CHANNELS OF FINANCIAL RISK CONTAGION IN THE GLOBAL FINANCIAL MARKETS

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Abstract

The financial risk contagion is highly disputed issue among economists and politicians alike. Due to theoretical and empirical understanding of contagion is limited and there is no consensus about the role that contagion has played in the recent financial crises that occurred around the world, it is important and useful to understand the process of financial risk contagion which could allow to prevent future crises or minimize the losses that occur when financial crisis spreads over the global financial markets.

In this article theoretical aspects of the concept of financial risk contagion are delivered, the mechanism of financial risk contagion from one market to another is presented, the channels through which financial risk has spread in global financial markets and the financial shocks transmitting ways are delivered. The main finding is that the different mechanisms by which a crisis can spread greatly differ from each other both in their causes and implications.

Keywords: financial crisis, financial risk, financial contagion, contagion channel, market shock.

JEL Classification: G01, G10, G15.

Introduction

For a long time economists have believed that financial systems are fragile in the sense that small shocks can cause serious disruption. Research has focused on phenomena, such as bank runs, which affect the stability of individual institutions. Only recently there has been interest in the phenomenon of contagion, in which financial distress in one institution or one sector of the financial system spreads to other institutions or sectors.

In the last decade internationalization and financial integration have increased the possibility of financial contagion among emerging and developed countries. Emerging markets have experienced a variety of financial crises over the past 20 years. The crises in Mexico in 1987, in South-East Asia in 1997 and Russia in 1998 have provoked speculation that financial crises have spread from one country to another. These financial crises were initiated by episodes of ‘local’ turmoil but ultimately spilled over to markets with little or no economic linkages to those initial shocks. This has been described as contagion or interdependence. The recent financial crisis, which began in 2007 in the United States, has proven the existence of contagion phenomena once again. Without a clear understanding of financial contagion and the mechanisms through which it works, we can neither assess the problem nor design appropriate policy measures to control it.

A poor understanding of the transmission of economic and financial crises has in the past few years prompted a surge of interest in international economic integration and its relationship to international financial contagion. The debate on the relative importance of trade linkages versus financial flows continues to be unresolved. A number of recent articles (Bae et al., 2003; Kaminsky & Reinhart, 2003; Pritsker, 2004; Clark et al., 2009; Cheung et al., 2010) have emphasized the importance of financial sector links in the propagation of crises across countries, while others (Claessens, 2001; Aheysinghe & Forbes, 2002; Rigobon, 2002; Kali & Reyes, 2009; Abd Majid & Hj Kassim, 2009) have stressed the importance of trade linkages. However, both strands of research note that it is difficult to separate the two because most countries that are linked in trade are also linked in finance.

This paper organizes and evaluates recent research on international financial contagion. The aim of this paper is to describe the mechanism of financial risk contagion from one market to another, to determine the channels through which financial risk has spread in global financial markets and to present the financial shocks transmitting ways in the context of the recent financial turmoil that occurred in the United States in the middle of 2007 and due to globalization suddenly spread out over the world and affected all the main global financial markets in Europe, Asia and Russia.

Globalization of financial markets

One of the most important factor influencing changes in the financial sector at the end of the twentieth century and in the beginning of the twenty-first century is a financial globalization. Globalization of financial markets is inevitable and ongoing dynamic process that leads to the capital resources, available to help
businesses and individuals, to a wider number of investment products and their diversity, to greater opportunities, but at the same time to a higher risk, diversification and the complexity of risk management problems.

Scientists (Gilpin, 1998; Garret, 2000; Wagner, 2005; Scardovo et al., 2010), while analyzing this becoming entrenched phenomenon of global financial system unanimously agree that globalization is a fundamental process that changes global structure of politics, economics and societies. For the first time appeared in the mid-term of the twentieth century the term "globalization" is used to define a wide range of information, economic and other processes associated with the increasing integration of economy and society and the intensification of mutual relations as well (Makarychev, 2000; Sergunin, 2000). According to Gilpin (1998), Garret (2000), Sergunin (2000), Wagner (2005) globalization can be defined as global converge process of co-production, technology, management patterns, social structures, political organizations, cultures and values, that leads to establishment of joint supranational institutions and toward a unified society. This process differs from the internationalization (increasing communications between countries, which nevertheless remains the key players) because the networks that cross countries’ boundaries and divisions are built up, and the community of countries with different level of economy are united where the principles and values are the same.

