

AN INQUIRY INTO CONTAGION TRANSMISSION AND SPILLOVER EFFECTS IN STOCK MARKETS

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Abstract: *This paper represents a theoretical enquiry in contagion and its transmission mechanism. Our main purpose is to present the different views regarding contagion as a mechanism, correlated with interdependence, a state of markets. We present numerous theories about the definition and the transmission of shocks. But As Rigobon (2002) states, the main problem of the theoretical literature of contagion is that the measurable events are more rare than the number of possible hypothesis. So the only aspect on which everybody agrees is that there is no unanimously accepted interpretation of contagion. The channels of contagion, according to our reasoning and based on the directions pointed out by theoretical literature, can be divided into channels which act in interdependent markets, and channels which can be attributed to investors behavior. In this case the cause of propagating the shock becomes the criterion upon which the transmissions of channels are classified. In this paper we present these channels together with their characteristics.*

Keywords: Contagion, Spillover Effects, Interdependence, Transmission mechanism, Stock markets.

JEL classification: G01; G15.

1. Introduction

In this paper we are interested of the conceptual overview of financial contagion alongside with interdependence, and the channels according to which financial distress is spread from one market to another.

Two main views are emerging in the theoretical literature. This first one is related to the rising level of interdependence between markets, toward integration, which can be viewed an extreme state of interdependence. In this case, more frequent and indefatigable shock transmissions make part of the actual equilibrium of markets. The second direction considers contagion outside of the actual general system. Contagion becomes the disease of it, in other words an epidemic of the markets. Thus the channels of transmissions become of crucial importance in studying the linkages between stock markets.

2. Contagion and Spillover effects

What is the difference between the two concepts? Forbes and Rigobon (2002) consider that contagion is only true contagion if there is no dependence between the markets prior to the shock. In this case contagion is a pronounced increase in the dependence of the markets. If two markets share a high degree of correlation during periods of stability, and after the shock the co-movement between them shows no significant increases, even if they are highly linked one to another, this phenomenon can't be regarded as contagion, rather than integration.

Bekaert, Harvey and Ng (2005) consider that contagion can be described as an excess of correlation between markets, more than it can be explained by economic fundamentals. The basic problem here is identifying the normal degree of dependence, together with the fundamentals.

Corsetti, Pericoli and Sbracia (2001) regard contagion as a break in the parameters governing the correlation system. According to them, if a shock occurs, which is caused by global or regional factors, some comovement across markets is normal, and can be regarded as a consequence of interdependence. The rise of volatility of asset prices in one market can be expected to be correlated with the rise of volatility in other markets, due to the international transmission mechanism. But if contagion occurs, the degree of transmission is very high, above what can be predicted with a constant transmission mechanism, and is it propagated by irrational investor behaviour and panic.

Kaminsky, Reinhart and Vegh (2003) define contagion as the instant effect following a shock, that progresses rapidly between the markets. According to this approach, the speed of diffusion of financial distress is crucial. If the propagation is gradual to the other markets, then the episodes can't be regarded as contagion, rather than a spillover episode. In the category of spillovers, the effects of common shocks in all the markets are included, such as changes in oil prices or international interest rate changes. Thus spillover effects are transmissions of financial distress due to interdependence among markets. Opposed to the previous view, Masson (1998), considers pure contagion to be associated with changes in investors' expectations, that are not related to a country's macroeconomic fundamentals, identified as monsoonal effects.

Karolyi and Stulz (1996) don't agree with this view, according to them contagion is only related to investors behaviour, when a shock as a panic is propagated from one market to another. They consider that market contagion can be defined indifferent if it is transmitted through macroeconomic fundamentals or not.

As we can observe there are different viewpoints regarding contagion. These distinctions are made about the prior linkages between stock markets, thus when a shock is propagated through macroeconomic fundamentals, it can be viewed as the result of an optimal response to an external shock. In anticipating the changes in the fundamentals, financial markets respond and adjust to a new equilibrium, but as Moser (2003) points out, they do not cause the change in equilibrium. So when one country is hit by a shock, the other markets will adjust the real and financial variables to the new equilibrium. These shocks are resulting from a normal interdependence between markets, they are not causing the shock, but they are propagating it and speeding up its transmission, so to say stock markets are catalyst towards a new equilibrium.

