The transmission of contagion in developed and developing international bond markets

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Abstract

The potential for contagion effects resulting from financial crises has become an important policy issue. The results presented in this paper quantify the impact of financial contagion in global bond markets from the Russian crisis and the LTCM near collapse during the latter part of 1998. Using a panel of bond spreads in 12 countries we find discernible contagion from these two crises to both developing and developed markets. The proportion of total volatility attributable to contagion varies widely across countries but it is not always the case that it is more substantial for developing countries. However, due to the absolutely higher level of volatility experienced in developing markets, the squared basis point contributions of contagion to volatility are relatively higher in those markets.

1. Introduction

The period 1994 to 2001 witnessed financial crises from diverse regions, including Mexico, East Asia, Russia, the near collapse of Long-Term Capital Management (LTCM) in the United States, Brazil, Turkey and Argentina. Although the origins of these crises can be geographically located, their effects were not necessarily isolated as shocks spilled over geographical boundaries causing financial turmoil in other, sometimes unrelated, financial markets. This was the case with the Russian crisis of August 1998, which precipitated sharp rises in bond spreads in a broad range of countries, which were followed in the next month by further movements in bond spreads arising from the near collapse of LTCM.

The Russian and LTCM crises are qualitatively different as the Russian crisis was a crisis of credit risk, whilst the LTCM crisis was a crisis of liquidity. The crises originated in very different markets as Russia is characterised as a developing market and the United States as developed, suggesting the impacts of the two crises on international bond markets should differ. CGFS (1999) claims that the Russian crisis affected only developing markets, while the LTCM crisis affected developed markets. A similar conclusion is put forward by Bae et al (2000), who find that for a range of international equity markets, developing markets are more susceptible to international financial crises than developed markets; see also Kaminsky and Reinhart (2002), who propose that developed markets act only as a conduit between regions of developing markets. However, these conclusions are not based on any formal study of the interactions of bond markets between countries. Part of the reason for the lack of emphasis on bond markets is the difficulty of constructing consistent data sets across both developed and developing bond markets. These data issues are addressed in this paper.

The aim of this paper is to investigate the transmission of the Russian and LTCM crises across the bond markets of nine developing and three developed countries. The countries are grouped into three regions: Argentina, Brazil and Mexico from Latin America; Indonesia, South Korea and Thailand from

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Asia; Bulgaria, Poland and Russia from eastern Europe; and the Netherlands, the United Kingdom and the United States as the representative developed markets. Daily yields on sovereign and corporate bond issues are used over the period February to December 1998.

The financial market shocks transmitted across geographical boundaries are specified to occur through either anticipated or unanticipated channels. The anticipated spillovers include linkages which capture changes in market fundamentals and economic relationships between countries. The unanticipated spillovers are the shocks of interest in the present study. These shocks represent the possibility of significant linkages between countries that are not transparent. Unanticipated spillovers are defined here as contagion; see Masson (1999a,b,c), Favero and Giazvazzi (2000) and Forbes and Rigobon (2000, 2002).

In modelling the international linkages between markets, anticipated spillovers are specified as latent factors to overcome the ad hoc identification of market fundamentals from proxy variables; see also Dungey et al (2000). As the latent factor model does not rely on observable data on market fundamentals, this structure has the additional advantage of allowing for high-frequency transmission processes, an advantage when shocks are relatively short-lived and occur in close succession as in the Russian and LTCM crises.

The rest of the paper proceeds as follows. Some background to the Russian and LTCM crises is presented in Section 2. A model of contagion is specified in Section 3. The empirical results are presented in Section 4 with concluding comments given in Section 5. The key result of the empirical analysis is that contagion from the Russian and LTCM crises is spread across both developing and developed bond markets. However, the impact of contagion from the Russian crisis on the bond markets of the three developed countries investigated, in terms of squared basis points, is relatively small. For the United States, the effect of contagion from the Russian crisis is less than 1 squared basis point, whereas the effect of contagion on the Russian bond market emanating from the LTCM crisis is over 6,000 squared basis points.

2. Background

On 17 August 1998, Russia announced sweeping changes to its financial system, including the intention to restructure all official domestic currency debt obligations falling due to the end of 1999, imposed a 90-day moratorium on the repayment of private external debt, and effectively devalued its currency by widening the trading band of the rouble (see Kharas et al (2001) for a discussion of the Russian crisis). These events in Russia led to increased volatility in global bond markets, as credit and sovereign risks were reassessed by the global financial community.

On 23 September 1998, just weeks after the instability caused by the events in Russia, financial markets were hit with another shock. The New York Federal Reserve was compelled to orchestrate a rescue package to prevent the US-based hedge fund LTCM from collapsing. The investment strategies of LTCM had priced risk using “normal” volatilities and spreads between closely related securities, some of which seemed to have changed in the aftermath of the Russian crisis.