Globalization in the financial system means that the banking institutions become global and are increasingly encouraged to work and function effectively in a competitive global market environment. However, various cultural, economic and financial environment leads to differences in a wide variety of banking and globalization. While the global trend remains the same, however, depending on the formed features of country’ economic, cultural, environmental and financial structure, the financial intermediaries in Europe, USA and Japan are developing quite differently. Therefore, the comparison of different forms of manifestation of globalization in different continents are quite difficult, because often the findings or trends of researchers who are studying the U.S. commercial and investment banking activities significantly differ from those that are mentioned in European and Asian scientists; works. After a systematic analysis of scientific literature there can be seen that both the U.S. (Eng et al., 1995; Eiteman et al., 1995; Rose, 1996; Canals, 1997; Tobin, 1999; Fubini, 2000; Marock et al., 2000; Cambell & Hulme, 2001; Alla & Leslie, 2001; Wagner, 2005; Kose et al., 2007) and Europe (Kersnar, 2000, Moore & Newby, 2000; Shirreff, 2000; Thiel, 2001; Beitel & Schiereck, 2003; Scardovo et al., 2010) scientists who analyze financial intermediaries distinguish very similar banking market modifying factors which have led to rise in the banking business globalization. Mostly in different scholars’ works such observed trends of fundamental changes in the financial sector are distinguished:

1. **Liberalization in global trade of financial services.** Opening of financial markets - is a complex and demanding process, which manifests itself as various types of risks that could lead the country to financial volatility and sudden changes in capital flow movements. Although after the Asian crisis, many scientists argued that globalization has gone too far, causing volatility in capital markets and costly crises, and suggested a return to financial control, a tighter control of the financial sector has not been implemented. Therefore, a new global financial crisis has hit the world. Thus, in both developing and economically developed countries changes that have occurred after the abolition of capital restrictions and opening country’s financial sector to foreign competition are very important and have affected the national economy and its financial sector and promote further process of globalization.

2. **Consolidation and conglomeration.** Over the past decade in the context of rapid scientific and technological progress, economic and financial integration in the new global market has very strongly reinforced. In order to survive global competition and the fight against banking giant heavy industries, many banks have started to actively join in the inner market and look for strong partners in international markets. They were encouraged by the governments that have adopted a series of legislative changes in order to encourage banks to consolidate and constantly look for new alliances. The process of banks consolidation is also encouraged by the integration in the unified economic and monetary unions. The consolidation in Europe has been particularly accelerated by the adoption of single currency - the euro in 1999. In addition, the globalization process has been bright and noticeable in industrial countries, where the pervasion of banking groups in the growing markets is ongoing: the Spanish banks - to Latin America, German banks – to the Central and Eastern Europe, Scandinavian banks - to Europe and North American banks – to the East Asian countries.

3. **Evolution of financial systems.** Recently, the processes of financial systems’ evolutionary in which the attention is focused from the mediation of the debt securities to the business itself take place in the
financial markets. Such financial markets create better opportunities for companies to contact with investors directly and to facilitate access to necessary financial services.

4. **Concentration of financial institutions.** Triggered by globalization the rapid merger process of financial institutions worldwide when banks and insurance companies come to the active-touch in order to meet their size requirements of capital markets, leads to declining numbers of financial institutions while increasing the average size of a financial institution simultaneously. This is going to improve banks' financial services positioning, when it becomes necessary to provide customers with new, high-quality products at competitive prices. Consequently, modernity and globality become very important and relevant.

5. **Development of new technologies.** Technology and particularly development of internet banking and brokerage services has led to the possibilities of globalization to go beyond the limits of the ownership structure of financial conglomerates and reach the retail markets. Many banks in order to pervade the foreign markets carried out their operations by the help of internet, thus avoiding expensive establishment of overseas departments. Also the creation of main banking and telecommunications conglomerate alliances suggests that the future competition in the electronic banking market will be fierce. In addition, the emergence of virtual banking, e-service development has created the opportunity to develop non-bank financial institutions which carry out basic banking functions as well.

6. **Universality of banking.** The rapid development of globalization is blurring out the boundaries between banks and non-bank financial services institutions. This trend is particularly noticeable in some European countries, and helps to predict the formation of conglomerates offering all types of financial services. Due to the rapid development of globalization, governments worldwide are facing new challenges conditioned by the phenomenon of the globalization – the spread of the financial risk, the interdependency between financial markets and its supervision and the maintenance of the stability of the financial sector. This is particularly important in the term when a financial crisis hits. The global financial markets have recently experienced the largest crisis since 1929, which is no simple repetition of the past. The Global Financial Crisis began in 2007 when the subprime mortgage crisis originated in the US spread rapidly to most financial markets around the globe. As the crisis deepened, stock markets worldwide experienced substantial falling asset prices and entered a period of high volatility. Major banks and financial institutions faced serious liquidity problems, and governments around the world attempted to coordinate efforts to provide financial rescue.