Another category of studies considers that the transmission of shocks is not related to any linkages between markets, but is solely the result of investors behaviour. As Engle (2009) indicates, the channels of contagion, next to the fundamentals, are found within the behaviour of investors, and can be traced to the portfolios that they trade within multiple markets. We know that assets are held by investors in anticipation of the payment that are to be made in the future, so a value of an asset is fundamentally linked to the forecast of his future price evolution. We also know that the news that are arriving on the market are what make investors change their forecast about the future, as formulated in the model of changing asset prices by Samuelson (1965). According to this rationalization, volatilities and the correlations between asset returns and stock markets depend on the information that is used to update these predictions. So countries with similar economies are correlated because they have the property to be influenced by the same events, the same news processes will force investors to reanalyze their beliefs. According to this approach, contagion can be defined as a sudden shift in investor's market expectations or confidence. But in the way in which information is used, we can distinguish between two types of contagion, a rational approach - forced contagion and irrational contagion.

As we can conclude, in the literature there is a little convergence about the definition of contagion and what its coverage area is. In the next section we are going to assess the different views regarding the transmission of distress between markets.

3. Transmission mechanism

Calvo and Reinhart (1996) recognize among the channels of contagion trade linkages, illiquidity of the stock markets, technological factors and information cost connectedness. Masson (1998,1999) considers as possible determinants of crises a common cause to all markets together with macroeconomic fundamentals and unexpected shifts in investors' expectation, which may trigger a shock without any change of the transmission mechanism. Moser (2003) believes that simultaneous crises are not a sufficient condition for contagion, in his view causal connections are required for this. So if a common shock arises simultaneously in Masson (1998, 1999), as in Summers (2000), Dornbush, Park and Claessens (2000) is regarded as contagion. In the same time Moser (2003) thinks that independent shocks can hit all the countries in the same time, all by coincidence, and this doesn't mean that there are any connections between the markets. Moser (2003) includes in the category of common shocks balance-of-payment difficulties of individual countries, changes in global or US interest rates, commodity prices or recessions in the major industrial countries as exchange rates between major currencies.

Summers (2000) includes among the causes of propagation common shocks like commodity price shocks; trade linkages which may transfer price and demand shocks from one country to another, competitive devaluations, financial linkages, market illiquidity, investors' irrationality like panic, herding and positive feedback trading together with reputation externalities.

Kaminsky and Reinhart (2000) identify a bank lending channel, a liquidity channel and a trade channel in the transmission of contagion. King and Wadhvani (1990) observe that an idiosyncratic shock, which is assumed to be uncorrelated across assets and uncorrelated with the factors, can represent a trigger for contagion. This is because investors will be inclined to adjust their portfolios in the other markets, if

they are uncertain about whether the shock is in fact idiosyncratic or not. In their view investors deduce their information from the price changes on the stock markets, and so 'a mistake' in one market can also be transmitted to other markets.

Claessens and Forbes (2004) consider that contagion can occur due to fundamental causes, such as common shocks, trade and financial linkages; or investors' behavior, which includes liquidity problems, incentive problems, informational asymmetries, market coordination problems and investors reassessment.

We started to classify the different transmission mechanism, based on the main directions point out by theoretical literature, a compendium can be found in Figure 1. The principal criterion of classification is the cause propagating the shock. Thus transmission mechanism between markets can be divided into channels which act in interdependent markets with spillover effects, are channels where the market are independent, so the linkages are attributed to investors behaviour. In this case, contagion flows through investors and the portfolios they hold. In interdependent markets we can have three possible channels, namely common shocks, trade linkages together with competitive devaluations, and finally financial linkages. These channels are the effect of different connections between markets. In the channel of common shocks Calvo and Reinhart (1996) include major increases in the global or US interest rates, Moser (2003) points out changes in commodity prices, recessions in major industrial countries and exchange rate changes between major currencies, while Chunan, Claessen and Mamingi (1998) consider that slowdowns in the US or global industrial production constitute a global factor also.