The Russian crisis and the near collapse of LTCM led to large jumps in spreads and risk premia. The impacts of these crises on the global bond markets are highlighted in Figure 1, which gives the daily spread of long-term debt over the appropriate risk-free yield for a range of developing and developed countries over the period May to December 1998 (see Appendix A for source descriptions and definitions). In the discussion that follows, the spread is referred to as the “premium” while recognising that it may reflect a myriad of factors.

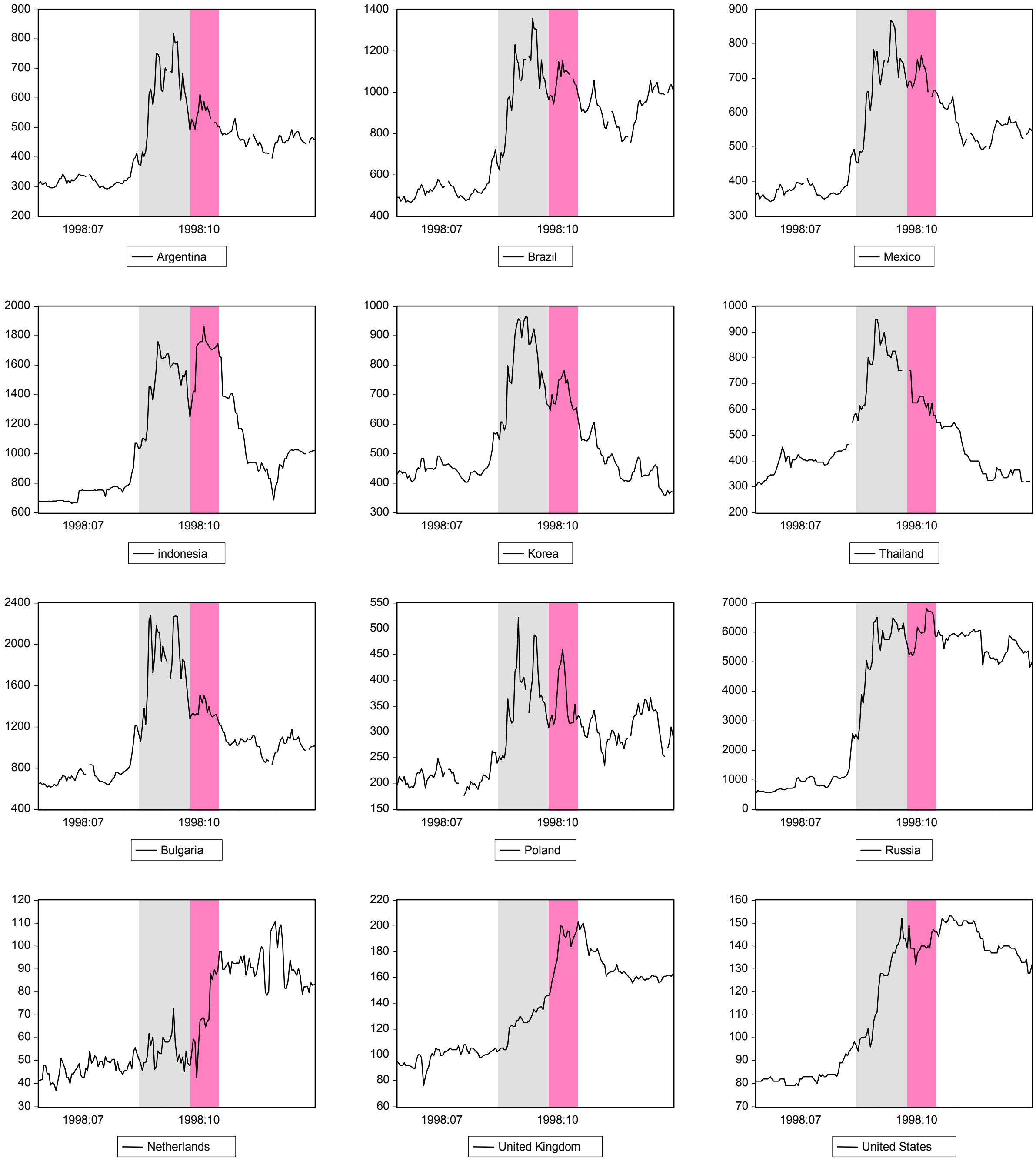
The extent and timing of the Russian and LTCM shocks on international bond markets are further highlighted in Figure 2, which gives daily changes in bond spreads in each country. One characteristic demonstrated in these figures is that both emerging and mature markets were affected by these unanticipated events.[2]

[2] The two crises had a much more dramatic impact on global bond spreads than other recent shocks, such as the Hong Kong speculative attack; see Dungey et al (2002).