Unlike past crises, such as the 1997 Asian financial crisis, the 1998 Russian crisis, and the 1999 Brazilian crisis, the current crisis originated from the largest and most influential economy, the US market (Eun & Shim, 1989; Jorion & Goetzmann, 1999; Abd Majid & Hj Kassim, 2009; Cheung et al, 2010). The current crisis seems to trigger a prolonged worldwide fear spillover and cause a fundamental change in the correlations among international markets, for both developed and emerging markets. It provides a unique natural experiment for examining the dynamic interrelationships among the global stock markets and the contagion effect during a worldwide financial crisis.

The degree of integration among global financial markets tends to change over time. Bekaert and Harvey (2000) show that equity correlations increase after liberalization of capital markets in emerging countries. Chen et al. (2002) document the dynamic interdependence of the major stock markets in Latin America. Goetzmann et al (2005) find that the correlation structure of the world equity markets varied considerably over the past 150 years and was high during the periods of economic integration. Bekaert et al (2007) show that global market integration is the strongest in countries that have liberalized their capital accounts, equity markets and banking systems. Özdemir & Çakan (2007) find that while the US stock market leads the other stock markets, the UK market can also Granger-causes the US market. Quinn & Voth (2008) argue that stock market correlations are mainly driven by greater freedom to move funds from one country to another, though increasingly correlated economic fundamentals also matter.

The previous studies also suggest that the interdependence among global markets tends to increase during the periods marked by financial crises. Tuluca & Zwick (2001) document an enhanced comovement in daily returns from 13 Asian and non-Asian markets after the advent of the Asian crisis. Yang et al (2002) find that both the long-run cointegration relationships and the short-run causal linkages among the US, Japanese and 10 Asian emerging stock markets were strengthened during the 1997 Asian financial crisis. Chakrabarti & Roll (2002) show that European and East Asian countries were not susceptible to volatility contagion in the pre-crisis era but the susceptibility increased significantly during the 1997 Asian financial crisis. Yang et al (2006) find that both the long-run price relationship and the dynamic price transmission were strengthened among the

Recent studies focus on global market contagion. Different theoretical models are developed in the literature (e.g. Allen & Gale, 2000; Kodres & Pritsker, 2002; Hasman & Samartin, 2008) to explain how a small liquidity shock in one region can spread by contagion throughout other regions. Longin & Solnik (2001) find that the equity market correlation is not related to market volatility per se but to the market trend, and the equity market correlation increases in bear markets. Campbell et al (2002) find further evidence on increased correlation in the international equity returns in bear markets. Van Royen (2002) suggests that the Russian crisis was characterized by both contagion and large aggregate outflows, and that contagion appears to be regional. Forbes & Rigobon (2002) show a high level of market comovement in all periods. Bekaert et al (2005) identify contagion during crisis periods and find time variation in world and regional market integration. Candelon et al (2008) suggest that the increases in comovement of stock markets are more of a sudden nature (i.e. contagion) instead of a gradual one (i.e. financial integration).

The concept of financial contagion

One of the most important factor influencing changes in the financial sector at the end of the twentieth century is the spread of financial crises across countries. Excessive information and capital flows between markets are observed during financial crises and other turbulent events, e.g. explosions of stock market bubbles, terrorist attacks, bankruptcies of large companies, parliamentary elections. Depressing news from important international markets often causes a rapid fall of stock prices on the local market. In this way financial crises may expand from one market to other countries or regions. Extreme events such as crises are occasionally blamed for breaking or boosting ordinary linkages between stock markets. Intensive relationships between a crisis market and calm markets can lead to the spread of the crisis, which is often called financial contagion.

Before discussing the potential sources of contagion, it is necessary to clarify exactly how contagion is defined. When it is talking about the financial risk and financial crisis contagion or simply financial contagion, the following definition of contagion is used:

Contagion is a phenomenon that occurs when a shock to one or a group of markets, countries, or institutions, spread to other markets, countries, or institutions.

Before 1997, the term “contagion” usually referred to the spread of a medical disease when a disease is transmitted by direct or indirect contact. A search for contagion before this year finds hundreds of examples in major newspapers, almost none of which refer to turmoil in international financial markets. This changed in July of 1997. A currency crisis in Thailand quickly spread throughout East Asia and then on to Russia and Brazil. Even developed markets in North America and Europe were affected, as the relative prices of financial instruments shifted and caused the collapse of Long-Term Capital Management (LTCM), a large U.S. hedge fund. These global repercussions from what began in the relatively small Thai economy have sparked the widespread use of a new meaning for the term contagion. A search of major newspapers since mid-1997 finds that almost all articles using the term contagion referred to the spread of financial market turmoil across countries.