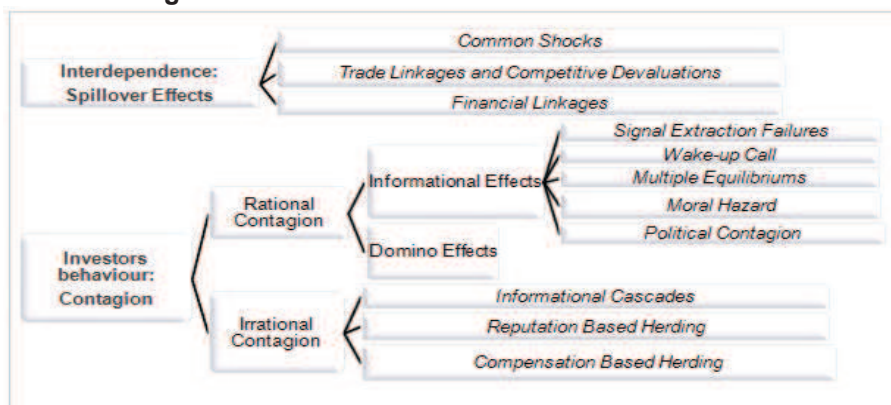
Through trade linkages, such as bilateral change between two countries, a crisis can also be exported into other markets. In this case, if the income of a country decreases, it leads to a reduction in demand for imports, and this is equivalent with the reduction of exports of other countries. In a scenario like this, the balance of payments and other fundamental variables are affected. Competitive devaluations, as shown by Corsetti, Pesenti, Roubini and Tille (1999) describe a situation where a crisis has the effect of currency depreciation in one country. So the exports of other countries are altered, by making the exports of the depreciated currency country more attractive. In this case the other countries will be inclined to depreciate their own currency also, for competitive reasons, and so a wave of depreciations is perceptible on the markets. Usually the final amount of total depreciations exceeds the necessary depreciations allowed by the equilibrium, and this constitutes contagion. These linkages are found significant by Eichengreen and Rose (1998a, 1998b); Glick and Rose (1998) together Forbes (2000, 2001); while Masson (1998) together with Baig and Gooldfajn (1999) believe that these are not central in shock transmission. Kaminsky and Reinhart (2000) together with Van Rijckeghem and Weder (1999a, 1999b) consider that trade linkages are subordinated to other factors in the transmission of crises. The last linkage in dependent markets is the financial one, where Claessens and Forbes (2004) suggest that these may be constructed from foreign direct investment, reduction in trade credit, or changes in other capital flows between countries.

Rigobon (2002) considers that financial linkages can be associated with all the institutions which are necessary for the functioning of financial markets. Van Rijckeghem and Weder (1999a, 1999b) consider the common bank lender effect, where one country is hit by a shock, and if a bank has high exposure on the affected market, probably it will suffer major losses. This has the direct consequence that it

will meet margin calls, or will readjust its risk exposures, reduce lending on other markets for the purpose of restoring the capital asset rations, and so the crisis is transported in the other markets also. Kaminsky and Reinhart (2000) suggests that banking institutions play an extensive role in the transmissions of shocks, while Kaminsky, Lyons and Schmukler (2001) together with Broner, Gelos and Reinhart (2004) emphasize the importance of mutual fund in crisis propagation. Claessens and Forbes (2004) consider that similar employed VAR (Value-at-Risk) model can produce similar behavioural patterns and decision.

In the second case of transmission mechanism, there are no dependences between the countries, the catalyst of common collapse is represented by investor's behaviour. As it was pointed out by Devenow and Welch (1996), this can be classified as a rational or irrational reaction to an external event.

Figure 1: Transmission mechanism between stock markets



Source: Own processing

A rational reaction to an event can be also called forced contagion, which, in Moser's (2003) vision can be divided into informational effects and domino effects. Moser (2003) believes that we can speak about informational effects in transmitting a contagion, when a shock in a single market forces investors to update and change their expectations regarding the other markets. On the other hand domino effects are propagated through indirect financial linkages. Bikhchandani and Sharma (2000) see forced contagion as a false herding behaviour, as opposed to pure herding investors take decisions based solely on their own private information.

Informational effects can be divided in (i) *Signal Extraction Failures*, as discussed by King and Wadhvani (1990), where the transmission of crisis is attributed to the misinterpretation of the behaviour of other investors from the market. Moser (2003) considers that these effects can appear from the mistaken view of investors about fictional interdependence between markets, or the hypothesis that similar markets will tend to behave similar, in other words the lump together hypothesis. Another informational effects is the so called (ii) *Wake-up call* which is introduced by Goldstein (1998), and refers to the case when a shock in a market forces investors to update correctly their initial mistaken beliefs. The third element in informational effects is represented by the (iii) *Multiple Equilibriums*, which is referred to as expectations interaction by Moser (2003), multiple equilibrium by Dornbush, Park

