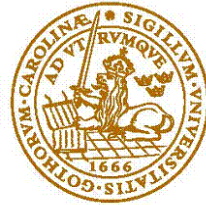**May 2012**

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Contagion from the US debt crisis: the relationship between integration and contagion and the mitigating effect of anti-crisis measures

Master thesis MSc Finance | Vytautas Verbus and Klaas Sportel

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Abstract

The aim of the paper is to draw a conclusion about the effect that integration has on the (in)stability of the linkages between international stock markets. To measure this (in)stability we focus on the contagion effect caused by the US debt crisis. Furthermore, we take the anti-crisis policies of the different countries into account and discuss whether this could have a mitigating effect on the relationship between integration and contagion. Our findings show that there is no clear evidence that more integrated countries face more contagion. Liquidity provisions seem to be more effective for less integrated countries, while capital injections and liability guarantees seem to have less effect for integrated countries. A cut in the interest rate is an anti-crisis measure that can be associated with a decrease in contagion, regardless of the level of integration.

Keywords: Contagion, Integration, Anti-crisis measures

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1. Introduction

The globalization of the past decades has made the economies throughout the world more integrated. The fact that roughly every financial market is accessible for foreign investors, implies that these markets are not only exposed to their national economy but also to changes in the economic situation in other countries. This vulnerability to markets abroad has increased throughout the years. Empirical evidence shows, in line with this observation, an increase in correlations among the international stock markets (e.g. Prasad et al., 2003, Rasek 2004, Kim et al, 2005, Jappelli and Pagano, 2008, Chiu and MacKay, in press).

When we take this into account, it is reasonable to assume that a crisis in one country will not stay local but will spread to other economies. Thus, the question in times of a crisis in a particular country is not whether the problems will spill over to other parts of the world, but rather to what extent the other economies will be affected.

This effect can be also seen on the financial stock markets. The volatility of the stock markets will increase during a crisis and will be transmitted to a certain extent to other stock markets. In tranquil times the relationship between countries' financial markets can be characterized by a relatively stable correlation. However this linkage could significantly change during a crisis, which is where contagion comes into play.

Contagion can be defined as : *"a significant increase in cross-market linkages after a shock to one country (or group of countries)"* (Forbes and Rigobon, 2002).

In this paper we discuss the relationship between integration and contagion during the US debt crisis. This relationship can be possibly influenced by the anti-crisis policies, which are mostly initiated in 2008 and 2009. Therefore we include the different anti-crisis measures in our discussion.

Our results from the contagion test show no clear evidence that more integrated countries face more contagion. Even though we find contagion for several countries during the first months of the financial crisis, the results are not sufficient to prove the assumed relationship. An important factor that influences the contagion results is the prudence of country's banking sector. Such prudence and stability was observed in Canada, Brazil and Australia, which

managed to thwart contagion.

Regarding the effectiveness of anti-crisis measures, we found that a measure that potentially has the best mitigating effect on contagion is a cut in policy rates. Cuts in policy rates seem to perform well regardless of the level of integration. Liquidity provisions seem to be more effective for less integrated countries, while capital injections and liability guarantees seem to have less effect for integrated countries.

This paper is structured as follows. In this first chapter we will discuss the aim, the contribution to previous research and the relevance for policymakers and investors. The second chapter is dedicated to the available research about integration and contagion. In the third chapter we introduce our hypothesis that connects integration and contagion. Our data and research methodology is introduced and discussed in chapter four. The results of our empirical tests are presented in chapter five. The remaining chapters include the discussion part, conclusions, limitations and suggestions for further research.

1.1   Aim

Our aim is to draw a conclusion about the effect that integration has on the (in)stability of the linkage between international stock markets. To measure this (in)stability we focus on the contagion effect caused by the US debt crisis. We take the anti-crisis policies of the different countries into account and discuss whether this has a mitigating effect on the relationship between integration and contagion.

Our corresponding research question is :

To which extent are more integrated stock markets more contagious and what is the effect of anti-crisis measures on this relationship?

We test the contagion effect during the crisis on two groups of countries:

More integrated countries: Australia, Canada, Germany, and Japan.

Less integrated countries (BRIC): Brazil, Russia, India and China.

In order to answer our research question we test the following two hypotheses:

Hypothesis 1: The contagion effect of the US debt crisis is higher for countries that are more

integrated with the United States than for countries that are less integrated.

Hypothesis 2: A country that has more crisis measures is less affected by the US debt crisis than other countries that are similarly integrated.

1.2   Contribution to previous research

Up until now, there are numerous research papers that attempt to measure the level of integration between countries and regions. Other researchers focus on the modeling of contagion. However, to our knowledge, there is so far, no real attempt to link integration with contagion and explain if higher levels of integration result in more contagion.

Secondly, there is lack of empirical evidence regarding the tools a government has to mitigate the contagion risk during a crisis. It is widely assumed that government´s policies do have an influence on the contagion risk the country faces. However the measures that are used in the crisis period have rarely been included in the discussion about contagion. We add this in our research and provide a detailed discussion about the implications the different measures have for the relation between integration and contagion.

1.3   Relevance

It is of necessity to gather more in-depth knowledge about the interaction between integration and contagion, since this relationship could have direct implications for our view on the systemic risk we face in the current global economy. In case there is a positive relation between integration and contagion, it would imply that the evolution towards one financial market causes more instability. This kind of systemic risk is hardly taken into account in the current economic models. A better understanding of the relationship between the two concepts is therefore of considerable interest for, but not limited to, policy makers and investors.

Relevance for Policymakers

Policymakers across the world have to make the decision whether to integrate more or to keep the so called 'firewalls' to protect their economies against worldwide shocks. This discussion

is of particular interest for emerging countries that are developing at a high pace and are getting more integrated with the global financial market. Politicians that are against more integration, usually warn for the increased risk of contagion when economies are getting more dependent on each other (De Gregorio, 2001). By examining this relationship we can see whether a higher contagion effect is inextricably connected with more integration.

However this discussion is not only relevant for emergent economies but is also meaningful for the developed countries. Europe can be taken as an example. There is an ongoing debate in which the direction of integration is widely questioned. Nowadays, a political decision which leads to a less integrated European market is no longer farfetched but a realistic option (Auerback, 2010).

The fact that the financial markets are highly integrated means that a crisis in a certain region could cause a high degree of volatility to the financial markets worldwide. Claessens et al. (2001) argues that politicians and economists need a better understanding of the contagion effect to be able to initiate the right reform proposals to mitigate the risk.

By including a discussion about the effect of the anti-crisis measures on the relationship between integration and contagion, we are able to draw a conclusion about the ability a government has to protect their stock market against a crisis in another country. By utilizing the anti-crisis measures governments have the intention to protect their economies to a certain extent against the extreme shocks that occur somewhere else in the world. However it is the question whether this is effective when a country is already to a high extent integrated with the global market.

Relevance for Investors

From an investor's point of view, the contagion effect is of particular relevance for those who want to decrease their risks by diversifying their portfolio (Asgharian and Nossman, 2011). It is far more difficult for a global investor to hedge a portfolio when a crisis spreads around the world and does not stay local (Markwat et al, 2009). The theory of international diversification is based on low correlations among international stock markets (Morana and Beltratti, 2008). The biggest problem however is not the fact that countries are getting more dependent on each other, but rather that the linkages between countries are not stable throughout the time. The existence of the contagion effect could make the investors more

exposed to other markets than they would expect, since their diversification decisions and hedging strategy are largely based on correlations (Asgharian and Nossman, 2011).

2. Theoretical background

In this chapter we will start with a discussion about integration of the global economy and the stock markets in particular. Subsequently, we will elaborate on the contagion effect and will finish this chapter by including the government policies in our discussion.

2.1 Integration

Integration depends on the real linkages between countries. Pritsker (2000) presents main channels, through which countries can be linked. These channels are : (1) Real sector linkages, (trade in goods and services) (2) Financial markets.[1] (3) Banks and (4) non-bank financial participants. Thus, the more intensively countries rely on these channels the more linked they are with each other, which results in more integration. From here we will focus on the integration of financial markets

Shin and Yang (2007) findings complement Pritsker's arguments. They found that trade in goods and cross-border financial activities complement each other, which leads to the expectation that more trade would cause more financial integration. However, even though the study by the International Monetary Fund (IMF) (2011) recognizes this cause and effect relationship, their research of Asian economies have found that for most of the Asian countries trade does not result in more integration.

An important advantage of more financial integration is the optimization of risk sharing by facilitating cross-country borrowing and lending (IMF, 2011, Rungcharoenkitkul and Unteroberdoerster, 2012)[2]. Secondly it encourages investors to transfer their funds from less productive to more productive economies. And thirdly, it fosters financial development and

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[1] Real linkages between countries also cause them to be more exposed to common macroeconomic influences/fundamentals, which in turn cause financial markets to be linked (Pritsker, 2000).

[2] An extensive and econometrical explanation about the risk-sharing benefit can be found in Rungcharoenkitkul and Unteroberdoerster (2012).

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access to financial services in the integrating economies (Rungcharoenkitkul and Unteroberdoerster, 2012).

These three positive effects could ultimately lead to more economic growth (IMF, 2011, Rungcharoenkitkul and Unteroberdoerster, 2012). This implied relationship between integration and economic growth is often studied and accepted by researchers and practitioners (see Obsfeld, 1998, Prasad et al., 2003, Rasek 2004).