Although analogies comparing the spread of financial crises to the spread of a medical disease can be overdone, this comparison is useful on several levels, because contagion incorporates many different ideas and concepts. At one level, contagion is a “disease”. The financial crises of the late 1990s that led to sharp contractions in income levels and standards-of-living in many emerging markets were certainly as devastating as many diseases. Contagion also refers to the “transmission” of a disease. As the Thai crisis spread across the globe, it became clear that understanding why the original crisis spread was just as important as understanding what prompted the initial events. This definition of contagion also emphasizes that it can occur through “direct or indirect” contact. This has also been a key aspect of the ongoing debate on international financial contagion. Do currency crises spread through direct economic linkages, such as bilateral trade flows? Or do they spread through indirect linkages, such as changes in investor sentiment?

Even the earlier, non-medical definitions of contagion are highly applicable to turmoil in international financial markets. Some of the leading explanations for financial contagion, especially after the Russian default in 1998, were based on changes in investor “psychology,” “attitude,” and “behavior”. Many countries subject to contagion in the late 1990s, and especially countries with relatively strong fiscal and current account balances, argued that the spread of contagion to their economies was unwarranted given their strong economic fundamentals. Many blamed their subsequent difficulties on the “harmful corrupting influence” of...
investors in other countries instead of on their own characteristics and policies. Finally, the last dictionary usage of the term contagion, “the tendency to spread,” captures the heart of the debate about contagion. Why do local crises spread internationally? Why can an event in a relatively small economy have such pervasive global ramifications? What can be done to limit the spread of crises in the future? Prior to the East Asian financial crisis, there was relatively little analysis of why country specific crises could spread internationally. However, the financial crisis quickly spread across Asia and elsewhere. The recent financial turmoil that began in the US in 2007, has focused attention on the financial risk contagion issue over again.

The theories of financial contagion

Focusing on the broader definition of contagion, there are a number of different theories why contagion can occur. This literature can be divided into two broad groups: fundamental causes (including common shocks, trade linkages and certain financial linkages) and investors’ behavior (including liquidity problems, incentive problems, informational asymmetries, market coordination problems, and investor reassessment) (Claessens et al, 2001; Moser, 2003; Forbes, 2004; Scardovo et al., 2010).

Contagion can occur due to a number of different fundamental causes. One type of fundamental cause is a common or global shock (which has also been called a “monsoonal effect”) (Calvo et al, 1996; Masson, 1998). For example, a major economic shift in industrial countries (such as changes in interest rates or currency values), a change in commodity prices, and/or a reduction in global growth can trigger crises and large capital outflows from emerging markets. Any of these common shocks can lead to increased comovements in asset prices and capital flows.

A second major group of fundamental causes is trade linkages, which include linkages through direct trade and competitive devaluations (Gerlach & Smets, 1995, Eichengreen et al, 1996; Glick & Rose, 1999; Corsetti et al, 2000; Forbes, 2002; Bordo, 2008). A crisis in one country can cause a reduction in income and corresponding reduction in demand for imports, thereby affecting exports, the trade balance, and related economic fundamentals in other economies through direct trade links. Moreover, if a crisis in one country causes its currency to be devalued, this can reduce the relative export competitiveness of other countries that compete in third markets. This effect of “competitive devaluations” can put pressure on the other countries’ currencies to depreciate or devalue. A series of competitive devaluations can cause larger currency depreciations than required by the initial deterioration in fundamentals.

A final major group of fundamental causes is financial linkages (Goldfajn & Valdés, 1997; Van Rijckeghem & Weder, 2001; Marsili & Raffaelli, 2006; Hudson & Maioli, 2010). In a world or region that is highly integrated, a crisis in one country can have direct financing effects on other countries, such as through reductions in trade credit, foreign direct investment, and other capital flows. More specifically, a crisis in one country can reduce the supply of capital from that country, thereby reducing the country’s ability to provide bank lending and other forms of investment to a second country. The crisis could also indirectly affect the supply of capital through third parties (as discussed in more detail below). For countries heavily reliant on external funding, a reduction in capital inflows due to this effect can cause a sharp increase in borrowing costs and pressure on a currency to depreciate.

In addition to fundamental causes, the other major group of theories explaining contagion is based on investors’ behavior. There is some overlap, however, between theories classified as fundamental causes and investors’ behavior. More specifically, if actions of investors are ex-ante individually rational as well as collectively rational, this is often classified as a fundamental cause of contagion (such as through financial linkages). To simplify discussion, however, we group the various theories of contagion based on investor behavior below (even though some could also be classified as fundamental causes). These theories based on investor behavior can be grouped into five broad categories: liquidity problems, incentive problems, informational asymmetries, market coordination problems, and investor reassessment. One theme underlying most of these theories is that although investor behavior is often ex-ante, individually rational, it can still lead to excessive comovements in market prices, in the sense that market prices are not explained by real fundamentals.

