_t^*} =$ Square root of diagonal elements of $\boldsymbol{Q_t}$

$$\boldsymbol{Q_t^*} = \begin{bmatrix} \sqrt{q_{11,t}} & 0 \\ 0 & \sqrt{q_{22,t}} \end{bmatrix}$$

$\boldsymbol{a}$ and $\boldsymbol{b}$ are scalars such that $\boldsymbol{a + b < 1}\ ;\ \boldsymbol{a \geq 0}\ \boldsymbol{b}\ \boldsymbol{\geq 0}$

$\boldsymbol{q_{ij,t}} =$ Conditional Covariance between the Standardized Residuals $\boldsymbol{u_t}$ and u_t^T

Thus, Conditional correlation is written as follows

$$\boldsymbol{\rho_{ij,t}} = \frac{\boldsymbol{q_{ij,t}}}{\sqrt{\boldsymbol{q_{ii,t}q_{jj,t}}}} \qquad \textbf{(e.q. 5)}$$

The parameters of the DCC model are estimated by likelihood technique

Let the parameters in $\boldsymbol{D_t}$ be denoted by $\boldsymbol{\theta}$ and $\boldsymbol{R_t}$ be denoted by $\boldsymbol{\varphi}$ the log likelihood function can be written as the sum of volatility part and correlation part

$$\boldsymbol{L(\theta,\varphi)} = \left[-\frac{\boldsymbol{1}}{\boldsymbol{2}}\sum_{\boldsymbol{t}}(\boldsymbol{nlog(2\pi) + log|D_t|^2 + e_t' D_t^{-2} e_t})\right]$$

$$+\left[-\frac{\boldsymbol{1}}{\boldsymbol{2}}\sum_{\boldsymbol{t}}(\boldsymbol{logR_t + u_t' R_t^{-1} u_t - u_t' u_t})\right] \qquad \textbf{(e.q. 6)}$$

The log likelihood function can be maximized in the first stage over in $\boldsymbol{D_t}$ for finding the volatility part and the correlation part is then maximized in the second stage, given the estimate value in the first stage.

3.3.4 How to test contagion

Although investigate contagion can be analyzed form mean equation or variance equation, in this paper I focus to test contagion only at mean equation since the result from using variance equation provide less meaningful if. Hence, after conditional correlations between the returns of U.S. stocks and international stocks based on firm characteristics are obtained from the DCC-GARCH model in **e.q. 6**, then I will examine whether the conditional correlations significantly increased during the crisis period by adding the dummy variables into the model. In addition, for the Figure, presenting the level of stock market correlations in each period during 2003-2009, obtained from DCC-GARCH model, of each country, is exhibited in APPENDIX section.

The regression model is written as follows

$$\boldsymbol{\rho_{ij,t}} = \boldsymbol{a_0} + \boldsymbol{a_1}\boldsymbol{\rho_{ij,t-1}} + \sum_{k=1}^{3} \boldsymbol{b_k}\boldsymbol{D_{k,t}} + \boldsymbol{e_{ij,t}} \qquad \textbf{(e.q. 7)}$$

where

$\boldsymbol{\rho_{ij,t}}$ = The pair-wise correlation coefficient between the stock returns of U.S, and international countries, considered based on firm characteristics such that i refers to U.S.; j refers to five developed and five emerging countries

$\boldsymbol{D_{k,t}}$ = Dummy variable - $\boldsymbol{D_{1,t}}$ is dummy variable for the first phase of crisis (pre- Lehman), $\boldsymbol{D_{2,t}}$ is dummy variable for the second phase of crisis (Lehman) and $\boldsymbol{D_{3,t}}$ is dummy variable for the post crisis period.

The hypothesis for testing contagion effect is

$$\boldsymbol{H_0}: \boldsymbol{b_k} \leq \boldsymbol{0} \qquad \text{no contagion}$$

$$H_1: b_k > 0$$ contagion

Then, reject H_0 imply the contagion effect existing between two markets

Additionally, for determine which type of each firm characteristic is less likely to have evidence indicating contagion effect, I will use the statistical test purposed by Paternoster, Brame, Mazerolle, and Piquero (1998) to compare the equality of coefficients between two regressions.

$$z = \frac{b_{k,c1} - b_{k,c2}}{\sqrt{S.E._{b_{k,c1}}^{\ 2} + S.E._{b_{k,c2}}^{\ 2} - 2cov_{b_{k,c1}b_{k,c2}}}} \quad \text{(e.q. 8)}$$

where

$b_{k,c1}$ = The coefficient of the independent variable of firm characteristic type-I, estimated form **e.q. 7**

$b_{k,c2}$ = The coefficient of independent variable of firm characteristic type-II[9]

$S.E.$ = Standard deviation

cov = Covariance between coefficients of these two regressions, obtained from estimate **e.q. 7** with the method of seemingly unrelated regression (SUR) model. Then use z statistic to test the significance of this difference.

9 For example, $b_{1,c1}$ represents for the coefficient of dummy variable, testing contagion in first phase, from small-cap indices, $b_{1,c2}$ represents for the coefficient of dummy variable, testing contagion in the first phase. From large-cap indices)

3.3.5 Examine the relationship between conditional correlation and conditional volatility

According K. J. Forbes and R. Rigobon (2002) an increase of conditional correlation over period may be as a consequence of the increase in conditional volatilities from one country are not essentially from the fundamentally cross-country linkages. If volatility in one country rises, though the linkage between two countries does not change, the correlation of returns between two countries will automatically increase as well since an idiosyncratic shock in this country will affect and transmit to the return in second country as a result of statistical reasons.

In addition, Cappiello et al. (2006) demonstrated that conditional volatilities will also drive the conditional correlation across countries to increase especially, during the turmoil period. If conditional volatilities move along with same direction with cross-country correlations, the diversification benefit will decline. The long run risks are higher than they appear in the short run. Therefore, to capture this relationship I will have another regression to estimate

$$\boldsymbol{\rho_{ij,t} = a_0 + a_1\rho_{ij,t-1} + a_2\sigma_{i,t} + a_3\sigma_{j,t} + e_{ij,t}} \qquad \textbf{(e.q. 9)}$$

where

$\boldsymbol{\sigma_{i,t}}$ = The conditional volatility of the U.S. stock index

$\boldsymbol{\sigma_{j,t}}$ = The conditional volatility of indices, constructed by each firm characteristic, from international market

If $\boldsymbol{a_2}$ and $\boldsymbol{a_3}$ have significantly positive value, it implies that the correlation between U.S. and international stock, constructed by each firm characteristic, are higher at any time of the U.S. stock or those international stocks become more chaotic. However, if $\boldsymbol{a_2}$ and $\boldsymbol{a_3}$ have significantly

negative value, suggesting that the correlations will decrease even though the volatility form either U.S or domestic index, leading to gain diversification benefit.

3.3.6 Testing the effect of surprised in country policy rate and to the correlation coefficients

It should be realized that the noise of correlation coefficients in **e.q.7** might be affected and sensitive not only to the conditional volatility, but also to the news about changes in interest rate policy which bring about the second research question. Thus, to examine this impact, the model 7 is rewritten as

$$\boldsymbol{\rho_{ij,t} = a_0 + a_1\rho_{ij,t-1} + \sum_{k=1}^{3} b_k D_{k,t} + \sum_{s=-1}^{0} \varphi_s^1 I_{i,t-s}^{(T_a)} + \sum_{s=-1}^{0} \varphi_s^2 I_{j,t-s}^{(T_a)} + e_{ij,t}} \quad \textbf{(e.q. 10)}$$

where

$\boldsymbol{I^{T_a}}$ is the variable for measuring the effect of surprise change in policy rate that reaches to the market at time t = T

$\boldsymbol{I_{i,t-s}^{(T_a)}}$ and $\boldsymbol{I_{j,t-s}^{(T_a)}}$ are used to capture the effect of policy interest rate changes occurring in U.S. or global country (five emerging and five developed countries) with a window length of s, spanning from (T – 1) to (T)

$\boldsymbol{\varphi_s^1}$ and $\boldsymbol{\varphi_s^2}$ are constant coefficients, subscript i refer to U.S. and j refer to international countries.

The indicator variable for s = -1, and 0 takes the form of:

$\boldsymbol{I^{T_a}}$ is calculated by:

$$I_{i(j),t}^{(T_a)} = \begin{cases} \Delta m^u & , \ t = T_a \\ 0 & , \ t \neq T_a \end{cases} \qquad \text{(e.q. 11)}$$

Δm^u denotes as the unexpected (surprised) change in interest rate announcement, which come from either the unexpected changes in fed-fund rate (Δm_i^u) or the unexpected changes in domestic policy rate (Δm_j^u) of each country. Despite most of existing papers tend to use the methodology purposed by (Kuttner, 2001) which use future contact of their policy interest rate to estimate these unexpected components, many emerging markets do not provide these future-data. Therefore, in this paper I use another approach, purposed by Reinhart and Simin (1997) to calculate the unexpected change in policy rates.

$$\Delta m^u = \Delta m - \Delta m^e \qquad \text{(e.q. 12)}$$

From this approach, the unexpected change in policy rate is defined as the difference between actual repurchase rate change (Δm) and the expected repurchase rate change (Δm^e). The expectation of policy rate change is calculated by using the survey data obtained from the Bloomberg database. Survey from Bloomberg is reliable data that used to be a proxy of market expectation since this survey are widely accepted as come from the consensus of various kinds of specialist in the markets. Many investors are also convinced by this data. Moreover, Valente (2009) demonstrated that the unexpected change in policy rates, which implies from Federal Funds futures contract and the survey data from Bloomberg also provide the preciseness and same direction of relationship to the stock returns. I collect this expected-data from Bloomberg Survey, occurring from January 2007 to October 2009 which are consistent to period that unexpected of policy rate seem not to have an influence to stock returns.

---- Insert Table 5 about here-----

Table 5 report the summary of monetary policy surprise of each country during 2007-2009. This table demonstrates that in each country almost of the surprised in monetary action, occurring during Subprime, are categorized as positively surprised (bad news) in more amount than the negative (good news) (Except England and Canada) referring that the announcement tend to create the “bad news” to investors. However, Mean of country’s policy rate surprise in several countries become negative value, meaning that even the amount of time of negative surprise is less than positive surprise, but each time of negative surprise occur, it provides the bigger surprised to market such as cutting the policy rate in larger amount than market expectation in order to stimulate the economic during trouble in 2007-2009.

Chapter 4
Empirical results and results discussion

4.1 Results of contagion testing

Before going to reveal the result of investigating financial contagion at firm level data, based on firm specific characteristics, I will present the contagion testing of the aggregate stock level of each country since this evidence will become the primary guideline when analyzing contagion of each country.

---- Insert Table 6 about here-----

Table 6 presents the estimated result of contagion testing at the aggregate level. Surprisingly, there are two countries (Thailand and Korea) which have evidence indicating no contagion are propagating at aggregate data. This finding is inconsistent with the prior study from (D. G. Baur, 2012) which found that Thailand and Korea has been severely affected by the contagion, transmitting from U.S subprime crisis. Possible explanations for this result may come from that he used the weekly data and factor-model to test contagion, whereas in this paper I use daily data and DCC-model to test financial contagion so, the results in this paper are quite different to his finding.

In addition, I find that in Hong Kong the coefficients $\boldsymbol{b_1}$, testing contagion during pre-Lehman crisis, show statistically significant negative value, meaning that the correlations between Hong Kong and U.S. stock decrease during the early stage of the crisis. This evidence might be explained by the interpretation from Chiang et al. (2007) which pointed that In the early periods,

investors might not fully recognized the impact of financial crisis, then stock market correlations of returns from this couple likely to decline. However, the result of the rest countries still reconciles to the majority of other findings. The estimation result suggests that most of sample countries were affected financial contagion particularly, during Lehman collapsed, all developed markets were detected the evidence, indicating contagion, implying that stock of developed market is likely to catch the stronger impact of Subprime crisis than the emerging. Besides, even analyzing contagion during post-Lehman collapsed period, several countries still exhibit that they still face the contagion problem, causing the diversification benefit decrease.

---- Insert Table 7A - 7C about here-----

Turning to examine financial contagion based on firm characteristic**.** Table 7A-7C displays the results from the regression model testing for the contagion based on firm characteristic in each country. The finding shows that coefficient $\boldsymbol{a_0}$ and $\boldsymbol{a_1}$ which represents the constant term and lagged terms of correlations are statistically significant in almost sample of countries and tend to have a positive relationship with the correlations. The positive sign implies that returns of international stock always move along with the returns from U.S. equity market and the correlations always driven by their one day lagged which similar to the results when analyzing in aggregate market.

As the impact of contagion, incurred by Subprime mortgage crisis, is likely to transmit to construct Indices differently, thus the coefficient administrating contagion ($\boldsymbol{b_i}$) tends to differ significantly across countries, time and also company-specific characteristics. Preliminarily, It should be realized that if coefficient $\boldsymbol{b_i}$ of whichever indices, constructed based on different kind of

company-specific characteristics, is statistically significant, we can imply it only as these indices were affected by an increase of co-movement in the U.S. equity market – called it as “contagion”. However, for those indices which their coefficient $\boldsymbol{b_i}$ does not exhibit the evidence of contagion we cannot imply these firm characteristics did not affected by the Subprime crisis. We had better interpreted it as these characteristics did not bear from the effect of increased co-movement.

Turning to consider financial contagion based on each firm characteristic, beginning with size, in the first-phase of crisis period, I find that many countries do not show the significant increase of their cross-country correlation since in the early phase, the turbulence has not been fully recognized. I find that for those countries which categorized as emerging markets, firms with large-cap tend to be affected by the contagion effect than small-cap firms. On the other hand, in developed countries, firm with small-cap tend to be observed contagion is propagating than larger-cap firms. The reason for explaining this distinction might come from that for emerging markets, financial facilities are more defective if compared to developed market. The market information does not be provided in widespread. Hence, foreign investors prefer to invest in larger shares than smaller shares due to reputation and easy-to-access (S. Eun et al., 2008). When the crisis arises, they will sell stocks in order to move their capital back, most of which are large-cap shares. Therefore, the result suggests that for emerging markets, large-cap firms incline to have a contagion effect than small-cap firms during the initial phase of the crisis. Additionally, this finding also supports the evidence from Jia Wang et al. (2009); J. Wang et al. (2010) which found that large-cap firm will lose more value during a market crash date than small-cap firm in the 2008 crisis.

However, for developed countries, market information is fully informed and easy to access even they are small. The expansion of impact will occur in these groups before other. Investors in developed market likely to be an initiator group realizing that this shock will bring about severely

impact to global markets, especially in developed countries as they have more financial and economic linkage with U.S. market than those groups of emerging. (Dooley & Hutchison, 2009) Then, they began to invest in safe assets since in this period. Therefore, stocks with larger-cap in mature countries have less evidence indicating the contagion effect if compared to the result from emerging markets.

For the second phase of the crisis, defined as a peak of deterioration and the epicenter of this crisis, stock market correlations dramatically increases since Lehman was bankrupt and news about crisis turned into more widespread. Then the coefficient $\boldsymbol{b_2}$ of both developed and emerging markets become statistically significant which mean that almost of stock sorted based on firm characteristic tend to have a contagion effect to exist. In addition, The result indicates that small-cap firms from both emerging, except Brazil and Mexico, and developed market will be affected by the contagion effect rather than high-cap firms since, as time passes, the severity of the crisis has increased steadily and cannot be predicted the turning point yet, hence investors seek to invest the safe asset following to the flight to quality behavior. Therefore, correlations of stocks with small-cap which seem to be riskier (Fama & French, 1992), tend to significantly increase than large-cap stocks during this period.

In the post crisis period, I find that stock from many countries turn back to have less evidence indicating contagion since their correlations did not significantly differ to pre-crisis period as a consequence of quantitative easing tapering from the U.S. government. The coefficients $\boldsymbol{b_3}$ are not statistically significant in many countries, especially the emerging markets. Hence, we cannot find the difference when comparing the probability to observe the contagion effect based on firm characteristic, during this period.

Second firm valuation, the result exhibit that during pre-Lehman, stock of firms with high market-to- book ratio (growth stocks) tends to be affected contagion problem more than firms with low market-to-book ratio (value stocks). This result can be explained that normally, value firms provide dividend higher than growth firms since growth firms always bring their profit to reinvest rather than pay it back to shareholders. Hence value stocks can be viewed as a safer asset since at least investors still earn the dividend from these shares. Accordingly, the returns from this share were less likely to be affected by the impact of crisis., this result is consistent with the prior evidences from Lakonishok et al. (2004), Huang & Yang (2008), Athannassakos (2009) and Hoekjan (2012) which indicated that value stocks provide higher returns, less sensitive to market perils and lower respond to the recession than growth stocks.

Reversely, for second stage, - I observe that value-stocks tend to have result demonstrating the existence of contagion effect than growth-stocks. Investors are concerned that the collapse of Lehman brother will cause the huge damage to global markets then, many firms will encounter with bankruptcy risk. Thus, they hesitate to hold stocks with low market-to-book ratio regardless of earning more dividend income as they afraid that these stocks may be sold at lower prices than the book price when faced with financial distress. (Fama & French, 1992). In addition, Table 7A reports that in Korea, the coefficients $\boldsymbol{b_2}$ of stock with higher market-to-book ratio provides a negative value during this stage, implying the correlation between this constructed indices and U.S. stock tend to decrease, which help to support the trend of this firm characteristic that less likely to affected by the contagion.

Third – cash-ratio, the results can be revealed that, firms with lower cash - ratio tend to be detected the evidence of contagion propagating than firm with higher cash - ratio. Nevertheless, in the early period, several countries have an evidence, indicating that firm with a higher cash - ratio tend to be affected by the contagion more than firm with lower cash-ratio, especially the results

from developed countries. This finding is consistent with the evidence from Acharya et al. (2008) who found that riskier firms are likely to hold higher amounts of cash reserves. They argued that in the short term, high cash reserves can reduce the probability to default, but in long terms high cash reserves cause cash-shortage, contributing more probability to default. Then the impact of crisis leads firms with a higher cash - ratio tends to lose more value. Moreover, in fact, most of companies in developed countries hold derivative assets which are based on U.S. asset more amount if compared to emerging. Thus, when these instrument defaults due to the Subprime - value of mortgage backed assets decline dramatically, so firms which had held this liquid asset in large amount, their stocks will lose more value, causing their returns perform more correlated with the U.S. stock significantly.

Despite the beginning phase of crisis, some countries have evidence indicating firms with a high cash - ratio tend to have more probability to be detected contagion, if turning to analyze the contagion effect into a second and third phase of crisis period, the results of these countries change by expressing that stocks with lower cash-ratio tend to face the contagion problem more than stock with a higher cash-ratio. As firms with higher liquid assets can be viewed as safe shares due to low probability to trigger with the cash shortage problem. This result is consistent with the study from J. Wang et al. (2010) which found that firms with high liquid asset favored to lose less value since they have lower financial constraints.

For investment-to-asset ratio, the results in Table 7C shows the consensus trend, presenting that in the overview, firms with higher investment-to-asset are obviously appearing the evidence of contagion than those firms with lower investment-to-asset. This result is not consistent with the previous evidence from Vito Gala (2006) who purposed that in bad times, firms with lower investment have more constraint to disinvest or sell off their capital stocks but firms with higher investment ratio can exchange their positive investment to additional fund easier due to lower

constraints, compared to the lower investment firm. Therefore, stock of firm with lower investment-ratio will lose more value during that time.

The reason behind this contradict evidence may be described as First, firm with high investment-to-asset can be viewed as this firm becomes more risky due to overinvestment from their manager (Jensen, 1986). Second, during Subprime crisis, almost assets were in trouble. Most projects provided negative returns and contributed intense constraint, come from rental cost, or interest cost, causing liquidity problems to those firms that have ever been invested in large proportion. Hence, performance of firms which have higher investment-ratio should lose more value during Subprime and will faced the contagion problem rather than the stock of firm with lower investment.

Fifth – debt-ratio, although, considering in board picture the result shows those indices which characterized as the higher debt will occur the evidence of contagion more than the indices with lower debt-ratio, which is consistent with the finding from Miyajima and Yafeh (2007) and J. Wang et al. (2010), when focusing in more detail, I find that debt-ratio becomes an important factor that can determine the magnitude of contagion effect, each firm will be affected during Subprime crisis, only for mature markets. The result from Table 7B presents that during Lehman broke down, stock of firms with lower debt-ratio in developed market incline to have less evidence demonstrating an existence of contagion than firm with higher debt-ratio. However, for emerging markets, the proportion of debt to firm's total asset has relatively weak association to chance of detecting the existence of contagion. Specifically, during Lehman and post-Lehman periods, the results show that 4 of 5 emerging markets (except China) do not exhibit the outstanding evidence indicating that stocks with higher debt-ratio were severely affected financial contagion than stocks with lower debt-ratio.

For liquidity – the result, reported in Table 7C, demonstrates that if consider the trend in whole picture, stocks with higher liquidity tend to appear contagion effect to exist more than stock with lower liquidity (illiquid stock) which consistent with the prior evidence asserting that the bad news from the crisis will contribute less negative impact to stocks with lower liquidity to trade than higher liquid stocks since lower liquidity stock appear to respond to new market information slower. (Amihud, 2002)

However, if focus into the evidences from developed country in the first stage and second stage of crisis period, the result shows that higher liquid stocks do not significantly differ to illiquid stocks when analyze to the type of this firm characteristic that likely to incur contagion effect more than another. This weired evidence, indicating indifference between the level of debt to an occurrence of contagion, supports the latest finding from J. Wang et al. (2010) which observed that liquidity did not be the determinant factor to influence U.S. stock returns during subprime crisis, That is, prices of either liquid or liquid stocks were affected by the impact of contagion effect from Subprime crisis similarly.

Beta, I find the mixed results which some of them are not consistent with the hypothesis in section 3.1. The estimation result, reported in Table 7C, can be revealed that not necessarily that all of stock with lower beta likely to be detected less evidence indicating contagion than stock with higher beta. One of possible argument to clarify this result might be that if their country index did not have evidence indicating contagion, those stocks with higher beta, implying that their price are heavily driven by country index, will be weakly affected by contagion as well. Another possible reason is that since this crisis contributes strong impact to financial market leading all of stock indices tend to co-move with U.S. equity market. Therefore, even stocks with low beta, normally have lower correlation with U.S. markets, were driven by this impact in high degree too. The

correlation of these stocks increases significantly, whereas the correlation of those stocks with high beta also increase but does not significant (interdependence)

--- Insert Figure 3 and about here---

For example, In Thailand, according to Figure 3 which presents the conditional correlations between Thailand and U.S market, considered in term of CAPM beta, the Figure shows that during Lehman period (the first lines) correlation coefficients of lower beta stock which have lower level of correlations seem to increase in more level from the pre-crisis (change from 0.12 into 0.16) period than stock with higher beta (still moving around 0.15-0.25), causing low beta stock in Thailand more likely to be detected the evidence of contagion effect if compared to high beta stock. Likewise Thailand, in Figure 3b show that the level of stock market correlations of the lower beta from Canadian equity market seem to increase significantly more percentages from pre-crisis period, if compared to stock with higher beta. Therefore, the result from both markets show that lower beta likely to find a contagion effect than higher beta stocks.

Lastly – Return on asset (ROA), from Table 7C, I find that almost of countries in this sample except Canada (9 out of 10) show the result indicating that stocks of firms with lower ROA likely to be affected contagion more than stocks of firms with high ROA. This finding does not reconcile the evidence from which found that ROA ratio does not be a factor that are significantly related to the co-movement with U.S stock market during 2007-2009 but it support the evidence from J. Wang et al. (2010) which demonstrated that stock with high ROA ratio tend to lose less value on the crash date during 2008 meltdown.

In addition, from Table 7B the result suggests that during subprime, high ROA ratio can be the one of good firm-characteristic that investors could selected to alleviate the impact of contagion,

as several countries show the trend of results pointing out that indices, constructed based on high ROA likely to have no/less evidence, indicating contagion effect are propagating, even consider during the peak of the crisis (the collapsed of Lehman).

Additionally, I find the trend demonstrating that in Brazil and Mexico, which their territory located near the U.S. then, they tend to have high economic and financial linkage with the U.S. market. Their economy always depends on the economy from the U.S. in high degree. Hence, I find that for these two countries, firm characteristics with can be classified as lower constrained or seem to perform as a healthier condition (e.g. large-capital, high market-to-book-ratio or high cash-ratio) tend to have more evidences indicating contagion effect than firm characteristics with can be classified as higher constrained (small- capital, lower market-to-book ratio, lower cash-ratio). Even though, I consider contagion effect during the second stage of crisis period (during Lehman bankrupt) which normally, investors always try to avoid to invest in stock of firm that seem to have riskier condition. One possible reason to explain this trend might come from that only the firm performing less constrained in Brazil and Mexico have the capability to contact with U.S.'s companies that would like to move their capital to invest in Brazil or Mexico. Consequently, during the crisis when several U.S. companies moved their capital back or faced bankruptcy problems so, the valuation of those firms, which have high interaction with the U.S. companies, tend to lose more amount than firms with lower interaction with the U.S..

In sum, I conclude that firm characteristics have an influence for contagion effect to exist. Some firm characteristics are less likely to be found the evidence of contagion such as firm with large cap, high liquid asset (high cash ratio) or high ROA. However, these characteristics may not appropriate to lessen the contagion effect in some period of crisis or in some country. (e.g. The large - cap firm may not lessen the contagion effect in emerging countries during the first stage of the crisis) Nevertheless, investing in firm with high ROA is the best firm characteristics, examine in

this paper) that will provide a higher level of diversification benefit due to less likely to be affected by contagion.

4.2 Results of Examine the relationship between conditional correlation and conditional volatility

---- Insert Table 8 about here-----

Table 8 suggests that the coefficients $\boldsymbol{a_2}$, a proxy to measure the influence of conditional volatility of U.S. market to correlation across countries during 2003-2009, are not statistically significant in almost sample countries except Thailand and Canada but coefficients $\boldsymbol{a_3}$ are statistically positively significant in several countries, meaning that during that time if consider in U.S. investor's perspective, they cannot gain diversification benefit from investing in international equity markets in several countries.

---- Insert Table 9A - 9C about here-----

Change to consider at firm level data. Overview, the result, reported in Table 9A, manifests that both conditional volatility of U.S stock market and the conditional volatility of domestic indices, constructed based on each firm characteristic, are statistically significant and contribute a positive influence to the correlation coefficients, at 10% significance level at least in several countries and several firm characteristics. These findings imply that when the volatility increases (from domestic and/or U.S market), the correlations between U.S. markets and international market, considered based on each firm characteristic, are also likely to hike, causing diversification benefits

decline during this volatile period. However, in China, the result indicates that their correlations do not respond to the volatility from their own market or from the U.S. market like others. Which may come from as a consequence of that they have unique economic, having strictly policy about capital controlled.