However a development towards more financial integration does not come without any costs and it is faulty to assume that it will only bring economic growth and positive externalities. The increasing financial integration means that national markets are getting more dependent on shocks in other markets. A country's stock exchange is nowadays to a certain extent vulnerable to a crisis in any other region in the world. The extent to which a national financial system is vulnerable depends on the 'strength' of the linkages between two financial regions (Oxelheim, 1996). When there are more linkages among countries, there is a higher probability of crisis spillovers due to the fact that there are more ways how a shock in one country can spread to other countries. This shock does not necessarily need to start in the real sector. It can also start from a non-bank financial player such as a hedge fund. Assuming that a hedge fund is tightly linked to banks and investment banks, the shock in hedge fund will affect the banks. This will in turn affect financial markets and will ultimately be transmitted to the real sector of specific countries, which depends on the particular financial market (Pritsker, 2000).

It follows from this discussion that countries will be more integrated if they trade more with each other and allow other countries´ banks and non-bank financial institutions to carry out their activities across borders.

Financial integration throughout the years

In addition to the linkages between individual countries, there are global factors that made the financial markets more integrated. The main drivers are changes in technology and a more international focus of investors and politicians. Nowadays, investors are buying and selling on markets that are thousands miles away from their 'own' market.

This evolution cannot be separated from a widespread deregulation of the various financial

markets. The external deregulation of financial markets leads to several gains for the economic actors (Oxelheim, 1996):

- Increased efficiency in national financial sectors as a result of an increasing competition with international players;
- Improved global intermediation of resources between savers and borrowers, which leads to a more productive investment;
- Increase in internationally diversified asset portfolios, in such a way that an investor is less exposed to a country's specific risk;
- Easier access to international financial markets;
- Reduced transactions costs for financial operations.

The degree to which the countries are integrated with the global financial market or specific regions differs. Emergent economies are typically less integrated with markets abroad compared to developed countries. However their economic development goes often hand in hand with more integration. Therefore we can usually see that in a longer period an emerging country is getting more dependent on the worldwide economy.

Implications of systemic risk

The ongoing process of growing global integration has a positive effect from a risk management point view, because of an increased ability to allocate capital and thereby hedge the investment portfolios. At the other hand this integration process has a negative effect on the systemic risk[3] one has to face.

When the countries throughout the world are getting more financially linked, it produces two negative consequences for our assessment of systemic risk: 1) the systemic risk increases 2) the measurement of the systemic risk is getting more complicated.

The first effect is that the total systemic risk increases since a shock in one country can hardly be isolated (Eisenberg and Noe, 2001). This increases the probability that a local crisis will evolve to worldwide economic depression.

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[3] Systemic risk can be defined as : *the risk of distress in the financial system caused by an imbalance or a failure of a significant part of the financial sector – one large institution or many smaller ones – that has the potential to have serious negative consequences for the real economy (*Schwerter, 2011).*

When the market becomes more integrated it is harder to assess how high the risk is. This is the case since it is not transparent how all the actors in the system are linked. A clear example is the fact that at the time of the bankruptcy Lehman Brothers banks around the world had difficulties with assessing their exposure, since they were all connected to each other. This not only has implications on the level of a (financial) sector, but also has an effect on the global economy.

The above discussion implies that the more integrated countries become, the higher the possibility that a country specific risk can extend and affect other countries. This could cause sudden increases in cross-country linkages and lead to the possibility of a contagion. Later in this chapter we will elaborate more on the interactions between integration and contagion.

Financial integration of the BRIC countries

The fact that emerging markets are becoming more integrated can also be seen for the so called BRIC countries, which consist of Brazil, Russia, India and China. These countries have been in a process of financial liberalization since the beginning of the 1990's (Bhar and Nikolova, 2009).

For each country there is a different point in time, which shows the start of the liberalization and the increasing integration. Bekaert et al. (2003) states the different points in time from which the financial markets of the BRIC countries started to get more liberalized. The authors define these regulatory reform dates as: *"the date of formal regulatory change after which foreign investors officially have the opportunity to invest in domestic equity securities, and domestic investors the right to transact in foreign equity securities abroad"*.

Bekaert et al. (2003) use this definition to define the regulatory reform dates for the BRIC countries. They come up with the following periods: May 1991 for Brazil, November 1992 for India, January 1994 for Russia and July 1993. One could argue whether these dates can been seen as the exact starting points of the liberalization for the individual BRIC countries. However it is a common view that these countries do have a comparable pattern of economic development.

When we take Brazil as an example, May 1991 is chosen since from that month the

Resolution 1832 Annex IV became effective. This legislation allows foreign investors to buy up to 49 per cent of the voting stock and 100 per cent of the non-voting stock of a company. Furthermore, the tax rules were eased and foreign investment capital had to remain in Brazil for 6 years instead of 12 years.

The example of Brazil shows that even if an emergent country initiates a regulatory reform, it does not imply that afterwards it will have a completely open economy without any constraints for foreign investors. Therefore it is important to notice that a regulatory reform date is just a starting point rather than a sign that they are equally liberalized as the developed countries. When comparing the BRIC countries with our group of developed countries, it can be seen that they have in general more restrictions for foreign investors to invest in stocks listed on the national stock market (Appendix: Table 1 Country restrictiveness). This is not only the case for the financial sector, but for the physical trade as well. Brazil and Japan are outliers in both case (Appendix: Table 1 and Table 2) and score respectively better and worse than expected. The figures from the Worldbank show that the BRIC countries have a lower ranking than the developed countries (Appendix: Table 2 Trading across borders).

The measurements of integration are in line with this observation and show that the BRIC countries are in general less integrated with the other national financial market than developed countries (Kenourgios, et al 2010). But as stated before, the development of the economy is related to an increasing integration. Empirical evidence about the Indian stock exchange underlines this and shows that it became throughout the time more dependent on other global markets (Raj and Dhal, 2008).

Financial integration developed countries

The developed countries have in tranquil times a more stable link with other developed countries compared to the developing countries. The level of integration is not expected to growth at the same pace as the integration of the developing countries. However that does not mean that the financial integration of the developed countries is constant. Morana and Beltratti (2008) show the movements throughout the years of the integration of stock markets. The authors find that the linkages between the developed stock markets have grown stronger throughout the previous decades.

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Unlike the BRIC countries, the developed countries already went through different stages of the liberalization process. A sudden jump in the integration process caused by a policy measure is therefore less likely. However a jump in integration is not completely unthinkable. The introduction of the euro can be taken as an example. As a consequence of an introduction of a common currency the countries of the already developed European market became more dependent on each other. This effect was not limited to the integration between countries in the euro zone. Empirical evidence shows a significant increase in integration between the United States and the European stock markets after the introduction of the euro (Kim et al, 2005).

2.2   Contagion

The described process of national financial markets that become more integrated leads inherently to an increase in dependency on fundamentals of other countries. It could be questioned however if these renewed linkages between the countries are stable in times of a crisis. Defenders of less integration usually refer to contagion as the major drawback of more open markets (De Gregorio, 2001). Their argument is that a more integrated market leads inherently to a more unsecure economic future. This implicates that a highly integrated market cannot rely any longer on their own fundamentals to get a reliable insight of the economic prospects.

This instability of markets can be characterized by contagion. The concept of contagion is a popular research topic nowadays. However there is no absolute consensus about the exact meaning of contagion. Given this fact, it is essential to continue with a short discussion about the type of contagion we will focus on in this paper.

Definition of contagion

The most used definition of contagion in the recent literature comes from Forbes and Rigobon (2002). They define contagion as: *"a significant increase in cross-market linkages after a shock to one country (or group of countries)"*. This definition is commonly referred to as the *'narrowest definition'* of contagion (See for example: Madaleno and Pinho, 2012, Syllignakis

and Kouretas, 2011, Serwa and Bohl 2005).

However, as stated above, not every article about contagion uses the same definition.[4] There are several articles that perceive contagion as the change in asset returns or exchange rates which has been caused by a shock in another country or region (Eichengreen et al, 1996, Kaminsky and Reinhart, 2000, Akram et al, 2011). The main difference with the definition of Forbes and Rigobon (2002), is that this approach does not distinguish a contagion effect from the "normal" interdependence in relatively stable times. In other words this definition, focuses on the comovements between regions and countries while the definition used by Forbes and Rigobon (2002) refers to the excess comovements.

To illustrate the difference between both definitions: in case we would find a reaction from the stock markets of the BRIC countries caused by the shocks of the US stock market, we could state by following the second definition that contagion has occurred. However we cannot draw any conclusions from this single observation when we use the first, more narrow definition. When we apply this approach, we first have to analyze the correlation that already existed between the two regions and to control for the change in the so called common factors, before we can say anything about the contagion effect (See for further explanation: Chapter 3. Model). By doing this we are able to account for the effect of a sudden change in the common factors among the countries due to the deteriorated economic situation in the crisis zone. The change in the linkages caused by the change in fundamentals can be called *fundamental-based contagion* (Calvo and Reinhart, 1996).

Since the several definitions have different implications, it is important to stress that this paper will focus on a contagion effect that is in line with the definition of Forbes and Rigobon (2002). When we take into account our aim to draw a conclusion about the (in)stability of the fundamental linkages between the United States and other countries, we can see that the narrowest definition of contagion is the most suitable to use.

Relationship between integration and contagion

This leads to our first hypothesis, which we state as follows:

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[4] See for an extended discussion about the different definitions and usage of contagion : Forbes, K. and Rigobon, R. (2001)

Hypothesis 1: The contagion effect of the US debt crisis is higher for countries that are more integrated with the United States than for countries that are less integrated.

This relationship is so far not often explicitly discussed in the academic literature. Bekaert et al (2005) includes a discussion about integration in his article about contagion. However the relationship between the effects of the level of integration on the contagion has not been explicitly discussed.

Gelos and Sahay (2001) go one step further after finding that the more advanced financial markets show more signs of contagion in response of the Czech and Asian crises compared to the European transition economies. Additionally, they found that transition economies with the most liberal capital policy witnessed the largest pressure during the Asian Crisis of 1997. They conclude that a further liberalization and integration of the economies in transition could make them more exposed to contagion risk.