Figure 1

Bond spreads, May-December 1998[1]

(basis points)



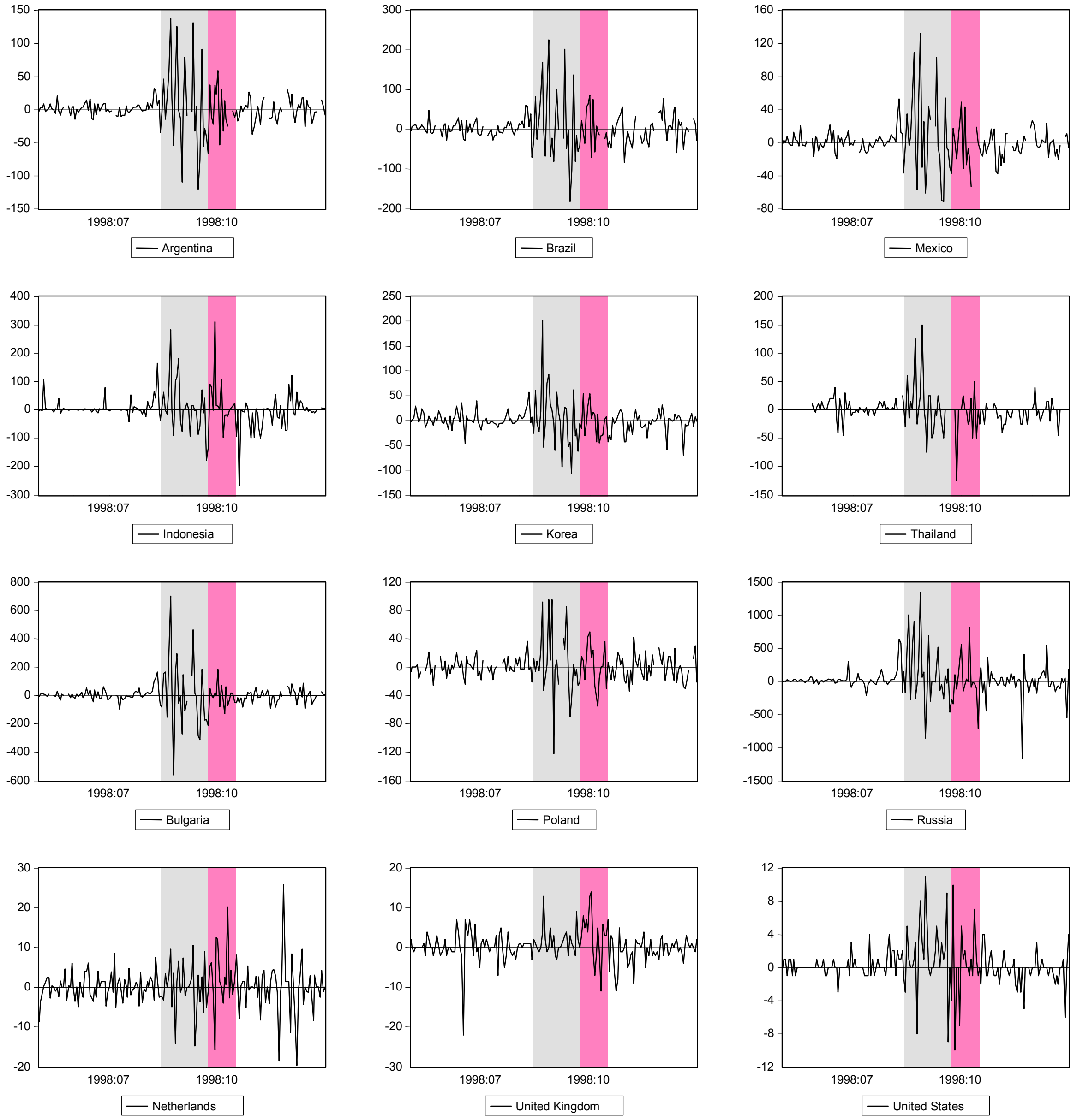
[1] The shaded areas refer to episodes of crisis in international bond markets during this period: the Russian bond default on 17 August 1998; the bailout of LTCM orchestrated by the New York Federal Reserve on 23 September 1998; and the inter-FOMC Fed interest rate cut on 15 October 1998 which signalled thebeginning of the “end” of the LTCM crisis.

Sources: US Federal Reserve; Bloomberg; Scotia Capital; Credit Suisse First Boston.

Figure 2

Bond spreads in first differences, May-December 1998[1]

(basis points)



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Sources: US Federal Reserve; Bloomberg; Scotia Capital; Credit Suisse First Boston.

Figures 1 and 2 suggest that the aggressive easing of monetary policy in the United States was helpful in ending the LTCM crisis.[3] The interest rate cuts were in part motivated by concerns that the US economy was on the verge of experiencing a liquidity crash as bond spreads in the United States, and

[3] According to market participants surveyed by CGFS (1999), the surprise inter-FOMC meeting interest rate cut on 15 October 1998 signalled the beginning of the abatement of financial constraints.

many other countries, rose to exceptionally high levels. The Federal Reserve actions may have staved off an even more dramatic crisis. Based on interviews with market participants, CGFS (1999, p 40) noted (our italics) that:

"Only a very small number of market participants declined to characterise the 1998 crisis as "exceptional". Most interviewees mentioned that the events described […] led to *the worst crisis ever*."