Next, considering in each pair of firm characteristic by comparing this-à-this type, beginning with size, I find that conditional volatility of domestic stock and conditional volatility of U.S. stock contributed more positive influence to correlation coefficients of small-cap indices than large-cap indices in almost countries except Mexico. This evidence is another reason for explaining that why the results of Mexico, shown in topic 4.1, indicate that large-cap firms likely to be detected contagion effect more than those groups of small-cap.

For Market-to-book ratio, volatility of U.S. stock market incurs more positive association to correlation coefficients of stock with lower market-to-book ratio than stocks with higher market-to-book ratio. Consequently, in the long run stocks with low market-to-book ratio is likely to be affected contagion problem than high market-to-book ratio stocks. This finding support to the results when investigate contagion, expressing that In the early phase of crisis, stocks with high market-to-book ratio tend to be more infected contagion problem than stocks with low market-to-book, however, as time passed over and over, I find that low market-to-book will replace to receive more contagion effect.

In cash-ratio, I find that in some markets, cash does not be a significant determinant factor to explain the impact of conditional volatility to the correlation across-country. That is correlations of high cash-ratio and low cash-ratio of developed country tend to be affected by the conditional volatility of U.S. market in the same magnitude. In addition, the influence of conditional volatility from domestic market, constructed based on either higher or lower cash-ratio also contribute the

same level of association to the correlation coefficient between U.S. and stock from emerging markets.

However, results from the rest countries suggest the trend indicating that correlations of stock with higher cash-ratio will be stronger determined by conditional volatility from the U.S. market than those stocks with lower case-ratio (Korea, Brazil, Mexico and Canada) whereas, stocks with lower cash-ratio will be more driven by conditional volatility from domestic market relative to stocks with higher cash (the evidence from Germany Japan and Canada)

In terms of investment-to-asset ratio and debt-ratio, the results are inconclusive and variety since they do not exhibit an outstanding trend of the difference when compare each couple of correlations, consider based on firm characteristic, that are determined by stock volatility, come from domestic and/or U.S. stock markets.

Turning to consider the impact of firm's liquidity, I find an obvious result, suggesting that over Subprime period, the volatility of U.S stock market can influence correlation coefficients of stocks with lower liquidity more magnitude than stock with higher liquidity which reconcile with the evidence when consider in term of size, as these two factors are highly correlated. However, correlation of higher liquid stock become more associated by the conditional volatility from domestic market, if compared to low liquid stocks, meaning that high liquid shocks will react to the internal shocks more magnitude than the lower one.

Firm's beta – Table 9C report that several countries have evidences presenting that stock with lower beta likely to be driven by volatility from their own market more than stock with a higher beta especially, the evidence from developing country. However, if switch to consider to the impact of volatility spread from the U.S. market, many countries do not show the specific type of CAPM beta that will incur greater influence to pairwise correlation like the result of the domestic.

This evidence reconciles to the finding, reported in Table 3 which show that during crisis period volatility of lower beta stock has gradual increase but their correlation quite increase a lot, if compared to pre-crisis period, whereas the volatility of higher beta stock has dramatically increased but their correlation seem to increase in a lower degree. This illustration implies that the correlation of lower beta is sensitive to the shock from their own market more magnitude than stock with a higher beta as their volatility increase a bit but the correlations rise in high amount. This evidence comes from the effect of correlations break-down during crisis period – the correlation of returns between two markets increase due to an increase of volatility in one market. Then, in U.S. investor's perspective, the diversification benefit from investing in low beta stock from international equity markets seems to decline in larger amount, if compared to reduction of diversification benefit when invest in high beta shares.

Last but not least, ROA – the results from a Table 9A-9C demonstrate that correlation of stock of company with lower ROA ratio will rise by the volatility form U.S. market more association than the stock with higher ROA especially, the evidence from developing markets in this sample. Besides from Table 9A, I find that the coefficients $\boldsymbol{a_3}$ which represent the impact of volatility from U.S. market of high ROA ratio indices from England, Hong Kong and Canada markets demonstrate the significantly negative value which imply that when the volatility of U.S. market rise the correlation between this firm characteristic and U.S. stock market tend to fall, causing the usefulness to gain the diversification benefit from this kind of stock during Subprime. This evidence also supports that why we do not find the evidence indicating contagion existing in stock with high ROA in many countries in Table 7A.

4.3 Result of testing the effect of unexpected change in policy rates

This section I will provide the result from testing the impact of unexpected change in policy rate to dynamic structure of cross-country correlations between returns from U.S. market and returns from international markets, considered based on firm characteristics.

---- Insert Table 10, 11A-11D about here -----

However, before going to reveal the estimation results, testing the impact of unexpected change in policy rates to cross country correlations. I would like to present the result of contagion testing after concerning the impact of unexpected change in policy rate. In other words, after adding an unexpected change in the policy rate to be the control variable as written in e.q.10, I will reexamine whether the evidence of contagion testing (focusing on $\boldsymbol{b_i}$ coefficients of dummy variable have changed from the result, presented in section 4.1

I find that the result stays unchanged indicating that there exists a contagion effect regardless of whether control variable is added into the model or not. Taking the size issue in the China case for instance, Table 7C, the result from the model that the control variable (an unexpected change in policy rate) is omitted, shows that there is an evidence of contagion impact for the size issue in several emerging countries tested except China. Large-capital equities tend to be adversely affected more than those small-capital stock during the first-stage of the crisis. Further in Table 11D, even after I have controlled for an unexpected change in policy rate, the result still confirms the existence of the contagion effect in almost nations analyzed including China. In brief, in all firm characteristics tested, I observe that the trend of results reported in Table 11D, specifying

the type that are likely to strongly affected by contagion in each period, still consistent with the result presenting in Table 7C.

I also notice that for cash-ratio, after comparing the result of contagion testing between Table 7C (without accounting the impact of unexpected change in policy rate) and Table11C (concerning the impact of change in policy rate) though, the trend of results does not considerable changes, I find that cash-ratio become an outstanding firm characteristics that their result are differ from the original in several countries and time periods. This mean that cash-ratio likely to be firm characteristics that sensitive to the impact of unexpected change from policy rate more than the others.

In conclusion, the evidence of contagion testing in this section suggests that an unexpected change in policy rate may shape the cross-country correlation only during announcement date of monetary policy meeting of the U.S. or domestic Central bank to change. However, if considering the dynamic structure of correlation in long period like when analyze contagion effect, it has weak association to drive the correlations during crisis period to permanently increase from pre - crisis period. Hence, almost evidences of contagion testing does not differ to the result from Section 4.1.

Turning back to consider the impact of unexpected change in policy rate to cross-country correlations. I find that regardless of the fact that, some recent studies demonstrated unexpected change in policy rate did not determine stock returns during subprime crisis (A. Gregoriou et al., 2009; Kontonikas et al., 2013), this paper find that surprise of monetary policy announcement from both U.S. Central Bank and Domestic Central Bank still has an influence on the correlation coefficients between U.S. and their own markets, even consider in aggregate or firm level data, constructed based on several kinds of firm characteristic.

The significant of lagged term implying that the impact of this surprise dose does not fade away within one day due to different speeds in reacting to the announcement, purposed by Chiang et al. (2007). In addition, the significant of this term come from the fact that I use daily data to analyze financial contagion causing, I have pre-correlation between the returns of international markets at day (t+1) or day (t) and the return of the U.S. market of the day (t) as mentioned in section 3.2. Then today cross-country correlation will be affected by unexpected change from the U.S. Central Bank or from its own Central Bank, announced on today or previous day.

For example, supposed we are looking at the pair-correlation between U.S. and Thailand stock in day 2, consisted of stock returns from U.S. in day 2 and stock returns from Thailand in day 3 as shown in Table12, hence the correlation of this day may be determined by the surprised in monetary policy announced from U.S. Central Bank on day 2 and announced by Thailand's Central Bank on day 1 (meaning affected the surprised at one day lagged from Thailand)

---- Insert Table 12 about here-----

Besides, the results from Table 11A and 11B exhibit that correlations of several stocks, considered based on firm characteristic, from emerging markets (e.g. Thailand, Brazil, Mexico or Korea) tends to have more amount of evidences, indicating that their correlation are significantly influenced by a surprised change from the U.S. policy rate than the evidence from developing countries. This evidence implies that correlations of stocks from developed market have a weaker association determined by the surprise change from the Fed announcement if compared to emerging.

In addition, Table 11A also indicates that In China, Thailand, Korea, England, Germany, Japan and Hong Kong markets, the correlations between U.S. equity market and their market,

constructed, based on several kinds of firm characteristic, are positively determined by the surprise change from the U.S. policy rate ($\boldsymbol{\varphi_s^1}$; s= -1, 0) whereas in Brazil, Mexico and Canada, their correlation coefficient is inclined to be negatively associated.

One of the possible reasons to explain why the sign of surprise change, affecting on correlation, is different in each country is due to the dissimilarity of speeds in reacting to the announcement. As in China, Thailand, Korea, England, Germany, Japan and Hong Kong markets, they have trading hour that quite inconsistent with the trading time in U.S markets and basically move along with the one day lag in U.S. which contrast to Brazil, Mexico and Canada that always have contemporary trading time with the U.S. stock. Therefore, if stock returns in both England and U.S. react spontaneously to this unexpected change, but with the different speeds as the impact of trading-hours so, the correlation coefficients tend to decline as investors have more time to adjust their portfolio against anomalies in the U.S. market. This phenomenon causes the correlations of these markets tend to have a positive relationship to negative surprise from U.S. policy rates. In addition.

Conversely, supposed the returns of stock of Canada, Brazil and Mexico market, located nearby U.S. co-move with the return of the U.S. equity market at the same speed, leading their correlation coefficient still to become positive even though, during a subprime unexpected change in policy rate did not contribute negative influence to returns of U.S. stock as argued by A. Gregoriou et al. (2009), since their stocks have already responded and adapt consistent with this anomaly performance immediately, consequently, the negative surprise from U.S. policy rate will contribute positive impact to their correlation coefficients.

For the impact of an unexpected change of domestic policy on the correlation coefficient, the result indicates that unexpected change of domestic policy has less influence to the correlation coefficient if compared to unexpected changes of U.S. policy. Additionally, I observe that an

unexpected change in the policy rate from Germany and Japan tend to have an influence on the pairwise correlation between these countries and U.S. stock markets more than the rest country. These results may be according to the fact that these countries have large economy, causing the unexpected decision of their Central Banks (ECB and BOJ) will not only determine stock return in their market but also influence the returns on the U.S. stock market.

On the other hand, some countries, e.g. Thailand, Brazil or Mexico, their economy is categorized as small and normally do not have an influence on U.S market. Then, the result of these countries demonstrates that unexpected change of policy rate from their Central Bank tend to dose not have significant dominant to the correlations between U.S. and these countries.

Changing to consider the attribution of each firm specific characteristic to the influence of surprise change from U.S. policy rate on the correlations, starting with size and market to book ratio, I find that correlations of stock with, no matter which are classified as large or small shares, or no matter which are classified as low or high market-to-book ratio, are likely to be influenced by this surprise change in identical magnitude as most of evidences (6 out of 10 countries) indicate the statistically indistinguishable of the difference between these couples. These results are inconsistent with hypothesis 2 which I expected that large-cap stock and stock of firm with high market-to-book ratio, defined as low constrained firm, tend to more strongly react to this monetary surprised than small-cap and stock with lower market-to-book ratio, respectively, but this evidence seem to consistent with the finding from Yaowaluck (2012) which found that market-to-book ratio and size are not as important factors to influence returns of Thailand stock during the U.S. announcement date.

However, for cash-ratio I find the trend indicating that stock of firms with higher cash-ratio in several countries, their correlations likely to react to the unexpected change from U.S. monetary policy more magnitude than firms with lower cash-ratio.

To illustrate, in Brazil, which their correlation is negatively related to this unexpected change in U.S policy rate, implying that an unexpected cut (negative surprised) in U.S. fed-fund rate leads the dynamic correlation of returns between U.S. and Brazil stock market to rise. Hence, the result from Table 11C can be interpreted that on average, during the monetary announcement from U.S. returns of stock with a higher cash - ratio in Brazil will co-move with returns from U.S. stock in more degree[10], if compared to stock with lower cash - ratio.

For investment ratio, debt ratio and liquidity ratio I find that several countries do not show the outstanding of the difference when I compare each pair of firm characteristic with respect to unexpected change in the policy rate from the U.S. Central Bank.

For beta, the result suggests that correlation of stock with dissimilar types of beta tend to react to the impact of this U.S. policy surprise differently - correlations of high beta stock likely to be influenced by this unexpected change more than those stocks with low beta. This finding reconciles with the argument of Wongswan (2009) which proposed that stocks with having more sensitive to the market movement, their returns will react more responding to the U.S. policy surprised.

For ROA, I find that if considering in developed markets, 3 out of 5 countries in this group show that the correlation of indices, classified as a proxy of company with lower-ROA ratio seem to be influenced by the surprise change from U.S. monetary action more magnitude than those indices, representing higher-ROA ratio. However, if the focus into emerging markets, I find the trend indicate that correlation of stock with higher ROA ratio will respond to this surprise higher than stock with lower ROA. The explanation for the difference between these evidences might come from that in emerging markets, firms with high ROA have the capacity to access to global funding

10 If returns of U.S. stock rise, on average the return of firm with higher cash rise more amount but if the returns of U.S. stock fall, the return of firms with higher cash will decline more as well.

resources, hence when the surprised occurs from U.S., and affecting global interest rates, this company likely to get the impact more than firms with lower ROA, which are able to access to global exposure harder. In contrast, in developed county, lower ROA firms will face that they can raise additional fund harder if compared with higher ROA firms then their correlations likely to be more sensitive to the unexpected change from the U.S. policy rate. Karim (2009); Yaowaluck (2012)

Therefore, I conclude that, the impact of unexpected change in U.S. monetary policy still have an influence on the correlations of stock indices between international and U.S. equity markets, in term of firm level data, based on firm specific characteristic. The evidence supports that the firm characteristic is matter to this impact which consistent with the expectation in hypothesis 2. The outstanding firm characteristic that has strong evidences, indicating that it will grant more pronounced contribution to the effect of surprise change in U.S. monetary are consisted of firms with higher cash-ratio or higher CAPM beta. Additionally, ROA is another firm characteristic that has an influence to this relation, but the specific type of ROA depend on the kind of markets (developed or emerging). However, in the aspect of size, market-to-book ratio, Investment-to-asset, debt-ratio, and liquidity-ratio there has weak evidence to support that these factors can determine the correlations during the U.S announcement date.

Next, I will provide the result from the unexpected change in domestic policy rate on the correlations. Interestingly, I find that only size becomes an important factor to determine correlation coefficient during an announcement date since several countries (5 out of 9) exhibit that an unexpected change in domestic policy will relatively contribute more impact on the correlation of the small-cap firm than those large-cap. However, for market-to-book ratio, the result still indicates an indifference of the attribution of this firm characteristic to the pairwise correlations similar to the result when analyzing the surprise occurring from the U.S. Central Bank.

Similarly for the rest of firm characteristics, cash ratio, investment ratio, firm's liquidity, debt ratio, CAPM beta and ROA ratio, I find mixed evidence suggest that these multiples are not as important factors as they did when considering in term of surprise change, come from the U.S. since they do not exhibit the outstanding trend indicating the specific type that likely to contribute more influence to correlations during the announcement date.

In summary, the impact of unexpected change in domestic monetary policy on the correlations of stock indices between international and U.S. equity markets, in term of the firm level data, based on firm specific characteristic. I find that only stocks with small-cap tend to determine the correlation coefficients more than others. Additionally, size is firm specific characteristic that has evidence support with the argument from Ehrmann and Fratzscher (2004); Wongswan (2009) which pointed that firm with high constrained characteristic should absorb more impact of change in Central bank action than the unconstrained.

Chapter 5
Conclusion

The topic on financial contagion has become more consideration as financial inter-linkage played a crucial role during crisis. However, most of existing evidences used aggregate stock indices to test the contagion effect which cannot provide a narrow scope for selecting the proper share in order to alleviate the contagion effect. Therefore, this paper is aimed to investigate the spread of Subprime mortgage crisis, which are called "financial contagion" to other international equity markets by focusing on firm level data based on several types of firm characteristics. I use the dynamic conditional correlation (DCC) model to capture the shift in the time varying correlation and construct the indices, representing of each type of firm characteristic, to analyze contagion.

The finding indicates that at firm level, there is heterogeneity in the contagion effect, incurred by the subprime crisis, to individual stocks in each country. I find the trend, indicating that stocks with large capitalization incline to have less evidence of contagion and also find that correlation of stocks of companies with higher market-to-book ratio, lower debt ratio, higher cash-ratio are tend not to significantly increase during subprime. Investing in stocks with low Beta is not a good choice to alleviate contagion in some markets, however, investing in firms with high level of ROA become a better guideline to investors in order to lessen contagion effect during Subprime.

In addition, since time-varying correlation that be used to investigate contagion in this paper may be influenced by several factors. Then, I also examine the impact of conditional volatility from U.S. market and conditional volatility from domestic market, based on firm characteristic to the pair-wise correlations by concerning the impact of firm characteristics to this relationship. The result suggests that both of these volatility have a positive influence to the correlation coefficients. Stocks with small-cap or with lower ROA are only outstanding types of firm

characteristics that have distinguishable evidences, suggesting that they are likely to be influenced by these stock's variance in high degree. On the other hand, for the rest, I cannot find the prominent trend when comparing the difference in the degree of their association.

Besides, I also study the impact of news about changes in policy rate during Subprime that might affect to the correlation coefficients. The finding indicates that surprised changes in monetary policy rate from both U.S. Central Bank and Domestic Central Bank can shape the dynamic structure of correlation, even some studied indicated that the surprise of monetary policy action cannot determine stock returns during Subprime.

I observe that the unexpected change in the policy rate from the U.S. Central Bank likely to have more emphatic effect on the stock market correlations of the company that have high cash-ratio, high ROA or high beta. However, for the rest of firm characteristics such as size, market-to-book ratio, investment-ratio, they are not being an important factor that has an influence to the relations between unexpected change in U.S. policy rate and stock market correlations.

However, if I focus on the impact of unexpected change, come from the domestic policy rate, I find that it will contribute strong influence to stock market correlations of only the firm with small-cap. On the other hand, for the rest (e.g., market-to-book, cash ratio, investment ratio, beta or liquidity ratio) they have weak evidence to support the role of these firm-specific idiosyncratic-factors into an explanation of the response of correlation coefficients to the news about changes in domestic monetary policy rate.

Future research could investigate contagion, based on firm characteristic that transmitting from other event such as Asian crisis or European debt crisis. Future research can be another type of data, such as weekly data or micro data for analyzing contagion and then compare the result with this finding. Additionally, focusing in other firm characteristics that can lessen contagion or analyzing the impact of other explanatory variables (e.g. change in other macro-variable) that can

shape the pattern of stock market correlations to increase are another interesting topic to study, such as the firm-characteristic like current-ratio or the proportion of foreign-asset to total firm-asset.

Table 1: Result of structural break date testing.

The estimated breakpoint specifications of U.S. stock, using the sample between 1/1/2003 – 31/10/2009 and 5 maximum breakpoint to estimate, generated by E-views

Schwarz criterion selected breaks:	5
LWZ criterion selected breaks:	5

Breaks:	Sum of Sq. Resids.	Log-L	Schwarz* Criterion	LWZ* Criterion
1	3.13E+09	-21969.44	14.00599	14.02424
2	1.59E+09	-21088.93	13.33729	13.36771
3	1.13E+09	-20642.52	13.00124	13.04383
4	1.00E+09	-20484.20	12.88596	12.94071
5	8.55E+08	-20276.95	12.73317	12.80010

Estimated break date

1: 11/04/2004

2: 11/17/2005, 9/29/2008

3: 11/04/2004, 9/27/2006, 9/15/2008

4: 7/02/2002, 12/31/2003, 1/06/2006, 9/29/2008

5: 7/02/2002, 12/31/2003, 6/30/2005, 12/29/2006, 9/15/2008

Table 2: How to identify proxy of each firm characteristic

Characteristic	Proxy	Calculated by
Size	*Size*	- log of market capitalization,
Valuation	*Market-to-Book*	- book value of equity/market value of equity
Cash-Flow	*Liquid-to-asset*	- (cash + marketable securities) / total asset
Investment	*Investment-to-Asset*	- investment is the annual change in property, plant, and equipment divided by lagged total asset
Liquidity	*Illiquid ratio* $\frac{\sum_{i=1}^{T} \frac{\lvert r_i \rvert}{Volume_i}}{T}$	- where r stands for returns. Volume is the daily volume. T is the estimation period, -252 to -30 days prior to crash event
Leverage	*Liquid-to-asset*	- (cash + marketable securities) / total asset
Beta	*CAPM beta*	- computed with monthly returns data for 5 years period prior to the event date, obtained from Data stream
Earning	*ROA*	- income before extraordinary item / total asset

Table 3: Descriptive statistics on stock return of established indices

Country	Characteristic		Panel A : Before crisis Mean.	Var.	Skew.	Kurt.	Corr.	Panel B: After crisis Mean.	Var.	Skew.	Kurt.	Corr.
U.S.			0.060	0.542	-0.019	1.511	-	-0.044	4.202	-0.242	5.389	-
China	Size	-Small	0.034	2.837	-0.545	2.345	0.000	0.084	6.249	-0.723	1.382	0.132
		-large	0.094	2.195	-0.433	5.020	0.016	-0.026	6.440	-0.369	1.079	0.168
	M/B	- Low	0.079	2.970	-0.753	4.661	-0.007	0.048	8.226	-0.646	1.283	0.130
		- High	0.050	2.140	-0.390	4.504	0.018	-0.021	5.876	-0.402	1.335	0.157
	Cash	- Low	0.083	2.678	1.278	23.951	0.004	0.005	6.305	-0.528	1.208	0.149
		- High	0.090	2.877	1.203	22.231	0.000	0.010	6.555	-0.483	1.405	0.148
	IA	- Low	0.064	2.659	-0.560	3.589	-0.006	0.045	6.964	-0.551	1.298	0.128
		- High	0.084	2.423	-0.605	4.863	0.016	-0.016	6.970	-0.483	1.138	0.159
	Debt	- Low	0.070	2.380	-0.526	4.347	0.006	0.012	6.118	-0.427	1.334	0.150
		- High	0.056	2.475	-0.497	3.018	-0.001	0.011	6.991	-0.562	1.104	0.143
	Liq	- Low	0.101	2.511	-0.545	4.774	0.012	0.007	7.465	-0.486	1.143	0.147
		- High	0.017	2.399	-0.524	2.656	0.000	0.008	5.404	-0.515	1.359	0.151
	Beta	- Low	0.073	2.032	-0.633	5.689	0.004	0.004	5.580	-0.387	1.436	0.143
		- High	0.058	2.826	-0.439	2.502	0.009	0.016	7.751	-0.567	1.135	0.149
	ROA	- Low	0.039	2.677	-0.499	2.144	-0.004	0.042	6.431	-0.638	1.147	0.130
		- High	0.093	2.265	-0.458	4.730	0.020	-0.008	6.149	-0.371	1.258	0.166
Thailand	Size	-Small	0.061	0.792	0.050	4.977	0.093	-0.020	0.619	-1.322	5.343	0.186
		- large	0.073	1.666	-0.719	14.784	0.076	-0.054	2.383	-1.095	6.724	0.309
	M/B	- Low	0.060	0.479	-0.262	5.394	0.063	0.029	0.858	-1.057	5.342	0.232
		- High	0.066	1.622	-0.779	8.330	0.081	-0.075	1.416	-1.064	6.942	0.264
	Cash	- Low	0.054	0.732	-0.834	11.431	0.040	-0.021	0.459	-1.348	8.162	0.192
		- High	0.064	0.895	0.670	32.263	0.046	-0.018	1.247	-1.537	8.821	0.277
	IA	- Low	0.044	0.735	0.378	18.570	0.058	-0.020	0.823	-0.968	4.053	0.231
		- High	0.088	1.278	-0.743	10.513	0.052	-0.052	1.892	-0.921	4.869	0.263
	Debt	- Low	0.027	0.473	-0.590	7.233	0.048	-0.026	0.751	-2.008	14.994	0.225
		- High	0.112	2.034	-0.304	8.019	0.092	-0.067	1.049	-0.952	3.975	0.230
	Liq	- Low	0.070	2.386	-0.804	11.880	0.079	-0.056	3.717	-0.628	4.274	0.311
		- High	0.049	0.313	0.233	2.375	0.041	-0.025	0.306	-0.739	3.854	0.111
	Beta	- Low	0.047	0.580	-3.848	66.607	0.004	-0.017	0.362	-1.446	8.976	0.174
		- High	0.059	2.314	-0.752	9.085	0.086	-0.066	2.726	-1.259	6.352	0.289
	ROA	- Low	0.070	1.480	-0.504	9.161	0.112	-0.047	1.115	-1.675	9.040	0.206
		- High	0.045	0.890	-1.583	32.781	0.162	-0.017	1.107	-1.103	5.898	0.293