The first group of theories explaining contagion based on investors’ behavior focuses on the role of liquidity problems (Valdés, 1997; Kaminsky et al, 2001; Kose et al, 2007). Losses in one country may induce investors to sell securities in other markets in order to raise cash in anticipation of greater redemptions. Also, if banks experience a marked deterioration in the quality of their loans to one country, these banks may attempt to reduce the overall risk of their loan portfolios by reducing their exposure in other high-risk investments, which could include other emerging markets. These liquidity-driven types of
behavior are more likely to occur among certain types of investors, including more leveraged investors (such as hedge funds), banks facing margin calls, and open-ended fund managers (who are more likely to need to raise liquidity in anticipation of future redemptions). Faced with liquidity problems, any of these investors are more likely to keep those assets whose prices have already collapsed and where secondary markets have become less liquid, causing them to sell other assets in their portfolios. This behavior can cause asset prices outside of the crisis region to fall, and the original disturbance can spread across different financial instruments, affecting a broad spectrum of markets and borrowers.

A second, and closely related, group of theories explaining how investors’ behavior can cause contagion is based on *incentive structures and changes in risk aversion* (Schinasi & Smith, 2001; Broner et al., 2004; Marsili & Raffaelli, 2006). A crisis in one emerging market may induce investors to sell their holdings in other emerging markets in order to maintain certain proportions of a country’s or region’s stock in their portfolios. Similarly, an increase in risk aversion (which could be caused by a crisis in one country or below-average returns) can cause investors to sell assets in which they are overweight in order to more closely track their benchmarks. If a large number of investors are evaluated based on similar benchmarks or have fixed country portfolio weights, this could lead to large price declines and currency depreciations. Value-at-Risk models, which have recently become more popular and are used by many commercial banks, can cause similar incentives and behavior patterns. These models can explain why banks and other investors may find it optimal to sell many higher-risk assets after a shock to one asset. While individually rational, this type of behavior can lead to adverse aggregate outcomes.

A third set of theories explaining how investors’ behavior can cause contagion focuses on *informational asymmetries and imperfect information* (Pasquariello 2006; Scardovo et al., 2010). Investors often do not have a complete picture of the conditions in every country that can affect their portfolios’ returns, partly due to the cost of gathering and processing information. In the absence of better information, a financial crisis in one country may lead investors to believe that other countries could face similar problems. As a result, investors could sell assets in other countries, especially those with similar conditions to those in the country where the crisis originated. This type of behavior can reflect rational as well as irrational behavior. If a crisis reveals weak fundamentals, investors may rationally conclude that similar countries could also face comparable problems, thereby causing contagion.

Further complicating this scenario, investors’ behavior may be determined not only by their information (or lack thereof) on countries in their portfolio, but also by *information on the actions of other investors* (Calvo & Mendoza, 1998; Agéor & Aizenman, 1998; Summers, 2000; Crotty, 2009). Uninformed investors may find it less costly, and therefore more advantageous, to follow the investment patterns of other, informed investors, thereby generating additional effects from informational asymmetries on investor behavior. This type of herd behavior may not only be an outcome of optimal portfolio diversification, but may also become more common as: the fixed cost of gathering and processing country-specific information increases, the number of countries with investment opportunities grows, and the range of investors widens. Also, with more diverse investors, establishing individual reputations becomes more costly, making it more likely that investors will follow the herd. Herd behavior is likely to be more prevalent when investors, such as fund managers, are evaluated based on the performance of their portfolios relative to that of a specific index rather than absolute performance.

A fourth group of theories explaining contagion based on investors’ behavior focuses on *market coordination problems* (Kindleberger, 1978; Jeanne, 1997; Masson, 1998; Kaminsky & Reinhart, 2000; Chang & Majnoni, 2001; Chan-Lau et al., 2004; Marsili & Raffaelli, 2006). Investors’ can modify their behavior based on self-fulfilling expectations that can generate multiple equilibrium. More specifically, investors could suddenly withdraw from a country if they fear that they will otherwise be left with no claim on a limited pool of foreign exchange reserves, similar to what can occur during a bank run. Some analysts believe that these types of sudden shifts in market confidence and expectations are one of the most important factors causing contagion. In some cases, however, it is difficult to differentiate this cause of contagion from a fundamental cause of contagion, because a jump in investor expectations causing a shift between equilibrium could be triggered by many factors, including fundamentals. It is worth noting that these changes in investor behavior based on market coordination problems involve behavior that is individually rational, but nevertheless increases financial volatility and can yield suboptimal outcomes.