Inspection of the bond spreads in the second half of 1998 (Figures 1 and 2) suggests that the Russian crisis had a substantial impact on all countries examined, both advanced economies and emerging markets. The LTCM shock also appears to have had an impact on all the countries, with a relatively smaller hump experienced by most emerging markets relative to the effect of the Russian shock. An inspection of the data suggests that the Russian and LTCM shocks were reinforcing in international financial markets as practically all markets experienced two jumps in their spreads: one following the Russian default (the first band in the figures) and another one following the announcement of LTCM's financial problems (the second band in the figures). Similarly, the fact that bond spreads began to rise in the United States following the Russian crisis and the Russian sovereign spread rose further in the aftermath of the LTCM crisis suggests that these two events were not totally independent.

The financial crises during August-September 1998 are interesting because the shocks during this period seem to have been transmitted across countries with little in common - including countries that do not fit traditional explanations of contagion based on trade links, competitive devaluation or regional effects (see for example Lowell et al (1998) and Goldstein (1998) for taxonomies of contagion). The crises of 1998 affected countries as diverse as Russia and Brazil (Baig and Goldfajn (2000) argue that the Russian crisis precipitated the Brazilian crisis), and emerging and advanced economies. Examining these crises is complicated by the fact that the two shocks occurred within weeks of each other.

3. A model of contagion

Existing empirical models of contagion generally proceed by both conditioning on a set of economic indicators to proxy market fundamentals and specifying the timing of contagious events. These choices tend to be based on an ex post evaluation of the data, and are often statistically insignificant (see, for example, Eichengreen et al (1995, 1996), Sachs et al (1996) and Glick and Rose (1999)). Latent factor models provide a desirable alternative circumventing the need to choose specific indicators to proxy economic fundamentals (see Dooley (2000) and Edwards (2000)). This type of model has been adopted previously for equity markets (Forbes and Rigobon (2002), King et al (1995)), currency markets (Dungey (1999), Mahieu and Schotman (1994), Diebold and Nerlove (1989)) and fixed interest markets (Gregory and Watts (1995), Dungey et al (2000)).

The premium of each of the 12 countries in Figures 1 and 2 is presumed to evolve in response to a number of alternative types of factors. These factors are classified as common to the entire set of countries, common to a regional grouping of countries, or idiosyncratic and related only to individual countries themselves. However, in contrast to many of the existing empirical models of contagion, the factors are not assumed to be observed directly, instead the revealed information in the data on premia is used to identify the factors. The structure of the factor model developed here has origins in the two factor models developed particularly in the equity market, where equity market returns are classified into common and country-specific shocks; see, for example, King et al (1995). In the case of the $N=12$ countries investigated in this paper, it is natural to include also a further set of regional factors to capture shocks contained within specific geographical areas. Thus the premium $P_{i,t}$ on the bond in country i at time t is expressed as

$$P_{i,t} = \lambda_i W_t + \phi_i f_{i,t} + \gamma_i R_{k,t} \qquad i = 1,...,12,\ k = Latin,\ Asia,\ Europe, \qquad (1)$$

where the premium is represented as the sum of a time-varying common factor, W_t, a time-varying country-specific factor, $f_{i,t}$, and a time-varying regional factor, $R_{k,t}$. The loadings on these factors vary across countries and are given by the parameters λ_i, ϕ_i and γ_i.

To identify the latent factors, and hence the parameters of the model, the common world factor W_t and the three regional factors $R_{k,t}$ are modelled to evolve as unit root processes

$$W_t = W_{t-1} + \eta_t, \qquad (2)$$

$R_{k,t} = R_{k,t-1} + \nu_{k,t}$ *where k = Latin, Asia, Europe*, (3)

where η_t and $\nu_{k,t}$ are stationary and independent disturbance terms. This structure is motivated by the need to specify a model which captures the unit root properties in the premium variables (see Dungey et al (2002) for details of the unit root tests). The remaining factors, the country-specific factors $f_{i,t}$, are specified as stationary and independent disturbance terms. In addition, Figure 1, and in particular Figure 2, highlight the occurrence of volatility clustering especially during the two crisis periods. To capture this autocorrelation in the volatility of the bond spreads, the world common factor error term η_t is assumed to have a GARCH (1,1) conditional variance.[4]

Equation (1) provides an initial decomposition of the premia of each of the 12 countries in terms of common, country-specific and regional factor shocks. To capture the effects of contagion across country bond markets, equation (1) is expanded to include the effects of the transmission of unanticipated shocks across international bond markets. The focus of the empirical investigation is on identifying and measuring the relative size and impact of contagion from the Russian and LTCM crises. Equation (1) is expanded as

$$P_{i,t} = \lambda_i W_t + \phi_i f_{i,t} + \gamma_i R_{k,t} + \delta_i f_{Russia,t} + \rho_i f_{US,t} \qquad i = 1,...,12,\ k = Latin, Asia, Europe, \tag{4}$$

where δ_i, measures the impact of contagion from Russia, and ρ_i measures the impact of contagion from the LTCM crisis, which is proxied by the unanticipated shocks from the US bond market.