Table 3: continued - I

Country	Characteristic		Panel A : Before crisis Mean.	Var.	Skew.	Kurt.	Corr.	Panel B: After crisis Mean.	Var.	Skew.	Kurt.	Corr.
Brazil	Size	-Small	0.181	1.310	0.200	7.694	0.201	0.037	2.491	-0.272	3.482	0.506
		-large	0.114	2.561	-0.145	0.762	0.473	0.008	6.420	-0.251	3.656	0.722
	M/B	- Low	0.207	1.767	4.735	82.057	0.333	0.086	4.671	-0.282	2.381	0.643
		- High	0.130	2.046	-0.446	33.776	0.295	-0.065	3.449	-0.634	7.574	0.645
	Cash	- Low	0.182	3.259	10.188	223.40	0.230	0.016	2.321	-0.335	2.933	0.643
		- High	0.103	1.550	0.324	21.472	0.335	0.040	3.447	-0.122	5.219	0.602
	IA	- Low	0.198	2.407	-0.131	4.728	0.395	-0.008	3.917	-0.435	5.500	0.646
		- High	0.160	2.319	9.072	193.22	0.280	0.018	6.448	-0.244	4.309	0.701
	Debt	- Low	0.170	2.065	0.173	4.110	0.328	0.004	4.714	-0.607	4.403	0.617
		- High	0.187	2.973	0.276	19.22	0.230	0.024	5.453	-0.285	4.643	0.698
	Liq	- Low	0.133	2.792	-0.061	0.983	0.491	0.017	5.922	-0.150	3.452	0.723
		- High	0.141	1.303	-0.019	11.206	0.138	0.014	2.409	-0.469	2.109	0.556
	Beta	- Low	0.175	1.464	9.234	193.61	0.114	-0.038	2.246	-0.659	3.518	0.574
		- High	0.131	2.329	-0.313	1.051	0.476	0.019	7.198	-0.101	3.440	0.708
	ROA	- Low	0.183	2.252	-0.233	1.767	0.314	-0.031	3.513	-0.417	4.463	0.666
		- High	0.172	1.495	3.347	53.108	0.363	-0.002	4.316	-0.310	2.694	0.659
Mexico	Size	- Small	0.139	0.719	-0.003	5.010	0.084	-0.031	0.980	-0.915	12.836	0.174
		-large	0.137	0.884	-0.179	3.279	0.603	0.004	2.692	0.163	2.252	0.759
	M/B	- Low	0.157	0.618	0.582	12.602	0.095	-0.020	0.773	-0.889	7.660	0.280
		- High	0.138	0.889	-0.182	3.575	0.535	-0.053	2.236	-0.069	2.374	0.700
	Cash	- Low	0.120	0.439	0.086	9.219	0.361	-0.069	1.000	0.112	17.242	0.320
		- High	0.122	0.833	-0.499	6.800	0.489	-0.026	2.609	-0.114	2.944	0.719
	IA	- Low	0.132	0.572	-0.351	7.114	0.419	-0.041	1.696	-0.299	3.009	0.649
		- High	0.149	0.497	-0.106	2.487	0.404	0.006	1.120	-0.227	1.535	0.534
	Debt	- Low	0.133	0.643	-0.340	4.687	0.351	-0.041	1.377	-0.589	3.248	0.523
		- High	0.106	0.657	0.311	7.358	0.339	-0.024	1.879	-0.357	4.660	0.546
	Liq	- Low	0.156	1.188	-0.376	3.142	0.616	-0.042	4.631	-0.056	6.390	0.760
		- High	0.112	0.819	-0.297	5.650	0.098	-0.029	0.609	-0.670	4.455	0.239
	Beta	- Low	0.110	0.514	-0.288	6.190	0.391	-0.023	1.152	-0.195	1.188	0.501
		- High	0.160	1.837	8.614	199.49	0.279	0.006	5.000	-1.181	16.280	0.346
	ROA	- Low	0.077	0.859	-0.371	16.007	0.007	-0.095	1.235	-2.846	32.603	0.028
		- High	0.142	1.068	8.576	188.25	0.062	0.014	4.481	-0.998	9.847	0.023

Table 3: continued - II

Country	Characteristic		Panel A : Before crisis					Panel B: After crisis				
			Mean.	Var.	Skew.	Kurt.	Corr.	Mean.	Var.	Skew.	Kurt.	Corr.
England	Size	-Small	0.151	0.202	-0.555	2.408	0.311	0.005	0.789	-0.807	1.964	0.356
		- large	0.052	0.214	-0.043	4.495	0.363	0.000	1.323	-0.167	2.072	0.409
	M/B	- Low	0.120	0.214	-0.770	2.895	0.495	-0.039	1.730	-0.428	2.572	0.517
		- High	0.065	0.183	-0.677	4.010	0.497	-0.036	1.513	-0.459	3.169	0.593
	Cash	- Low	0.095	0.208	-0.909	3.134	0.535	-0.091	1.195	-0.322	1.053	0.538
		- High	0.096	0.267	-0.787	5.615	0.459	-0.006	1.728	-0.507	2.237	0.578
	IA	- Low	0.082	0.243	-0.749	2.181	0.509	-0.053	1.101	-0.564	1.498	0.550
		- High	0.091	0.237	-0.869	5.016	0.465	-0.054	1.634	-0.677	2.959	0.558
	Debt	- Low	0.108	0.213	-0.799	4.041	0.502	-0.041	1.522	-0.820	4.702	0.572
		- High	0.071	0.220	-0.724	4.156	0.479	-0.027	1.325	-0.159	0.956	0.580
	Liq	- Low	0.060	0.360	0.108	3.528	0.569	-0.037	1.828	0.069	3.649	0.618
		- High	0.101	0.204	-0.723	3.705	0.386	-0.069	0.737	-0.490	2.014	0.330
	Beta	- Low	0.106	0.216	-0.594	4.837	0.371	-0.037	0.979	-0.866	3.313	0.470
		- High	0.112	0.430	-0.193	1.669	0.467	0.014	2.702	-0.097	1.285	0.557
	ROA	- Low	0.111	0.565	-0.659	3.422	0.382	-0.040	2.547	-0.405	2.302	0.493
		- High	0.087	0.431	-0.788	8.572	0.349	-0.027	2.897	-0.471	2.432	0.538
Germany	Size	-Small	0.133	0.389	-0.269	1.077	0.320	-0.068	0.685	-0.398	6.896	0.492
		- large	0.112	0.467	-0.916	4.053	0.556	-0.087	1.717	-0.521	2.610	0.587
	M/B	- Low	0.141	0.419	-0.200	4.686	0.348	-0.061	0.634	-0.627	3.715	0.521
		- High	0.101	0.394	-1.158	6.592	0.453	-0.098	1.432	-0.580	5.063	0.574
	Cash	- Low	0.113	0.271	-0.528	2.413	0.430	-0.064	0.756	-0.648	4.536	0.554
		- High	0.090	0.441	-0.874	3.601	0.457	-0.058	1.285	-0.381	6.325	0.558
	IA	- Low	0.099	0.380	-0.612	2.143	0.407	-0.064	0.880	0.960	13.079	0.454
		- High	0.115	0.441	-1.049	6.280	0.368	-0.107	1.554	-0.587	3.192	0.564
	Debt	- Low	0.078	0.792	-0.311	2.119	0.362	-0.083	1.472	-0.539	3.775	0.479
		- High	0.142	0.448	0.221	4.392	0.430	-0.118	0.861	0.695	10.729	0.455
	Liq	- Low	0.122	1.546	-0.998	9.031	0.552	-0.081	5.659	0.191	5.985	0.690
		- High	0.092	1.157	-0.722	14.948	0.134	-0.117	0.929	-0.228	4.525	0.251
	Beta	- Low	0.084	0.152	-0.133	4.047	0.017	-0.080	0.479	-0.168	7.400	0.021
		- High	0.118	0.610	-0.860	4.292	0.512	-0.094	2.211	-0.496	2.945	0.568
	ROA	- Low	0.129	1.566	-0.129	3.208	0.258	-0.102	2.218	-0.783	2.778	0.410
		- High	0.106	0.863	-1.476	15.148	0.390	-0.076	3.011	0.242	10.432	0.570

Table 3: continued – III

Country	Characteristic		Panel A : Before crisis					Panel B: After crisis				
			Mean.	Var.	Skew.	Kurt.	Corr.	Mean.	Var.	Skew.	Kurt.	Corr.
Korea	Size	-Small	0.114	1.208	-1.787	12.361	0.266	-0.072	2.048	0.227	12.598	0.479
		-large	0.071	1.166	-0.463	1.614	0.428	-0.126	5.081	-0.264	4.743	0.585
	M/B	- Low	0.101	0.810	-1.225	6.501	0.332	-0.052	2.677	0.040	6.341	0.512
		- High	0.065	1.543	-1.267	8.029	0.332	-0.138	3.613	-0.246	6.955	0.501
	Cash	- Low	0.094	1.120	-1.196	5.606	0.340	-0.092	3.631	-0.055	6.508	0.512
		- High	0.075	1.535	-1.236	7.918	0.308	-0.069	2.637	-0.273	6.680	0.501
	IA	- Low	0.077	0.936	-1.145	6.126	0.335	-0.090	2.732	-0.079	6.874	0.522
		- High	0.083	1.126	-1.474	8.884	0.319	-0.121	3.949	-0.192	5.884	0.511
	Debt	- Low	0.085	0.944	-1.464	8.734	0.330	-0.104	2.991	-0.127	6.493	0.507
		- High	0.079	1.227	-1.001	4.768	0.340	-0.104	4.112	-0.116	5.505	0.534
	Liq	- Low	0.097	0.881	-1.100	5.204	0.358	-0.086	3.326	-0.003	5.501	0.538
		- High	0.074	1.059	-1.624	10.769	0.319	-0.098	2.197	-0.132	8.227	0.520
	Beta	- Low	0.065	0.430	-1.204	7.225	0.308	-0.063	1.445	0.091	12.906	0.458
		- High	0.084	2.025	-1.099	5.782	0.305	-0.121	5.631	-0.052	5.545	0.497
	ROA	- Low	-0.019	6.356	-21.76	623.49	0.147	-0.117	3.478	-0.311	4.773	0.503
		- High	0.001	0.000	-1.134	6.525	0.275	-0.001	0.000	0.131	9.469	0.451
Japan	Size	-Small	0.070	1.549	-1.316	7.260	0.281	0.020	2.832	-1.600	10.237	0.365
		-large	0.104	1.885	-0.610	1.889	0.285	-0.016	4.716	-0.528	5.690	0.315
	M/B	- Low	0.182	0.996	-0.677	3.311	0.295	-0.014	2.953	-1.230	8.555	0.206
		- High	0.112	1.688	-0.741	3.379	0.300	-0.077	5.216	-0.632	4.838	0.243
	Cash	- Low	0.122	1.314	-0.956	3.877	0.298	-0.059	3.739	-0.874	5.627	0.238
		- High	0.140	1.094	-0.756	3.112	0.335	-0.057	4.004	-0.873	6.626	0.239
	IA	- Low	0.163	1.406	-0.660	2.490	0.292	-0.019	3.225	-0.544	5.934	0.217
		- High	0.121	1.601	-0.621	3.324	0.288	-0.121	14.170	-0.393	3.509	0.190
	Debt	- Low	0.112	1.001	-0.719	4.102	0.284	-0.068	3.303	-0.688	5.444	0.226
		- High	0.109	1.939	-0.852	4.421	0.259	-0.068	5.157	-1.234	6.846	0.202
	Liq	- Low	0.133	1.886	-0.866	3.625	0.313	-0.046	5.939	-0.706	5.467	0.276
		- High	0.137	0.752	-0.634	2.508	0.291	-0.076	2.473	-1.314	8.845	0.269
	Beta	- Low	0.095	1.057	-0.651	2.588	0.252	0.001	1.682	-1.318	11.166	0.361
		- High	0.079	2.247	-0.894	3.359	0.294	-0.038	6.086	-0.685	4.764	0.314
	ROA	- Low	0.100	2.020	-0.980	3.267	0.274	-0.020	3.921	-1.192	6.738	0.351
		- High	0.071	1.187	-0.803	2.696	0.319	-0.001	3.041	-0.756	7.226	0.352

Table 3: continued – IV

Country	Characteristic		Panel A : Before crisis Mean.	Var.	Skew.	Kurt.	Corr.	Panel B: After crisis Mean.	Var.	Skew.	Kurt.	Corr.
H.K.	Size	-Small	0.195	1.529	-0.750	5.595	0.269	0.029	4.127	-0.901	3.634	0.476
		- large	0.117	1.918	-0.264	3.588	0.397	-0.037	9.531	-0.038	3.286	0.457
	M/B	- Low	0.191	1.552	-0.349	3.029	0.318	-0.027	6.469	-0.345	2.804	0.471
		- High	0.111	1.569	-0.535	4.464	0.394	0.002	4.956	-0.347	3.238	0.437
	Cash	- Low	0.153	2.379	-0.503	3.247	0.305	-0.031	10.069	-0.014	2.621	0.461
		- High	0.133	1.313	-0.673	4.309	0.358	0.014	5.532	-0.353	2.536	0.471
	IA	- Low	0.160	1.746	-0.097	5.546	-0.012	-0.024	6.005	-0.126	2.802	0.019
		- High	0.131	1.764	-0.708	3.563	0.376	-0.041	7.880	-0.317	3.665	0.470
	Debt	- Low	0.133	1.967	-0.811	6.184	0.288	-0.003	6.429	-0.413	2.656	0.482
		- High	0.168	2.265	-0.538	4.172	0.321	-0.046	9.118	0.138	3.023	0.443
	Liq	- Low	0.157	2.712	-0.302	2.755	0.352	0.024	11.394	0.200	2.350	0.434
		- High	0.178	1.251	-0.584	4.850	0.144	-0.022	4.411	-0.715	2.814	-0.013
	Beta	- Low	0.161	1.600	-0.474	3.183	0.352	-0.016	3.574	-0.689	3.442	0.490
		- High	0.116	1.722	-0.544	4.511	0.382	-0.036	11.186	0.035	3.092	0.446
	ROA	- Low	0.152	2.018	-0.540	4.757	0.284	-0.050	6.634	-0.157	2.956	0.440
		- High	0.137	1.463	-0.635	3.681	0.416	-0.015	7.696	-0.097	2.128	0.476
Canada	Size	-Small	0.167	1.716	-0.392	4.948	0.305	-0.025	4.706	-0.818	3.115	0.524
		- large	0.094	0.952	0.005	1.610	0.573	-0.051	6.033	-0.570	3.155	0.698
	M/B	- Low	0.106	1.003	-0.864	6.060	0.317	-0.045	3.698	-0.612	3.950	0.657
		- High	0.078	1.305	-0.346	1.838	0.484	-0.066	5.031	-0.694	3.892	0.681
	Cash	- Low	0.106	1.003	-0.864	6.060	0.317	-0.045	3.698	-0.612	3.950	0.657
		- High	0.087	0.904	0.039	2.010	0.574	-0.053	6.148	-0.555	3.000	0.706
	IA	- Low	0.057	0.979	-0.454	2.311	0.430	-0.019	3.760	-0.611	4.765	0.676
		- High	0.087	0.904	0.039	2.010	0.574	-0.053	6.148	-0.555	3.000	0.706
	Debt	- Low	0.057	0.979	-0.454	2.311	0.430	-0.019	3.760	-0.611	4.765	0.676
		- High	0.105	2.229	4.099	77.167	0.343	-0.065	7.505	-0.377	1.821	0.571
	Liq	- Low	0.097	1.335	-0.286	1.429	0.475	-0.047	5.028	-0.559	2.620	0.667
		- High	0.076	0.564	-0.907	4.824	0.564	-0.066	2.177	-0.445	3.438	0.715
	Beta	- Low	0.153	2.630	-0.198	11.775	0.232	-0.047	2.393	-0.498	3.543	0.649
		- High	0.112	0.918	-0.340	1.240	0.616	-0.021	6.195	-0.409	2.571	0.716
	ROA	- Low	0.141	1.746	0.109	2.349	0.434	0.035	12.476	-0.415	3.358	0.572
		- High	0.091	0.605	-0.805	5.649	0.448	-0.062	1.150	-0.390	3.681	0.642

Note: Observations for all series in whole sample period are 1776 observations which (1/1/2003-31/10/2009) are divided into 2 categories – Before crisis period include 1180 and after crisis period include 594 observations respectively. All variables are first difference of the natural log of stocks indices times 100. Varr refers to Variance, Skew refers skewness, Kurt refers to kurtosis, Corr refers to unconditional correlation of stock returns between U.S and international market, constructed based on firm characteristic. Size refer to firm's capital, M/B refer to market-to-book ratio, Cash refer to cash-to-asset ratio, IA refer to investment-to-asset, Debt refer to debt-ratio, Liq refer to liquidity of stock, - Beta refer to CPAM beta, - ROA refer to return-on-asset

Table 4: The impact of size to constructed indices

Country/Cha.	M/B	Cash	IA	Debt	Liq	Beta	ROA
CHN	0.2876	0.27233	0.1982	0.2124	0.3548	0.3400	0.4684
THA	0.4328	0.2445	0.1805	0.2317	0.4900	0.2949	0.4147
BRA	0.3054	0.2683	0.2208	0.1875	0.3948	0.3995	0.3764
MEX	0.4232	0.1467	0.1002	0.1525	0.4724	0.2097	0.3994
ENG	0.3872	0.2395	0.2378	0.2482	0.6158	0.2727	0.2962
GER	0.1980	0.1222	0.1444	0.1490	0.3774	0.1195	0.2021
JAP	0.3261	0.1918	0.2546	0.2778	0.5309	0.3216	0.3335
H.K.	0.3261	0.1918	0.2546	0.2778	0.5309	0.3216	0.3335
CAN	0.3193	0.4954	0.2322	0.2877	0.5755	0.1278	0.2973
KOR	0.4520	0.3157	0.2442	0.1602	0.4176	0.3341	0.3766
Averg.	0.3478	0.2488	0.2067	0.2185	0.4830	0.2742	0.3498

Note M/B refers to market-to-book ratio, Cash refers to cash-to-asset ratio, IA refers to investment-to-asset, Debt refers to debt-ratio, Liq refers to liquidity of stock, - Beta refers to CPAM beta, - ROA refers to return-on-asset.
CHN is an abbreviation of China, THA-Thailand, KOR- Korea, BRA-Brazil, MEX- Mexico, ENG- England, GER- Germany, JPN-Japan, HK-Hong Kong and CAN- Canada)

Table shows the proportion of constructed that are contemporarily located in both of size indices and indices, constructed based on each kind of firm characteristic Since I rank stock based on each firm characteristic every year and some might suspect that the constructed indices, based on several firm characteristic may be heavily determined by size hence In each characteristic I calculate the proportion of firm which simultaneously located in indices, constructed based on several kind of firm characteristic except size and indices constructed based on size and divide to the total number of firms located in this index

For example in China, cash show the value = 0.2723 implying that constructed indices based on cash-ratio such as high-cash are consisted of the firm that are defined as large capped around 0.2723

Table 5: Summary of descriptive statistic of surprise change in policy rate, announced by Central Bank in each country

Panel A: separate each kind of surprise

Central Bank	Target rate surprises			
	Total	Positive Surprise	Negative Surprise	No surprise
U.S.A.	24	8	6	10
China	10	5	5	0
Thailand	24	11	9	4
Korea	34	6	5	23
Brazil	24	8	8	8
Mexico	34	4	3	27
England	32	10	11	11
Germany	38	7	6	25
Japan	41	6	3	32
Canada	25	5	6	14

Panel B : summary statistic of policy rate announcement

Central Bank	Summary statistics			
	Mean	Standard Deviation	Max	Min
U.S.A.	-0.020	0.074	0.075	-0.229
China	-0.08	0.125	0.270	-0.75
Thailand	-0.010	0.158	0.240	-0.620
Korea	0.002	0.124	0.250	-0.500
Brazil	-0.013	0.110	0.210	-0.290
Mexico	-0.002	0.139	0.250	-0.500
England	-0.028	0.172	0.250	-0.900
Germany	-0.001	0.044	0.214	-0.136
Japan	0.007	0.091	0.500	-0.186
Canada	-0.017	0.090	0.258	-0.239

Note I The table display summary of descriptive statistic of surprise change in policy rate, announced by Central Bank in each country (percentage). The sample includes the monetary announcement from January 2007 through October 2009. Data of each policy announcement from each country and data about market's expectation of policy rate are obtained from Bloomberg. The number of surprised are different from the actual rate change, announced by each Central Bank is come from the fact that some surprises was excluded since it occur outside the date of meeting schedule.

Note II the table does not exhibit the surprise change in policy rate from Hong Kong as their Central Bank use exchange rate (bound with U.S. exchange rate) to be the major tool of their Ultimate policy. For China, their Central Bank do not provide the schedule date of monetary meeting so I assume that their actual change in policy rate can be substitute to be the surprise change.

Table 6: presents the estimation result of contagion testing at aggregate level.

Regression equation: $\boldsymbol{\rho_{ij,t} = a_0 + a_1\rho_{ij,t-1} + \sum_{k=1}^{3} b_k D_{k,t} + e_{ij,t}}$

Country	Contagion testing				
	Intercept	Lagged	Dummy I	Dummy II	Dummy III
China	0.00304[d]	0.96408[d]	0.00315[d]	0.00172[d]	0.00068[b]
	(0.0006)	(0.0062)	(0.0009)	(0.0006)	(0.0003)
Thailand	0.00382[d]	0.98464[d]	0.00035	6.7E-05	-1.4E-05
	(0.0010)	(0.0044)	(0.0002)	(0.0001)	(0.0001)
Korea	0.00306[c]	0.99151[d]	0.00041	0.00022	-3.2E-05
	(0.0012)	(0.0034)	(0.0003)	(0.0002)	(0.0001)
Brazil	0.02653[d]	0.95903[d]	0.00234	0.00312[c]	0.00188[c]
	(0.0044)	(0.0067)	(0.0017)	(0.0012)	(0.0008)
Mexico	0.01901[d]	0.97164[d]	0.00135[c]	0.00201[d]	0.00048
	(0.0036)	(0.0054)	(0.0006)	(0.0005)	(0.0003)
England	0.00535[d]	0.99049[d]	0.00052	0.00082[c]	0.00047[b]
	(0.0017)	(0.0030)	(0.0005)	(0.0003)	(0.0002)
Germany	0.00667[d]	0.98885[d]	0.00031	0.00094[c]	0.00054[b]
	(0.0020)	(0.0033)	(0.0005)	(0.0004)	(0.0002)
Japan	0.01411[d]	0.96834[d]	0.00131[b]	0.00168[d]	0.00064[b]
	(0.0026)	(0.0058)	(0.0007)	(0.0005)	(0.0004)
Hong Kong	0.00278[d]	0.99377[d]	-0.00017[c]	-3.5E-06	1.3E-05
	(0.0008)	(0.0019)	(7.1E-05)	(4.2E-05)	(2.7E-05)
Canada	0.02539[d]	0.96396[d]	0.00104	0.00217[c]	0.00103[d]
	(0.0044)	(0.0062)	(0.0010)	(0.0007)	(0.0004)

Brief summary of table 6

T	Country									
	CHN	THA	KOR	BRA	MEX	ENG	GER	JPN	HK	CAN
T_1	C				C			C	C	
T_2	C			C	C	C	C	C		C
T_3	C			C		C	C	C		C

Note 1) Dummy I, Dummy II, Dummy III are dummy variables for first stage of crisis period (before Lehman, second stage (during Lehman) and third stage of crisis (post-Lehman), respectively.

2) T refers to time period of crisis - T_1, T_2 and T_3 are the first phase of crisis (before Lehman, second phase (during Lehman) and third phase of crisis (post- Lehman), respectively C refers that coefficient of dummy variables in table 6 is statistically significant at least 10 % level implying contagion was existing,

3) CHN is an abbreviation of China, THA-Thailand, KOR- Korea, BRA-Brazil, MEX- Mexico, ENG- England, GER- Germany, JPN-Japan, HK- Hong Kong and CAN- Canada

4) superscript "b", "c", "d" refers that coefficients is statistically significant at 10%, 5% and 1%, respectively

Table 7A: Contagion testing I

The table shows the estimation results of regression examining for contagion based on firm characteristic

Regression equation: $\boldsymbol{\rho_{ij,t} = a_0 + a_1\rho_{ij,t-1} + \sum_{k=1}^{3} b_k D_{k,t} + e_{ij,t}}$