A final group of theories explaining how investors’ behavior can cause contagion is based on *investors’ reassessment of the rules under which international financing takes place*. This could reflect increased concern that countries might follow unilateral, confrontational policies regarding foreign private
creditors. This could also reflect increased concern that international financial institutions are less likely to assist countries with financial difficulties, either due to a change in policy or a limited supply of funds. For example, if the international financial institutions lent to one country during a crisis, this could trigger a run on other countries based on the fear that there will be insufficient funds available to support these other countries during a crisis. A reassessment based on any of these factors could cause investors to sell a range of assets outside of the original crisis country, thereby causing contagion.

The channels of financial risk contagion

In order to examine the process of financial risk contagion it is important to determine the individual channels through which contagion might occur, rather than focusing on changes in aggregate volatility or correlations. The knowledge of financial contagion mechanism provides more insight on exactly why a crisis in one country affects other countries, and has recently been the most popular approach used in academic studies. Some of the most recent work in this area has also used firm-level data to examine the exact channels through which crises spread. Since many cross-country linkages through trade and financial channels are highly correlated, focusing on microeconomic data permits a more concise identification of the various channels through which contagion can occur.

The real sectors, the financial markets, the banks, and the non-bank financial market participants are the main economic units in the financial risk contagion mechanism. The linkages among the economic units are used in order to derive the contagion channels.

1. **The Real Sector.** Ideally, the real sector linkages should be derived from an open economy model of the world macroeconomy. All potential financial market participants can trade in all markets. Therefore the attributes of the financial markets such as the actual prices of the assets in one market, the liquidity of the market, and the extent to which the prices reflect the true values of the assets are very related. Conditions in financial markets affect real sector GDP for three potential reasons. First, the price of assets affects national wealth, and hence aggregate demand. Second, the liquidity of financial markets and the price of the assets affect businesses desire and ability to raise money for investment. This has implications for aggregate demand today and for aggregate supply in the future. Banks are very important economic units for their ability and willingness to finance investments in the economy whereas the GDP of the real sectors of the other countries stays significant because of the effect that other countries GDP has on net exports for primary country. Finally, the monetary, fiscal, and exchange rate policies of a country also influence GDP through their effect on aggregate demand in that country.

2. **The Financial Markets.** The assets that trade on the market of a country are claims on the cash flows of the real sector. In a world with complete and perfect markets, the price of the assets should depend only on how the cash flows covary with consumption, and there should be no need for financial intermediaries. However, because there are market imperfections, intermediaries play an important role in lending funds (banks), underwriting security issues (investment banks), providing liquidity in markets (securities broker/dealers and market markets), and in spreading risks towards those investors most willing to bear them (hedge funds and mutual funds). Therefore, the prices and liquidity of financial markets are potentially affected by the capital position of these intermediaries relative to their risks. For example, banks with low capital relative to risk may be less willing to purchase risky securities or extend credit to others for doing so, potentially impairing market liquidity. The financial position of non-bank financial market participants (NBFMP) relative to their risks may also affect securities prices. Specifically, if NBFMP are unable to assume risks that securities broker/dealers can only hold temporarily, then broker/dealers may be less willing to take on risk, reducing liquidity. NBFMPs may affect markets for a different reason: If they hit hard constraints on borrowing, they may be unable to provide further liquidity, and may become liquidity demanders if they are forced to sell a large amount of securities over a short amount of time.

3. **The Banks.** Banks take deposits and extend loans to financial and non-financial firms. The value of the bank’s assets potentially depends directly on the real sector of each country because whether the country is in recession or not affects the likelihood of defaults by its debtors. The bank’s liability base depends on the financial health of other banks that have deposits with it because these deposits might be withdrawn when those banks face financial distress. The value of the bank’s assets and liabilities also depend on the prices and liquidity in financial markets because the value of banks’ assets and liabilities fluctuate with market prices, and because banks are brokers and dealers in many markets. To
the extent that banks also make deals with NBFMPs, the value of the bank’s financial position and its risk is also tied to the financial performance of NBFMPs.

4. **Non-Bank Financial Market Participants.** Non-bank financial market participants (NBFMP) take funds from the general public, and borrow from banks, in order to invest in financial markets. Their ability to attract funds for investment depends on their own financial position as determined by the assets they hold, and financial market prices. Besides, their ability to borrow also depends on the willingness of banks and the general public to extend credit, or to place funds under management with an NBFMP. Finally, the NBFMPs financial position also depends on NBFMP-specific influences such as the skill of the management team, and the NBFMP’s reputation and track record.