and Claessens (2000), market coordination problem by Claessens and Forbes (2004) together with Marshall (1998); and political contagion by Drazen (2000). This contagion is similar to a mental contagion, where each investor would choose the best option, only if the others would proceed similar. The best decision would be not to sell, and so asset prices would remain stable. The worst decision, which is pareto optimal, refers to the belief that everybody will sell, and so they all start selling, which causes assets prices to decline. Since we discuss a sequential process, the trigger variable becomes of primordial importance, which determines investors to change their expectations about the likelihood of a crisis. Diamond and Dybvig (1983) propose the model of bank runs, while Obstfeld (1986) discusses self-fulfilling speculative attacks. Marshall (1998) together with Chang and Velasco (2001) apply these models in international context, where liquidity needs are a sufficient condition for crises to be triggered. (iv) *Moral Hazard*, which is addressed by Dooley's (1997) model, discusses the possibility when international investors are convinced that in times of major turbulences central banks will intervene and calm the spirits. (v) *Political Contagion* is another form of informational effect in transmitting contagion, which is discussed by Drazen (2000), or by Moser (2003) with the term membership contagion, by Dornbush, Park and Claessens (2000) as contagion deriving from the changes in the rules of the game.

In the second category of rational contagion we find the so called domino effects, related to which Valdés (1997) discusses a contagion model related to wealth effects. These contain liquidity shocks, but which are pure shocks, so they do not start from stock markets. The effect of a liquidity shock is the reduction of wealth, which in turn forces market participants to reduce their exposure on stock markets. A similar approach is incorporated by Calvo (1999), together with Kyle and Xiong (2001).

The second category of contagion transmission, as an irrational reaction to an event, is also discussed by Keynes (1936), with the well known term '*following the herd*'. Bikhchandani and Sharma (2000) suggest that the main reason for herd behaviour is the presence of imperfect information on markets, together with concern for reputation and unfair market compensation structures. Hirshleifer and Teoh (2003) suggest that payoffs or network externalities, sanctions upon deviants, preferential interactions, direct communication and observational influences are the possible sources of herding. There are different viewpoints, but a classification of herding could be perceived as (i) *informational cascades* as considered by Bikhchandani, Hirshleifer and Welch (1992,1998) together with Bannerjee (1992). These occur when an investor, noticing the actions of other investors, chooses to make the same decision, regardless of his private information and personal opinion. (ii) *Reputation Based Herding* models are discussed by Scharfetein and Stein (1990), Trueman (1994), Prendergast and Stole (1996), Devenow and Welch (1996), Graham (1999), Welch (2000), where portfolio managers choose herding, because they believe that in this case it is less likely to obtain sub optimal results compared to the other participants. (iii) *Compensation Based Herding* is discussed in the models of Dow and Gordon (1995), Maug and Naik (1995) together with Admati and Pfleiderer (1997), where investors are rewarded externally according to the achieved performances. So investors will be stimulated to copy the herd behaviour, because they want to reach at least the average level of performance. So, instead of encouraging investors to achieve superior performances, outside incentives will only

bring investors more closer to herding, because they choose to copy the movements of others, and obtain medium benefits instead of the risk of obtain nothing.

4. Discussion

With these we have exhausted the possible causes for transmission channels between markets, and the difference between contagion and spillover effects. As we have seen, there are different viewpoints regarding contagion. These distinction are made about the prior linkages between stock markets, thus when a shock is propagated through macroeconomic fundamentals, it can be viewed as the result of an optimal response to an external shock. In anticipating the changes in the fundamentals, financial markets respond and adjust to a new equilibrium, but as Moser (2003) points out, they do not cause the change in equilibrium. These shocks are resulting from a normal interdependence between markets, they are not causing the shock, but they speeding up its transmission. So, if markets are interdependent, we speak about spillover effects which run through real and financial linkages. On the other hand, if no connections can be identified between the markets, than the transmission of contagion is solely the result of investor's behaviour. This is true contagion, which is transmitted thought investors and the portfolios they hold on multiple international markets.

Based on the dependence between markets, we classified the different transmission mechanism. In interdependent markets we can have three possible channels, namely common shocks, trade linkages together with competitive devaluations, and finally financial linkages. In markets with no dependence two distinctive contagion types are identified. As pointed out Devenow and Welch (1996), this be classified as investor's rational or irrational reaction to a shock. A rational reaction to an event can be also called forced contagion, which, in Moser's (2003) vision can be divided into informational effects and domino effects. The second category of contagion transmission, as an irrational reaction to an event, is knows as '*following the herd*'. *In this category we included* informational cascades, reputation based herding and compensation based herding.

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