	CHN		THA		KOR		BRA		MEX	
Cha	Low	High	Low	High	Low	High	Low	High	Low	High
Size										
a_0	0.00252[d]	0.00543[d]	0.04521[d]	0.00344[d]	0.00833[d]	0.00664[d]	0.00562[d]	0.03075[d]	0.00058[b]	0.03030[d]
	(0.0006)	(0.0008)	(0.0026)	(0.0010)	(0.0015)	(0.0013)	(0.0013)	(0.0040)	(0.0004)	(0.0045)
a_1	0.90582[d]	0.92805[d]	0.50622[d]	0.98376[d]	0.96348[d]	0.97144[d]	0.97920[d]	0.94271[d]	0.99528[d]	0.95397[d]
	(0.0102)	(0.0089)	(0.0205)	(0.0046)	(0.0064)	(0.0056)	(0.0044)	(0.0073)	(0.0028)	(0.0069)
b_1	0.00171	0.00064	0.00484	0.00082[b]	-0.00078	-0.00028	0.00305[b]	0.00614[d]	0.00019	0.00184[b]
	(0.0012)	(0.0007)	(0.0038)	(0.0004)	(0.0009)	(0.0007)	(0.0013)	(0.0019)	(0.0007)	(0.0009)
b_2	0.00238[d]	0.00143[b]	0.00641[c]	0.00019	0.00177[d]	0.00091[b]	0.00282[d]	0.00530[d]	0.00010	0.00288[d]
	(0.0009)	(0.0005)	(0.0026)	(0.0003)	(0.0007)	(0.0005)	(0.0010)	(0.0015)	(0.0004)	(0.0007)
b_3	0.00038	0.00039	0.00116	0.00000	0.00021	0.00027	0.00168[d]	0.00324[d]	0.00024	0.00057
	(0.0005)	(0.0003)	(0.0017)	(0.0002)	(0.0004)	(0.0003)	(0.0006)	(0.0010)	(0.0003)	(0.0004)
M/B										
a_0	0.01519[d]	0.00445[d]	0.00421[d]	0.00213[d]	0.00029[d]	0.00384[d]	0.00573[d]	0.00614[d]	0.00111[d]	0.01228[d]
	(0.0013)	(0.0007)	(0.0008)	(0.0006)	(0.0004)	(0.0011)	(0.0016)	(0.0017)	(0.0004)	(0.0027)
a_1	0.60915[d]	0.96942[d]	0.97107[d]	0.98806[d]	0.99864[d]	0.98481[d]	0.98651[d]	0.98101[d]	0.99158[d]	0.97837[d]
	(0.0189)	(0.0050)	(0.0056)	(0.0033)	(0.0015)	(0.0042)	(0.0034)	(0.0043)	(0.0030)	(0.0047)
b_1	0.00411[b]	0.00001[b]	0.00001	0.00108[c]	-0.00006	0.00062[b]	0.00117	0.00452[c]	0.00092[d]	0.00064
	(0.0024)	(0.0002)	(0.0002)	(0.0004)	(0.0001)	(0.0003)	(0.0015)	(0.0022)	(0.0004)	(0.0007)
b_2	0.00498[d]	0.00034[d]	0.00033[b]	0.00024	0.00008[c]	-0.00039[b]	0.00224[b]	0.00335[c]	0.00082[d]	0.00200[d]
	(0.0017)	(0.0002)	(0.0002)	(0.0003)	(0.0000)	(0.0002)	(0.0011)	(0.0015)	(0.0003)	(0.0006)
b_3	0.00120	0.00018	0.00017[b]	-0.00004	0.00001	-0.00001	0.00094	0.00120	0.00043[b]	0.00052
	(0.0011)	(0.0001)	(0.0001)	(0.0002)	(0.0000)	(0.0001)	(0.0007)	(0.0009)	(0.0002)	(0.0004)
Cash										
a_0	0.00145[d]	0.01940[d]	0.00137[d]	0.00359[d]	0.00422[d]	0.01941[d]	0.00142[b]	0.01853[d]	0.01228[d]	0.04715[d]
	(0.0008)	(0.0030)	(0.0005)	(0.0010)	(0.0011)	(0.0018)	(0.0008)	(0.0032)	(0.0023)	(0.0054)
a_1	0.99568[d]	0.95469[d]	0.98926[d]	0.98155[d]	0.98234[d]	0.92842[d]	0.99579[d]	0.95670[d]	0.96662[d]	0.91622[d]
	(0.0022)	(0.0065)	(0.0035)	(0.0047)	(0.0044)	(0.0068)	(0.0024)	(0.0069)	(0.0060)	(0.0095)
b_1	0.00112[b]	0.00326[b]	0.00146[d]	0.00081	0.00053[b]	-0.00233[d]	0.00109	0.00315	0.00261	0.00445[b]
	(0.0010)	(0.0025)	(0.0007)	(0.0008)	(0.0003)	(0.0004)	(0.0010)	(0.0025)	(0.0017)	(0.0020)
b_2	0.00098[d]	0.00443[d]	0.00014	0.00041	-0.00056[d]	-0.00046[b]	0.00096	0.00425[c]	-0.00080	0.00500[d]
	(0.0007)	(0.0018)	(0.0004)	(0.0005)	(0.0002)	(0.0003)	(0.0007)	(0.0018)	(0.0011)	(0.0014)
b_3	0.00030	0.00175	0.00005	0.00009	0.00010	-0.00013	0.00029	0.00168	0.00229[d]	0.00013
	(0.0004)	(0.0011)	(0.0002)	(0.0003)	(0.0001)	(0.0002)	(0.0004)	(0.0011)	(0.0008)	(0.0009)
IA										
a_0	0.00232[d]	0.00371[d]	0.00077[d]	0.00384[d]	0.02794[d]	0.00283[d]	0.01393[d]	0.01275[d]	0.02046[d]	0.01294[d]
	(0.0005)	(0.0006)	(0.0004)	(0.0010)	(0.0023)	(0.0008)	(0.0025)	(0.0024)	(0.0034)	(0.0028)
a_1	0.93312[d]	0.93584[d]	0.99390[d]	0.97976[d]	0.88535[d]	0.98579[d]	0.96764[d]	0.96810[d]	0.95694[d]	0.97470[d]
	(0.0085)	(0.0084)	(0.0027)	(0.0050)	(0.0093)	(0.0040)	(0.0056)	(0.0055)	(0.0070)	(0.0052)
b_1	0.00131	0.00133	0.00036	0.00114[d]	-0.00081[b]	0.00066[d]	0.00278[b]	0.00536[c]	0.00326	0.00044
	(0.0008)	(0.0008)	(0.0005)	(0.0005)	(0.0004)	(0.0002)	(0.0015)	(0.0024)	(0.0021)	(0.0017)
b_2	0.00149[d]	0.00162[d]	0.00016	0.00008	0.00066[b]	0.00040[c]	0.00382[d]	0.00477[d]	0.00277[b]	0.00362[d]
	(0.0005)	(0.0006)	(0.0003)	(0.0003)	(0.0003)	(0.0002)	(0.0012)	(0.0017)	(0.0015)	(0.0013)
b_3	0.00020	0.00040	0.00004	-0.00009	-0.00007	0.00015	0.00122[b]	0.00278[c]	0.00144	0.00140[b]
	(0.0003)	(0.0004)	(0.0002)	(0.0002)	(0.0002)	(0.0001)	(0.0007)	(0.0011)	(0.0009)	(0.0008)

Table 7A: Contagion testing (continued – I)

	CHN		THA		KOR		BRA		MEX	
Cha	Low	High	Low	High	Low	High	Low	High	Low	High
Debt										
a_0	0.00369[d]	0.00426[d]	0.00295[d]	0.00157[d]	0.00362[d]	0.024941[d]	0.00293[d]	0.00360[d]	0.01108[d]	0.01093[d]
	(0.0006)	(0.0008)	(0.0008)	(0.0006)	(0.0009)	(0.0019)	(0.0012)	(0.0013)	(0.0023)	(0.0021)
a_1	0.92499[d]	0.89295[d]	0.98211[d]	0.98993[d]	0.98355[d]	0.882563[d]	0.99255[d]	0.98928[d]	0.97222[d]	0.97120[d]
	(0.0091)	(0.0108)	(0.0046)	(0.0037)	(0.0037)	(0.0088)	(0.0028)	(0.0035)	(0.0056)	(0.0054)
b_1	0.00126[b]	0.00238[b]	0.00112[b]	0.00117[c]	-0.00134[b]	-0.00051	0.00079	0.00250	0.00186	0.00028
	(0.0008)	(0.0014)	(0.0006)	(0.0007)	(0.0007)	(0.0005)	(0.0009)	(0.0017)	(0.0013)	(0.0010)
b_2	0.00169[d]	0.00273[d]	0.00038	0.000184	0.00060	6.45E-05	0.00116[b]	0.00249[c]	0.00255[b]	0.00280[d]
	(0.0006)	(0.0010)	(0.0004)	(0.0004)	(0.0004)	(0.0003)	(0.0007)	(0.0012)	(0.0010)	(0.0008)
b_3	0.00028	0.00071	0.00012	-0.00013	0.00025	0.00016	0.00043	0.00127	0.00122[b]	0.00077
	(0.0003)	(0.0006)	(0.0003)	(0.0002)	(0.0003)	(0.0002)	(0.0004)	(0.0008)	(0.0006)	(0.0005)
Liq										
a_0	0.00459[d]	0.00379[d]	0.00061[c]	0.00201[d]	0.01379[d]	0.00358[d]	0.01947[c]	0.00313[d]	0.00051[c]	0.03417[d]
	(0.0007)	(0.0006)	(0.0003)	(0.0007)	(0.0019)	(0.0010)	(0.0036)	(0.0011)	(0.0003)	(0.0049)
a_1	0.92426[d]	0.89053[d]	0.99424[d]	0.98986[d]	0.94370[d]	0.98504[d]	0.96482[d]	0.98699[d]	0.99615[d]	0.94796[d]
	(0.0091)	(0.0109)	(0.0024)	(0.0035)	(0.0077)	(0.0040)	(0.0063)	(0.0038)	(0.0022)	(0.0075)
b_1	0.0013[b]	0.00190[b]	0.00016	0.00061[b]	-0.00064	-9.46E-05	0.002325	0.00265[b]	0.000361	0.00229[b]
	(0.0008)	(0.0012)	(0.0001)	(0.0004)	(0.0005)	(0.0003)	(0.0019)	(0.0015)	(0.0005)	(0.0010)
b_2	0.00150[d]	0.00255[d]	0.00012[b]	-0.00012	0.000337	0.00036	0.00314[d]	0.00258[c]	0.00016	0.00316[d]
	(0.0006)	(0.0008)	(0.0001)	(0.0002)	(0.0003)	(0.0002)	(0.0014)	(0.0011)	(0.0003)	(0.0008)
b_3	0.00046	0.00043	1.94E-05	4.23E-06	6.11E-05	0.00024	0.00165[b]	0.00147[c]	0.00051[c]	0.00042[b]
	(0.0004)	(0.0005)	(0.0000)	(0.0001)	(0.0002)	(0.0002)	(0.0009)	(0.0007)	(0.0002)	(0.0004)
Beta										
a_0	0.00421[d]	0.03193[d]	0.00180[d]	0.00343[d]	0.00453[d]	0.01199[d]	0.00154[d]	0.01569[d]	0.01760[d]	0.00708[d]
	(0.0006)	(0.0017)	(0.0005)	(0.0007)	(0.0011)	(0.0018)	(0.0008)	(0.0032)	(0.0030)	(0.0019)
a_1	0.91366[d]	0.41580[d]	0.98839[d]	0.97919[d]	0.978387[d]	0.94592[d]	0.99259[d]	0.97139[d]	0.95813[d]	0.98075[d]
	(0.0097)	(0.0217)	(0.0033)	(0.0041)	(0.0048)	(0.0077)	(0.0029)	(0.0057)	(0.0069)	(0.0046)
b_1	0.00060	0.00580[c]	0.00134[c]	0.00130[b]	-9.25E-05	-0.00084	0.00228	0.00202	0.00267	0.00052
	(0.0007)	(0.0028)	(0.0006)	(0.0006)	(0.0007)	(0.0009)	(0.0014)	(0.0016)	(0.0023)	(0.0019)
b_2	0.00160[d]	0.00596[d]	0.00026[d]	0.00048	0.00156[d]	0.00096	0.00217[d]	0.00217[d]	0.00372[c]	0.00214[b]
	(0.0006)	(0.0019)	(0.0004)	(0.0004)	(0.0006)	(0.0006)	(0.0010)	(0.0011)	(0.0016)	(0.0013)
b_3	0.00039	0.00152	-0.00012	0.00015	9.17E-05	0.00037	0.00079[b]	0.00140[b]	0.00189[b]	0.00158
	(0.0004)	(0.0012)	(0.0002)	(0.0003)	(0.0003)	(0.0004)	(0.0006)	(0.0007)	(0.0011)	(0.0009)
ROA										
a_0	0.00256[d]	0.00863[d]	0.00266[d]	0.00252	0.00446[d]	0.00841[d]	0.00446[d]	0.00841[d]	-0.00027[c]	0.00082[b]
	(0.0007)	(0.0000)	(0.0006)	(0.0000)	(0.0015)	(0.0000)	(0.0015)	(0.0000)	(0.0001)	(0.0000)
a_1	0.89705[d]	0.95980[d]	0.97717[d]	0.98652	0.98910[d]	0.98032[d]	0.98910[d]	0.98032[d]	0.99073[d]	0.98762[d]
	(0.0106)	(0.0066)	(0.0049)	(0.0042)	(0.0035)	(0.0047)	(0.00350)	(0.0047)	(0.0029)	(0.0038)
b_1	0.00175	0.00003	0.00077[b]	0.00076	0.00140	0.00262	0.00140	0.00262	0.00011	-0.00032
	(0.0012)	(0.0005)	(0.0005)	(0.0005)	(0.0011)	(0.0018)	(0.0011)	(0.0018)	(0.0002)	(0.0009)
b_2	0.00267[d]	0.00103[c]	0.00033	0.00031	0.00180[d]	0.00275	0.00180[d]	0.00275	-0.00003	-0.00041
	(0.0009)	(0.0004)	(0.0003)	(0.0004)	(0.0008)	(0.0013)	(0.0008)	(0.0013)	(0.0001)	(0.0006)
b_3	0.00059	0.00022	-0.00003	0.00006	0.00050	0.00132	0.00050	0.00132	0.00016[b]	0.00055
	(0.0009)	(0.0002)	(0.0002)	(0.0002)	(0.0005)	(0.0008)	(0.0005)	(0.0008)	(0.0001)	(0.0004)

Table 7A: Contagion testing (continued – II)

	ENG		GER		JAP		HK		CAN	
Cha	Low	High	Low	High	Low	High	Low	High	Low	High
Size										
a_0	0.00439[d]	0.00416[d]	0.02182[d]	0.02312[d]	0.01494[d]	0.02214[d]	0.04695[d]	0.00275[c]	0.00672[d]	0.05912[d]
	(0.0010)	(0.0014)	(0.0025)	(0.0034)	(0.0022)	(0.0031)	(0.0040)	(0.0013)	(0.0017)	(0.0062)
a_1	0.97823[d]	0.99186[d]	0.92572[d]	0.96024[d]	0.94999[d]	0.94767[d]	0.85414[d]	0.99364[d]	0.98043[d]	0.90109[d]
	(0.0046)	(0.0028)	(0.0079)	(0.0058)	(0.0074)	(0.0073)	(0.0123)	(0.0032)	(0.0046)	(0.0103)
b_1	0.00072[b]	-0.00009	0.00403[b]	0.00117	0.00081	0.00158	0.00309[d]	0.00023	0.00024	0.00265
	(0.0004)	(0.0008)	(0.0023)	(0.0011)	(0.0008)	(0.0010)	(0.0010)	(0.0004)	(0.0016)	(0.0019)
b_2	0.00069[d]	0.00078	0.00425[b]	0.00202[c]	0.00199[d]	0.00198[d]	0.00309[d]	-0.00001	0.00299[b]	0.00340[c]
	(0.0003)	(0.0006)	(0.0017)	(0.0008)	(0.0006)	(0.0007)	(0.0007)	(0.0002)	(0.0012)	(0.0013)
b_3	0.00017	0.00056	0.00274[b]	0.00135[d]	0.00072[b]	0.00113[c]	0.00062	-0.00001	0.00135[b]	0.00064
	(0.0002)	(0.0004)	(0.0011)	(0.0005)	(0.0004)	(0.0004)	(0.0004)	(0.0001)	(0.0008)	(0.0008)
M/B										
a_0	0.00437[d]	0.00230[d]	0.00212[d]	0.00684[d]	0.02209[d]	0.01169[d]	0.00897[d]	0.01078[d]	0.01466[d]	0.01335[d]
	(0.0014)	(0.0010)	(0.0008)	(0.0017)	(0.0029)	(0.0022)	(0.0017)	(0.0019)	(0.0030)	(0.0029)
a_1	0.98964[d]	0.99415[d]	0.99311[d]	0.98522[d]	0.93681[d]	0.96760[d]	0.97441[d]	0.97282[d]	0.97324[d]	0.97457
	(0.0033)	(0.0026)	(0.0028)	(0.0037)	(0.0083)	(0.0060)	(0.0047)	(0.0049)	(0.0053)	(0.0053)
b_1	0.00049	0.00011	0.00092	0.00090	0.00103	0.00119	0.00143[d]	0.00225[d]	-0.00008	0.00283[b]
	(0.0005)	(0.0010)	(0.0006)	(0.0008)	(0.0009)	(0.0009)	(0.0005)	(0.0007)	(0.0013)	(0.0015)
b_2	0.00060[b]	0.00081	0.00076[b]	0.00127[c]	0.00163[d]	0.00119[b]	0.00090[d]	0.00011	0.00259[d]	0.00217[c]
	(0.0003)	(0.0007)	(0.0004)	(0.0006)	(0.0007)	(0.0007)	(0.0004)	(0.0004)	(0.0009)	(0.0010)
b_3	0.00034[b]	0.00061[b]	0.00062[c]	0.00071[b]	0.00086[b]	0.00049	-0.00001	-0.00009	0.00136[b]	0.00075
	(0.0002)	(0.0005)	(0.0003)	(0.0004)	(0.0004)	(0.0004)	(0.0002)	(0.0002)	(0.0006)	(0.0007)
Cash										
a_0	0.01021[d]	0.00251[d]	0.00774[d]	0.00557[d]	0.01361[d]	0.01757[d]	0.00311[d]	0.02339[d]	0.01025[d]	0.28224[d]
	(0.0020)	(0.0011)	(0.0017)	(0.0011)	(0.0023)	(0.0019)	(0.0012)	(0.0032)	(0.0023)	(0.0124)
a_1	0.97833[d]	0.99331[d]	0.98219[d]	0.97233[d]	0.96222[d]	0.93678[d]	0.99088[d]	0.93937[d]	0.97338[d]	0.54463[d]
	(0.0044)	(0.0028)	(0.0041)	(0.0055)	(0.0064)	(0.0068)	(0.0034)	(0.0081)	(0.0054)	(0.0200)
b_1	0.00073	0.00001	0.00083	0.00147[c]	0.00063	0.00012	0.00105	0.00448[d]	0.00250	0.00738[c]
	(0.0006)	(0.0010)	(0.0007)	(0.0006)	(0.0006)	(0.0006)	(0.0007)	(0.0012)	(0.0021)	(0.0030)
b_2	0.00117[b]	0.00067	0.00115[b]	-0.00031	0.00073[b]	0.00027	0.00033	0.00109	0.00430[d]	0.00606[d]
	(0.0005)	(0.0007)	(0.0005)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0008)	(0.0016)	(0.0021)
b_3	0.00045	0.00080	0.00065[b]	0.00004	0.00038	-0.00010	0.00023	0.00021	0.00254[b]	0.00216
	(0.0003)	(0.0005)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0002)	(0.0005)	(0.0010)	(0.0013)
IA										
a_0	0.00956[d]	0.00379[d]	0.00699	0.00394[d]	0.01267[d]	0.01076[d]	-0.00048[d]	0.02114[d]	0.01085[d]	0.00734[d]
	(0.0018)	(0.0010)	(0.0014)	(0.0010)	(0.0023)	(0.0021)	(0.0003)	(0.0031)	(0.0027)	(0.0020)
a_1	0.97974[d]	0.98961[d]	0.98291	0.98948[d]	0.96533[d]	0.96935[d]	0.97000[d]	0.94546[d]	0.98173[d]	0.97834[d]
	(0.0038)	(0.0025)	(0.0034)	(0.0025)	(0.0062)	(0.0058)	(0.0059)	(0.0079)	(0.0045)	(0.0047)
b_1	0.00066	0.00038	0.00095	0.00155	0.00119	0.00117	-0.00035	0.00145[d]	0.00203	0.00338
	(0.0006)	(0.0010)	(0.0007)	(0.0010)	(0.0009)	(0.0007)	(0.0006)	(0.0005)	(0.0009)	(0.0021)
b_2	0.00110[b]	0.00090[b]	0.00116	0.00147[b]	0.00154[b]	0.00124[c]	-0.00019	0.00042	0.00153[b]	0.00355[c]
	(0.0005)	(0.0007)	(0.0005)	(0.0007)	(0.0007)	(0.0005)	(0.0004)	(0.0004)	(0.0007)	(0.0016)
b_3	0.00041[b]	0.00106[c]	0.00085	0.00103[d]	0.00062	0.00071[d]	-0.00002	-0.00005	0.00070[b]	0.00257[c]
	(0.0003)	(0.0005)	(0.0003)	(0.0005)	(0.0004)	(0.0003)	(0.0003)	(0.0002)	(0.0004)	(0.0011)

Table 7A: Contagion testing (continued – III)

	ENG		GER		JAP		HK		CAN	
Cha	Low	High	Low	High	Low	High	Low	High	Low	High
Debt										
a_0	0.00295[d]	0.00281[d]	0.0098[d]	0.00212[d]	0.01352[d]	0.01292[d]	0.00751[d]	0.00368[d]	0.01268[d]	0.02242[d]
	(0.0010)	(0.0009)	(0.0018)	(0.0006)	(0.0023)	(0.0023)	(0.0014)	(0.0012)	(0.0028)	(0.0038)
a_1	0.99303[d]	0.99287[d]	0.97063[d]	0.99124[d]	0.96253[d]	0.96457[d]	0.97688[d]	0.98978[d]	0.97604[d]	0.96232[d]
	(0.0024)	(0.0021)	(0.0049)	(0.0025)	(0.0064)	(0.0062)	(0.0042)	(0.0033)	(0.0051)	(0.0064)
b_1	0.00031	0.00027	0.001874	0.00049	0.00098	0.00136	0.00302[d]	0.00093[d]	0.00296[b]	0.00176
	(0.0003)	(0.0005)	(0.0015)	(0.0004)	(0.0008)	(0.0009)	(0.0012)	(0.0005)	(0.0014)	(0.0011)
b_2	0.00049	0.00065	0.001576	0.00074[b]	0.00125[b]	0.00173[c]	0.00117[b]	0.00013	0.00144	0.00242[d]
	(0.0002)	(0.0004)	(0.0010)	(0.0003)	(0.0006)	(0.0007)	(0.0008)	(0.0003)	(0.0009)	(0.0008)
b_3	0.00029	0.00059	0.000684	0.00034[d]	0.000529	0.00107[d]	0.000455	3.69E-06	0.00104[b]	0.00090[b]
	(0.0002)	(0.0003)	(0.0006)	(0.0002)	(0.0004)	(0.0004)	(0.0005)	(0.0002)	(0.0006)	(0.0005)
Liq										
a_0	0.00500[d]	0.02411[d]	0.00294[d]	0.02078[d]	0.01164[d]	0.01638[d]	0.000461	0.00279[b]	0.00137[d]	0.02836[d]
	(0.0013)	(0.0033)	(0.0007)	(0.0036)	(0.0022)	(0.0026)	(0.0004)	(0.0012)	(0.0008)	(0.0045)
a_1	0.98324[d]	0.95709[d]	0.97609[d]	0.96311[d]	0.96713[d]	0.95637[d]	0.99475[d]	0.99278[d]	0.99586[d]	0.95552[d]
	(0.0043)	(0.0060)	(0.0051)	(0.0064)	(0.0061)	(0.0069)	(0.0026)	(0.0033)	(0.0023)	(0.0069)
b_1	-0.00013	0.00071	0.00111	0.00151	0.001192	0.00146	-0.00023	0.00040	0.00039	0.00161
	(0.0003)	(0.0008)	(0.0007)	(0.0012)	(0.0010)	(0.0009)	(0.0006)	(0.0004)	(0.0012)	(0.0015)
b_2	5.19E-05	0.00196[d]	0.00132[b]	0.00240[d]	0.00149[d]	0.00169[d]	0.00013	-5.05E-06	0.00179[c]	0.00214[b]
	(0.0002)	(0.0006)	(0.0005)	(0.0009)	(0.0007)	(0.0007)	(0.0004)	(0.0002)	(0.0008)	(0.0010)
b_3	-0.00016	0.00106[d]	0.00015	0.00165[d]	0.00053	0.00095[b]	-0.00030	3.88E-05	0.00056	0.00080
	(0.0001)	(0.0004)	(0.0003)	(0.0006)	(0.0004)	(0.0004)	(0.0002)	(0.0001)	(0.0005)	(0.0007)
Beta										
a_0	0.00368[d]	0.00368[d]	0.00671[d]	0.00469[d]	0.01160[d]	0.01328[d]	0.00464[d]	0.00652[d]	0.01198[d]	0.01469[d]
	(0.0012)	(0.0012)	(0.0016)	(0.0014)	(0.0021)	(0.0022)	(0.0015)	(0.0018)	(0.0025)	(0.0028)
a_1	0.99044[d]	0.99044[d]	0.97750[d]	0.98840[d]	0.96331[d]	0.95952[d]	0.98745[d]	0.98397[d]	0.97579[d]	0.96730[d]
	(0.0032)	(0.0032)	(0.0051)	(0.0035)	(0.0064)	(0.0066)	(0.0041)	(0.0045)	(0.0050)	(0.0060)
b_1	0.00120	0.00120	0.00086	0.00146	0.00087	0.00174[b]	0.00167[c]	0.00047[b]	0.00244[c]	0.00025
	(0.0008)	(0.0008)	(0.0012)	(0.0010)	(0.0011)	(0.0010)	(0.0009)	(0.0002)	(0.0010)	(0.0018)
b_2	0.00105	0.00105[b]	0.00089	0.00181[d]	0.00100	0.00192[d]	0.00054	5.97E-05	0.00211[d]	0.00149
	(0.0006)	(0.0006)	(0.0009)	(0.0007)	(0.0008)	(0.0007)	(0.0004)	(0.0001)	(0.0007)	(0.0012)
b_3	0.00060	0.00060[b]	9.30E-07	0.00119[b]	0.00023	0.00124[b]	-7.25E-06	-1.78E-05	0.00011	0.00180[b]
	(0.0003)	(0.0003)	(0.0006)	(0.0005)	(0.0005)	(0.0005)	(0.0003)	(0.0001)	(0.0004)	(0.0008)
ROA										
a_0	0.00313[d]	0.00113[d]	0.00219[c]	0.00315[c]	0.02328[d]	0.01081[d]	0.00386[d]	0.00416[d]	0.00921[d]	0.01019[d]
	(0.0011)	(0.0007)	(0.0008)	(0.0000)	(-0.0020)	(0.0000)	(0.0010)	(0.0000)	(0.0021)	(0.0000)
a_1	0.99268[d]	0.99659[d]	0.99267[d]	0.99299[d]	0.89420[d]	0.96339[d]	0.98824[d]	0.99035[d]	0.97741[d]	0.97920[d]
	(0.0025)	(0.0019)	(0.0027)	(0.0027)	(-0.0090)	(0.0063)	(0.0031)	(0.0032)	(0.0049)	(0.0046)
b_1	0.00042	-0.00001	0.00035	0.00044	0.00107[c]	0.00067	0.00130[b]	0.00040	0.00030	0.00338
	(0.0003)	(0.0009)	(0.0006)	(0.0004)	(-0.0004)	(0.0006)	(0.0006)	(0.0002)	(0.0014)	(0.0012)
b_2	0.00061[c]	0.00078	0.00096[b]	0.00075[c]	0.00144[d]	0.00099[c]	0.00042	-0.00001	0.00182[b]	0.00229[d]
	(0.0002)	(0.0006)	(0.0004)	(0.0003)	(-0.0002)	(0.0004)	(0.0003)	(0.0001)	(0.00105)	(0.0008)
b_3	0.00035[c]	0.00061	0.00053	0.00031	0.00042[c]	0.00048	0.00011	0.00003	0.00166[c]	0.00103[b]
	(0.0001)	(0.0004)	(0.0003)	(0.0002)	(-0.0002)	(0.0003)	(0.0002)	(0.0001)	(0.00071)	(0.0005)

Table 7B: contagion testing II

The table shows the summary of coefficients, indicating contagion was occurring, form table 7A

Note: L refers to firm characteristic type-I, come from the lowest 25 percent of that multiple after rank stock with respect to that firm characteristic e.g. small-cap indices then, H refers to firm characteristic type-II, come from the highest 25 percent of that multiple after rank stock with respect to that firm characteristic e.g. Large-cap indices, with respect to size. Thus,

- Size L refer to stock with small caps, H refer to stock with large caps
- M/B L refer to stock with low market-to-book, H refer to stock with high market-to-book
- Cash L refer to stock with low cash-to-asset, H refer to stock with high-to-asset
- IA L refer to stock with low investment-to-asset, H refer to stock with high investment-to-asset
- Debt L refer to stock with low debt ratio, H refer to stock with high low debt ratio
- Liquid L refer to illiquid stock, H refer to high liquid stock
- Beta L refer to stock with low beta, H refer to stock with high beta
- ROA L refer to stock with low ROA, H refer to stock with high ROA