The framework of potential interlinkages provide for a large number of channels through which a shock in one place, or to one type of economic unit can be transmitted to others. The model of shocks transmission can be applied as proceeding along chains, i.e. the shock begins with one economic unit. It then spreads to a first set of economic units that are linked with it, and then to a second set of economic units that are linked to the first set, and so on. In scientific literature all of the analysis attention is restricted to transmission chains that involve only a small number of links. This is with little loss of generality because longer chains will mostly contain repetition of the connections that can be explored in the shorter chains.

There are two different types of shocks that can be transmitted among economic units. The first type is *intermediary-specific shocks*. It means a shock that hits a bank or a non-bank financial market participant, but which is specific in its origin to that bank or financial market participant. Intermediary-specific shocks should be viewed as idiosyncratic to that intermediary. The second type of shocks is *real shocks*. A real shock is a shock to the real sector of the economy. Real shocks include but are not limited to “innovations” in technology, or a flow of information on the performance of real or financial assets. There can also be shocks that originate in the financial sector, but are not intermediary-specific as real shocks to the financial sector.

**Real shocks.** There are three possibilities of how a shock can appear to spread between countries. The first is coincidence two different countries both get hit with independent shocks at the same time. The second is a common global shock - both countries were exposed to the same global shock such as a change in the price of oil, and the third is through contagion between these two countries.

A list of some of the channels through which a real shock from one country (a) can be transmitted to another country (b) is shown in Figure 1. An arrow from one economic unit to another denotes that along that pathway a shock transmits from the economic unit at one end of the arrow towards the economic unit where the arrow is pointing.

The simplest way in which a shock to one country is transmitted to others is through direct real linkages such as through trade in goods and services (*Channel 1*). One example of how real shocks can spread through trade linkages is through a chain of speculative attacks on exchange rate pegs. For example, if countries a and b peg their currencies, and country a experiences a real shock that makes its current exchange rate peg less desirable, then it may choose to devalue, or it may be forced to devalue due to a speculative attack. Because country a’s devaluation affects the competitiveness of country b, it may be more desirable for it to devalue, or it may become more vulnerable to speculative attack. Although direct real trade linkages may explain the contagion between economies that are closely integrated, it does not explain the contagion between countries such as Brazil and Russia, or between Brazil and the economies of South East Asia that emerged after the Asian crisis.

An alternative channel for contagion is that a real shock in country a negatively affected the capital position of one of the international banks (say Bank), that lends to the companies in country b. If Bank also has positions in country b, then it may be optimal for Bank to alter the amount of lending in country b, and/or alter the composition of its loans in country b. This alteration of the Bank’s loan portfolio effectively transmits the real shock from country a to country b. I refer to this channel for contagion as the common financial institution channel, or common FI (*Channel 2*). The common FI channel is explored in Kaminsky & Rheinhart (1999), Van Rijckeghem & Weder (1999), Pritsker (2000) Kali & Reyes (2009) and Cheung et al (2010).

A third possible channel for contagion (*Channel 3*) is that a real shock in country a causes Bank1 to lose money on its loans in country b. If Bank1 has deposits with some other Bank2 that has loans in country b, then the problems with Bank1 can cause it to withdraw its deposits from Bank2, which then causes problems at Bank2. As a result Bank2 alters its loan portfolio in country b. This results in the real shock being transmitted from country a to country b through a chain of interconnected lenders. I refer to contagion via interconnected lenders as financial institutions contagion.
The fourth and fifth channels through which a real shock in country $a$ can be transmitted to country $b$ is through the interaction of financial institutions with financial markets. In Figure 1, I have labeled these channels as FI & FM interaction (Channel 4) and as FM & FI interaction (Channel 5). The different ordering denotes the direction in which the shocks get transmitted. For example, a real shock in country $a$ can affect Bank because it has investments there. If Bank is an important participant in the financial market of country $b$, then the shock to Bank can cause it to reduce credit provision or liquidity in financial market $b$, which can affect the real sector in country $b$. Because the shock goes from bank to financial market, this is labeled as the FI & FM channel. Alternatively, the shock could have gone from the real sector of country $a$ to the financial market of country $a$. Then, if Bank lost money in country $a$’s financial market, then it might alter its loan portfolio in country $b$ as a result. Thus, the contagion is transmitted between countries via the FM & FI channel.