In measuring the relative size of the impact of contagion across international bond markets, the latent factor model can be used to decompose the relative contributions of each factor to the volatility in the bond premium of each market. In deriving this decomposition it is necessary to work with the change in the bond premia, as these variables are non-stationary. To achieve this, equation (4) is interpreted as a cointegrated system which is used to derive an error correction model in terms of $\Delta P_{i,t}$. Following Dungey et al (2002), the volatility decomposition is expressed as

$$Var(\Delta P_{i,t}) = \lambda_i^2 + 2\phi_i^2 + \gamma_i^2 + 2\delta_i^2 + 2\rho_i^2. \tag{5}$$

In turn, the total decomposition can be re-expressed as a proportion of the contribution of each factor to total volatility:

(i) contribution of the world factor $\dfrac{\lambda_i^2}{Var(\Delta P_i)}$

(ii) contribution of country-specific factor $\dfrac{2\phi_i^2}{Var(\Delta P_i)}$

(iii) contribution of the regional factor $\dfrac{\gamma_i^2}{Var(\Delta P_i)}$

(iv) contribution of contagion from Russia $\dfrac{2\delta_i^2}{Var(\Delta P_i)}$

(v) contribution of contagion from LTCM $\dfrac{2\rho_i^2}{Var(\Delta P_i)}$

These statistics are average measures over the sample of the proportion of volatility arising from shocks from each factor. It is also possible to calculate conditional decompositions, which give the proportionate contribution of each shock at each point in time over the sample period.

In the special case where the factors have autoregressive representations and homoskedastic error variances, a Kalman filter can be used to estimate the unknown parameters. However, the inclusion of

[4] Univariate GARCH (1,1) tests on the individual country premium data confirm the presence of GARCH processes, with some common features. In earlier work we allowed the GARCH to apply to a greater variety of the factors, but found that this was generally insignificant. In line with Dungey et al (2000) and Kose et al (1999), GARCH on the common factor appears to capture the properties of the data.

conditional volatility in the factor variances precludes the use of the Kalman filter, as the parameter estimates are no longer consistent. To overcome this problem a simulation-based estimator is adopted following the approach of Gourieroux et al (1993) and Gallant and Tauchen (1996) (see also Gourieroux and Monfort (1994)). The approach consists of simulating the contagion model in equations (2) to (4) to generate a set of simulated bond spreads for the 12 countries in the sample. The simulated spreads are then calibrated with the actual bond spreads via a set of moment conditions derived from a set of VARs based on both the levels and squares of the bond spreads (the details of the estimation method are contained in Dungey et al (2002)).

4. Results

This section presents the results of estimating the latent factor contagion model for international bond markets. The sample period consists of daily bond yield spreads in 1998, beginning in February and ending in December, for the 12 countries shown in Figures 1 and 2.

Table 1 gives the volatility decompositions based on equation (5), expressed in percentage terms, whilst Figure 3 provides a graphical representation. Given the integration of international financial markets, volatility in bond premiums should exhibit strong co-movements. The contributions of the world factor confirm this, accounting for between 82% and 99% of total volatility. The regional and country-specific factors have little influence on volatility, with these factors accounting for less than 1% of total volatility, with the exceptions of the Netherlands and South Korea, where the effects are still relatively small.

Table 1

Volatility decomposition with contagion effects from Russia and the United States

(contribution to total volatility, in percentages)

	World	Country	Regional	Contagion		
				From Russia	From US	Total
Industrial						
US	91.080	0.050	0.000	8.870	–	8.870
UK	99.344	0.133	0.000	0.040	0.482	0.523
Netherlands	82.793	2.777	0.000	10.615	3.815	14.431
Eastern Europe						
Russia	89.145	0.222	0.086	–	10.547	10.547
Poland	88.963	0.050	0.514	1.279	9.194	10.473
Bulgaria	90.204	0.375	0.417	8.111	0.893	9.004
Asia						
Indonesia	99.213	0.268	0.254	0.217	0.048	0.265
South Korea	91.285	5.269	0.913	0.163	2.369	2.533
Thailand	91.174	0.786	0.547	1.521	5.973	7.493
Latin America						
Mexico	99.426	0.003	0.002	0.327	0.242	0.569
Argentina	83.436	0.028	0.007	0.022	16.508	16.529
Brazil	84.388	0.055	0.045	11.1047	4.407	15.511