T refers to time period of crisis - T_1, T_2 and T_3 are the first phase of crisis (before Lehman, second phase (during Lehman) and third phase of crisis (post- Lehman), respectively. Cov. Is the covariance between coefficients, obtained from regress model with SUR method

$$\boldsymbol{\rho_{ij,t} = a_0 + a_1 \rho_{ij,t-1} + \sum_{k=1}^{3} b_k D_{k,t} + e_{ij,t}}$$

. C refers that coefficient of dummy variables in table 7A is statistically significant at least 10 % level implying contagion was existing in that firm characteristics therefore if C jointly occurring in both types of firm characteristics in one country at the same time (the bold letter), I must compare this pair that which of them are likely to be stronger affected contagion than another by using the statistical test

$$\boldsymbol{z = \frac{b_{k,c1} - b_{k,c2}}{\sqrt{S.E._{b_{k,c1}}{}^2 + S.E._{b_{k,c2}}{}^2 - 2cov_{b_{k,c1} b_{k,c2}}}}}$$

The results of this comparison are provided in Table 7C

	CHN			THA			KOR			BRA			MEX			ENG			GER			JAP			HK			CAN		
Cha	L	H	Cov.	L	H	Cov.	L	H	Cov.	L	H	Cov.	L	H	Cov.	L	H	Cov.	L	H	Cov.	L	H	Cov.	L	H	Cov.	L	H	Cov.
Size																														
T_1					C					C	C	1.1E-07		C		C														
T_2	C	C	3.4E-07	C			C	C	4.2E-07	C	C	5.5E-08		C		C			C	C	6.1E-07	C	C	2.5E-07	C			C	C	5.2E-07
T_3										C	C	2.0E-08							C	C	2.5E-07	C	C	9.9E-08	C			C		
M/B																														
T_1	C	C	4.7E-06		C			C			C		C												C	C	1.8E-07		C	
T_2	C	C	2.2E-06	C			C	C	5.6E-07	C	C	1.9E-08	C	C	-5.4E-09	C			C	C	1.7E-07	C	C	3.5E-07	C			C	C	5.1E-07
T_3													C						C	C	2.5E-07	C						C		
Cash																														
T_1	C	C	1.4E-06	C			C	C	7.0E-07					C						C						C			C	
T_2	C	C	7.1E-07				C	C	3.5E-07		C			C		C			C			C						C	C	1.0E-06
T_3													C						C									C		
IA																														
T_1					C		C	C	1.4E-06	C	C	8.9E-07														C				
T_2	C	C	2.9E-07				C	C	7.3E-07	C	C	4.3E-07	C	C	-2.5E-08					C				2.8E-07				C	C	3.9E-07
T_3										C	C	1.7E-07		C		C	C	2.3E-08		C			C				C	C	1.6E-07
Debt																														
T_1	C	C	1.0E-06	C	C	1.9E-07	C																		C			C		
T_2	C	C	5.0E-07							C	C	2.1E-07	C	C	5.8E-08					C		C	C	3.3E-07					C	
T_3											C		C	C	-1.6E-08					C			C					C	C	1.1E-07
Liq																														
T_1	C	C	8.4E-07		C						C			C																
T_2	C	C	4.1E-07	C						C	C	4.3E-07		C			C		C	C	1.6E-07	C	C	3.9E-07				C	C	3.0E-07
T_3										C	C	1.6E-08		C			C			C			C						
Beta																														
T_1		C		C	C	3.6E-08																	C		C	C	1.1E-07	C		
T_2	C	C	9.8E-07	C			C			C	C	6.2E-07		C			C			C			C					C		
T_3				C						C	C	2.6E-07	C	C	8.5E-08		C			C			C						C		
ROA																														
T_1				C																		C			C				C	
T_2	C	C	2.1E-08				C			C						C			C	C	1.2E-07	C	C	7.8E-08				C	C	3.0E-07
T_3													C			C												C	C	1.4E-07

Table 7C: Contagion testing III

The table shows the summary of the type of firm characteristics that likely to incur contagion effect in each country

Cha.	T	Country									
		CHN	THA	KOR	BRA	MEX	ENG	GER	JPN	HK	CAN
Size	T_1		large		large	large	small			small	
	T_2	small	small	small	large	large	small	small		small	
	T_3				large						small
M/B	T_1		high	high	high	low				high	high
	T_2		low	low	high	high	low		low	low	
	T_3					low			low		low
Cash	T_1	low	low	low		high		high		high	high
	T_2	low			high	high	low	low	low		
	T_3					low		low			low
IA	T_1		high	high						high	
	T_2					high					high
	T_3				high	high	high		high		high
Debt	T_1	high		high						low	low
	T_2	high						high	high		high
	T_3							high	high		
Liq	T_1		high		high	high					
	T_2	low	low			high	high				
	T_3					high	high	high	high		
Beta	T_1	high	high		low				high	low	low
	T_2	high	low	low		low	high	high	high		low
	T_3		low				high	high	high		high
ROA	T_1		low				low			low	high
	T_2	low		low	low		low	low	low		
	T_3					low	low		low		

Note 1) M/B refers to market-to-book ratio, Cash refers to cash-to-asset ratio, IA refers to investment-to-asset, Debt refers to debt-ratio, Liq refers to liquidity of stock, - Beta refers to CPAM beta, - ROA refers to return-on-asset.

2) T refers to time period of crisis - T_1, T_2 and T_3 are the first phase of crisis (before Lehman, second phase (during Lehman) and third phase of crisis (post- Lehman), respectively

3) CHN is an abbreviation of China, THA-Thailand, KOR- Korea, BRA-Brazil, MEX- Mexico, ENG- England, GER- Germany, JPN-Japan, HK- Hong Kong and CAN- Canada

Table 8: presents the estimation result of testing the impact of conditional volatility to correlation coefficients, consider in term of aggregate level.

Regression equation: $\boldsymbol{\rho_{ij,t} = a_0 + a_1\rho_{ij,t-1} + a_2\sigma_{i,t} + a_3\sigma_{j,t} + e_{ij,t}}$

Country	Contagion testing			
	Intercept	Lagged correlation	Volatility U.S.	Volatility Domes
China	0.00182[b]	0.97115[d]	0.00085	0.00026
	(0.0010)	(0.0056)	(0.0005)	(0.0007)
Thailand	0.00584[d]	0.98144[d]	0.00058[d]	-0.00125[c]
	(0.0013)	(0.0044)	(0.0002)	(0.0005)
Korea	0.00173[b]	0.99345[d]	-0.00020	0.00120[c]
	(0.0010)	(0.0029)	(0.0002)	(0.0005)
Brazil	0.01995[d]	0.96225[d]	0.00044	0.00293[b]
	(0.0051)	(0.0067)	(0.0014)	(0.0016)
Mexico	0.01740[d]	0.96950[d]	8.02E-05	0.00283
	(0.0035)	(0.0053)	(0.0006)	(0.0011)
England	0.00419[d]	0.99243[d]	-4.6E-05	0.00033
	(0.0015)	(0.0025)	(0.0001)	(0.0002)
Germany	0.00667[d]	0.98885[d]	0.00094[c]	0.00031
	(0.0020)	(0.0033)	(0.0004)	(0.0005)
Japan	0.01289[d]	0.96508[d]	0.00025	0.00240[d]
	(0.0025)	(0.0058)	(0.0007)	(0.0008)
Hong Kong	0.00183	0.99594	6.39E-05	-7.2E-05[d]
	(0.0007)	(0.0017)	(0.0000)	(0.0000)
Canada	0.02567[d]	0.9615[d]	0.00378[c]	-0.0018
	(0.0042)	(0.0062)	(0.0018)	(0.0020)

Brief summary of table 8

Volatility	Country									
	CHN	THA	KOR	BRA	MEX	ENG	GER	JPN	HK	CAN
U.S		C					C			C
Domes		C	C	C				C	C	

Note 1) U.S. refers to conditional standard deviation of U.S. stock index, Domes is the conditional standard deviation of index constructed by each firm characteristic from international market.

2) C refers that coefficient of conditional volatility in table 9A is statistically significant at least 10 %

3) CHN is an abbreviation of China, THA-Thailand, KOR- Korea, BRA-Brazil, MEX- Mexico, ENG- England, GER- Germany, JPN-Japan, HK- Hong Kong and CAN-Canada

4) superscript "b", "c", "d" refers that coefficients is statistically significant at 10%, 5% and 1%, respectively

Table 9A: Conditional volatility testing I

The table shows the estimation results of regression examining for the relationship between conditional correlation and conditional volatility from U.S. and/or domestic stock, based on firm characteristic.

Regression equation: $\boldsymbol{\rho_{ij,t} = a_0 + a_1\rho_{ij,t-1} + a_2\sigma_{i,t} + a_3\sigma_{j,t} + e_{ij,t}}$

	CHN		THA		KOR		BRA		MEX	
Cha	Low	High	Low	High	Low	High	Low	High	Low	High
Size										
a_0	0.00256[d]	0.00568[d]	0.03450[d]	0.00282[d]	0.00360[b]	0.00454[d]	-0.00071	0.01810[d]	-0.00021	0.02975[d]
	(0.0006)	(0.0008)	(0.0051)	(0.0010)	(0.0014)	(0.0013)	(0.0018)	(0.0042)	(0.0011)	(0.0045)
a_1	0.91571[d]	0.92752[d]	0.50161[d]	0.98455[d]	0.95554[d]	0.96602[d]	0.98062[d]	0.95412[d]	0.99485[d]	0.94799[d]
	(0.0097)	(0.0099)	(0.0206)	(0.0043)	(0.0064)	(0.0057)	(0.0039)	(0.0071)	(0.0025)	(0.0072)
a_2	0.00001	0.00000	0.00550[d]	0.00033	0.00045	-0.00058	0.00148[b]	0.00072	0.00024	0.00023
	(0.0000)	(0.0000)	(0.0019)	(0.0002)	(0.0005)	(0.0005)	(0.0008)	(0.0015)	(0.0003)	(0.0008)
a_3	0.00000	0.00000	0.00901	0.00020	0.00505[d]	0.00283[d]	0.00460[d]	0.00445[c]	0.00080	0.00477[d]
	(0.0000)	(0.0000)	(0.0057)	(0.0003)	(0.0008)	(0.0006)	(0.0014)	(0.0017)	(0.0011)	(0.0013)
M/B										
a_0	0.01425[d]	0.08839[d]	0.00419[d]	0.00075	-0.00022	0.00367[d]	0.00379[b]	0.00507[c]	0.00380[d]	0.01333[d]
	(0.0012)	(0.0015)	(0.0008)	(0.0007)	(0.0003)	(0.0010)	(0.0016)	(0.0023)	(0.0011)	(0.0028)
a_1	0.66316[d]	-0.43392[d]	0.96393[d]	0.99282[d]	1.00008[d]	0.98843[d]	0.99040[d]	0.97107[d]	0.99746[d]	0.96837[d]
	(0.0179)	(0.0215)	(0.0059)	(0.0032)	(0.0010)	(0.0037)	(0.0033)	(0.0055)	(0.0018)	(0.0052)
a_2	0.00001	0.00001	0.00027[b]	0.00016	0.00005	-0.00030	0.00145[b]	0.00207	0.00036[b]	0.00047
	(0.0000)	(0.0000)	(0.0001)	(0.0002)	(0.0000)	(0.0002)	(0.0008)	(0.0014)	(0.0002)	(0.0007)
a_3	0.00000	0.00002	0.00122[d]	0.00041	0.00011[b]	-0.00026	-0.00041	0.00327[c]	-0.00454[d]	0.00468[d]
	(0.0000)	(0.0000)	(0.0004)	(0.0003)	(0.0001)	(0.0003)	(0.0008)	(0.0013)	(0.0013)	(0.0012)
Cash										
a_0	0.00502[d]	0.00544[d]	-0.00025	0.00172	0.00424[d]	0.01467[d]	0.00078	0.00768[d]	0.00870[d]	0.04380[d]
	(0.0008)	(0.0007)	(0.0006)	(0.0011)	(0.0009)	(0.0017)	(0.0007)	(0.0021)	(0.0027)	(0.0053)
a_1	0.90231[d]	0.89743[d]	0.99474[d]	0.98105[d]	0.98579[d]	0.94342[d]	0.99584[d]	0.97322[d]	0.97528[d]	0.91491[d]
	(0.0104)	(0.0107)	(0.0028)	(0.0048)	(0.0038)	(0.0063)	(0.0019)	(0.0054)	(0.0053)	(0.0096)
a_2	0.00000	0.00001	0.00015	0.00029	-0.00035[b]	-0.00026	0.00098[b]	0.00356[d]	0.00019	0.00315[b]
	(0.0000)	(0.0000)	(0.0003)	(0.0004)	(0.0002)	(0.0003)	(0.0005)	(0.0012)	(0.0010)	(0.0016)
a_3	0.00002	0.00000	0.00119[b]	0.00199[d]	-0.00035	0.00040	-0.00003	0.00002	0.00123	0.00204
	(0.0000)	(0.0000)	(0.0005)	(0.0007)	(0.0003)	(0.0004)	(0.0000)	(0.0001)	(0.0028)	(0.0026)
IA										
a_0	0.00192[d]	0.00437[d]	0.00007	0.00192[c]	0.03040[d]	0.00166[c]	0.01108[d]	0.01018[d]	0.01614[d]	0.00870[d]
	(0.0004)	(0.0007)	(0.0005)	(0.0009)	(0.0024)	(0.0007)	(0.0029)	(0.0025)	(0.0036)	(0.0026)
a_1	0.94920[d]	0.93299[d]	0.99435[d]	0.98515[c]	0.86726[d]	0.99185[d]	0.96271[d]	0.97133[d]	0.95434[d]	0.96867[d]
	(0.0078)	(0.0088)	(0.0026)	(0.0044)	(0.0100)	(0.0034)	(0.0063)	(0.0057)	(0.0070)	(0.0054)
a_2	0.00001	0.00001	0.00011	0.00005	0.00057[b]	-0.00017	0.00291[d]	0.00441[d]	0.00064	0.00114
	(0.0000)	(0.0000)	(0.0002)	(0.0002)	(0.0003)	(0.0002)	(0.0011)	(0.0014)	(0.0017)	(0.0021)
a_3	0.00001	0.00000	0.00075	0.00084[b]	0.00096[b]	0.00014	0.00209	-0.00081	0.00701[b]	0.01404[d]
	(0.0000)	(0.0000)	(0.0005)	(0.0005)	(0.0005)	(0.0001)	(0.0013)	(0.0007)	(0.0040)	(0.0039)

Table 9A: Conditional volatility testing (continued – I)

	CHN		THA		KOR		BRA		MEX	
Cha	Low	High	Low	High	Low	High	Low	High	Low	High
Debt										
a_0	0.00345[d]	0.00328[d]	0.00176[b]	0.00038	0.00081	0.02739[d]	0.01018[d]	-0.00061	0.00802[d]	0.00811[d]
	(0.0006)	(0.0006)	(0.0009)	(0.0003)	(0.0010)	(0.0021)	(0.0025)	(0.0022)	(0.0022)	(0.0020)
a_1	0.93679[d]	0.92353[d]	0.98240[d]	0.99440[d]	0.99020[d]	0.86176[d]	0.97133[d]	0.99244[d]	0.96836[d]	0.96875[d]
	(0.0086)	(0.0093)	(0.0044)	(0.0021)	(0.0035)	(0.0103)	(0.0057)	(0.0030)	(0.0057)	(0.0056)
a_2	0.00001	0.00000	0.00039	0.00012[c]	0.00040	-0.00003	0.00441[d]	0.00053	0.00151[b]	0.00059
	(0.0000)	(0.0000)	(0.0003)	(0.0001)	(0.0005)	(0.0003)	(0.0014)	(0.0010)	(0.0008)	(0.0008)
a_3	0.00000	0.00001	0.00147[b]	0.00026	0.00074	0.00126[d]	-0.00081	0.00183	0.00466[d]	0.00410[d]
	(0.0000)	(0.0000)	(0.0008)	(0.0003)	(0.0007)	(0.0004)	(0.0007)	(0.0013)	(0.0017)	(0.0014)
Liq										
a_0	0.00459[d]	0.00316[d]	0.00038	0.00157[b]	0.00183[b]	0.01288[d]	0.00082	0.00991[b]	-0.00003	0.03506[d]
	(0.0007)	(0.0006)	(0.0003)	(0.0007)	(0.0010)	(0.0019)	(0.0016)	(0.0039)	(0.0014)	(0.0048)
a_1	0.93341[d]	0.91463	0.99440[d]	0.99198[d]	0.98799[d]	0.94018[d]	0.98896[d]	0.96326[d]	0.99864[d]	0.94034[d]
	(0.0088)	(0.0098)	(0.0021)	(0.0033)	(0.0037)	(0.0078)	(0.0031)	(0.0062)	(0.0019)	(0.0076)
a_2	0.00025	0.00053	0.00012[d]	0.00002	0.00007	-0.00008	0.00162[b]	-0.00060	0.00003	0.00029
	(0.0000)	(0.0000)	(0.0001)	(0.0002)	(0.0003)	(0.0003)	(0.0009)	(0.0014)	(0.0002)	(0.0008)
a_3	8.04E-07	1.82E-05	0.00026	0.00005	0.00106[c]	0.00117[b]	0.00090	0.00666[d]	0.00039	0.00380[d]
	(0.0000)	(0.0000)	(0.0003)	(0.0003)	(0.0005)	(0.0004)	(0.0013)	(0.0019)	(0.0016)	(0.0009)
Beta										
a_0	0.02788[d]	0.00337[d]	0.00096[b]	0.00229[d]	-0.00135	0.00981[d]	-0.00027	0.00989[d]	0.01301[d]	0.00541[d]
	(0.0033)	(0.0009)	(0.0003)	(0.0012)	(0.0012)	(0.0017)	(0.0013)	(0.0033)	(0.0036)	(0.0019)
a_1	0.41906[d]	0.91513[d]	0.98727[d]	0.97440[d]	0.97429[d]	0.93748[d]	0.99524[d]	0.97185[d]	0.95710[d]	0.98161[d]
	(0.0216)	(0.0097)	(0.0029)	(0.0055)	(0.0049)	(0.0078)	(0.0023)	(0.0056)	(0.0069)	(0.0043)
a_2	0.00330[b]	0.00094[b]	0.00044[d]	0.00046	0.00040	-0.00102[b]	0.00076	-0.00114	0.00238[b]	0.00206[b]
	(0.0016)	(0.0005)	(0.0001)	(0.0004)	(0.0005)	(0.0006)	(0.0008)	(0.0014)	(0.0014)	(0.0010)
a_3	0.00130	0.00012	0.00031[b]	0.00115[b]	0.00641[d]	0.00323[d]	0.00084	0.00418[d]	0.00489	0.00000[d]
	(0.0017)	(0.0005)	(0.0002)	(0.0006)	(0.0010)	(0.0006)	(0.0012)	(0.0015)	(0.0041)	(0.0000)
ROA										
a_0	0.00085	0.00923[d]	0.00207[d]	0.00300[d]	0.00471[d]	0.00702[d]	-0.00039	4.92E-03[c]	0.00045[b]	0.00014
	(0.0016)	(0.0015)	(0.0007)	(0.0007)	(0.0015)	(0.0014)	(0.0022)	(0.0021)	(0.0002)	(0.0006)
a_1	0.89951[d]	0.95446[d]	0.97726[d]	0.98402[d]	0.96140[d]	0.94508[d]	0.990344[d]	0.97980[d]	0.99374[d]	0.99046[d]
	(0.0106)	(0.0071)	(0.0044)	(0.0034)	(0.0059)	(0.0069)	(0.0032)	(0.0047)	(0.0025)	(0.0034)
a_2	0.00141	-0.00027	0.00046[b]	0.00064[c]	-1.28E-03	-0.00002	4.20E-04	0.000867	0.00009	-0.00060
	(0.0008)	(0.0003)	(0.0002)	(0.0003)	(0.0006)	(0.0003)	(0.0008)	(0.0011)	(0.0001)	(0.0005)
a_3	0.00050	0.00115	0.00023	-0.00063[c]	0.00572[b]	0.00344[d]	0.00281[b]	0.00267[b]	-0.00075[d]	0.00080[d]
	(0.0009)	(0.0004)	(0.0003)	(0.0003)	(0.0009)	(0.0005)	(0.0014)	(0.0015)	(0.0002)	(0.0002)

Table 9A: Conditional volatility testing (continued – II)

	ENG		GER		JAP		HK		CAN	
Cha.	Low	High	Low	High	Low	High	Low	High	Low	High
Size										
a_0	0.00390[d]	0.00548[d]	-0.00054[d]	0.02245[d]	0.01153[d]	0.01443[d]	0.04395[d]	0.00229[c]	0.00273	0.05981[d]
	(0.0009)	(0.0014)	(0.0042)	(0.0033)	(0.0022)	(0.0028)	(0.0039)	(0.0010)	(0.0019)	(0.0062)
a_1	0.97393[d]	0.98754[d]	0.92532[d]	0.95380[d]	0.94309[d]	0.96176[d]	0.85121[d]	0.99450[d]	0.97950[d]	0.89410[d]
	(0.0048)	(0.0030)	(0.0087)	(0.0059)	(0.0075)	(0.0063)	(0.0124)	(0.0024)	(0.0045)	(0.0105)
a_2	-0.00006	-0.00137[b]	0.00046	-0.00072	0.00157[d]	0.00047	0.00117[b]	-0.00025	0.00036	0.00299
	(0.0003)	(0.0008)	(0.0014)	(0.0009)	(0.0005)	(0.0007)	(0.0006)	(0.0002)	(0.0013)	(0.0025)
a_3	0.00221[d]	0.00251[d]	0.02836[d]	0.00555[d]	0.00418[d]	0.00224[d]	0.00273[d]	0.00022	0.00321[b]	0.00102
	(0.0007)	(0.0008)	(0.0051)	(0.0011)	(0.0007)	(0.0008)	(0.0008)	(0.0002)	(0.0016)	(0.0023)
M/B										
a_0	0.00505[d]	0.00327[d]	0.00044	0.00349[c]	0.01903[d]	0.00925[d]	0.00761[d]	0.00779[d]	0.01055[d]	0.00919[d]
	(0.0011)	(0.0010)	(0.0007)	(0.0015)	(0.0029)	(0.0023)	(0.0016)	(0.0015)	(0.0024)	(0.0025)
a_1	0.98613[d]	0.98899[d]	0.99430[d]	0.98616[d]	0.93073[d]	0.96602[d]	0.97720[d]	0.97947[d]	0.97696[d]	0.97793[d]
	(0.0029)	(0.0023)	(0.0023)	(0.0034)	(0.0083)	(0.0061)	(0.0046)	(0.0039)	(0.0044)	(0.0043)
a_2	-0.00007	0.00250[d]	0.00046	-0.00054	-0.00008	0.00077	0.00074[b]	-0.00004	0.00200[b]	0.00093
	(0.0004)	(0.0007)	(0.0003)	(0.0006)	(0.0006)	(0.0006)	(0.0004)	(0.0004)	(0.0011)	(0.0012)
a_3	0.00140[d]	-0.00063	0.00145[b]	0.00415[d]	0.00560[d]	0.00209[d]	-0.00005	0.00047	0.00047	0.00161
	(0.0005)	(0.0008)	(0.0007)	(0.0008)	(0.0010)	(0.0006)	(0.0004)	(0.0004)	(0.0011)	(0.0014)
Cash										
a_0	0.00930[d]	0.00299[d]	0.00481[d]	0.00431[d]	0.01115[d]	0.01900[d]	0.00201[b]	0.01520[d]	0.00541[b]	0.27532[d]
	(0.0017)	(0.0010)	(0.0016)	(0.0012)	(0.0023)	(0.0020)	(0.0008)	(0.0023)	(0.0024)	(0.0117)
a_1	0.97733[d]	0.98950[d]	0.98099[d]	0.97821[d]	0.95949[d]	0.93084[d]	0.99323[d]	0.95779[d]	0.97024[d]	0.55076[d]
	(0.0040)	(0.0024)	(0.0038)	(0.0049)	(0.0064)	(0.0071)	(0.0021)	(0.0057)	(0.0048)	(0.0187)
a_2	0.00015	-0.00056	-0.00018	0.00008	-0.00025	0.00054	-0.00022	0.00026	0.00002	0.01112[d]
	(0.0005)	(0.0008)	(0.0005)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0008)	(0.0020)	(0.0041)
a_3	0.00206[b]	0.00204[d]	0.00530[d]	0.00019	0.00327[d]	-0.00014	0.00038	0.00102	0.00662[b]	-0.00466
	(0.0008)	(0.0007)	(0.0013)	(0.0012)	(0.0005)	(0.0001)	(0.0003)	(0.0008)	(0.0027)	(0.0039)
IA										
a_0	0.00538[d]	0.00474[d]	0.00364[b]	0.00024	0.00864[d]	0.00785[d]	-0.00070	0.01946[d]	0.01207[d]	0.00016
	(0.0012)	(0.0010)	(0.0015)	(0.0010)	(0.0023)	(0.0020)	(0.0006)	(0.0028)	(0.0032)	(0.0033)
a_1	0.98488[d]	0.98639[d]	0.98611[d]	0.99151[d]	0.96441[d]	0.97029[d]	0.96597[d]	0.94721[d]	0.97248[d]	0.97329[d]
	(0.0030)	(0.0025)	(0.0035)	(0.0026)	(0.0061)	(0.0056)	(0.0061)	(0.0076)	(0.0055)	(0.0054)
a_2	0.00002	-0.00102[c]	0.00016	-0.00124	0.00012	0.00028	-0.00118[b]	-0.00065	0.00373[b]	-0.00285
	(0.0004)	(0.0005)	(0.0005)	(0.0008)	(0.0006)	(0.0005)	(0.0006)	(0.0005)	(0.0018)	(0.0023)
a_3	0.00180[b]	0.00266[d]	0.00261[d]	0.00455[d]	0.00446[d]	0.00228	0.00086	0.00116[c]	-0.00120	0.00786[c]
	(0.0007)	(0.0006)	(0.0009)	(0.0011)	(0.0009)	(0.0005)	(0.0005)	(0.0005)	(0.0023)	(0.0031)

Table 9A: Conditional volatility testing (continued – III)