So far, to show, how non-bank financial market participants and their actions may transmit contagion, consider a shock to the real sector of country $a$ which affects the financial market of country $a$. If a non-bank financial market participant has a position in country $a$, then he may optimally alter his position in country $a$ in response to the shock. It may also be optimal to alter his position in other countries financial markets following the shock, including the market of country $b$. Thus the real shock in country $a$ gets transmitted to country $b$ by non-bank financial market participants through the financial markets of countries $a$ and $b$. This channel of shock transmission is labelled as Financial Market (FM) Contagion via a non-bank financial market participant (NBFMP) (Channel 6). If instead contagion was transmitted from financial market $a$ to $b$ through the actions of a Bank which has positions in both markets, then, in Figure 1 the pattern of contagion is labeled as Financial Market Contagion via a Bank (Channel 7).

**Intermediary-specific shocks.** All of the contagion channels that were presented so far involve the transmission of a shock to the real sector of a country. Of course, there is no reason that a shock needs to begin in the real sector of a country to propagate to other countries. Instead it could begin with a shock to a bank or non-bank financial market participant, and then spread. One possible path is that a shock begins with an international bank or perhaps with the banking sector of a large country (say Japan) and then spills over to the real sectors of other countries through decreased lending by the bank as in Figure 1. A different scenario is that a shock could begin with a large non-bank financial market participant. If this large participant is in turn linked to a number of banks and investment banks that are important for providing liquidity provision in markets, then the shock to the non-bank participant can potentially percolate through the financial sector from banks, to markets, and then to the real sectors of economies that depend on those markets, as in the pyramidal diagram provided in Figure 2. Whether the pathways that shocks follow in Figure 1 and Figure 2 are plausible depends on the financial and economic structure of the economies in each country, and on the fragility of the real economy and of the financial system.
Figure 2 illustrates how a shock originating with a non-bank market participant (NBFMP) can spread to the banks that lend to NBFMP, and then to the financial markets (FM) in which the banks provide liquidity, and then eventually to the real sectors (RS) that are tied to the financial markets.

The financial risk contagion is still a very significant issue in financial literature. It has obviously asserted in the term of recent financial crisis that took place in 2007-2009. Risks from contagion in international financial markets still remain, especially for developing countries. If a large country experiences a crisis, it will inevitably spill over to other countries through trade, financial markets, and the other cross-country linkages discussed above. As financial integration continues to increase around the world, this will tend to link countries closer together through periods of strength as well as weakness. Furthermore, even without crises, international financial markets will remain volatile. Therefore, government officials, investors, and policymakers should continue to take steps to strengthen individual economies and the international financial system in order to reduce the risks from contagion in the future.

Conclusions

1. The fundamental changes in the financial sector due to phenomenon of globalization have been identified as liberalization in global trade of financial services; consolidation and conglomerations; evolution of financial systems; concentration of financial institutions; development of new technologies; universality of banking.

2. Over the past two decades, financial market crises with similar features have occurred in different regions of the world. The idea that since countries are interconnected through trade linkages, a shock originating in one country can be transmitted and amplified because of the pattern of interconnections in the network has been provided in the scientific financial literature. Unstable cross-market linkages during a crisis are referred to as financial contagion.

3. There are a number of different theories why financial contagion can occur. Fundamental causes (including common shocks, trade linkages and certain financial linkages) and investors’ behavior (including liquidity problems, incentive problems, informational asymmetries, market coordination problems, and investor reassessment) are the main reasons why the financial risk contagion appears.

4. There are many possible channels by which a crisis in one country or region may spread to other countries or regions. The severity and scope of the contagion depend on the particular type of contagion involved. In this paper different channels through which real shocks are transmitted from one country to another are discussed. They involve contagion via real linkages, contagion via a common lender, contagion via financial markets, contagion via financial institutions, and contagion via the interaction of financial institutions and markets.

5. Although the phenomenon of financial risk contagion has been extensively investigated in the financial literature, it has not been studied through computational intelligence techniques that could help to detect contagion at an earlier stage, hence recognizing financial crises with the potential to destabilize cross-market linkages. In the real world, such information would be extremely valuable in developing appropriate risk management strategies.

6. None of these contagion channels require irrationality for shocks to be transmitted. Nevertheless, due to market imperfections involving information asymmetries, the price movements that occur in one market or country as a result of contagion from elsewhere can sometimes be excessive relative to full-information fundamentals. This suggests that more public information production and insider trading laws may improve market function and reduce unnecessary contagion.

7. Policy makers also need to understand the spillover effect when coordinating their efforts to alleviate the current crisis. For future research, it is important to better understand factors that may affect the
dynamics of global interdependence, such as market imperfection, investors’ sentiment, and information efficiency. The steps that could help to strengthen individual economies and the global financial system can be classified into three broad categories: better country policies, improved investor strategies, and stronger global frameworks.

References