Detecting Shift Contagion in Currency and Bond Markets*

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It is well known that equity, currency, or banking crises generate substantial real costs for the country in which they occur. Authorities and financial market participants have often been concerned that these crises would spill over or spread, leading to financial system volatility or crises elsewhere in the world. The recent Mexican, Asian, and Russian crises are examples where shocks originating in one country are believed to have spread to other nations and to have resulted in significant costs to the international community.

The transmission of crises from one country to another (or from one market to another) is loosely referred to as contagion, but its definitions are many. One is that contagion occurs when the propagation of shocks is in excess of fundamentals, that is, when shocks have an impact beyond the amount channelled through the usual commercial, financial, and institutional ties between markets. Another, more narrow description is that contagion occurs when shocks spread through herding or irrational behaviour. In contrast, a third and much broader definition refers to contagion as the transmission of shocks through any channels that cause markets to co-vary. There is now a fourth and more precise definition, referred to as "shift contagion," which suggests that contagion occurs when the propagation of shocks during crisis periods increases systematically from that observed during normal times. Given this multiplicity of definitions, it is not surprising to find widely

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varying opinions as to which crisis events cause (or have caused) contagion. Even when using similar definitions of contagion, empirical studies sometimes conclude differently, especially depending on how they choose to quantify fundamentals.[1]

In this paper, we develop a methodology to statistically detect shift contagion. In particular, we examine whether existing linkages between assets of different countries remain stable during crises or whether they grow stronger. Our approach relies on testing for structural change in the correlation between assets of two markets.

Testing for a shift in how shocks are transmitted across countries has been attempted before, with preliminary results that suggested the existence of contagion. For example, King and Wadhwani (1990) found that the correlation between international equities increased significantly after the October 1987 crash. But Forbes and Rigobon (1999) and others have argued that these conclusions may be misleading, since the simultaneous nature of financial interactions and data heteroscedasticity were not properly accounted for. Taking one or more of these econometric concerns into account, these authors concluded that there is, in fact, little or no contagion. For example, Lomakin and Paiz (1999) found low probabilities of contagion between various country bond markets when they computed the likelihood that a crisis will occur in one country given that it has occurred in another. Forbes and Rigobon (1999) and Rigobon (2001) found little incidence of shift contagion during the Mexican, Asian, and Russian crises in various emerging-country equity and bond markets. Rigobon (1999) found evidence of shift contagion in 15 per cent of the cross-country equity markets he examined during these same crises. Finally, Rigobon (2000) concluded that no shift contagion occurred between 1994 and 1999 in the Brady bond markets of Argentina and Mexico.

These later studies account for certain econometric complications in the data. In particular, the methodology used in Rigobon (2000, 2001) is valid in the presence of both simultaneity bias and data heteroscedasticity. In fact, the method exploits the presence of heteroscedasticity in asset returns, which, it assumes, is due entirely to changes in the variance of the crisis-generating country shock. Under this assumption, if the propagation of shocks between countries is stable, the determinant of the difference between the variance-covariance matrix of returns during normal and crisis periods is zero. The methodology is shown to perform relatively well in

1. Refer to Forbes and Rigobon (2000) and Goldstein, Kaminsky, and Reinhart (2000) for additional details.

Monte Carlo experiments. Nevertheless, the author also points out some drawbacks to the technique.

One is that crisis periods are designated as such, ex post. That is, the beginning and ending dates of crises are determined exogenously. Yet, while there is relative agreement in the literature on the starting date of crises, there is far less of a consensus with respect to ending dates. The associated low-variance periods are generally also determined by rule of thumb. Since test conclusions depend crucially on the choice of the normal and crisis periods, such practices may lead to spurious results. A second drawback is the assumption that increases in the variance of returns during crises are caused entirely by increases in the idiosyncratic shock of one country—the country where the crisis originated. In addition to assuming that the identity of the country generating the crisis is known, according to this hypothesis, a rejection of the null implies either that the propagation mechanism was unstable (i.e., that shift contagion occurred), or that more than one country shock variance increased during the crisis period. Since it is likely that certain common factors will create higher structural uncertainty in a number of economies at the same time (such as unexpected commodity price shocks or policy changes in a large economy), the ambiguity of how to interpret a rejection of the null hypothesis is a serious concern. Furthermore, even if the heteroscedasticity in returns is due to variance changes in the idiosyncratic shock of a single country, there may be more than one candidate for the country of origin.

We propose a methodology for detecting shift contagion that is not subject to the above concerns. First, crisis and low-variance periods are entirely model-determined, instead of being exogenously assigned. Second, the country where the crisis originated needs neither to be known nor included in the system being analyzed. Third, a rejection of the null, in our case, provides unambiguous evidence for shift contagion within the markets examined. Finally, our identification strategy is valid in the presence of variable simultaneity and data heteroscedasticity.

We make use of a bivariate unobserved factor model for asset returns. The asset returns are assumed to be correlated, which is modelled by having correlated disturbance terms for the two processes. In turn, these disturbance terms are decomposed into common and idiosyncratic structural shocks. We allow for independent regime switching in the variance of the common and idiosyncratic shocks, which allows us to develop a test for shift contagion. This test assumes that in the absence of shift contagion (the null), common large shocks do not change the propagation mechanism of these shocks.

Our methodology is applied to bond markets of four emerging countries (Argentina, Mexico, Brazil, and Venezuela) and currency markets of seven developed countries (Canada, Australia, Japan, Germany, Sweden, Norway, and Switzerland). Contagion has traditionally been examined in emerging countries, since assets in these markets are particularly volatile and crises occur frequently. Our bond market data are therefore included for comparison with previous studies, such as Rigobon (2000, 2001).[2] We also examine currency markets of developed countries. Given the greater economic transparency, efficiency, and integration in these countries, assets are less volatile than in emerging markets. Therefore, less attention has been paid to structural change in the co-movement of assets in these markets. Indeed, a priori, it should be more difficult to detect shift contagion in these cases.

Interestingly, our results do reveal evidence of shift contagion in some of these currency markets. More specifically, in some of the developed currency markets, there is evidence to suggest that propagation of common shocks is stronger during turbulent periods. In particular, the results indicate that the null of no shift contagion is rejected at the 10 per cent level for the following country pairs: Sweden-Germany, Sweden-Japan, Sweden-Switzerland, Switzerland-Germany, Norway-Australia, and Norway-Japan. Our results also support Rigobon's (2000) findings, since we also find no evidence of shift contagion among the Latin American bond markets examined. That is, the empirical results suggest that shocks are transmitted via long-term linkages between these countries.

Our findings should be regarded as a first step in addressing the issue of how policy-makers should react when observing periods of heightened volatility and increased cross-market correlations. One objective of the contagion literature is to ascertain how countries can reduce their vulnerability to external shocks. In this vein, it is important to understand whether a shock is transmitted across markets via channels that appear only during turbulent periods (crisis-contingent channels), or whether these shocks are transmitted via channels or interlinkages that exist in all states of the world. The existence of shift contagion would suggest that shocks are propagated via crisis-contingent channels. The effectiveness of short-term or temporary policy measures aimed at reducing a market's vulnerability to contagion will depend on whether or not contagion occurred as a result of the transmission of shocks through pre-existing long-term linkages or through crisis-contingent channels.

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2. Strictly speaking, changes in the co-movement of assets are detected whether they occur as a result of a crisis, or because of some other high-variance news event.

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