	ENG		GER		JAP		HK		CAN	
Cha	Low	High	Low	High	Low	High	Low	High	Low	High
Debt										
a_0	0.00376[d]	0.00255[d]	0.00256	-0.00153	0.01093[d]	0.00867[d]	0.00514[d]	0.00262[d]	0.00962[d]	0.02378[d]
	(0.0011)	(0.0008)	(0.0018)	(0.0010)	(0.0023)	(0.0022)	(0.0018)	(0.0011)	(0.0024)	(0.0039)
a_1	0.98998[d]	0.98965[d]	0.98467[d]	0.99659[d]	0.95951[d]	0.96580[d]	0.97931[d]	0.99201[d]	0.97653[d]	0.95666[d]
	(0.0026)	(0.0020)	(0.0038)	(0.0019)	(0.0064)	(0.0060)	(0.0048)	(0.0031)	(0.0046)	(0.0067)
a_2	-0.00081	-0.00118[c]	-0.00054	0.00028	0.00018	0.00007	0.00036	-0.00037	0.00014	0.00257[c]
	(0.0005)	(0.0006)	(0.0007)	(0.0002)	(0.0005)	(0.0007)	(0.0008)	(0.0004)	(0.0012)	(0.0013)
a_3	0.00230[d]	0.00365[d]	0.00506[d]	0.00275[d]	0.00364[d]	0.00343[d]	0.00116	0.00043	0.00252	0.00029
	(0.0008)	(0.0007)	(0.0011)	(0.0007)	(0.0007)	(0.0008)	(0.0007)	(0.0003)	(0.0017)	(0.0020)
Liq										
a_0	0.02417[d]	0.00370[d]	0.00174[b]	0.00363	0.00832[d]	0.01080[d]	0.00024	0.00195[d]	0.00249	0.02867[d]
	(0.0032)	(0.0010)	(0.0012)	(0.0016)	(0.0015)	(0.0017)	(0.0005)	(0.0010)	(0.0020)	(0.0060)
a_1	0.95297[d]	0.98307[d]	0.96532[b]	0.98557[d]	0.97024[d]	0.96538[d]	0.99567[d]	0.99486[d]	0.99482[d]	0.95167[d]
	(0.0060)	(0.0043)	(0.0060)	(0.0033)	(0.0041)	(0.0045)	(0.0023)	(0.0025)	(0.0021)	(0.0091)
a_2	-0.0006	0.00037	0.00225[c]	-0.00225[d]	0.00160[d]	0.00096[b]	-0.00006	-0.00013	0.00190[c]	0.00233
	(0.0009)	(0.0003)	(0.0006)	(0.0007)	(0.0005)	(0.0005)	(0.0004)	(0.0003)	(0.0008)	(0.0018)
a_3	3.51E-03[d]	-2.74E-04	0.00362[d]	0.00531[c]	0.00094[b]	0.00152[b]	0.00009	0.00012	-0.00154	0.00035
	(0.0012)	(0.0007)	(0.0015)	(0.0007)	(0.0005)	(0.0006)	(0.0005)	(0.0002)	(0.0014)	(0.0018)
Beta										
a_0	0.00171[c]	0.00263[b]	0.00155	-0.00102	0.00781[d]	0.00912[d]	0.00114	0.00453[b]	0.01000[d]	0.01220[d]
	(0.0008)	(0.0010)	(0.0018)	(0.0013)	(0.0021)	(0.0022)	(0.0012)	(0.0014)	(0.0023)	(0.0028)
a_1	0.98764[d]	0.99080[d]	0.97252[d]	0.99059[d]	0.95712[d]	0.96110[d]	0.99183[d]	0.98869[d]	0.97173[d]	0.96789[d]
	(0.0028)	(0.0031)	(0.0050)	(0.0027)	(0.0065)	(0.0065)	(0.0029)	(0.0035)	(0.0051)	(0.0059)
a_2	-0.0004	0.00035	-0.00105	0.00008	-0.00056	0.00093	-0.00040	-0.00018	0.00056	0.00016
	(0.0006)	(0.0008)	(0.0008)	(0.0006)	(0.0007)	(0.0007)	(0.0004)	(0.0002)	(0.0007)	(0.0025)
a_3	0.00307[c]	0.00085	0.01377[d]	0.00395[d]	0.00896[d]	0.00219[d]	0.00186[d]	0.00018	0.00525[d]	0.00147
	(0.0010)	(0.0010)	(0.0029)	(0.0009)	(0.0016)	(0.0006)	(0.0006)	(0.0001)	(0.0016)	(0.0017)
ROA										
a_0	0.00265[d]	0.00091	-0.00107	0.00080	0.04076[d]	0.00722[d]	0.00324[d]	0.00432[d]	0.00433[b]	0.00755[b]
	(0.0010)	(0.0008)	(0.0013)	(0.0011)	(0.0022)	(0.0019)	(0.0012)	(0.0014)	(0.0023)	(0.0020)
a_1	0.99197[d]	0.99434[d]	0.99364[d]	0.99294[d]	0.88595[d]	0.96474[d]	0.98834[d]	0.98926[d]	0.97812[d]	0.98105[d]
	(0.0024)	(0.0019)	(0.0026)	(0.0024)	(0.0090)	(0.0062)	(0.0036)	(0.0032)	(0.0046)	(0.0041)
a_2	0.00019	-0.00133	0.00046[d]	-0.00065[b]	0.00788[b]	0.00197[d]	0.00015	-0.00040[c]	-0.00098	0.00076
	(0.0003)	(0.0007)	(0.0004)	(0.0003)	(0.0006)	(0.0005)	(0.0004)	(0.0002)	(0.0016)	(0.0009)
a_3	0.00092	0.00307[d]	0.00219[b]	0.00326	1.27E-03[d]	0.00070[d]	0.00039	0.00049[b]	0.00360[b]	0.00141
	(0.0006)	(0.0008)	(0.0009)	(0.0005)	(0.0002)	(0.0004)	(0.0004)	(0.0002)	(0.0018)	(0.0009)

Note 1) M/B refers to market-to-book ratio, Cash refers to cash-to-asset ratio, IA refers to investment-to-asset, Debt refers to debt-ratio, Liq refers to liquidity of stock, - Beta refers to CPAM beta, - ROA refers to return-on-asset.

2) CHN is an abbreviation of China, THA-Thailand, KOR- Korea, BRA-Brazil, MEX- Mexico, ENG- England, GER- Germany, JPN-Japan, HK- Hong Kong and CAN- Canada

3) superscript "b", "c", "d" refers that coefficients is statistically significant at 10%, 5% and 1%, respectively

Table 9B: Volatility testing II

The table shows the summary of coefficients, indicating stock market correlations rise due to an increment of volatility in one country, form table 9A

Note: L refers to firm characteristic type-I, come from the lowest 25 percent of that multiple after rank stock with respect to that firm characteristic e.g. small-cap indices then, H refers to firm characteristic type-II, come from the highest 25 percent of that multiple after rank stock with respect to that firm characteristic e.g. Large-cap indices, with respect to size. Thus,

- Size L refer to stock with small caps, H refer to stock with large caps
- M/B L refer to stock with low market-to-book, H refer to stock with high market-to-book
- Cash L refer to stock with low cash-to-asset, H refer to stock with high-to-asset
- IA L refer to stock with low investment-to-asset, H refer to stock with high investment-to-asset
- Debt L refer to stock with low debt ratio, H refer to stock with high low debt ratio
- Liquid L refer to illiquid stock, H refer to high liquid stock
- Beta L refer to stock with low beta, H refer to stock with high beta
- ROA L refer to stock with low ROA, H refer to stock with high ROA

U.S. refers to conditional standard deviation of U.S. stock index, Domes is the conditional standard deviation of index constructed by each firm characteristic from international market. Cov. Is the covariance between coefficients, obtained from regress model with SUR method.

$$\boldsymbol{\rho_{ij,t} = a_0 + a_1\rho_{ij,t-1} + a_2\sigma_{i,t} + a_3\sigma_{j,t} + e_{ij,t}}$$

C refers that coefficient of dummy variables in table 9A is statistically significant at least 10 % level therefore if C jointly occurring in both types of firm characteristics in one country at the same time (the bold letter), I must compare this pair that which of them are likely to be stronger affected by conditional volatility than another by using the statistical test

$$\boldsymbol{z = \frac{b_{k,c1} - b_{k,c2}}{\sqrt{S.E._{b_{k,c1}}{}^2 + S.E._{b_{k,c2}}{}^2 - 2cov_{b_{k,c1}b_{k,c2}}}}}$$

The results of this comparison are provided in Table 9C

	CHN			THA			KOR			BRA			MEX			ENG			GER			JAP			HK			CAN		
Cha	L	H	Cov.	L	H	Cov.	L	H	Cov.	L	H	Cov.	L	H	Cov.	L	H	Cov.	L	H	Cov.	L	H	Cov.	L	H	Cov.	L	H	Cov.
Size																														
U.S.				C						C												C			C			C		
Do							C	C	1.3E-07	C	C	1.4E-07		C		C	C	1.1E-08	C	C	1.3E-06	C	C	1.73E-07	C					
M/B																														
U.S.				C						C			C												C			C		
Do				C			C				C		C	C	9.8E-09	C	C	1.4E-08	C	C	9.00-08	C	C	3.0E-07						
Cash																														
U.S.							C			C	C	1.7E-07		C															C	
Do				C	C	1.4E-07										C	C	1.9E-08	C			C						C		
IA																														
U.S.							C			C	C	1.4E-07					C								C			C		
Do					C		C						C	C	-1.2E-08	C	C	1.9E-07	C	C	2.3E-07	C				C			C	
Debt																														
U.S.					C					C			C				C												C	
Do				C				C					C	C	9.8E-09	C	C	2.8E-07	C	C		C	C	3.1E-07						
Liquid																														
U.S.				C						C									C	C	1.7E-07	C	C	2.5E-07				C		
Do							C	C	8.7E-08	C	C			C		C			C	C	1.6E-07	C	C	2.5E-07						
Beta																														
U.S.	C	C	6.2E-07	C				C					C	C	3.1E-07															
Do							C	C	2.3E-07		C			C		C			C	C	3.3E-07	C	C	4.3E-07	C	C	1.7E-08	C		
ROA																														
U.S.				C	C	1.1E-08											C		C	C	7.4E-08	C	C	6.1E-10		C				
DO					C		C	C	2..3E-07	C	C	2.9E-07	C	C	-8.3E-07		C		C			C	C	4.3E-08		C		C		

Table 9C: Volatility testing III

The table shows the summary of type of firm characteristic that likely to attribute the stronger impact of conditional volatility to correlation coefficients

Cha.	Volatility from	Country									
		CH	THA	KOR	BRA	MEX	ENG	GER	JP	HK	CA
Size	U.S.		small	small	small		small			small	
	Domes			small		large		small	small	small	small
M/B	U.S.		low	low	low	low				low	low
	Domes		low	low	high	high	high	high	low		
Cash	U.S.			high	high	high					high
	Domes							low	low		low
IA	U.S.			low						high	low
	Domes		high	low			high	high	low	high	high
Debt	U.S.		high		low	low	high				high
	Domes		low	high	low		high				
Liquid	U.S.		low		low			low	low		low
	Domes				high	high	high		high		
Beta	U.S.	high	low	high							
	Domes			low	high	high		low	low	low	low
ROA	U.S.			low			low	low	low	low	
	Domes		low	low		low	high			high	low

Note 1) M/B refers to market-to-book ratio, Cash refers to cash-to-asset ratio, IA refers to investment-to-asset, Debt refers to debt-ratio, Liq refers to liquidity of stock, - Beta refers to CPAM beta, - ROA refers to return-on-asset.

2) U.S. refers to conditional standard deviation of U.S. stock index, Domes is the conditional standard deviation of index constructed by each firm characteristic from international market.

3) CHN is an abbreviation of China, THA-Thailand, KOR- Korea, BRA-Brazil, MEX- Mexico, ENG- England, GER- Germany, JPN-Japan, HK- Hong Kong and CAN- Canada

Table 10: presents the estimation result of surprised change in monetary policy rate to cross-country correlation, consider in term of aggregate level.

Country	Contagion testing			Surprised in policy rate			
				From U.S.		From Domestics	
	Dummy I	Dummy II	Dummy III	One day Lagged	Current Term	One day lagged	Current Term
China	0.00323[d]	0.00177[d]	0.00068[b]	0.03454	0.02018	0.00359	-0.00352
	(0.0009)	(0.0006)	(0.0004)	(0.0343)	(0.0345)	(0.0103)	(0.0103)
Thailand	0.00036	0.00008	-0.00002	0.05537[c]	0.36642[d]	-0.00061	-0.00674[d]
	(0.0002)	(0.0002)	(0.0001)	(0.0240)	(0.02287)	(0.0012)	(0.0017)
Korea	0.00023	0.00011	0.00001	-0.10804[d]	0.38056[d]	-0.00759[d]	0.00379[d]
	(0.0001)	(0.0001)	(0.0001)	(0.0279)	(0.0286)	(0.0027)	(0.0013)
Brazil	0.00249	0.00311[c]	0.00186[c]	0.12188	-4.97994[b]	0.00882	-0.04709
	(0.0018)	(0.0013)	(0.0008)	(2.7136)	(2.7142)	(0.1403)	(0.1403)
Mexico	0.00131[c]	0.00206[d]	0.00049[b]	0.62862[d]	-0.17597[d]	0.01842	0.00747
	(0.0006)	(0.0004)	(0.0003)	(0.0542)	(0.0544)	(0.0171)	(0.0086)
England	0.99056[d]	0.00053[d]	0.00082	0.00048[c]	-0.98194[d]	0.38851	-0.00142
	(0.0029)	(0.0004)	(0.0003)	(0.0001)	(0.0395)	(0.0391)	(0.0073)
Germany	0.00030	0.00096[d]	0.00055[d]	-0.01209	-0.00565	-0.03823[d]	0.00504[b]
	(0.0005)	(0.0004)	(0.0002)	(0.0093)	(0.0122)	(0.0039)	(0.0028)
Japan	0.00130[b]	0.00169[d]	0.00065[c]	-0.49777[d]	0.98301[d]	-0.00076	0.00323[c]
	(0.0007)	(0.0006)	(0.0003)	(0.0676)	(0.0658)	(0.0013)	(0.0013)
Hong	-0.00017[c]	-0.00001	0.00001	0.05352[d]	-0.14072[d]		
	(0.0001)	(0.0001)	(0.0000)	(0.0066)	(0.0065)		
Canada	0.00100	0.00217[d]	0.00103[d]	-0.02749	0.00851	0.00348	-0.02593
	(0.001)	(0.0006)	(0.0003)	(0.0194)	(0.0155)	(0.0128)	(0.02271)

Brief summary of Table 10

	Country									
T	CHN	THA	KOR	BRA	MEX	ENG	GER	JPN	HK	CAN
T_1	C				C	C		C	C	
T_2	C			C	C	C	C	C		C
T_3	C			C	C		C	C		C
u_{t-1}		C	C		C	C		C		
u_t		C	C	C	C	C	C	C	C	
D_{t-1}			C				C		NA	
D_t		C	C				C	C	NA	

Note 1) u_{t-1} refers to one day lagged of unexpected change in U.S. policy rates, u_t refers to unexpected change in U.S. policy rates, D_{t-1} refer to one day lagged of unexpected change in Domestic rates, D_t refers to unexpected change in Domestic policy rates

2) C refers that coefficient is statistically significant at least 10 %

3) CHN is an abbreviation of China, THA-Thailand, KOR- Korea, BRA-Brazil, MEX- Mexico, ENG- England, GER- Germany, JPN-Japan, HK- Hong Kong and CAN-Canada

4) superscript "b", "c", "d" refers that coefficients is statistically significant at 10%, 5% and 1%, respectively

Table 11A: the effect of unexpected change in policy rate I

Regression equation is

$$\boldsymbol{\rho_{ij,t}} = \boldsymbol{a_0} + \boldsymbol{a_1\rho_{ij,t-1}} + \sum_{k=1}^{3} \boldsymbol{b_k D_{k,t}} + \sum_{s=-1}^{1} \boldsymbol{\varphi_s^1 I_{i,t-s}^{(T_a)}} + \sum_{s=-1}^{1} \boldsymbol{\varphi_s^2 I_{j,t-s}^{(T_a)}} + \boldsymbol{e_{ij,t}}$$

Note To save the space, the table 11A will provide the only coefficient indicating the impact of unexpected change in policy rate of U.S. and domestic country

	CHN		THA		KOR		BRA		MEX	
Cha	Low	High	Low	High	Low	High	Low	High	Low	High
Size										
b_1	0.00189	0.00153[b]	0.00572	0.00084[c]	-0.00062	-0.00018	0.00280[b]	0.00646[d]	0.00018	0.00177[b]
	(0.0012)	(0.0008)	(0.0037)	(0.0004)	(0.0009)	(0.0006)	(0.0015)	(0.0021)	(0.0006)	(0.0010)
b_2	0.00240[d]	0.00166[d]	0.00696[b]	0.00021	0.00191[d]	0.00102	0.00285[d]	0.00512[d]	0.00015	0.00281[d]
	(0.0009)	(0.0006)	(0.0031)	(0.0003)	(0.0007)	(0.0007)	(0.0010)	(0.0013)	(0.0006)	(0.0006)
b_3	0.00038	0.00045	0.00107	0.00000	0.00017	0.00025	0.00164[d]	0.00319[d]	0.00025	0.00057
	(0.0005)	(0.0003)	(0.0018)	(0.0002)	(0.0004)	(0.0003)	(0.0006)	(0.0009)	(0.0002)	(0.0004)
$\boldsymbol{\varphi_{-1}^1}$	0.05289	0.04246	0.53776	0.01166	0.11378[d]	0.07628[d]	0.00470	0.01722	-0.01931	-0.03906
	(0.0570)	(0.0398)	(0.2567)	(0.0139)	(0.0365)	(0.0435)	(0.0251)	(0.0255)	(0.0209)	(0.0299)
$\boldsymbol{\varphi_1^1}$	0.07087	0.03711	0.18176[b]	0.01453[b]	0.05289	0.02619[d]	-0.14676[d]	-0.15838[c]	0.01733	0.00047
	(0.0445)	(0.0235)	(0.0889)	(0.0083)	(0.0365)	(0.0130)	(0.0340)	(0.0692)	(0.0129)	(0.0154)
$\boldsymbol{\varphi_{-1}^2}$	-0.01793	-0.01027	0.00957	-0.00300	-0.00395	-0.00211	0.08490[d]	0.03591	-0.00161	0.00074
$\boldsymbol{\varphi_1^2}$	(0.0186)	(0.0092)	(0.0591)	(0.0026)	(0.0191)	(0.0031)	(0.0249)	(0.0451)	(0.0158)	(0.0088)
	0.00974	0.00623	-0.03898	0.00185	0.01622	0.01592	-0.00131	-0.02500	0.02820[b]	-0.00486
	(0.0091)	(0.0056)	(0.0974)	(0.0064)	(0.0191)	(0.0107)	(0.0220)	(0.0478)	(0.0171)	(0.0075)
M/B										
b_1	0.00412[b]	0.00283[b]	0.00005	0.00103[c]	-0.00005	0.00057[b]	0.00063	0.00483[c]	0.00090[b]	0.00076
	(0.0022)	(0.0017)	(0.0002)	(0.0004)	(0.0001)	(0.0003)	(0.0014)	(0.0021)	(0.0004)	(0.0009)
b_2	0.00465[d]	0.00367[d]	0.00035	0.00022	0.00009[b]	-0.00044	0.00168[b]	0.00378[d]	0.00081[b]	0.00229[d]
	(0.0016)	(0.0013)	(0.0002)	(0.0003)	(0.0001)	(0.0004)	(0.0008)	(0.0014)	(0.0003)	(0.0006)
b_3	0.00102	0.00062	0.00016	-0.00005	0.00001	-0.00001	0.00069	0.00135	0.00043[b]	0.00066[b]
	(0.0010)	(0.0007)	(0.0001)	(0.0002)	(0.0000)	(0.0002)	(0.0005)	(0.0009)	(0.0002)	(0.0003)
$\boldsymbol{\varphi_{-1}^1}$	0.10638	0.09174	0.02478[d]	0.02306[d]	0.00927	-0.03084	0.01684	0.01070	-0.01668	-0.04437
	(0.0931)	(0.0933)	(0.0049)	(0.0055)	(0.0068)	(0.0250)	(0.0197)	(0.0216)	(0.0080)	(0.0363)
$\boldsymbol{\varphi_1^1}$	0.13581	0.08370	0.01054	0.02144[c]	0.00327[b]	-0.01430	-0.11521[d]	-0.13723[b]	0.00174	-0.00608
	(0.0931)	(0.0539)	(0.0074)	(0.0089)	(0.0019)	(0.0186)	(0.0356)	(0.0717)	(0.0028)	(0.0136)
$\boldsymbol{\varphi_{-1}^2}$	-0.03459	-0.02098	-0.00416	-0.00173	-0.00063	0.00595	0.02961[b]	0.05135	0.00162	-0.04224
$\boldsymbol{\varphi_1^2}$	(0.0267)	(0.0180)	(0.0029)	(0.0025)	(0.0007)	(0.0037)	(0.0160)	(0.0310)	(0.0029)	(0.0377)
	0.01804	0.01385	0.00248	0.00167	0.00146	-0.00936	-0.04045	-0.03185	0.00114	0.00115
	(0.0267)	(0.0121)	(0.0027)	(0.0043)	(0.0009)	(0.0073)	(0.0386)	(0.0514)	(0.0010)	(0.0041)

Table 11A: the effect of unexpected change in policy rate (continued - I)

	CHN		THA		KOR		BRA		MEX	
Cha	Low	High	Low	High	Low	High	Low	High	Low	High
Cash										
b_1	0.00267[b]	0.00205[b]	0.00150[b]	0.00093	0.00048	-0.00039[d]	0.00104	0.00483	0.00248	0.00441[c]
	(0.0014)	(0.0011)	(0.0006)	(0.0006)	(0.0003)	(0.0002)	(0.0008)	(0.0021)	(0.0017)	(0.0017)
b_2	0.00284[d]	0.00255[d]	0.00022	0.00040	-0.00062[b]	0.00011	0.00098[b]	0.00378[d]	-0.00073	0.00486[d]
	(0.0010)	(0.0009)	(0.0004)	(0.0006)	(0.0003)	(0.0002)	(0.0006)	(0.0014)	(0.0011)	(0.0013)
b_3	0.00064	0.00056	0.00002	0.00010	0.00011	-0.00001	0.00030	0.00135	0.00229[d]	0.00014
	(0.0006)	(0.0005)	(0.0002)	(0.0004)	(0.0002)	(0.0001)	(0.0003)	(0.0009)	(0.0008)	(0.0010)
φ_{-1}^{1}	0.07541	0.05705	0.04854[d]	0.07642[b]	-0.04738	0.00463	0.00715	0.01070	0.05315	0.01361
	(0.0573)	(0.0667)	(0.0093)	(0.0397)	(0.0404)	(0.0072)	(0.0083)	(0.0216)	(0.0685)	(0.0282)
φ_{1}^{1}	0.08763	0.04994	0.01777	0.01103[b]	-0.01580	0.00795[d]	-0.04994[b]	-0.13723[b]	-0.06440	-0.12282[c]
	(0.0574)	(0.0323)	(0.0169)	(0.0062)	(0.0111)	(0.0042)	(0.0222)	(0.0717)	(0.0682)	(0.0624)
φ_{-1}^{2}	-0.02338	-0.01489	-0.02143[b]	0.00265	0.00454	-0.00232	0.01318	0.05135	-0.00820	-0.02679
	(0.0164)	(0.0138)	(0.0103)	(0.0059)	(0.0031)	(0.0019)	(0.0095)	(0.0310)	(0.0354)	(0.0435)
φ_{1}^{2}	0.01321	0.00930	-0.00444	0.00806	-0.00546	0.00610	0.00385	-0.03185	0.06106[b]	-0.00831
	(0.0164)	(0.0076)	(0.0119)	(0.0116)	(0.0047)	(0.0042)	(0.0136)	(0.0514)	(0.0356)	(0.0186)
IA										
b_1	0.00140[b]	0.00168[b]	0.00040	0.00119[c]	-0.00073	0.00026	0.00274[b]	0.00544[c]	0.00323	0.00058
	(0.0007)	(0.0010)	(0.0005)	(0.0005)	(0.0006)	(0.0002)	(0.0015)	(0.0022)	(0.0021)	(0.0016)
b_2	0.00152[d]	0.00192[d]	0.00018	0.00013	0.00074	0.00022	0.00402[d]	0.00464[d]	0.00284[b]	0.00361[d]
	(0.0005)	(0.0007)	(0.0003)	(0.0003)	(0.0004)	(0.0002)	(0.0010)	(0.0014)	(0.0015)	(0.0010)
b_3	0.00019	0.00045	0.00003	-0.00010	-0.00009	0.00008	0.00130[b]	0.00286[d]	0.00151	0.00145[c]
	(0.0003)	(0.0004)	(0.0002)	(0.0002)	(0.0002)	(0.0001)	(0.0006)	(0.0010)	(0.0009)	(0.0006)
φ_{-1}^{1}	0.03402	0.05499	0.02496	0.05081	0.07756[b]	-0.02680[d]	0.07634[b]	0.05712	0.04737	-0.00112
	(0.0322)	(0.0512)	(0.0178)	(0.0438)	(0.0469)	(0.0089)	(0.0330)	(0.0374)	(0.0855)	(0.0131)
φ_{1}^{1}	0.04032	0.04650[b]	0.01331	0.01814	0.01628[b]	-0.00015	-0.14816[b]	-0.18215[b]	-0.13388	-0.04176
	(0.0263)	(0.0268)	(0.0178)	(0.0139)	(0.0087)	(0.0089)	(0.0649)	(0.0968)	(0.0851)	(0.0300)
φ_{-1}^{2}	-0.00006	-0.00008	-0.01395	-0.00145	-0.00409	0.00319	0.03939	0.03051	-0.01792	-0.04872
	(0.0001)	(0.0001)	(0.0087)	(0.0034)	(0.0042)	(0.0047)	(0.0407)	(0.0476)	(0.0442)	(0.0332)
φ_{1}^{2}	0.00007	0.00008	0.01018	0.00134	0.00727	-0.00527	0.00091	-0.09548[b]	0.05793	0.01376
	(0.0000)	(0.0000)	(0.0087)	(0.0046)	(0.0086)	(0.0047)	(0.0601)	(0.0490)	(0.0444)	(0.0107)
Debt										
b_1	0.00134	0.00226	0.00118[b]	0.00125[b]	-0.00119[b]	-0.00049	0.00079	0.00240	0.00182	0.00052
	(0.0008)	(0.0012)	(0.0006)	(0.0007)	(0.0007)	(0.0005)	(0.0009)	(0.0016)	(0.0011)	(0.0010)
b_2	0.00171	0.00237	0.00041	0.00019	0.00066	0.00008	0.00108[b]	0.00247[c]	0.00246[d]	0.00292[d]
	(0.0006)	(0.0009)	(0.0005)	(0.0004)	(0.0004)	(0.0003)	(0.0005)	(0.0010)	(0.0008)	(0.0008)
b_3	0.00027	0.00061	0.00011	-0.00014	0.00021	0.00017	0.00044	0.00129[c]	0.00123[b]	0.00081[b]
	(0.0003)	(0.0005)	(0.0003)	(0.0002)	(0.0003)	(0.0002)	(0.0003)	(0.0006)	(0.0005)	(0.0005)
φ_{-1}^{1}	0.02578	0.05153	0.04995[d]	0.04319	0.01029	0.01961	0.00459	0.00450	-0.00557	0.02768
	(0.0327)	(0.0566)	(0.0143)	(0.0420)	(0.0256)	(0.0199)	(0.0171)	(0.0165)	(0.0233)	(0.0420)
φ_{1}^{1}	0.03779	0.07031	0.01116	0.00966	0.03218	0.00434	-0.04459[d]	-0.09083[c]	-0.05537[d]	0.02627
	(0.0245)	(0.0453)	(0.0111)	(0.0071)	(0.0256)	(0.0199)	(0.0166)	(0.0421)	(0.0135)	(0.0418)
φ_{-1}^{2}	-0.00894	-0.01764	-0.01245[b]	-0.00071	-0.00734	-0.00762	0.00719	0.02630	-0.02481	-0.01686
	(0.0083)	(0.0155)	(0.0061)	(0.0033)	(0.0134)	(0.0104)	(0.0125)	(0.0328)	(0.0405)	(0.0217)
φ_{1}^{2}	0.00696	0.01006	0.00625	-0.01183	0.02657[b]	0.00419	-0.03079[b]	-0.01065	0.00254	-0.02284
	(0.0057)	(0.0102)	(0.0126)	(0.0058)	(0.0134)	(0.0104)	(0.0175)	(0.0274)	(0.0049)	(0.0218)