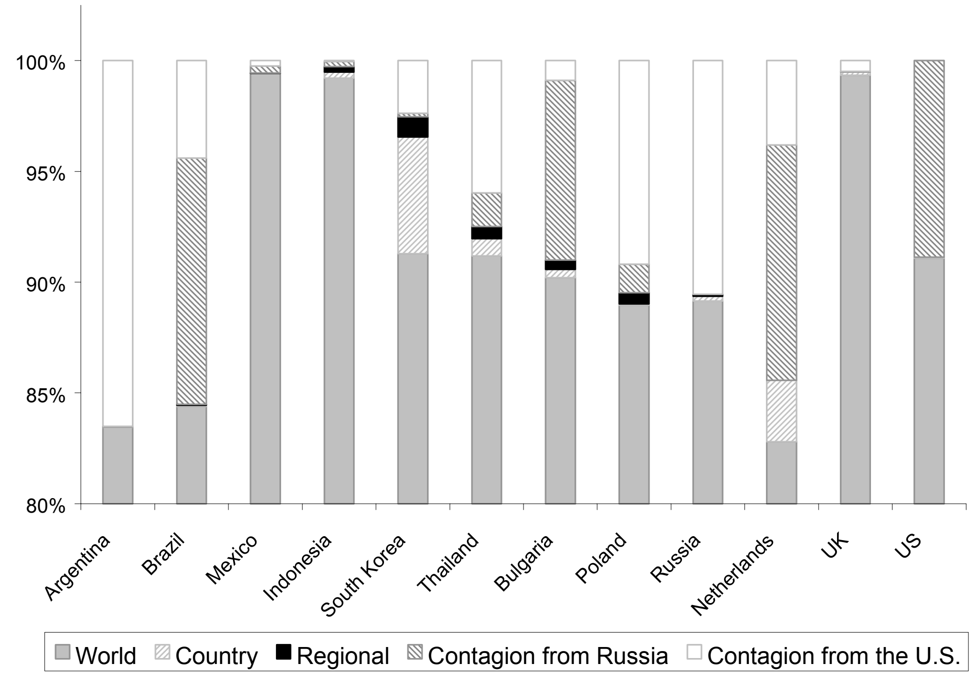
Table 1 shows that contagion is widespread, with five countries experiencing more than 10% of volatility due to contagion, three countries with contagion between 5 and 10% of total volatility, and four countries with contagion less than 5% of total volatility. The results also show that there is no clear association of contagion effects with either developed or developing countries. The three countries experiencing the largest proportion of volatility from contagion, at around 15%, are

Argentina, Brazil and the Netherlands. The three countries with the lowest total contribution from contagion are the United Kingdom, Indonesia and Mexico, with less than 1% in each. There is no evidence that contagion from Russia is confined to developing countries, or that contagion from LTCM mainly affects developed markets. In fact, the greatest impact of contagion from LTCM is felt in developing markets.

Figure 3

Volatility decomposition with contagion effects from Russia and the United States

(contribution to total volatility, in percentages)



The results in Table 1 also show that contagion is not generally contained within regions (the importance of regional effects has been studied by Goldstein (1998), Kaminsky and Reinhart (2002), Goldstein et al (2000), Eichengreen et al (1996) and Glick and Rose (1999)). For example, within the eastern Europe region, the Russian crisis has a substantial impact in Bulgaria, but not in Poland. Further, larger contagion effects are felt outside eastern Europe, in Brazil and the United States for example.

An alternative representation of the volatility decompositions is provided in Table 2 by expressing the volatility decompositions in squared basis points. This is achieved by multiplying the results in Table 1 by the sample variance of the daily change in the bond premia. Figures 4 and 5 provide a graphical representation of the relative size of contagion in terms of squared basis points.

The relatively higher overall level of volatility in developing markets means that the basis point effects of contagion are larger in developing markets than developed markets. In the United States and United Kingdom, contagion effects are less than 1 squared basis point. In the Netherlands, the effect is around 4 squared basis points. The only developing markets to have a single digit impact from contagion are Mexico, at 3 squared basis points, and Indonesia, at around 8 squared basis points. The remaining countries show contagion effects ranging from 21 squared basis points in South Korea to 6,200 in Russia.

The contribution of contagion to volatility in Russia and Poland is given as approximately 10% in Table 1, yet the scaled results in Table 2 show that contagion in Poland is only 55 squared basis points, in contrast with the 6,200 squared basis points for Russia. Similarly, the proportionate contribution of contagion from Russia to volatility in the United States and Bulgaria given in Table 1 is approximately the same, but translates to less than 1 squared basis point for the United States and about 811 squared basis points for Bulgaria.

Argentina and Brazil, the two developing countries most affected by contagion in percentage terms, were themselves to experience a financial collapse in January 1999 and 2001 respectively. However, the results in Table 1 show that the sources of contagion in these two countries are different. Almost all of the contagion to Argentina was sourced from the LTCM near collapse, with little impact from Russia. In Brazil approximately two thirds of the contagion effects were sourced from Russia, with the remaining third from the LTCM near collapse. This result is consistent with Baig and Goldfajn (2000), who emphasised the importance of contagion from Russia in explaining the financial crisis in Brazil in 1999. In basis point terms, volatility in Argentina and Brazil was substantial, with contagion from the crises contributing about 187 squared basis points to Argentina's premium, and 545 squared basis points to Brazil. These results may provide an interesting lead for future work in establishing at what point evidence of pre-crisis jitters are evident in financial markets.