Serwa and Bohl (2005) show similar results in their research with a focus on the European stock market. Their findings indicate that the countries in Central and Eastern Europe have been relatively immune against several financial crises that occurred in other parts of the world. A suggested but not tested explanation is the lack of integration of the stock markets in Central and Eastern Europe with the world stock market.

Bordo and Murshid (2001) take a different approach and does not make a comparison between countries, but focus instead on the historical evolution of the contagion effect among regions. They question whether the markets have become structurally more vulnerable to certain shocks due to higher integration. Their main contribution in comparison with other academic literature, is that they have included many different crises throughout the history. The crisis on the London Stock Exchange in 1825 is the oldest crisis in their sample and the devaluation of the Thai currency in 1997 is the most recent crisis taken into account. The authors do not find any empirical evidence to confirm this statement. However the econometrical methods used by Bordo and Murshid (2001) are not as advanced as in the other published papers about contagion.

Mendoza and Quarini (2010) explain how a globally financially integrated economy can be linked with contagion when it is highly leveraged. This is in line with Schinasi and Smith (2000), who find that a higher leverage increases the contagion. A further explanation of the relationship between integration and contagion can be found in the literature about liquidity

and incentive problems (Dornbusch and Claessens, 2000).

These liquidity and incentive problems have in two ways an effect on the relationship between integration and contagion. First of all, countries with widely traded assets and liquid markets are more vulnerable to contagion (Calvo and Mendoza, 1999, Kodres and Pritsker, 2002). As stated before, more integrated countries tend to have a liberalized stock market and therefore fewer barriers for investors to invest in their country. This openness makes an integrated country more vulnerable to contagion by a correlated liquidity shock. When a crisis occurs in other country investors that have assets in the crisis country could feel the urge to sell parts of their portfolio´s because of margin calls or redemptions from mutual funds. This is a threat for a stock market in the integrated and open economy since it has a relatively large number of foreign investors who are able to sell their stocks because of the sudden need for liquidity.

Secondly, the other way that makes an integrated country more vulnerable to a crisis abroad is the use of cross-market hedging. In order to be able to apply cross-market hedging an investor searches for markets that show a relatively high level of correlation (Kaminksy and Reinhart, 1998). When a shock occurs in one country investors who are focused on cross-market hedging tend to sell their stocks in other related markets.

In our case this would mean that investors sell their stocks in the developed countries as a reaction to the US debt crisis. However this leads to a possible contradiction from a risk management perspective. In case an investor is not focused on the cross-market hedging but rather on their overall portfolio risk, it is likely that the stock with the highest risk will be sold in the first place (Calvo, 1996, Schinasi and Smith, 2000). Investors perceive the BRIC countries as more risky compared to the stock market of the developed countries (Chen, 2008). One could therefore argue that during the current crisis investors will sell at least a part of their portfolio that is invested in the BRIC countries, to keep their overall portfolio risk under the limits.

As already mentioned before, more financial integration can lead to the potential drawback of contagion (De Gregorio, 2001). The IMF (2011) uses this line of reasoning and analyzes the trade-off between the potential benefit and drawback of financial integration, where the former is risk sharing and the latter is increased contagion. They found that there is a significant negative relationship between risk sharing and contagion effects. Furthermore,

they argue that contagion can spread through interconnected banks and other financial linkages (such as non-bank financial players).

The benefit of risk sharing is explained by Pritsker (2000), who proved that by diversifying borrowing and lending across many banks, one can reduce the risks of economic and financial shocks transmitted from different countries, thus, increasing risk-sharing benefits.

It follows from this discussion that countries can face more contagion the more they are linked through banking linkages.

2.3 Government policies

The suggested link between integration and contagion implies that the government could indirectly control the level of contagion risk by implementing measures that encourage (discourage) integration. They can do so by using more structural measures that have an effect in the long run, such as various protectionist policies. However, another set of anti-crisis measures, that are more ad-hoc and have a more short term effect, are used to deal with sudden shocks that effect country's economies and could cause a contagion effect. In the following part we will discuss the theory about the effectiveness of the anti-crisis measures and the effect it could have on the relationship between integration and contagion.

Anti-crisis measures during the global crisis

The bankruptcy of the Lehman Brothers in September 2008 and the subsequent shock affecting the financial sector stability, made governments across the whole world decide to support the financial firms in their country. The magnitude of this support was something that was never seen before and would have been called unrealistic in the period before the crisis occurred.

To save their national financial firms, countries and their central banks have used the following instruments (IMF, 2009c, Khatiwada, 2009) :

- Capital injections in financial firms;
- Purchases of assets and lending initiated by the treasury;

- Liquidity provision and other support provided by the central bank[5];
- Guarantees for bank deposits, interbank loans and bonds.

The IMF (2009b) study of the global financial crisis sought to explain the effectiveness of central bank and government interventions during the global crisis period. The researchers concentrated on measuring the effect of monetary (interest rate cuts and liquidity provisions) and financial (capital injections, guarantees, asset purchases) anti-crisis interventions on the following financial indicators: 1) Financial stress index (FSI)[6], (2) Economic stress index (ESI)[7], (3) LIBOR spread and the (4) spread of the Credit Default Swaps (CDS).

They found that monetary measures, such as cuts in interest rates and liquidity support, are more effective in reducing financial stress than economic stress. Results have shown that cuts in interest rates had a significant impact on the reduction of FSI during last months of 2008. Capital injections at the other hand have shown a more significant impact on reducing the financial stress. Additionally, liability guarantees and asset purchases interventions led to a decrease in bank CDS spreads for countries under study except for Japan and the United States. It was also found that capital injection efficiency is higher when it is combined with other financial measures or if it is initiated more times.

Announcements of recapitalizations and troubled assets purchases were the most effective measures in the later stages of the crisis, while in early stages liquidity support announcement were the most promising (IMF, 2009b).

An additional tool used by the counties during the crisis period was an adjustment in policy rates. This measure was used to boost aggregate demand and economic activity. In 2009, merely all major economies have adopted monetary easing. This was mainly due to decreasing commodity prices (Khatiwada, 2009).

Stimulus packages

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[5] Liquidity provisions include actions such as open market operations (buying selling bonds), increase/decrease in aggregate credit sealing loans and more (OECD, 2010).

[6] FSI aggregates: (1) liquidity and credit risk (LINOR-OIS and CDS spread) (2) profits/losses (3) level of bank capital (4) lending conditions proxied by credit standards used by banks.

[7] ESI index integrates: (consumer and business confidence indexes and forward looking indicators of nonfinancial firms' health, such as equity prices and corporate credit spreads.

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The second category consists of investments that are initiated by the governments to stimulate the broader economy rather than supporting only the financial firms. We can distinguish the following measures that are issued by either increasing the expenditures or lowering the state's revenues (IMF, 2009c). The table below shows the most often used measures.

Increasing expenditures	Lowering revenues
Infrastructure investment	Lowering Corporate Income Tax (CIT)
Support to SMEs and/or farmers	Lowering Personal Income Tax (PIT)
Safety nets	Indirect tax reductions/exemptions
Housing/construction support	
Strategic industries support	
Increase in public wage bill	

Anti-crisis measures as a part of stimulus packages. Source IMF 2009c

Fiscal rescue packages can be further divided into three categories: (1) public spending on goods and services, (2) fiscal stimulus aimed at consumers, and (3) fiscal stimulus aimed at firms (Khatiwada, 2009).

The biggest share of fiscal stimulus packages initiated due to a global crisis was used in 2009 (OECD, 2009). For most of the countries the fiscal injections are projected to diminish in 2010. The period ranging from September 2008 till December 2008 was characterized by frequent and diverse anti-crisis measures announced by both the central banks and the government. In the subsequent period until July 2009, the governmental policies were also characterized by diverse measures, but they were announced on a less frequent scale (IMF, 2009b).

Previous research has found that an increase in a fiscal stimulus package of 1 per cent has an immediate effect on the GDP which raises around 1 per cent as well (Blanchard and Perotti (2002); Romer and Romer (2010). In the long-run, after two/three years, the effects of stimulus packages increase GDP by 2 to 3 per cent. The estimated effects of stimulus packages would be smaller when the country has a smaller economy and is more open to trade (IMF, 2009a). Stimulus effects differ depending on the type of fiscal measures adopted, where measures such as direct purchasing of consumption and investment goods have bigger effects on the GDP than lump sum transfers. It could be inferred that countries more prone to buy troubled bank assets are able to better counteract the crisis.

The effect of fiscal stimulus measures differs among developed and developing countries. Government investment expenditures in particular, have greater effect on GDP for developed countries than for emerging markets (IMF, 2009a). The IMF research also shows what effects fiscal stimulus packages have on GDP growth on different countries and regions. The largest effects were observed among U.S. and emerging Asian markets and the lowest effects were found in the euro zone.

The argument that the effectiveness of fiscal measures depends on the economic environment in the particular country is further underlined by the following phrase: *"A key prerequisite for a successful fiscal stimulus is that it does not undermine the medium-term sustainability of fiscal policy* (IMF, 2009a)."

Effect on the relationship between Integration and Contagion

A government could curb the contagion by setting or keeping tight capital controls (De Gregorio, 2001). However this would lower the integration and subsequently lead to high costs in tranquil times since the economy cannot take all the benefits of a free flow of capital.

The IMF (2011) gives examples of policies for emerging markets that could lead to an optimal balance between risk sharing and financial contagion: 1) The development of a shared package of rules, that include harmonization of accounting standards and securities regulations. 2) A joint and coordinated reaction from the governments to shocks that could harm the stability of their financial systems. 3) Harmonizing the macroeconomic and monetary objectives. When the government does apply this, it enhances further capital mobility in the region and avoids sharp fluctuations in cross exchange rates.