Table 11A: the effect of unexpected change in policy rate (continued - II)

	CHN		THA		KOR		BRA		MEX	
Cha	Low	High	Low	High	Low	High	Low	High	Low	High
Liq										
b_1	0.00192[b]	0.00147[b]	0.00018	0.00064[b]	-0.00008	-0.00060	0.00261	0.00220	0.00040	0.00245[d]
	(0.0011)	(0.0008)	(0.0001)	(0.0003)	(0.0003)	(0.0005)	(0.0016)	(0.0018)	(0.0004)	(0.0009)
b_2	0.00239[d]	0.00152[d]	0.00013[b]	-0.00009	0.00040	0.00038	0.00261[d]	0.00306[d]	0.00018	0.00325[d]
	(0.0008)	(0.0006)	(0.0001)	(0.0002)	(0.0002)	(0.0004)	(0.0009)	(0.0012)	(0.0005)	(0.0007)
b_3	0.00040	0.00044	0.00002	-0.00001	0.00023	0.00005	0.00151[c]	0.00166[b]	0.00050[c]	0.00048
	(0.0004)	(0.0003)	(0.0000)	(0.0002)	(0.0001)	(0.0002)	(0.0006)	(0.0007)	(0.0002)	(0.0004)
φ_{-1}^{1}	0.02943	0.04718	0.00805[c]	0.01714	0.00900	0.01505	0.02590	0.08616[b]	0.03290	0.01950
	(0.0529)	(0.0374)	(0.0039)	(0.0218)	(0.0091)	(0.0264)	(0.0220)	(0.0506)	(0.0282)	(0.0222)
φ_{1}^{1}	0.05317	0.04505	0.00098	0.01673[b]	0.01676[b]	0.03019[b]	-0.08104[d]	-0.18123[d]	0.00403	-0.04728[b]
	(0.0371)	(0.0279)	(0.0039)	(0.0099)	(0.0097)	(0.0170)	(0.0278)	(0.0639)	(0.0114)	(0.0285)
φ_{-1}^{2}	-0.01583	-0.01154	-0.00129	-0.00314	-0.00419	-0.00682	0.03692	0.02996	-0.00668	0.01093
	(0.0147)	(0.0102)	(0.0019)	(0.0027)	(0.0036)	(0.0052)	(0.0360)	(0.0280)	(0.0126)	(0.0071)
φ_{1}^{2}	0.00830	0.00693	0.00061	0.00623	0.01320[b]	0.01640	-0.02122	-0.02591	0.00367	-0.02897
	(0.0080)	(0.0063)	(0.0019)	(0.0052)	(0.0077)	(0.0111)	(0.0235)	(0.0451)	(0.0020)	(0.0313)
Beta										
b_1	0.00134	0.00621[c]	0.00047[d]	0.00182[b]	0.00000	-0.00072	0.00217	0.00190	0.00256	0.00030
	(0.0008)	(0.0028)	(0.0002)	(0.0007)	(0.0007)	(0.0008)	(0.0013)	(0.0015)	(0.0023)	(0.0019)
b_2	0.00171[d]	0.00599[d]	0.00051[d]	0.00046	0.00169[c]	0.00107	0.00225[d]	0.00206[b]	0.00357[c]	0.00220
	(0.0006)	(0.0019)	(0.0002)	(0.0006)	(0.0006)	(0.0008)	(0.0008)	(0.0009)	(0.0016)	(0.0013)
b_3	0.00041	0.00148	0.00011	0.00012	0.00008	0.00035	0.00081	0.00143[b]	0.00190[b]	0.00165[b]
	(0.0003)	(0.0012)	(0.0001)	(0.0004)	(0.0003)	(0.0003)	(0.0006)	(0.0006)	(0.0011)	(0.0009)
φ_{-1}^{1}	0.03659	0.10854	0.02937[d]	0.02629	0.07649[b]	0.08428[b]	0.02484	0.00500	0.03256	0.00137
	(0.0387)	(0.1150)	(0.0108)	(0.0294)	(0.0288)	(0.0524)	(0.0235)	(0.0184)	(0.0952)	(0.0787)
φ_{1}^{1}	0.03879	0.16202	0.00320	0.04273[b]	0.02773	0.04089[b]	-0.05992[c]	-0.12429[b]	-0.15727	-0.10741
	(0.0252)	(0.1150)	(0.0022)	(0.0215)	(0.0288)	(0.0205)	(0.0304)	(0.0497)	(0.0947)	(0.0783)
φ_{-1}^{2}	-0.01036	-0.04678	0.00155[c]	-0.01098	-0.00120	-0.00299	0.02675	0.03604	-0.03689	0.04481
	(0.0099)	(0.0330)	(0.0007)	(0.0085)	(0.0150)	(0.0043)	(0.0214)	(0.0391)	(0.0492)	(0.0406)
φ_{1}^{2}	0.00693	0.02136	-0.00311	0.00851	0.02287	0.00966	0.02461	-0.04602	0.00861	0.03501
	(0.0062)	(0.0330)	(0.0022)	(0.0106)	(0.0150)	(0.0140)	(0.0472)	(0.0317)	(0.0495)	(0.0408)
ROA										
b_1	0.00190	0.00009	0.00081[b]	0.00080	0.00011	-0.00025	0.00137	0.00245	0.00011	-0.00032
	(0.0014)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0008)	(0.0009)	(0.0018)	(0.0002)	(0.0009)
b_2	0.00270[d]	0.00078	0.00035	0.00031	0.00110[b]	0.00113	0.00176[b]	0.00257[b]	-0.00004	-0.00031
	(0.0010)	(0.0005)	(0.0003)	(0.0004)	(0.0006)	(0.0008)	(0.0007)	(0.0014)	(0.0002)	(0.0007)
b_3	0.00057	0.00027	-0.00003	0.00006	0.00021	0.00018	0.00050	0.00133	0.00016[b]	0.00056
	(0.0005)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0004)	(0.0004)	(0.0008)	(0.0001)	(0.0004)
φ_{-1}^{1}	0.03871	0.00048	0.01863	0.02215	0.05267[b]	0.10508[b]	0.01452	0.01614	0.00056	0.00286
	(0.0493)	(0.0047)	(0.0138)	(0.0188)	(0.0355)	(0.0552)	(0.0176)	(0.0716)	(0.0034)	(0.0134)
φ_{1}^{1}	0.08393	-0.01556	0.01362	0.01380[b]	0.02866	0.03801[c]	-0.04185[b]	-0.15504[c]	-0.00158	0.04630[b]
	(0.0532)	(0.0372)	(0.0086)	(0.0082)	(0.0111)	(0.0185)	(0.0204)	(0.0721)	(0.0021)	(0.0245)
φ_{-1}^{2}	-0.02082	-0.00398	-0.00729[b]	-0.00164	0.00122	-0.00402	0.00202	0.03686	-0.00172[b]	0.04252[c]
	(0.0207)	(0.0043)	(0.0039)	(0.0026)	(0.0034)	(0.0039)	(0.0101)	(0.0506)	(0.0007)	(0.0169)
φ_{1}^{2}	0.01316	-0.01682	-0.00398	-0.00093	0.00532	0.02615	-0.00588	-0.05212	-0.00039	-0.00440
	(0.0113)	(0.0170)	(0.0091)	(0.0144)	(0.0118)	(0.0075)	(0.0214)	(0.0503)	(0.0007)	(0.0058)

Table 11A: the effect of unexpected change in policy rate (continued - III)

	ENG		GER		JAP		HK		CAN	
Cha	Low	High	Low	High	Low	High	Low	High	Low	High
Size										
b_1	0.00069[b]	-0.00009	0.00094[b]	0.00092	0.00078	0.00117	0.00314[d]	0.00021	0.00017	0.00249
	(0.0003)	(0.0006)	(0.0004)	(0.0005)	(0.0009)	(0.0008)	(0.0010)	(0.0003)	(0.0017)	(0.0019)
b_2	0.00070[b]	0.00064	0.00079[b]	0.00130[d]	0.00194[d]	0.00164[d]	0.00312[d]	-0.00002	0.00292[b]	0.00325[c]
	(0.0004)	(0.0004)	(0.0004)	(0.0007)	(0.0007)	(0.0006)	(0.0008)	(0.0002)	(0.0013)	(0.0013)
b_3	0.00015	0.00043	0.00060[b]	0.00069[d]	0.00080[b]	0.00082[c]	0.00061	-0.00001	0.00135[b]	0.00065
	(0.0001)	(0.0003)	(0.0002)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0001)	(0.0006)	(0.0008)
φ_{-1}^{1}	0.00735	-0.00397	0.00231[b]	0.01281	-0.01517	-0.04009	-0.02696	-0.02550	-0.04026	0.02136
	(0.0033)	(0.0240)	(0.0189)	(0.0083)	(0.0377)	(0.0312)	(0.0175)	(0.0145)	(0.0294)	(0.0790)
φ_{1}^{1}	0.00358	-0.01329	0.00471	0.00285	0.00418	0.00917	0.06511[b]	0.00942	-0.00389	-0.15314[b]
	(0.0116)	(0.0240)	(0.0127)	(0.0069)	(0.0377)	(0.0312)	(0.0376)	(0.0080)	(0.0760)	(0.0790)
φ_{-1}^{2}	0.00152	-0.00642	0.03343[d]	0.02311[d]	-0.07631[c]	-0.00298			-0.00864	0.04195
	(0.0024)	(0.0092)	(0.0077)	(0.0059)	(0.0241)	(0.0199)			(0.0172)	(0.0650)
φ_{1}^{2}	0.00823[d]	-0.00290	-0.00062	-0.00146	-0.03136	0.01737			-0.07110	-0.08599
	(0.0021)	(0.0092)	(0.0141)	(0.0087)	(0.0241)	(0.0199)			(0.0611)	(0.0649)
M/B										
b_1	0.00049	0.00012	0.00083[b]	0.00144[b]	0.00099	0.00113	0.00174[d]	0.00254[d]	-0.00013	0.00274[b]
	(0.0005)	(0.0010)	(0.0007)	(0.0006)	(0.0009)	(0.0009)	(0.0006)	(0.0008)	(0.0013)	(0.0015)
b_2	0.00059[b]	0.00079	0.00116[b]	-0.00032[b]	0.00161[b]	0.00115[b]	0.00113[d]	0.00012	0.00254[d]	0.00207[c]
	(0.0003)	(0.0007)	(0.0005)	(0.0004)	(0.0007)	(0.0007)	(0.0004)	(0.0004)	(0.0010)	(0.0009)
b_3	0.00034	0.00061	0.00063[d]	0.00003	0.00088[b]	0.00050	-0.00001	-0.00012	0.00136[b]	0.00076
	(0.0002)	(0.0005)	(0.0003)	(0.0002)	(0.0004)	(0.0004)	(0.0003)	(0.0003)	(0.0006)	(0.0006)
φ_{-1}^{1}	-0.00294	-0.01253	0.01135	-0.00950	-0.05000	-0.04658	-0.02990[b]	-0.05157	-0.00135	0.01073
	(0.0188)	(0.0410)	(0.0261)	(0.0166)	(0.0844)	(0.0692)	(0.0165)	(0.0323)	(0.0546)	(0.0207)
φ_{1}^{1}	0.00494	0.02258	-0.00090	-0.00597	0.00536	-0.00473	0.02035	0.01745	-0.03159	-0.09909[d]
	(0.0188)	(0.0410)	(0.0261)	(0.0127)	(0.0314)	(0.0228)	(0.0134)	(0.0134)	(0.0546)	(0.0320)
φ_{-1}^{2}	-0.00046	-0.00626	0.02546[d]	0.00069[d]	-0.00766[c]	-0.02122[c]			0.00673	0.01660
	(0.0072)	(0.0157)	(0.0361)	(0.0191)	(0.0028)	(0.0039)			(0.0449)	(0.0117)
φ_{1}^{2}	-0.00304	-0.00341	-0.00370	0.01415	0.03034[c]	0.02246[c]			-0.05243	-0.06984[b]
	(0.0072)	(0.0157)	(0.0361)	(0.0163)	(0.0085)	(0.0078)			(0.0449)	(0.0384)
Cash										
b_1	0.00075	0.00000	0.00109	0.00108[c]	0.00059	0.00006	0.00103	0.00443[d]	0.00246	0.00709
	(0.0006)	(0.0010)	(0.0007)	(0.0007)	(0.0006)	(0.0006)	(0.0007)	(0.0011)	(0.0021)	(0.0029)
b_2	0.00116[b]	0.00064	0.00127[b]	0.00112	0.00069	0.00024	0.00031	0.00105	0.00422[d]	0.00578[d]
	(0.0005)	(0.0007)	(0.0006)	(0.0005)	(0.0004)	(0.0004)	(0.0004)	(0.0008)	(0.0016)	(0.0021)
b_3	0.00045	0.00080	0.00090[b]	0.00073	0.00040	-0.00009	0.00023	0.00022	0.00254[b]	0.00217[b]
	(0.0003)	(0.0005)	(0.0004)	(0.0003)	(0.0002)	(0.0001)	(0.0002)	(0.0005)	(0.0010)	(0.0012)
φ_{-1}^{1}	0.00064	-0.01187	0.03880	0.00680	-0.03166	-0.05968	-0.03861	-0.09479	-0.00744	0.01631
	(0.0251)	(0.0398)	(0.0203)	(0.0081)	(0.0450)	(0.0599)	(0.0209)	(0.0519)	(0.0853)	(0.0309)
φ_{1}^{1}	0.01202	0.00894	-0.00395	0.00203	-0.00156	-0.00133	0.01754	0.06046[c]	-0.03056	-0.25191[d]
	(0.0251)	(0.0398)	(0.0083)	(0.0116)	(0.0120)	(0.0146)	(0.0209)	(0.0308)	(0.0853)	(0.0688)
φ_{-1}^{2}	-0.00378	-0.00527	0.01349	0.03832	-0.02008[c]	-0.00754[c]			0.01609	0.06918[c]
	(0.0096)	(0.0152)	(0.0044)	(0.0047)	(0.0052)	(0.0030)			(0.0701)	(0.0338)
φ_{1}^{2}	-0.00443	-0.00346	-0.00981	0.00199	0.00537[d]	0.03065[d]			-0.09408	-0.16290[c]
	(0.0096)	(0.0152)	(0.0122)	(0.0175)	(0.0015)	(0.0076)			(0.0701)	(0.0790)

Table 11A: the effect of unexpected change in policy rate (continued - IV)

	ENG		GER		JAP		HK		CAN	
Cha	Low	High	Low	High	Low	High	Low	High	Low	High
IA										
b_1	0.00008	.00060	0.00109	0.00108	0.00006	0.00114[b]	-0.00026	0.00142[d]	0.00096	0.00130
	(0.0004)	(0.0005)	(0.0007)	(0.0007)	(0.0006)	(0.0007)	(0.0007)	(0.0005)	(0.0017)	(0.0022)
b_2	0.00055	0.00077[b]	0.00127[b]	0.00112[c]	0.00024	0.00122[c]	-0.00012	0.00040	0.00046	0.00200
	(0.0004)	(0.0003)	(0.0006)	(0.0005)	(0.0004)	(0.0005)	(0.0006)	(0.0004)	(0.0021)	(0.0016)
b_3	0.00053[d]	0.00049[b]	0.00090[b]	0.00073[c]	-0.00009	0.00073[c]	-0.00004	-0.00004	0.00134[b]	0.00206[c]
	(0.0002)	(0.0002)	(0.0004)	(0.0003)	(0.0001)	(0.0003)	(0.0003)	(0.0002)	(0.0008)	(0.0010)
φ_{-1}^1	0.00358	-0.01815	0.03880[b]	0.00680	-0.05968	-0.02753	0.06366	-0.05169	-0.02257	-0.02739
	(0.0173)	(0.0132)	(0.0203)	(0.0081)	(0.0599)	(0.0555)	(0.0219)	(0.0298)	(0.0604)	(0.0919)
φ_1^1	0.00299	0.02135[b]	-0.00395	0.00203	-0.00133	0.00003	0.02345	0.03134[b]	-0.00865	-0.04790
	(0.0173)	(0.0138)	(0.0083)	(0.0116)	(0.0146)	(0.0172)	(0.0505)	(0.0176)	(0.0604)	(0.0919)
φ_{-1}^2	-0.00177	-0.00362	0.01349[d]	0.03832[d]	-0.00754[b]	-0.00953[d]			0.00804	0.03755
φ_1^2	(0.0066)	(0.0024)	(0.0044)	(0.0047)	(0.0030)	(0.0017)			(0.0497)	(0.0755)
	-0.00055	-0.00132	-0.00981	0.00199	0.03065[d]	0.01751[d]			-0.05325	-0.05807
	(0.0066)	(0.0021)	(0.0122)	(0.0175)	(0.0076)	(0.0045)			(0.0496)	(0.0755)
Debt										
b_1	0.00053	0.00031	0.00038	0.00067	0.00098	0.00138	0.00343[d]	0.00146[d]	0.00284[b]	0.00181[b]
	(0.0006)	(0.0006)	(0.0004)	(0.0005)	(0.0008)	(0.0009)	(0.0013)	(0.0005)	(0.0012)	(0.0011)
b_2	0.00057	0.00054	0.00066[b]	0.00061[c]	0.00124[b]	0.00174[c]	0.00132[b]	0.00030	0.00133	0.00244[d]
	(0.0004)	(0.0004)	(0.0003)	(0.0003)	(0.0006)	(0.0007)	(0.0008)	(0.0003)	(0.0008)	(0.0008)
b_3	0.00056	0.00031	0.00026	0.00046[d]	0.00054	0.00107[d]	0.00052	0.00000	0.00104[b]	0.00091[b]
	(0.0003)	(0.0002)	(0.0002)	(0.0002)	(0.0003)	(0.0004)	(0.0005)	(0.0002)	(0.0005)	(0.0005)
φ_{-1}^1	-0.00486	-0.01587	0.00807	0.01911[c]	-0.00210	0.00424	-0.07874	-0.01031	-0.00527	0.02460
	(0.0230)	(0.0113)	(0.0144)[b]	(0.0092)	(0.0205)	(0.0245)	(0.0447)	(0.0157)	(0.0174)	(0.0437)
φ_1^1	0.00336	0.00526	0.03068	0.00312	0.02214	0.02510	0.03175	0.00685	-0.06929[b]	-0.00994
	(0.0230)	(0.0091)	(0.0144)	(0.0072)	(0.0183)	(0.0207)	(0.0447)	(0.0157)	(0.0269)	(0.0437)
φ_{-1}^2	-0.00447	-0.00485[c]	0.02810	0.02454[d]	-0.02084[d]	-0.01581[d]			0.01768	0.00349
φ_1^2	(0.0088)	(0.0022)	(0.0198)	(0.0064)	(0.0033)	(0.0032)			(0.0130)	(0.0359)
	-0.00394	-0.00160	-0.02564	0.00043	0.00846[d]	0.00974[d]			-0.06847[b]	-0.03886
	(0.0088)	(0.0026)	(0.0198)	(0.0073)	(0.0030)	(0.0032)			(0.0387)	(0.0359)
Liq										
b_1	0.00006	0.00070	0.00216[c]	0.00176	0.00123	0.00149[b]	-0.00023	0.00039	0.00039	0.00153
	(0.0003)	(0.0006)	(0.0009)	(0.0015)	(0.0010)	(0.0009)	(0.0006)	(0.0004)	(0.0012)	(0.0015)
b_2	0.00041	0.00195[b]	0.00166[c]	0.00145	0.00153[c]	0.00172[b]	0.00014	-0.00001	0.00177[c]	0.00205[b]
	(0.0003)	(0.0011)	(0.0008)	(0.0010)	(0.0007)	(0.0007)	(0.0004)	(0.0002)	(0.0007)	(0.0009)
b_3	-0.00024[b]	0.00107[b]	0.00019	0.00061	0.00055	0.00099[b]	-0.00031	0.00004	0.00056	0.00081
	(0.0001)	(0.0006)	(0.0004)	(0.0006)	(0.0005)	(0.0004)	(0.0002)	(0.0001)	(0.0004)	(0.0005)
φ_{-1}^1	0.00141	-0.01541	0.08924	0.04256	-0.00161	0.00739	-0.01778	-0.02112	-0.01446	-0.00926
	(0.0050)	(0.0139)	(0.0529)	(0.0599)	(0.0298)	(0.0278)	(0.0223)	(0.0116)	(0.0144)	(0.0286)
φ_1^1	0.01296	0.00693	0.00085	-0.00443	0.02321	0.02620	0.02112	0.01025	-0.00416	-0.07057[d]
	(0.0141)	(0.0133)	(0.0281)	(0.0599)	(0.0173)	(0.0193)	(0.0223)	(0.0116)	(0.0069)	(0.0216)
φ_{-1}^2	-0.00059	-0.00296	0.11719[c]	0.10512	-0.01147[d]	-0.01150[d]			0.01185	0.01698
φ_1^2	(0.0010)	(0.0039)	(0.0481)	(0.0828)	(0.0024)	(0.0021)			(0.0120)	(0.0118)
	0.00446	-0.00269	-0.05848	-0.07687	0.03705[d]	0.02053[d]			-0.03517	-0.06008
	(0.0013)	(0.0027)	(0.1212)	(0.0828)	(0.0109)	(0.0062)			(0.0262)	(0.0405)

Table 11A: the effect of unexpected change in policy rate (continued - VI)

	ENG		GER		JAP		HK		CAN	
Cha	Low	High	Low	High	Low	High	Low	High	Low	High
Beta										
b_1	0.00017	0.00121[b]	0.00095	0.00150[b]	0.00094	0.00179[b]	0.00165[c]	0.00047[b]	0.00243[c]	0.00008
	(0.0007)	(0.0005)	(0.0013)	(0.0007)	(0.0011)	(0.0010)	(0.0008)	(0.0002)	(0.0010)	(0.0019)
b_2	0.00069	0.00104[b]	0.00097	0.00187[d]	0.00098	0.00194[b]	0.00053	0.00006	0.00208[d]	0.00135
	(0.0008)	(0.0004)	(0.0008)	(0.0006)	(0.0008)	(0.0008)	(0.0005)	(0.0002)	(0.0006)	(0.0012)
b_3	0.00003	0.00060[b]	0.00089[b]	0.00117[b]	0.00031	0.00125[d]	0.00000	-0.00002	0.00011	0.00177[d]
	(0.0003)	(0.0002)	(0.0005)	(0.0005)	(0.0006)	(0.0004)	(0.0002)	(0.0001)	(0.0004)	(0.0006)
φ_{-1}^{1}	-0.00754	-0.01131	0.04797[c]	0.02521[d]	-0.00515	0.00031	-0.04932	-0.01072[b]	-0.01798	-0.05524
	(0.0091)	(0.0127)	(0.0244)	(0.0074)	(0.0362)	(0.0229)	(0.0322)	(0.0059)	(0.0141)	(0.0455)
φ_{1}^{1}	0.00306	0.01894	0.02673	0.00634	0.01572	0.02514	0.02946	0.00714	0.00235	-0.08918[b]
	(0.0153)	(0.0208)	(0.0301)	(0.0112)	(0.0201)	(0.0223)	(0.0247)	(0.0048)	(0.0115)	(0.0375)
φ_{-1}^{2}	-0.00182	-0.00192	0.05376[d]	0.03769[d]	-0.00161	0.01507			0.00768	0.02608
	(0.0033)	(0.0049)	(0.0128)	(0.0049)	(0.0214)	(0.0128)			(0.0074)	(0.0287)
φ_{1}^{2}	0.00733[d]	-0.00304	-0.01887	0.00368	-0.02504	-0.02382			-0.02412	-0.08295
	(0.0028)	(0.0027)	(0.0220)	(0.0183)	(0.0263)	(0.0221)			(0.0198)	(0.0723)
ROA										
b_1	0.00042	-0.00002	0.00041	0.00046	0.00064[b]	0.00121	0.00166[b]	0.00040	0.00019	0.00331[d]
	(0.0003)	(0.0009)	(0.0005)	(0.0003)	(0.0007)	(0.0007)	(0.0007)	(0.0003)	(0.0016)	(0.0012)
b_2	0.00059[d]	0.00075	0.00102[d]	0.00077	0.00098[c]	0.00159[b]	0.00061	-0.00001	0.00172[b]	0.00222[d]
	(0.0002)	(0.0006)	(0.0005)	(0.0003)	(0.0005)	(0.0007)	(0.0004)	(0.0002)	(0.0011)	(0.0007)
b_3	0.00035[d]	0.00061	0.00049[c]	0.00029[b]	0.00049[b]	0.00048	0.00014	0.00003	0.00168[d]	0.00104[c]
	(0.0001)	(0.0004)	(0.0002)	(0.0001)	(0.0003)	(0.0002)	(0.0002)	(0.0001)	(0.0006)	(0.0004)
φ_{-1}^{1}	0.00001	-0.00597	0.00751	0.00506	-0.01821	-0.01428	-0.03733[b]	-0.01427[b]	-0.03887	-0.07012[d]
	(0.0036)	(0.0368)	(0.0164)	(0.0072)	(0.0521)	(0.0307)	(0.0213)	(0.0093)	(0.0479)	(0.0260)
φ_{1}^{1}	-0.00365	0.00123	0.03794[b]	0.00304	-0.00963	-0.00353	0.03223[b]	0.00988	-0.05061[b]	0.00796
	(0.0104)	(0.0368)	(0.0187)	(0.0031)	(0.0146)	(0.0161)	(0.0194)	(0.0093)	(0.0268)	(0.0196)
φ_{-1}^{2}	-0.00230[b]	-0.00562	0.04324[d]	0.02208	-0.00683[d]	-0.00070			0.00787	0.01531
	(0.0011)	(0.0141)	(0.0116)	(0.0051)	(0.0018)	(0.0017)			(0.0300)	(0.0114)
φ_{1}^{2}	-0.00219[b]	-0.00237	0.00499	0.00118	0.01799	0.00249			-0.06053	-0.04561
	(0.0011)	(0.0141)	(0.0359)	(0.0070)	(0.0041)	(0.0018)			(0.0524)	(0.0331)

Note 1) M/B refers to market-to-book ratio, Cash refers to cash-to-asset ratio, IA refers to investment-to-asset, Debt refers to debt-ratio, Liq refers to liquidity of stock, - Beta refers to CPAM beta, - ROA refers to return-on-asset.