Table 2

Volatility decomposition with contagion effects from Russia and the United States

(contribution to total volatility, in squared basis points)

	Total	Components			
		World	Country	Regional	Contagion
Industrial					
US	7.503	6.838	0.004	0.000	0.666
UK	13.895	13.822	0.019	0.000	0.073
Netherlands	29.052	24.053	0.807	0.000	4.192
Eastern Europe					
Russia	57872.003	52401.260	130.337	50.573	6199.837
Poland	527.622	469.385	0.263	2.715	55.259
Bulgaria	10006.001	9025.839	37.527	41.680	900.955
Asia					
Indonesia	3121.457	3096.893	8.359	7.941	8.264
South Korea	820.250	748.769	43.217	7.490	20.775
Thailand	499.870	455.843	3.928	2.735	37.465
Latin America					
Mexico	526.703	523.678	0.017	0.011	2.997
Argentina	1133.669	945.883	0.315	0.081	187.390
Brazil	3515.304	2966.509	1.939	1.585	545.270

The Indonesian results also raise interesting questions. In analyses of the East Asian crisis, Indonesia has been singled out as the country most affected by contagion (see Goldstein et al (2000) and Radelet and Sachs (1998)). However, the impact of contagion from both Russia and the LTCM near collapse in Indonesia is relatively small. This raises the question as to whether this is due to some structural change in Indonesia, or perhaps a heightened sensitivity to financial crises, moving the transmission mechanism to anticipated effects and hence away from contagion. A proposition worthy of investigation is whether a country can become immune to contagion, but nonetheless experience relatively high volatility from anticipated spillovers.

Figure 4

Contagion in squared basis points - the smaller contributions

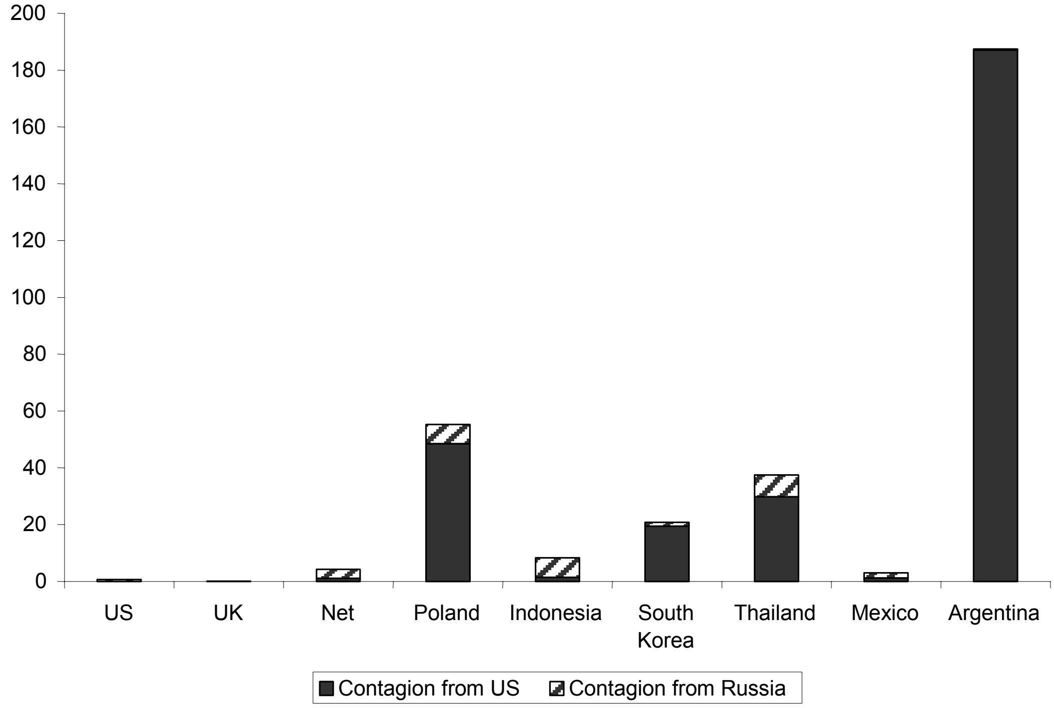
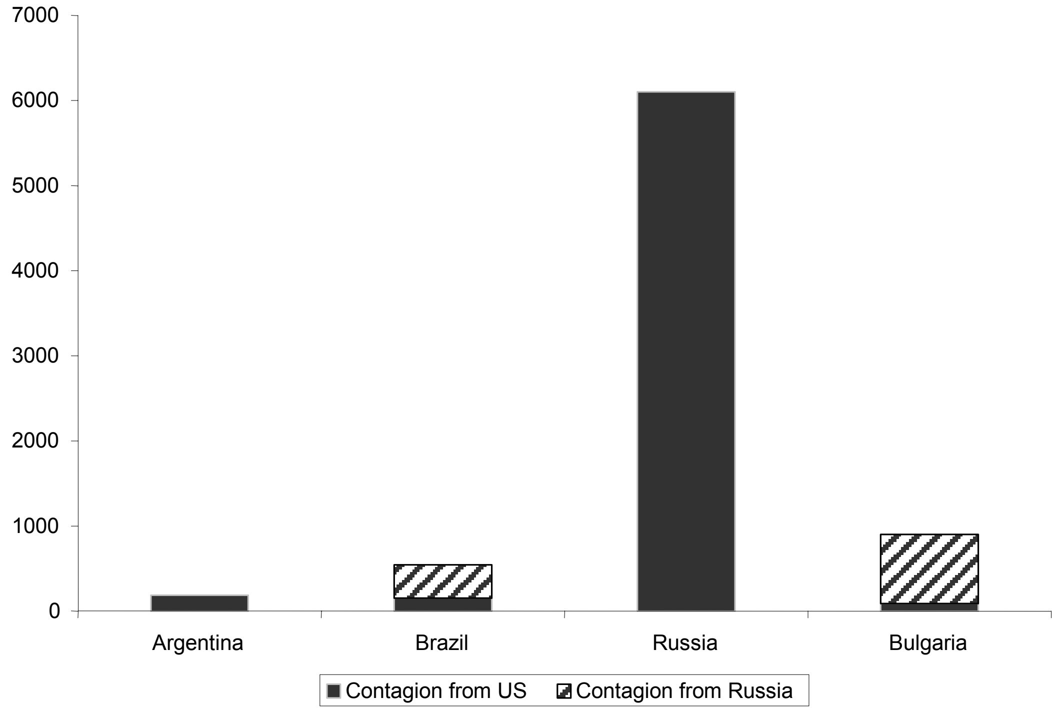