These suggested policies cover for the most part, a long term approach and do not prescribe a reaction to sudden shocks. It can be questioned whether a government has the ability to lower the contagion risk with ad hoc decisions when a crisis occurs.

To see whether the policies have an effect on the impact of the contagion we test the following hypotheses:

Hypothesis 2: A country that has more anti-crisis measures is less affected by the US debt crisis than other countries that are similarly integrated.

Debt and deposit guarantees of the government could reduce the impact that global shocks could have on a country specific equity portfolio. This effect could rise to more than thirty per cent (Bekaert et al, 2011). During the crisis the United States guaranteed to an extremely large amount debt and deposit repayment (Bank of England, 2009). Among the BRIC countries there was a difference of response to the crisis in the global economy.

Measures as capital injections, guarantees for bank and loans and the purchase of toxic assets are taken to calm down the financial markets and to restore investor's and public confidence.

It can be questioned however if a country that is already highly integrated can protect itself from contagion by these anti-crisis policies.

The extent to which the countries could lower their exposure to contagion is however not entirely clear. Edwards (2000) discusses the capital restrictions initiated by the Chilean government in the 1990s. Despite the fact that there were tight restrictions on the out- and inflow of capital, they cannot find empirical evidence that these rules protected Chile against contagion. Moreover Chile faced in this period the effects of contagion caused by the East Asian, Russian and Brazilian crisis.

In addition to this article, De Gregorio (2001) does not find any relevant effect of capital controls on a contagion effect. Instead, the authors find a highly significant effect for two other policy related actions: avoiding short-term debt and making the exchange rate flexible.

However, the fact that there is no such a thing as a free lunch goes also up for the government. The anti-crisis measures are expensive and could cause problems to the financial health of the government and the broader financial system of a country.

This makes a discussion about the implications and the potential benefits of the crisis policies relevant. The focus in our discussion about anti-crisis measures shall be on the relationship between integration and contagion. We are aware of many aspects and implications of the initiated anti-crisis measures. However this is out of the scope of our research and an extensive elaboration on these points would not help us in answering our research question.

3. Model

There exist different types of models available for measuring contagion effects. They can be

split into roughly four categories: 1) models that measure cross-market correlations, 2) garch models, 3) models that are based on the cointegration approach and 4) probit models.

We have chosen the first model, which test for significant increases in cross-market correlations. One of the main reasons for choosing this approach is the fact that tests based on cross-market correlations are straightforward and the results are easy to interpret. Moreover, regardless of different techniques employed using other approaches, all of them arrive at more or less similar results (Forbes, 2001). Lastly, the adequateness of some of the other models can be questioned. For example, techniques used for analyzing cointegration do not provide the right measure of contagion due to long periods under consideration (Forbes, 2001).

As mentioned before, the model used in this thesis to measure contagion effects is developed by Forbes and Rigobon (2002). The idea behind the model is to test for the existence of financial contagion, which is defined as a significant increase in cross-market linkages after a shock to one country. From an empirical perspective, this increase in cross-market linkages can be defined as the increase in correlations of the excess stock market returns between two countries/regions. To apply this model, we firstly measure the correlation of residuals between the crisis country (U.S.) and the non-crisis country (other 8 countries) during tranquil and crisis periods. Subsequently we have to tests for a significant increase in correlations using a Fisher "z" transformation.

The model used by Forbes & Rigobon (2002) is designed to find significant increases in excess stock market returns after controlling for common/external factors. These common factors explain the systematic portion of stock market volatility. Variables that are the most frequently used as a common factor are interest rates and exchange rates. This is in line with Rapach's (2005) finding, who concludes that interest rates are the most consistent predictor of stock returns. We have run a model with interest rates as a common factor. However the interest rates showed week explanatory power (See Appendix 1). Thus, following the Corsetti and Pericolli (2005) we employed the index returns of G7 countries to represent common factor. The index performed much better than the interest rates, with R^2 of 32 per cent on average (See appendix 2).

Two different crisis periods are being used: the short period and long period. The former is used to draw conclusions about the dependency of integration and contagion, while the latter is used to explain the effectiveness of stimulus packages. In order to account for exchange

rate fluctuation, dollar returns are used. Also, in order to adjust for different opening hours in different stock markets, rolling 2-day average returns are employed.

The model employed in this thesis is a VAR model, which is defined as follows. Just for the sake of an example, Japan is picked as a non-crisis country:

$$US_t = \sum_{i=1}^{5} \beta_{US,i} US_{t-i} + \sum_{i=1}^{5} \beta_{JP,i} JP_{t-i} + \sum_{i=1}^{2} \beta_{G7,i} G7_{t-i} + \varepsilon_t^{US};$$

$$JP_t = \sum_{i=1}^{5} \beta_{US,i} US_{t-i} + \sum_{i=1}^{5} \beta_{JP,i} JP_{t-i} + \sum_{i=1}^{2} \beta_{G7,i} G7_{t-i} + \varepsilon_t^{JP};$$

JP and US represent stock returns on Japan and US, respectively. US_{t-i} and JP_{t-i} represent lags of US and Japan returns, respectively. G7 represents returns of the common factor which is used to control for common movements in stock returns. ε_t^{JP} and ε_t^{JP} are idiosyncratic shocks of the respective countries, which are used for obtaining correlations. These correlations are the main inputs in the formula described below.

Forbes and Rigibon (2002) acknowledge difficulties of using this model, such as endogeneity and heteroscedasticity. Endogeneity can be dealt by employing VAR specification to model stock market returns. Moreover, the VAR model also helps to account for serial autocorrelation in returns. When it comes to heteroscedasticity, Forbes and Rigobon (2002) show that correlations between two countries during a crisis period increase due to higher volatility in the crisis country, even if interdependence between two countries stays the same. However, using the volatility of the crisis country (US in this case) during tranquil and crisis periods, they adjust for heteroscedasticity bias:

$$pC^* = \frac{pC}{\sqrt{1 + \left(\frac{\sigma_C^{US}}{\sigma_T^{US}} - 1\right)(1 - pC^2)}}$$

Where:

pC^* = unconditional correlation for crisis period,

pC = conditional correlation for the crisis period (before the correction)

pT = unconditional correlation for tranquil period,

σ_C^{US} = variance of US market during crisis period,

σ_T^{US} = variance of US market during tranquil period.

The null hypothesis, tested in this thesis, is - the unconditional excess correlation is less than or equal to the excess correlation in the tranquil period. The test statistic is obtained by first using Fisher's "Z" transformation to the correlation coefficients. The statistic is:

$$\xi = \frac{\frac{1}{2}\ln\left(\frac{1 + pC^*}{1 - pC^*}\right) - \frac{1}{2}\ln\left(\frac{1 + pT^*}{1 - pT^*}\right)}{\sqrt{\frac{1}{N_c - 3} + \frac{1}{N_f - 3}}}$$

Where:

$$N_c = sample\ size\ for\ the\ crisis\ period$$

$$N_t = sample\ size\ for\ tranquil\ period$$

$$H_0: pC^* - pT \leq 0$$

$$H_1: pC^* - pT \geq 0$$

4. Data

We use a broad national index as a proxy for the countries' stock markets. The indices we are using in this research are summarized in the table below. We have used Reuters Datastream to gather the data of the indices.

BRIC Countries	Developed Countries
Brazilian MSBRAZL	Canadian S&P/TSX
Russian RTS	Japanese Topix
Indian BSE	German DAX
Chinese Shanghai se A	Australian ASX

Included Indices

To get the stock market returns we used the log changes in the closing prices. From these log returns we calculated a rolling average two-day return. We do this to control for different opening hours of the international stock markets (Forbes and Rigobon, 2002). To control for fluctuations in the exchange rate we are using the returns in dollars.

The stock market returns that we take into account date from 30th April 2007 till 30th of December 2009. We divide this dataset into 3 smaller subsamples. The first subsample is our tranquil period and starts at 30th April 2007 and ends at 30th august 2008. This sample is large enough to get a reliable correlation. We do not take any older values into account because this could lead to a time bias, since a correlation between stock markets changes throughout the years as a result of an ongoing process of (dis)integration (Kim et al, 2005). When we would extend our tranquil period we would ignore this fact and implicitly assume a stable correlation throughout the longer period.

The second subsample starts at the 1st of September 2008 and ends at 30th of December 2008. (from now on referred as short crisis period) This period is characterized by the global financial crisis, which became visible in the beginning of September 2008 (Didier et al, 2012). We perform an additional test for the period from the 1st of September 2008 till the 30th of December 2009 (from now referred as long crisis period). In this period the crisis was still present and the US stock market was still highly volatile. We use this period to test our second hypothesis. The choice of the periods is very similar to the periods discussed in IMF (2009b).

Finally the returns are corrected for holidays, so this did not have an influence on the results.

In order to test our second hypothesis we take a longer period into account. By doing this we are able to include the effect of stimulus packages in our discussion. The stimulus packages were announced after the financial sector support was initiated by the government. The significant results we get can still be perceived as contagion since the markets stayed highly volatile and the United States were still in a crisis throughout 2009. Moreover, this extended crisis period is also considered in the IMF (2009b) report studying the anti-crisis measure effects. However it is worth noticing that there is a chance that these results are affected by an ongoing process of (dis)integration of certain countries. Meaning that, when the longer period is used, the contagion results still show significant increase in cross market linkages, but this increase is likely to be the result of gradual increase in linkages, rather than a sudden increase.