2) CHN is an abbreviation of China, THA-Thailand, KOR- Korea, BRA-Brazil, MEX- Mexico, ENG- England, GER- Germany, JPN-Japan, HK- Hong Kong and CAN- Canada

3) superscript "b", "c", "d" refers that coefficients is statistically significant at 10%, 5% and 1%, respectively

Table 11B: The effect of unexpected change in policy rate testing II

The table shows the summary of coefficients, indicating stock market correlations are determined by unexpected change in policy rates, form table 11A

Note: L refers to firm characteristic type-I, come from the lowest 25 percent of that multiple after rank stock with respect to that firm characteristic e.g. small-cap indices then, H refers to firm characteristic type-II, come from the highest 25 percent of that multiple after rank stock with respect to that firm characteristic e.g. Large-cap indices, with respect to size. Thus,

- Size L refer to stock with small caps, H refer to stock with large caps
- M/B L refer to stock with low market-to-book, H refer to stock with high market-to-book
- Cash L refer to stock with low cash-to-asset, H refer to stock with high-to-asset
- IA L refer to stock with low investment-to-asset, H refer to stock with high investment-to-asset
- Debt L refer to stock with low debt ratio, H refer to stock with high low debt ratio
- Liquid L refer to illiquid stock, H refer to high liquid stock
- Beta L refer to stock with low beta, H refer to stock with high beta
- ROA L refer to stock with low ROA, H refer to stock with high ROA

$\boldsymbol{u_{t-1}}$ refers to one day lagged of unexpected change in U.S. policy rates, $\boldsymbol{u_t}$ refers to unexpected change in U.S. policy rates , $\boldsymbol{D_{t-1}}$ refers to one day lagged of unexpected change in Domestic rates, $\boldsymbol{D_t}$ refers to unexpected change in Domestic policy rates. Cov. Is the covariance between coefficients, obtained from regress model with SUR method.

$$\boldsymbol{\rho_{ij,t} = a_0 + a_1\rho_{ij,t-1} + \sum_{k=1}^{3} b_k D_{k,t} + \sum_{s=-1}^{0} \varphi_s^1 I_{i,t-s}^{(T_a)} + \sum_{s=-1}^{0} \varphi_s^2 I_{j,t-s}^{(T_a)} + e_{ij,t}}$$

with SUR method. C refers that coefficient of unexpected change in policy rate is statistically significant at least 10 % level if C jointly occurring in both types of firm characteristics in one country at the same time (the bold letter), I must compare this pair that which of them are likely to be stronger affected by unexpected change in policy rate than another by using the statistical test

$$\boldsymbol{z = \frac{b_{k,c1} - b_{k,c2}}{\sqrt{S.E._{b_{k,c1}}{}^2 + S.E._{b_{k,c2}}{}^2 - 2cov_{b_{k,c1}b_{k,c2}}}}}$$

The results of this comparison are provided in Table 11C

	CHN			THA			KOR			BRA			MEX			ENG			GER			JAP			HK			CAN		
Cha	L	H	Cov.	L	H	Cov.	L	H	Cov.	L	H	Cov.	L	H	Cov.	L	H	Cov.	L	H	Cov.	L	H	Cov.	L	H	Cov.	L	H	Cov.
Size																														
T_1		C			C					C	C	7.0E-07		C		C			C						C					
T_2	C	C	4.2E-07	C			C			C	C	4.3E-07		C		C			C	C	6.2E-07	C	C	2.5E-07	C			C	C	5.3E-07
T_3										C	C	6.6E-08							C	C	2.5E-07	C	C	9.9E-08				C		
u_{t-1}							C	C	0.0006										C											
u_t				C	C	0.0011		C		C	C	0.0013													C				C	
D_{t-1}										C									C	C	0.0003	C	C	0.0004						
D_t													C			C						C	C	0.0005						
M/B																														
T_1	C	C	3.4E-06					C			C		C						C	C	3.3E-08				C	C	2.6E-07		C	
T_2	C	C	1.7E-06				C			C	C	1.7E-07	C	C	8.0E-08	C			C	C	1.8E-07	C	C	3.6E-07	C			C	C	5.1E-07
T_3													C	C	1.1E-08				C			C						C		
u_{t-1}				C	C	0.0012																								
u_t					C		C			C	C	0.0018							C	C	0.0008								C	
D_{t-1}										C																				
D_t																						C	C	0.0005					C	
Cash																														
T_1	C	C	1.5E-06	C				C						C						C			C			C				
T_2	C	C	7.5E-07				C			C	C	4.1E-07	C			C			C									C	C	1.1E-06
T_3													C						C									C	C	4.3E-07
u_{t-1}				C	C	0.0003																				C				
u_t					C			C		C	C	0.0013		C															C	
D_{t-1}				C																		C	C	0.0005					C	
D_t													C						C	C	-5.6E-05	C	C	0.0005					C	
IA																														
T_1	C	C	6.4E-07		C					C	C	1.4E-06					C						C			C				
T_2	C	C	3.2E-07							C	C	7.4E-07	C	C	-5.6E-09	C	C	4.8E-09	C	C	2.6E-07		C							
T_3										C	C	2.9E-07		C					C	C	1.1E-07		C					C	C	4.0E-07
u_{t-1}		C					C	C	0.0002	C									C							C				
u_t							C			C	C	0.0024					C													
D_{t-1}																			C	C	0.0014	C	C	0.0001						
D_t																						C	C	0.0001						

	CHN			THA			KOR			BRA			MEX			ENG			GER			JAP			HK			CAN		
Cha	L	H	Cov.	L	H	Cov.	L	H	Cov.	L	H	Cov.	L	H	Cov.	L	H	Cov.	L	H	Cov.	L	H	Cov.	L	H	Cov.	L	H	Cov.
Debt																														
T_1				C	C	1.9E-07	C			C	C	3.0E-07	C	C	2.2E-07										C	C	3.2E-07	C	C	5.9E-07
T_2											C		C	C	8.5E-08				C	C	2.8E-07	C	C	3.3E-07	C				C	
T_3																				C			C					C	C	1.2E-07
u_{t-1}				C																C										
u_t										C	C	0.0001	C						C									C		
D_{t-1}				C													C			C		C	C	0.0003						
D_t							C			C												C	C	0.0003				C		
Liq																														
T_1	C	C	8.1E-07		C									C						C			C							
T_2	C	C		C						C	C	1.5E-06		C			C		C	C	3.2E-07	C	C	4.0E-07				C	C	6.4E-07
T_3										C	C	3.4E-07	C			C	C	-1.3E-09		C			C							
u_{t-1}				C							C																			
u_t					C		C	C	0.0002	C	C	0.0014		C															C	
D_{t-1}																			C	C	0.0007	C	C	0.0003						
D_t							C												C			C	C	0.0003						
Beta																														
T_1		C		C	C	3.6E-08														C			C		C	C	9.5E-09	C		
T_2	C	C	4.2E-07	C			C			C	C	1.6E-07	C							C			C					C		
T_3											C		C	C	6.3E-07				C	C	4.2E-07		C						C	
u_{t-1}				C			C	C	0.0001										C	C	0.0008					C				
u_t					C			C		C	C	0.0010																	C	
D_{t-1}																			C	C	0.0017									
D_t																C														
ROA																														
T_1				C																		C			C				C	
T_2	C		1.0E-07							C	C					C			C			C	C	7.9E-08				C	C	6.8E-07
T_3													C			C			C	C	5.7E-08	C						C	C	3.4E-07
u_{t-1}							C	C	0.0001																C	C	1.1E-07		C	
u_t					C			C		C	C	0.0011		C		C			C						C			C		
D_{t-1}				C									C	C	2.29E-06	C			C	C	0.0017	C								
D_t																														

Table 11C: The effect of unexpected change in policy rate testing III

The table shows the summary of type of firm characteristic that likely to attribute the stronger impact of unexpected change in monetary policy rates to correlation coefficients

Unexpected change from U.S.

Cha	CH	THA	KOR	BRA	MEX	ENG	GER	JP	HK	CA
Size		small	high				small		small	
M/B		high	low				low			high
Cash		high	high	high	high				high	high
IA	high					high	low		high	
Debt		low			low		low			low
Liquid		high	low	high	high					
Beta		high	high	high			high		high	high
ROA		high	high	high	high		low		low	low

Unexpected change from Domestic

Cha	CH	THA	KOR	BRA	MEX	ENG	GER	JP	HK	CA
Size				small	small	small	small	small	N/A	large
M/B				low				low	N/A	high
Cash		low			low		low	high	N/A	high
IA							high		N/A	
Debt		low	low	low		high	high		N/A	low
Liquid			low			low	low	low	N/A	high
Beta						high	low		N/A	
ROA		low						low	N/A	

Note 1) M/B refers to market-to-book ratio, Cash refers to cash-to-asset ratio, IA refers to investment-to-asset, Debt refers to debt-ratio, Liq refers to liquidity of stock, - Beta refers to CPAM beta, - ROA refers to return-on-asset.

2) CHN is an abbreviation of China, THA-Thailand, KOR- Korea, BRA-Brazil, MEX- Mexico, ENG- England, GER- Germany, JPN-Japan, HK- Hong Kong and CAN- Canada

Table 11D: Summary result of Contagion testing after concerning the impact of unexpected changes in policy rate

The table shows the summary of the type of firm characteristics that likely to incur contagion effect in each country

Cha.	T	Country									
		CHN	THA	KOR	BRA	MEX	ENG	GER	JPN	HK	CAN
Size	T_1	large	large		large	large	small	small		small	
	T_2	small	small	small	large	large	small	small		small	
	T_3				large			small			small
M/B	T_1		high	high	high	low				high	high
	T_2			low	high	high	low	low		low	
	T_3							low	low		low
Cash	T_1		low	low	high	high		high		high	high
	T_2				high	high	low	low			
	T_3							low			low
IA	T_1		high		high				high	high	
	T_2								high		
	T_3				high	high	high		high		
Debt	T_1	high		high				high		low	low
	T_2	high									high
	T_3							high	high		
Liq	T_1		high		high	high		low	high		
	T_2	low	low	low		high	high	low			
	T_3					high	high		high		
Beta	T_1	high	high		low		high	high	high	low	low
	T_2	high	low	low		low	high	high	high		low
	T_3				high		high		high		high
ROA	T_1		low						low	low	high
	T_2	low		low	low		low				high
	T_3					low	low		low		low

Note 1) M/B refers to market-to-book ratio, Cash refers to cash-to-asset ratio, IA refers to investment-to-asset, Debt refers to debt-ratio, Liq refers to liquidity of stock, - Beta refers to CPAM beta, - ROA refers to return-on-asset.

2) T refers to time period of crisis - T_1, T_2 and T_3 are the first phase of crisis (before Lehman, second phase (during Lehman) and third phase of crisis (post- Lehman), respectively

3) CHN is an abbreviation of China, THA-Thailand, KOR- Korea, BRA-Brazil, MEX- Mexico, ENG- England, GER- Germany, JPN-Japan, HK- Hong Kong and CAN- Canada

Table 12: An example of the impact of unexpected change in policy rate to cross-country correlations

Day	Return of U.S. may affected by	Correlation	Return of Thailand may affected by
1	US_1	$US_1 - THA_2$	THA_2, US_1
2	US_2, THA_1	$US_2 - THA_3$	THA_3, US_2
3	US_3, THA_2	$US_3 - THA_4$	THA_4, US_3
t	US_t, THA_{t-1}	$US_t - THA_{t+1}$	THA_{t+1}, US_t

Figure 1: Trading hours of each market

The top line shows times in Eastern Daylight Saving, and times below are local times. (Wongswan, 2009)

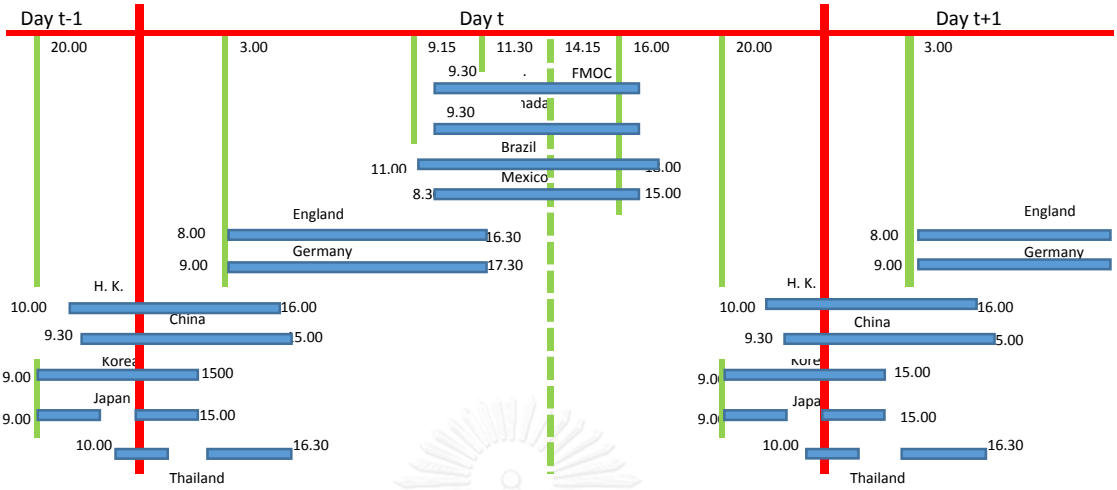


Figure 2A: Conditional Volatility of U.S. equity market.

The beginning of the excess volatility can be identified around July 2007 and the most extreme case occur around October 2008

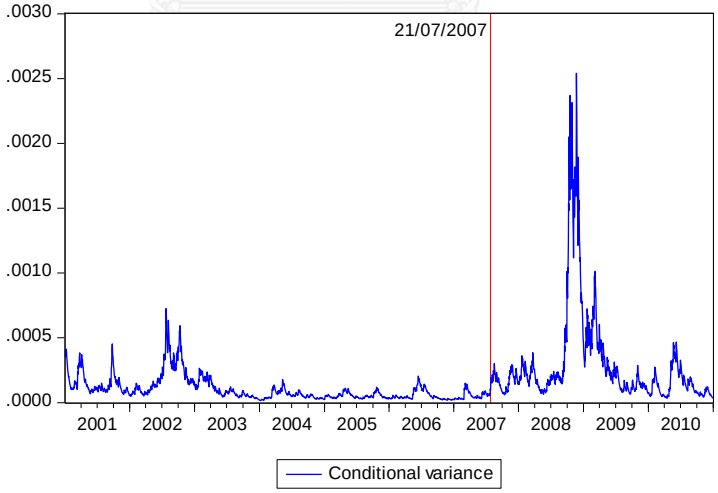


Figure 2B: Residual plot of structural break

The figure present residual plot of structural break date testing of U.S. stock during 1/1/2003 – 31/10/2009

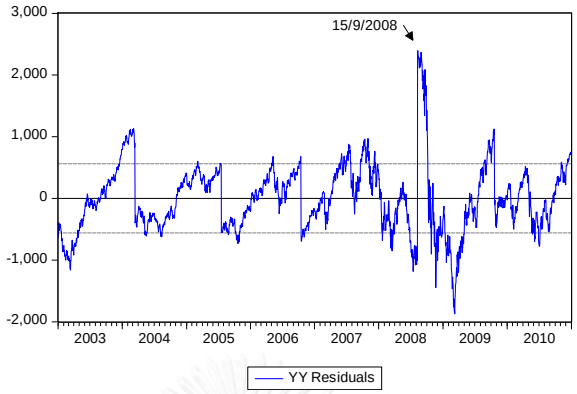
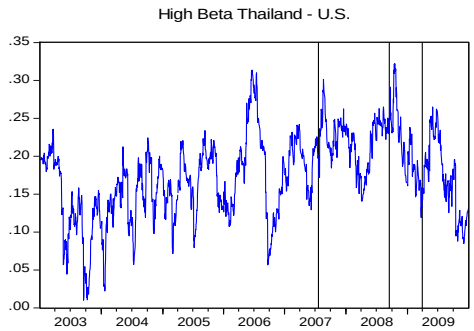
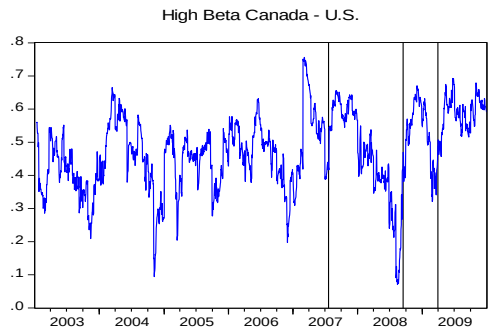


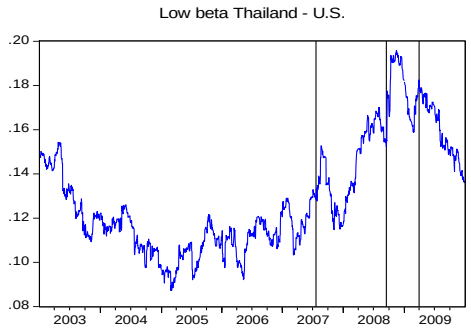
Figure 3: Example of Correlations coefficients

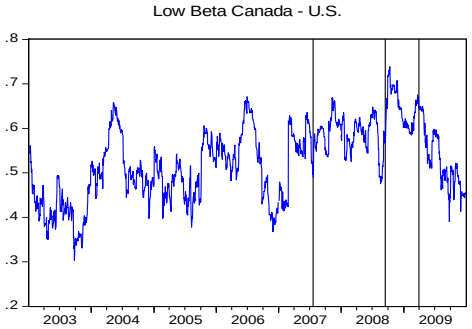
Panel A display conditional correlation between stock, characterized as High Beta and U.S. equity stock during 2003 – 2009





Panel B display conditional correlation between stock, characterized as Low Beta and U.S. equity stock during 2003 – 2009





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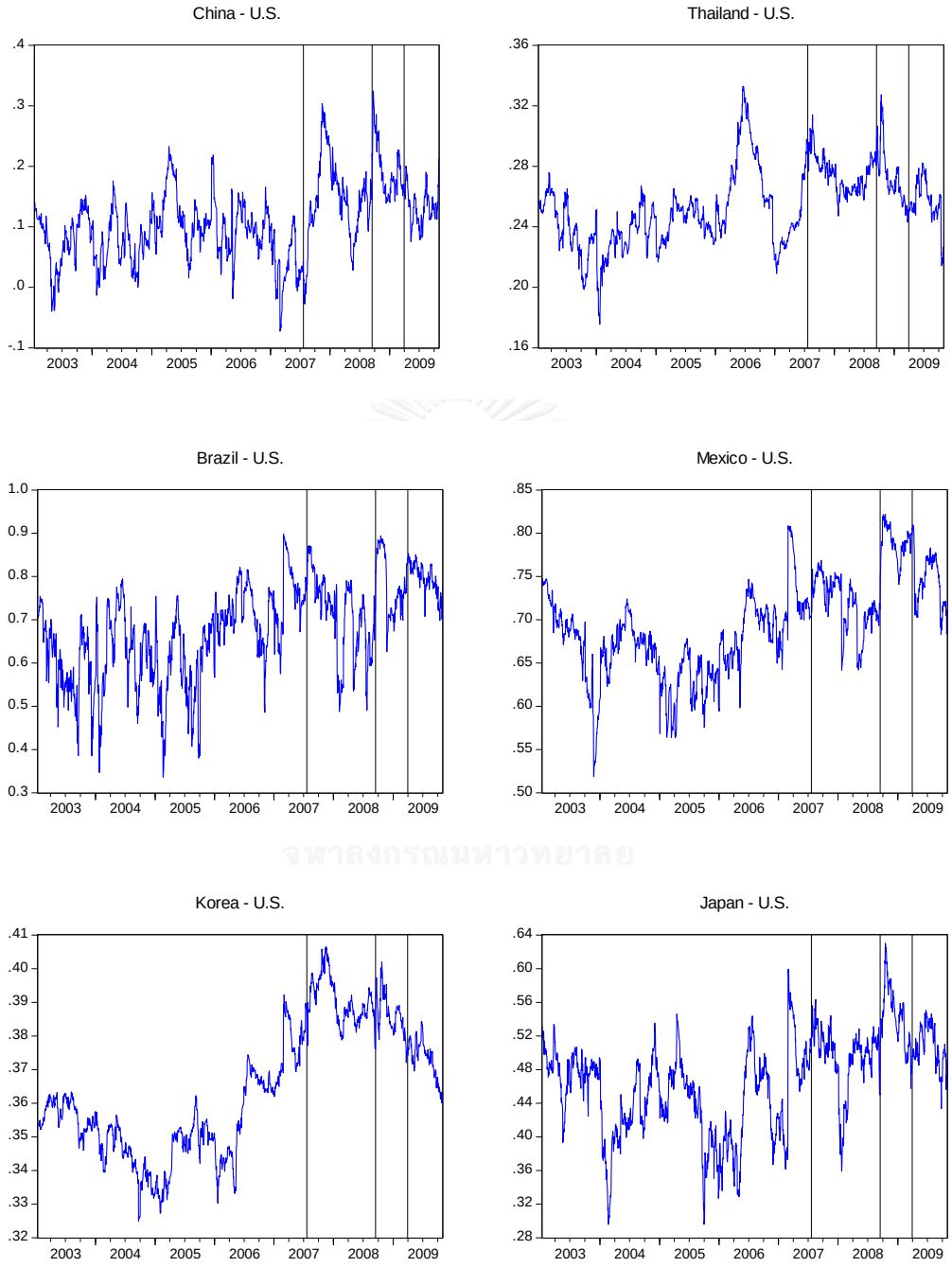
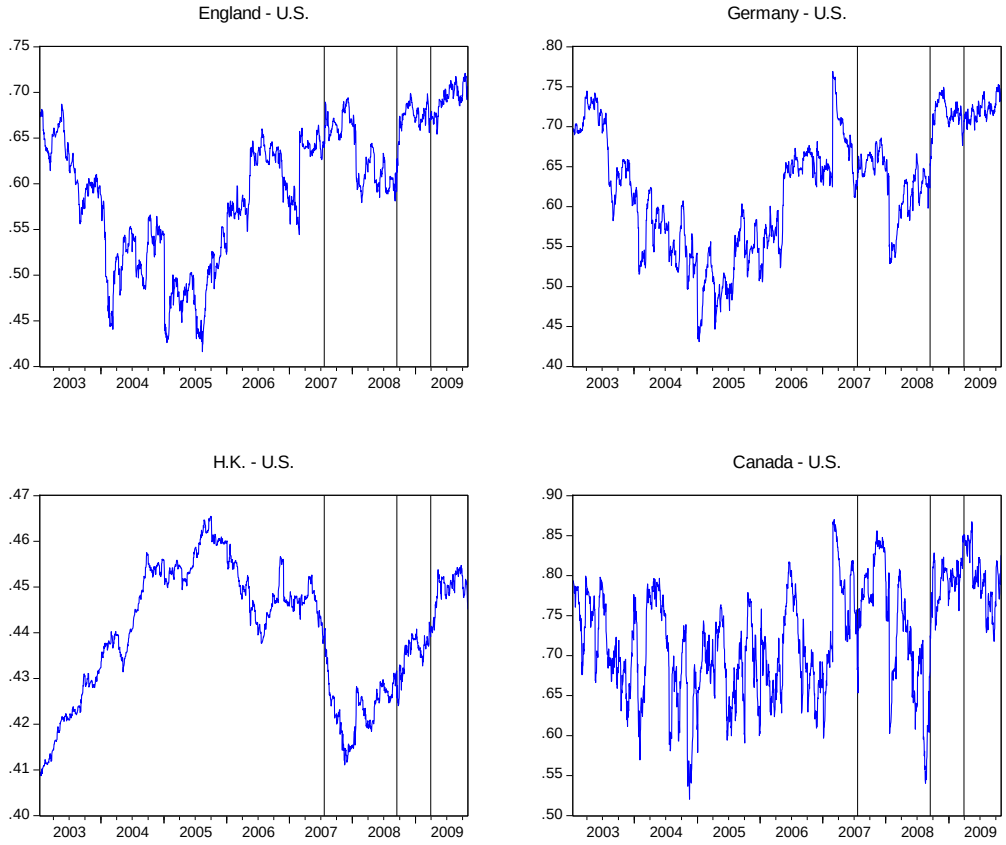
APPENDIX

Figure show the conditional correlation, calculated from DCC-model, of returns between U.S. stock market and international indices, during 1/1/2003 – 30/10/2009





Note in each figure I also plot 3 lines which represent three main structural break date when analyzing contagion. The left represent the staring date of pre-Lehman periods (20/7/2007), middle line - the staring date of Lehman period (15/9/2008) and the right - the staring date of post Lehman period (31/3/2009)

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