However, regardless of contagion possibilities during crisis times, we assume that during tranquil times, even if a longer period is considered, contagion should not occur, because typically the integration process between countries can be described as a gradual increase in dependencies (proxied by correlations). This type of development is preferred by most countries, especially during the crisis periods, since a sharp increase in dependencies with the crisis country can be deteriorating for other countries' stock markets.

We divide the anti-crisis measures in two different categories: financial sector support and stimulus packages. These crisis measures are initiated as a reaction to the global financial crisis that started with the bankruptcy of Lehmann Brothers in 2008. To be able to draw a conclusion about the impact that anti-crisis measures have on the relationship between integration and contagion, we look at the anti-crisis measures that are issued around 2008 and 2009. The numbers can be found in tables 3, 4 and 5 of the appendix. It is common for countries to announce financial sector support together with fiscal stimulus packages (Khatiwada, 2009). However we separated them to get a better inside of the different kind of measures used by the governments and central banks during the crisis. Fiscal stimulus packages are represented by the first column and the financial sector support is represented by all subsequent columns.

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Appendix 3 contains a summary of all the different policies and anti-crisis measures for every single country.

5. Results

5.1 Correlation test

In order to draw a conclusion about the relationship between integration and contagion, we have to test how different countries are financially integrated. From the literature discussed in the chapter 2 we know that developing countries are in general less integrated with other economies compared with developed countries.

Since the focus of our research is on the US mortgage debt crisis, we want to test for integration with the US stock market. As a proxy for integration we use simple correlations. This is line with other studies that focus on the integration between stock markets (Bekeart et al, 2002, Kim et al, 2005, Chiu and MacKay, in press).

The outcomes of our simple correlation test are shown in table 6 of the appendix.

The results show that there is a relatively large difference of correlation of the stock markets of the BRIC countries. China is by far the least integrated stock exchange of the sample. The Brazilian is the highest integrated stock market among the BRIC countries.

As can be inferred from the correlation results, developed countries in general exhibit higher integration with the United States. Although among all the countries, Brazil, which is regarded as one of the developing countries, shows the highest correlation results with U.S. This result contradicts the theory about the difference in integration between developed and developing countries, but can be explained by looking at other channels of integration.

The most pertinent channels to look at are the banks and non-bank financial players mentioned by Pritsker (2000), since they are the most related to financial market integration. These linkages can be proxied by claims that U.S. banks and non-bank financial players have in specific countries. As explained by the Bank of International Settlements bank claims are: *"banks' on-balance sheet financial claims on the rest of the world and thereby provide a measure of the risk exposures of lenders' national banking systems."* The numbers in table 8

of the appendix provide information, that show to what extent United States is involved in other countries when it comes to lending by banks, non-bank private sector and public institutions, which is aggregated under the term "foreign claims".

The high correlation for Brazil compared with other BRIC countries is in line with the statistics of the financial exposure from the US investors to these countries which is showed in appendix (table 7: Financial claims of the United States). The exposure to Brazil is far higher since the American investors have far more Brazilian derivatives and credit commitments than they have for the other BRIC countries.

However the result that the Brazilian stock market has the most integrated country among all the included countries is hard to explain and is not in line with the data of the financial linkages. As can be seen from the table 7 in the appendix, the United States is more active in countries regarded as more developed. This underlines the previous mentioned observation based on the articles, that more developed countries are more integrated. Additionally, when we look at table 8 of the appendix, we see that the foreign claims of the country´s GDP show a similar picture.

In general, the above discussed results point to the conclusion that the stock markets of developed countries are more financially integrated with the US stock markets. The Brazilian stock market can be seen as an exception of the rule. However the high correlation for Brazil is in line with other numbers related to financial integration.

5.2   Contagion Results

Short crisis period: September 2008 – 30 December 2008

To test our first hypothesis we take the crisis period from September 2008 till December 2008. The length of this period is similar with previous research about contagion (Forbes and Rigobon, 2002, IMF, 2009b). The results of this test can be found in table 9 of the appendix.

When we first look at the contagion results without correction for an increase in risk, we can see contagion only for Germany and Russia. The German stock market faced a significant increase in cross-market linkage during the 4 months crisis period in 2008. This is in line with our hypothesis that states that highly integrated countries face higher contagion during a crisis. However the other most integrated countries do not face contagion and have just a

small change in their cross-market linkages. Russia, which is considered as a less integrated country, is the only other country that faces contagion. The increase in the linkage is significant at 1 per cent level

If we apply the suggested correction by Forbes and Rigobon (2002) to adjust our results for the increase in risk in the United States during the crisis period we get different results. At a 5 per cent significance level we only find contagion in Japan.

A second result that is worth noticing is the cross-market linkage for Brazil and Canada. The dependency of these stock markets on the US stock market decreases in such a way that the results show a significant negative change at 5 per cent level. This in the opposite direction as expected. We could label this as negative contagion (Corsetti et al, 2005).[8]

Another noteworthy result is the large difference in linkage between the test results of both methods for the German market. This implies that a large part of the increase in the German-American cross-market linkage can be explained by an increase in risk of the American stock market. We can see large differences between the two methods for other countries as well. This is explicable by the enormous volatility of the American stock markets during the last months of 2009. When we filter out the effect it had on the cross-market linkages we get the most "purest" contagion. This describes the structural change in linkages between two countries. Therefore we consider the values that are corrected for the increase in variance as the most important results, which is in line with Forbes and Rigobon (2002)

Overall we do not find a higher increase in cross-market linkages among the more integrated countries compared with the less integrated economies.

Crisis period September 2008-December 2009

As mentioned before, contagion test is also employed using the longer crisis period. The results of this second contagion test can be found in table 10 of the appendix. We only use the contagion results that are corrected for the heteroscedasticity bias, since the increase in length of the period makes it more likely that our linkages are to a large extent affected by an increase in risk in the crisis country.

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[8] Corsetti et al (2005) argued that there is no reason to limit contagion as a significant increase in cross-market linkages, since many times stock market data indicates decrease in correlations coefficients

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Of all countries, included in our sample, India and Japan have the lowest p-values and the changes in linkages are significant at a 1 per cent level. The Chinese and the German stock markets returns show, contrary to the short crisis period, contagion at respectively 5 and 10 per cent level. Similar to the first period we find negative contagion for Brazil and Canada. Australia and Russia are the only two countries in the sample that avoid contagion both for longer and shorter crisis period

As show in tables 3, 4 and 5 the most integrated countries have in general more anti-crisis measures than the BRIC countries. However, among the most integrated countries. Brazil is the exception and has the lowest amount of anti-crisis measures. Table 3 in appendix shows the different types of anti-crisis measures employed by the countries under study to stimulate the financial sector. Developed countries including Canada, Japan, Australia and Germany rely more on debt guarantees, capital injections and purchase of assets compared to less developed BRIC countries. The opposite can be observed by looking at liquidity provisions, which were more popular among BRIC countries.

Among the less integrated countries, India and China face contagion. India did not invest a large amount of money in their financial sector and their fiscal stimulus package was relatively low. This could be the case because of the small share of the banking sector in the country's GDP (See as an indication table 11 in the appendix that shows the domestic credit supply provided by the banking sector).

Table 4 in appendix shows policy rate reductions, which are mostly used by countries to stimulate demand and avoid credit crunches during a crisis. Unlike the case with financial support measures, there seems to be no indication that more(less) integrated countries using more (less) policy rate reductions.

5.3   Sensitivity Analysis

We test the robustness of our contagion results in two different ways. Firstly we decrease the length of the crisis period to see if the results still hold. Secondly we change the number of lags used in our VAR-model.

We shift the start of the crisis period to September the 15th. On this day filed Lehman Brothers for bankruptcy, which is often considered as the trigger of the worldwide crisis. The reason

for choosing to include the first weeks in our initial crisis period, starting from September 1th,was the fact that the turbulence on the US stock markets started before the fall of the Lehman Brothers. One of the events that caused considerable turmoil in this period was the governmental intervention in Freddie Mac and Fannie Mae.

By changing the start of the crisis period we get higher cross-market linkages table 12 of appendix. From an empirical perspective this could be explained by two things. First of all, a lower variance in the excluded period compared with the rest of 2008. Although the American stock market was already in trouble during the first weeks of September, after the bankruptcy of the Lehman Brothers increased the volatility even more. This could explain our results since a higher variance is often associated with an increase in correlation. Secondly it implies that the crisis was in the first weeks more a local American crisis, rather than a global financial crisis. This is in line with IMF (2009b), which found the absence of a reaction from the governments worldwide regarding US anti-crisis measures in the days before the fall of the Lehman Brothers After the bankruptcy the instability of the worldwide financial sector became visible, which caused a big shock to the markets abroad. This underlines our observation that the comovements between the US stock markets and the other included markets increased after September 17th.

Furthermore we can see that the linkages in the tranquil period changes slightly. This is caused by the addition of the first weeks of September to the total tranquil period. The differences are relatively small and therefore do not have too much impact on the overall results.

On an individual level we can see that Japan and India are now significant at a 10 per cent significant level. The absolute values of their linkages changed by 0,05 after changing the crisis period. The correlation between the Russian stock market and the US has moved in the opposite direction. With the adjusted short crisis period, we find no significant increase while we found in the old period contagion at a 5 per cent significance level. When we compare the results of the test that is adjusted for an increase in variance in the United States, we can see almost no changes. The only minor change is the Japanese stock exchange, which is significant on a 5 per cent level instead of a 1 per cent level.

Overall we can conclude that the change of the period does not have considerable impact on our contagion results.

Change in Lags

A second way to test the robustness of our results is to change the number of lags that we are using in our model. The corresponding results can be found in Tables 13 and 14 on the appendix.

Firstly we test a model without any lagged values for the returns of the United States and the other country's stock market. This means that we measure contagion without controlling for serial autocorrelation. We have found for eight of the twenty-four results a change in the significance. The biggest change we can see is in the results of India in the short crisis period without controlling for an increase in variance of the United States. While the change in the cross-market linkage was not significant when we controlled for autocorrelation, we now get a significant result at a five per cent level. The other results show relatively small changes. Overall the patron of the results stays the same.

Secondly we use two lags in our VAR model to further check the impact of the lags. We can see that all the linkages are having lower values compared with the results we got by using our initial model with five lags.

The results are in general in the same direction, although there are some differences in significance level. Australia faces a contagion effect at a ten percent level for the shorter crisis period in case we control for an increase in variance. India shows again that it has one of the most fluctuating linkages. However the implications of our initial results do not change, by looking at this sensitivity test.

6. Discussion

Hypothesis 1: The contagion effect of the US debt crisis is higher for countries that are more integrated with the United States than for countries that are less integrated.

By looking at the results of our contagion test we cannot find a clear patron that point directly in the direction of our first hypothesis. We need to relate the results to the country's specific situation to get an understanding of the results we got.

The spillover effect of the US crisis was in the first months limited to the worldwide financial

firms only. Even though it was back then already common sense that the crisis would most likely hit non-financial firms in the near future, the impact on these firms was not clearly visible. Therefore we can see that the countries with a relatively stable financial sector show less contagion. This seems to be regardless of the country's level of integration. A striking example in this matter is Brazil. The Brazilian stock market is based on the simple correlations the most integrated country of our sample countries. At the same time we have found statistical evidence of negative contagion for the Brazilian market, which means that Brazilian market got less dependent on US markets during the crisis period. This can be explained by the strength of the financial sector in Brazil. Table 11 of the appendix shows that the Brazilian banks had more capital relatively to their (risky weighted) assets compared with the other countries. This makes the Brazilian banking sector more resistant against the shocks from the American banks.

During the crisis the country's stock markets returns were highly dependent on the (in)stability of the financial sector. The countries that had a sounder financial sector were more immune to the shock in the US stock market. This effect can also been seen by looking at the results of Canada and Australia. The banking sector is in both countries known to be relatively stable (OECD, 2010, OECD, 2010). Australia did not have a contagion effect while Canada got a negative contagion result.

Thus, our results indicate more towards the relevance of the strength of the banking sector instead of a relation between integration and contagion.

Hypothesis 2: A country that has more anti-crisis measures is less affected by the US debt crisis than other countries that are similarly integrated.

As argued before, a successful implementation of anti-crisis measures can help to reduce the negative effects of this dependency and help countries to revert to more stable cross-market linkages.

Canada invested heavily in the financial sector and that could explain the result that this country was less vulnerable to the US crisis, even though the country is highly integrated with the United States. The Canadian government has successfully implemented measures and thereby avoided financial contagion. This cannot be said of the German policymakers, who did not manage to protect their country against contagion by investing a lot in anti-crisis

measures.

The Deutsche Bank (2009) shows figures of the financial soundness of the emergent markets across the world, measured before the crisis. Russia and Brazil are ranked above average, while India and China have a far lower score. This is in line with our contagion results, where we found in the longer period (positive) contagion in India and China, but not in Brazil and Russia.

As discussed in the appedix, Japan supported the financial sector by a relatively large amount of capital injections. However while investing a lot of yens in the bank sector there is still a significant contagion effect on the Japanese stock market. This in line with (IMF, 2009b) results, which show that neither capital injection nor liability guaranties have significant impact in reducing economic or financial stress in Japan.

The cut of policy rates is known to be more effective in lowering the stress in the financial markets (IMF, 2009b). When we compare the decrease in policy rates in the table 15 of the appendix with the contagion results we see a similar effect. However, we cannot distinguish a difference in effect among integrated and non integrated countries.

Australia is the only developed country that does not show significant results in any direction regardless of the length of the crisis period considered. As discussed in the appendix Australia had a quick response and it turns out that the anti-crisis measures were also effective to protect against contagion.

Liability guarantees have been shown to be effective in decreasing bank CDS spreads, which is a proxy of credit risk in a specific country (IMF, 2009b). Liability guarantees seemed to help Australia to decrease contagion effects from United States and even more for Canada. Large amount of guarantees could also explain the creditworthiness of Canada's financial system discussed earlier. The absence of liability guarantees in India and China could have partially explained the contagion effects faced in the long crisis period..

China and India are considered to be emerging countries, which are less financially integrated with US market. This can be inferred by looking at the simple correlations results and foreign bank claim data. Since both countries are less financially integrated with the United States, it can be argued that initially their stock markets have been relatively prudent to shocks from US stock markets. However, when the crisis became global and affected real sectors as well,

China and India faced difficulties in terms decreased global demand.

These facts imply that the US debt crisis could have caused a more delayed effect on these two countries in comparison with the more financially integrated countries in the sample. Evidence of this can be seen by looking at tables 9 and 10 of the appendix. Both China and India do not face contagion during the short period. However, longer crisis period results are different and do show contagion for both countries. Moreover, both China and India were less prone to use anti-crisis measures aimed at financial sector support, which added to the vulnerability of these countries' stock markets. Even though China had the largest stimulus package, it did not seem to help mitigating contagion effects. This is in line with IMF (2009a) results, which showed that stimulus packages are less effective in emerging markets than in developed regions.

IMF (2009b) also found that announcements of recapitalizations and troubled assets purchases were the most effective measures in the later stages of the crisis, while in early stages liquidity support announcement were the most promising. Both China and India allocated one of the lowest amounts of recapitalizations (capital injections) and troubles asset purchases among the sample of countries, which could explain contagion in the long crisis period. On the other hand, India and Russia had one of the highest numbers in terms of liquidity provisions, which could explain the no-contagion results in the short-term period.

We observe that an integrated country in time of a crisis is able to protect the national economy against financial contagion in the long run. Australia and Canada are striking examples. Developing countries that are less financially integrated are less able to protect their countries against contagion in the long run even though they use a relatively large amount of fiscal stimulus packages.

7. Conclusion, limitations and suggestions for further research

7.1 Conclusion

Our initial premise was that more integrated countries will be exposed to more contagion, which is been deducted from previous research (Gelos and Sahay, 2001; Serwa and Bohl, 2005). However results from the contagion test show no clear evidence

of that. Contagion, as defined by Forbes and Rigobon (2002), was only observed in Japan. Our results are more in line with Bordo and Murshid (2000) who did not find any evidence that regions are becoming more vulnerable to shocks when they get more integrated.

Our results point in a different direction compared with the work of Pritsker (2000) and the IMF (2011) which suggests that magnitude of the financial channels, between countries would lead to more contagion. However our results imply, that it was not the strength of the linkages that mattered the most, but more the stability and prudence of country's banking sector. Such prudence and stability was observed in Canada, Brazil and Australia, which managed to thwart contagion. In general, the results showed that even integrated countries are able avoid contagion by having a sound fiscal policy and a prudent banking sector,

With our second hypothesis, we aimed to explore the effect anti-crisis measures have on contagion among similarly integrated countries. Measures, such as capital injections and guarantees were less effective in Japan and Germany, while measures in Canada and Australia showed much better performance.

It should be noted, however that for more integrated countries the effectiveness of anti-crisis measures depend much on the specificities of countries' economies. Even though prudent banking sector is important for countries to thwart contagion effects, there seems to be no consistency in which anti-crisis measures are more effective to reduce contagion and which ones are less effective.

When it comes to less integrated countries, for China, Russia and India short term measures seem to work better than the long term measures. Liquidity provisions, considered to be effective in the short term, showed positive effects for India and Russia, which avoided contagion in the short run. However, absence of measures such as capital injections and purchases of assets that are considered to be more effective in the long run, could have caused India and China to be more vulnerable in the long run. An interesting result was observed in Russia, which, similarly as China and India, did not invest much in capital injections and purchase of assets, but managed to avoid contagion in the long run. One of the possible explanations was the fact that among the emerging countries, Russia was considered as more financially sound country, which could have helped to thwart contagion effects from US.

Cut in policy rates was one of the measures, which seemed to show the surprising ability to explain the direction of contagion among countries in the sample. In general, the countries

that had higher policy rate reductions, exhibited less contagion effects. This would imply that larger cuts would lead to less contagion; however, due to the negative externality of higher inflation, a suggestion for countries to decrease interest rates as much as possible would not be the most welcome. Thus, a certain trade-off between contagion and inflation should be established.

The results show that a government is able to protect their national stock market against a contagion effect by using anti-crisis measures. . This is also possible when countries are more integrated. So the fact that a country is highly integrated does not necessarily mean that it is highly affected by the crisis.

A concluding remark which is important to mention, is that the absence of a contagion effect is not the same as being immune to a crisis. Firstly, it is possible in case of a global crisis originated in the United States, that a market is affected by shocks in other economies but not directly by the shock from the United States. This kind of chain reaction is not directly visible when we look at the linkage with the US stock market. It could be that a relatively small Asian economy is more dependent on China than on the United States. If China is affected by the United States than it could be that this small economy will end up in a crisis because of a contagion effect transmitted by China without having a significant increase with the US stock market. This is worth mentioning especially because of the fact that the US debt crisis became a global crisis and did not stay local.

Moreover, when a certain country is already highly correlated with the crisis country it will usually be more affected by the crisis even when a contagion effect is absent. In case the cross-market linkage with the crisis country is high in tranquil times and stays on the same level during the crisis, it means that the country is equally dependent on the crisis countries whether there it there is turmoil or not. This does not mean that the country managed to stay out of trouble. However a contagion effect makes it more severe since the increase in cross-market linkage is unexpected and thus have investors and policymakers less abilities to anticipate.

7.2 Limitations

We are aware of the limitations of our research and will briefly discuss the most important

points.

Firstly, the different kind of measures causes a diffuse view of the effect of the government's policies. It is reasonable to assume that a fiscal stimulus package, have a more long term effect on the financial sector than capital injections. The effect of this will be become visible after the crisis and does not necessarily have an impact on the stock market returns during the crisis. To draw conclusions about the exact effect of the different financial sector support measures and fiscal stimulus packages, further research is needed.

Secondly, the number of countries involved in our research is limited. By doing this we were able to gather more in depth knowledge about the specific situation of every single country. The drawback of this approach lays in the fact that it is harder to generalize and deduct these results to a broader set of countries. However we are convinced that this approach is needed to set in motion further research.

Thirdly, our research does not provide any guideline for a government how to handle during a crisis. This is because most of the anti-crisis measures are not mainly implemented to protect a country against contagion. The impact it has on the contagion effect is more a consequence instead of the main aim of the government. To give any advice, one needs to take many more things into account to get an inside of the relevance en full effectiveness of the anti-crisis measures.

7.3 Suggestions for further research

Our results suggest an important role for the strength of the financial system when it comes to the relation between integration and contagion. A sound financial system can work as a prerequisite for a country that gets more developed and wants to protect their stock markets against contagion risk. However the relationship between the strengths of the transmission channels and the contagion risk is not widely studied. A better insight is required to be able to draw more decisive conclusions.

We have used many anti-crisis measures in this study. It is clear from the discussion that the effect among the anti-crisis measures differ. Cuts in policy rates seem to have high explanatory power, while capital injections were less effective. Further research on policy measures and contagion could develop an empirical method in order to test for significant levels.

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Appendices

Appendix 1 : Interest rates as the common variable

Country	Country's interest rate		Country's Lag		US_Interest rate		US Lag		R²
Brazil	-0,283972	(0,834)	-0,074546	(0,956)	1,53258	(0,367)	-1,51138	(0,374)	0,016
Russia	-2,809753	(0,000)	3,012318	(0,000)	3,948899	(0,001)	-3,8	(0,001)	0,110
India	-0,775094	(0,089)	0,72758	(0,107)	6,440176	(0,000)	-6,26695	(0,000)	0,084
China	-1,111553	(0,179)	0,514131	(0,532)	3,30716	(0,052)	-3,0631	(0,071)	0,066
Australia	-0,963649	(0,431)	0,863012	(0,481)	4,95082	(0,000)	-4,94862	(0,000)	0,051
Canada	-0,476041	(0,734)	0,704509	(0,618)	1,665565	(0,116)	-1,78832	(0,095)	0,012
Germany	3,124169	(0,171)	-3,119887	(0,168)	3,239931	(0,001)	-3,20859	(0,001)	0,070
Japan	0,757384	(0,812)	-1,074096	(0,734)	3,188254	(0,000)	-3,21367	(0,000)	0,051

Coefficients and R2 when Interest rates is used as common factor (P-value between brackets)

Since the interest rates are widely use as a common vector in the VAR models for contagion, we firstly included this in our model. The results of the simple regression are shown in table above. However, interest rates employed in this study showed very low explanatory power (measured by R^2) and the corresponding coefficients were insignificant for most of the countries The R^2's where relatively low and not satisfying. This was enough reason to implement another common factor.

Appendix 2: G7 as the common variable

G7 country index represents the aggregated return of 7 countries: France, Germany, Italy, Japan, United Kingdom, United States and Canada. This index was used by Corsetti et al. (2005) in their study of Hong Kong crisis and the contagion effects on Asian, European and American countries. The G7 index showed much stronger explanatory power then the interest rates with an average R^2 of 32% for 8 countries under study. All G7 and G7 lag regression coefficients were significant at the conventional significance levels, except "g7" for China. Table below summarized results from country regressions:

Regression: $Country\ return_i = \alpha + \beta_1 G7 + \beta_2 G7_{t-1} + \varepsilon_i$ for each of the 8 countries under study.

	Coefficients			
Country	**C**	**g7**	**g7_lag1**	**R²**
Brazil	0.254292 (0.003)	0.553322 (0,000)	0.160448 (0.0122)	0.30814
Russia	0.031624 (0.635)	0.152725 (0.0027)	0.225356 (0)	0.153654
India	0.098038 (0.242)	0.174401 (0.0063)	0.429846 (0)	0.235942
China	-0.11959 (-0.2453)	-0.05558 (-0.4757)	0.19181 (-0.0143)	0.021247
Australia	0.090753 (0.1747)	0.138004 (0.0067)	0.403679 (0)	0.284958
Canada	0.119841 (0.0122)	0.249888 (0)	0.150418 (0)	0.2872
Germany	0.0693 (0.1103)	0.271126 (0)	0.15123(0)	0.352498
Japan	0.017553 (0.6874)	0.144755 (0)	0.212804 (0)	0.27454

Numbers in brackets indicate the p-values.

Appendix 3 : Anti-crisis measures summarized by country

In this appendix we will briefly summarize how different countries, selected for this study, reacted to the global crisis originated in United.States.

BRIC countries

Brazil

Brazil is one of the countries with the least anti-crisis measures. The Brazilian government responded with monetary easing, fiscal stimulus and credit expansion. Nevertheless, the absolute and relative value of these measures are on a considerable lower level than the other BRIC countries. Nowadays the lending support from the Brazilian central bank is the most striking example of government support. The banks can therefore borrow money below short-term market rates (OECD,2009, OECD,2011a).

Russia

The stimulus package, which was announced in 2008, consisted of tax cuts, faster amortization schedules and measures to help SMEs. The most important measure was the proposal to cut corporate tax rate with 4 per cent and leaving the possibility for local authorities to further decrease it by a maximum of 4 per cent. This would have an impact on the budget of over Rb500 bn (16,2 bn dollar) (The Economist intelligence unit, 2009).

Measures to support the economy reached $40billion and could be expanded if needed. All the financing came from the reserve fund and national welfare fund, according to the finance minister of Russia (Reuters, 2009).

India

Fiscal consolidation achieved before the global recession in 2008 has helped India to become more flexible in implementing discretionary measures for boosting the demand. Two of the measures were tax cuts in central excise duties[9] and cuts in the central service tax.

The Indian government stimulated the economy by investing more in education, health and rural infrastructure which led to a increase in spending of 2,2 per cent of their GDP. In addition, NRGES (which is responsible for finding short-term jobs for rural inhabitants) received more financing, which increased inhabitant's income levels. The reserve ratio was cut to 24 per cent. The restrictions on external commercial lending were eased. The RBI started buying monetary stabilization bonds and induced a liquidity boost in the markets.

China

China's response to the global crisis can be summarized into three main categories: (1) curbing of exchange rate appreciation in July 2008, (2) cuts in interest and reserve rates and (3) announcement of series of fiscal measures, from which the biggest one amounted 6.5 per cent of annual GDP. In addition to the fiscal plan, other measures such as decrease in interest rates on mortgages, consumer subsidies, alignment of VAT regime on exports, have amounted 2.8 per cent of GDP (OECD, 2011c).

Developed countries

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[9] taxes collected by Indian government only on production and manufacture.

Canada

The reaction of the financial markets was less severe in Canada compared to other global markets. But the country was not immune to global crisis; the country's short-term debt market was seriously affected. The central bank in Canada reacted with a relatively large package of anti-crisis measures consisting of purchase and resale agreements against securities with a relatively long maturity, swap agreements with the Federal Reserve and other instruments to provide liquidity for financial firms. The central government responded with the so called Extraordinary Financing Framework (EFF). A part of the programme was the purchase of mortgage backed securities by a government owned institution. Furthermore the government initiated a support for sales of assets through the purchase of asset-backed securities that were backed by loans and leases. When the financial markets stabilized in the central bank and the central government decided to end all their programmes. This means that during the European crisis, there were no big Canadian measures to protect the financial industry effective. After all the Canadian banking sector appeared to bit much more healthier compared to other developed countries. One striking example is that the Canadian banks stayed profitable through the global financial crisis.

As many other central banks, the central bank of Canada lowered their policy rate. The Canadian policy rate dropped dramatically from 4,5 to 0,25 per cent. The stimulus package initiated in 2009 the government is relatively big and amounts to 4,1 of the 2008's GDP. The estimated stimulus package for 2010 and 2011 was roughly 1,6 of the Canadian GDP (OECD, 2010a).

Japan

Japan invested a relatively high amount in stabilizing the financial sector. The Japanese government issued short term loans, bought commercial paper and corporate bonds and shares of investment-grade firms from banks in December 2009. These measures were partly withdrawn in 2010. However new purchases of commercial paper and corporate bonds were included in the newly announced package of anti-crisis measures in 2010.

The stimulating package announced in September 2009 amounts to 1,5 per cent of the Japanese GDP. In September and October the government announced two new packages of respectively 0,2 per cent and 1,1 per cent of the GDP. In addition, the Japanese authorities

sold in 2010 2.1 trillion yen to lower currency value of Yen (OECD,2011c).

Japan faced a crisis in 2002 as well. Back then the bank of Japan have released relatively large liquidity provisions and capital injection packages. It was effective to reduce market stress. IMF(2008b) findings suggest that similar effect occurred during the global subprime mortgage crisis.

Germany

In 2008 October Germany initiated a policy called: the "German stabilization act", which meant that around 500 billion euro rescue package is provided for financial institutions, pensions fund, insurance companies. 500 billion euro consisted of 100 billion in cash and another 400 billion in the form of guarantees. After 2 days, stabilization fund because operational. This fund was responsible for: (1) Financial guarantees, (2) Purchases of risky assets, (3) Acquiring troubled entities through acquisitions of equity stakes.

BayernLB, the largest state own bank in term of the mount of assets it holds, was the first bank to receive a relieve from German stabilization fund. BayernLB was followed by two other big banks, WestLB and HSH Nordbank. German stabilization act included provisions that helped it to acquire risky assets more easily (Friend Frank, 2008).

Australia

Australia suffered less than other countries during the global crisis and was one of the view economies that did not end up in a recession. The banking sector was already heavily reformed in previous periods and was therefore relatively resistant to the shocks that caused trouble to foreign competitors.

The government implemented relatively large stimulus packages and is assessed by the OECD as one of the most effective packages among the member states. The packages consisted of measures to increase consumption and investments. The total invested amount by the government relative to the country's GDP in 2008-2010 was the third highest of all the OECD countries, after the USA and Korea. Moreover, Australia was quick with their response to the upcoming crisis. A month after the bankruptcy of Lehman Brothers, the government announced the first part of their recovery plan (2009). The authorities learnt from the tardy fiscal response to the early 1990s recession that a quick response was essential. =

Appendix 4 : Tables

Table 1 Country restrictiveness

	Equity Restrictions	Total FDI Restrictiveness Score
All Countries	0,072	0,117
BRIC Countries	(Average: 0,178)	(Average: 0,294)
Brazil	0,08	0,116
Russia	0,216	0,384
India	0,191	0,22
China	0,226	0,457
Developed Countries	(Average: 0,085)	(Average: 0,139)
Japan	0,23	0,241
Germany	0,02	0,025
Canada	0,067	0,153
Australia	0,023	0,138

Source: Kalinova et al, 2010): The higher the score the more restrictive the country is regarding foreign direct investments

Table 2 :Trading across borders: BRIC and developed countries compared

Countries	Worldbank ranking	Documents to exports	Time to export (days)	Cost to export ($)	Documents to import	Time to import (days)	Cost to import ($)
BRIC – Countries							
Brazil	121	7	13	$ 2 215	8	17	$ 2 275
Russia	160	8	36	$ 1 850	10	36	$ 1 800
India	109	8	16	$ 1 095	9	20	$ 1 070
China	60	8	21	$ 500	5	24	$ 545
Developed Countries							
Japan	16	3	10	$ 880	5	11	$ 970
Germany	12	4	7	$ 872	5	7	$ 937
Canada	42	3	7	$ 1 610	4	11	$ 1 660
Australia	30	6	9	$ 1 060	5	8	$ 1 119

Source: The World Bank (2010),Doing Business in a More Transparent World

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Table 3: Financial sector support

	Capital injections[2]	Purchase of Assets and lending by treasury[2]	Liquidity provisions and other support by Central bank[2]	Guarantees (excluding guarantees by deposit insurance agencies)[2]	Total
Canada	0,9	8,8	1,9	13,5	25,1
Japan	2,4	11,4	1,2	7,3	22,2
Australia	0	3,5	0	8,8	9,5
Germany	3,8	0,4	0	18	80,3
Brazil	0	0	1,5	0	1,7
Russia	0,6	0,5	7,6	0,5	9,2
India	0,4	0	6,3	0	6,3
China	0	0	0	0	0

Sources: (1) (Khatiwada, 2009), (2) (Fiscal Affairs department, 2009), (3) (Reuters, 2009)

Table 4: Policy rate reductions

Country	Policy rate reductions
Canada	3,25%
Japan	0.4%
Australia	3,75%
Germany	3.25%
Brazil	1%
Russia	4.25%[*]
India	2.5%
China	2,16%

Sources: Khatiwada, 2009 * (Reuters, 2009)

Table 5: Fiscal Rescue packages

Country	Size (% of GDP)
Canada	2,0
Japan	2,3
Australia	2,5
Germany	2,8
Brazil	0,2
Russia	1,1
India	0,3
China	13,0

Table 6 : Correlation Results

BRIC Countries	Correlation	Developed Countries	Correlation
Brazil (MSBRAZL)	0,60	Canada (S&P/TSX)	0,58
Russia (RTS)	0,28	Japan (Topix)	0,34
India (BSE)	0,23	Germany (DAX)	0,55
China (Shanghai se A)	-0,04	Australia (ASX)	0,33

Table 7: Financial claims of the United States

BRIC Countries	Derivatives	Guarantees	Credit commitments	Other potential exposures
Brazil	26,174	57,734	14,385	98,293
Russia	1,137	78,24	0,755	80,132
India	3,101	17,45	1,728	22,279
China	5,309	38,546	4,214	48,069
Developed Countries	**Derivatives**	**Guarantees**	**Credit commitments**	**Other potential exposures**
Canada	15,89	87,771	53,61	157,271
Japan	29,231	195,748	23,424	248,403
Germany	60,381	346,664	28,694	435,739
Australia	16,398	16,398	15,345	161,815

Table 8: Foreign bank claims directed to the United States

BRIC Countries	Foreign Claims	% of GDP
Brazil	41,105	2,0%
Russia	15,745	1,0%
India	48,68	2,8%
China	25,797	0,4%
Developed Countries	**Foreign Claims**	**% of GDP**
Canada	64,002	3,7%
Japan	128,314	2,2%
Germany	128,095	3,6%
Australia	52,831	3,6%

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Table 9: Contagion Results Short Period

Country (ranked on integration)	Tranquil period	Crisis	Crisis : Adjusted for an increase in risk
Brazil MSBRAZL	0,38	0,39	0,13(**)
Canada S&P/TSX	0,41	0,39	0,13(**)
Germany DAX	0,18	0,53***	0,19
Japan Topix	-0,29	-0,15	-0,05***
Australia ASX	0,04	0,03	0,01
Russia RTS	0,02	0,22*	0,07
India BSE	-0,10	0,05	0,02
China Shanghai se A	-0,10	-0,18	-0,06

Significance levels: *** 1% ** 5% * 10%. Asterisks between brackets indicate negative contagion.

Table 10 : Cross market linkages and anti-crisis measures

Country (ranked on integration)	Tranquil period	Short Crisis period	Long Crisis Period	Total Anti-crisis measures (in % of GDP)
Brazil MSBRAZL	0,38	0,13(**)	0,25(**)	1,7
Canada S&P/TSX	0,41	0,13(**)	0,24(**)	27,1
Germany DAX	0,18	0,19	0,30*	25
Japan Topix	-0,29	-0,05***	-0,04***	24,6
Australia ASX	0,04	0,01	0,14	14,8
Russia RTS	0,02	0,07	0,12	10,3
India BSE	-0,1	0,02	0,12***	7
China Shanghai se A	-0,1	-0,06	0,05**	13,0

Significance levels: *** 1% ** 5% * 10% Asterisks between brackets indicate negative contagion.

Table 11: Bank Regulatory Capital 2008

Country	Bank Regulatory Capital to Risk-Weighted Assets in %	Bank Capital to Assets in %
Brazil	18,4	9,1
Russia	16,8	13,6
India	12,3	6,4
China	12	6,1
Australia	10,9	4,5
Canada	12,7	5,1
Germany	12,9	4,5
Japan	12,8	3,6

Source: IMF June 2009

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Table 12: Sensitivity Analysis : Shorter crisis period (17th September 2008- 31st December 2008)

Country (ranked on integration)	Tranquil period	Crisis	Crisis : Adjusted for an increase in risk
Brazil MSBRAZL	0,38	0,43	0,14**
Canada S&P/TSX	0,39	0,42	0,14**
Germany DAX	0,18	0,56***	0,20
Japan Topix	-0,28	-0,10*	-0,03**
Australia ASX	0,03	0,07	0,02
Russia RTS	0,03	0,17	0,05
India BSE	-0,12	0,10*	0,03
China Shanghai se A	-0,11	-0,14	-0,04

Table 13 : Sensitivity Analysis VAR (0)

Country (ranked on integration)	Tranquil period	Short crisis period		Long Crisis Period
		Without adjustment	Adjusted for an increase in risk	Adjustment for increase in
Brazil MSBRAZL	0,4	0,4	0,14**	0,24**
Canada S&P/TSX	0,43	0,43	0,15***	0,26***
Germany DAX	0,21	0,60***	0,23	0,32
Japan Topix	-0,21	-0,04	-0,01*	0,00***
Australia ASX	0,11	0,19	0,06	0,17
Russia RTS	0,1	0,30*	0,1	0,15
India BSE	-0,04	0,21**	0,07	0,14**
China Shanghai se A	-0,1	0	0	0,07***

Table 1 VAR (0) Underlined values have a change in significance level

Table 14: Sensitvity Analysis VAR (2)

Country (ranked on integration)	Tranquil period	Short crisis period		Long Crisis Period
		Without adjustment	Adjusted for an increase in risk	Adjustment for increase in
Brazil MSBRAZL	0,37	0,32	0,10**	0,15***
Canada S&P/TSX	0,41	0,35	0,12***	0,15***
Germany DAX	0,17	0,53***	0,19	0,19
Japan Topix	-0,27	-0,19	-0,06	-0,03***
Australia ASX	0,05	0,06	0,02*	0,09
Russia RTS	0,01	0,21*	0,07	0,07
India BSE	-0,10	0,13**	0,04	0,08**
China Shanghai se A	-0,12	-0,10	-0,03	0,03**

Table 15 : Policy rate and contagion results

Country	Policy rate reductions [2]	Contagion in the long crisis period (5% significance level)
Canada	3,25 %	Negative contagion
Japan	0.4%	Contagion
Australia	3,75%	No contagion
Germany	3.5%	No contagion
Brazil	1%	Negative contagion
Russia	4.25% [3]	No contagion
India	2.5%	Contagion
China	2,16%	Contagion