Figure 5

Contagion in squared basis points - the larger contributions



5. Conclusion

The Russian and LTCM crises have measurable contagion effects across a broad range of international bond markets in developing and developed countries. The markets examined were those of nine developing countries - Thailand, South Korea and Indonesia in Asia; Poland, Bulgaria and Russia in Eastern Europe; and Mexico, Argentina and Brazil in Latin America - and three developed markets - the US, UK and Netherlands markets. Contagion effects from both crises affected all countries and regions to differing degrees.

The results show that the Russian crisis produced contagion to both developing and developed markets, with the largest proportionate effects on Brazil, Bulgaria, Thailand and the Netherlands. The LTCM crisis effects were generally smaller, but were felt most in Argentina and Russia. The mix of developing and developed markets in the results belies the conclusions of CGFS (1999) that the effects of the Russian crisis were felt in developing markets and that the LTCM near collapse mainly impacted mature markets.

Contagion effects expressed as a proportion of total volatility did not provide clear evidence as to whether contagion had a greater effect on developing or developed markets. The greatest proportionate effects were felt in Brazil and the Netherlands, and the least in Mexico and the United Kingdom, that is in a developing and developed country in both cases. However, when the results were expressed in squared basis points, contagion effects were larger in developing markets as a result of the higher degree of volatility in these markets.

The results also showed that Brazil was affected by contagion prior to its currency crisis in January 1999. The relatively large contagion effects may be a reflection of the vulnerability of this country. This hypothesis provides scope for future work identifying the timing of financial crises through the identification of pre-crisis jitters in financial markets.

Contagion has been viewed in the literature as mainly a concern for developing countries. The evidence from the Russian and LTCM crises suggest this is not necessarily the case. The overall higher volatility in developing markets means that the effects of contagion in those markets are higher measured in squared basis point terms. However, in proportionate terms, contagion effects are widely distributed across both developed and developing markets. Contagion is not a phenomenon reserved for developing countries; developed markets are also affected.

Appendix A:
Data definitions and sources

The data represent the spread of long-term debt over the appropriate risk-free yield for each country. The choice of the risk-free rate was specific to each long-term bond, because it depends at least in part on the currency of denomination of the bond issue. In the case of the emerging market countries, sovereign bonds were issued in US dollars, rather than in domestic currency, and hence the spread is calculated against the comparable maturity-matched US Treasury bond rate. To the extent possible, the bonds selected for emerging markets were sovereign issues (rather than Brady) to reflect the true cost of new foreign capital. For the advanced markets, which are able to issue international bonds in domestic currency, benchmark BBB investment grade corporate bonds were used and compared to the corresponding risk-free Treasury bond in each country. Sources of the data are:

Argentina: Republic of Argentina bond spread over US Treasury. Source: US Federal Reserve.

Brazil: Republic of Brazil bond spread over US Treasury. Source: US Federal Reserve.

Mexico: JP Morgan eurobond index Mexico sovereign spread over US Treasury. Source: US Federal Reserve.

Indonesia: Indonesian yankee bond spread over US Treasury. Source: US Federal Reserve.

South Korea: Government of Korea 8 7/8% 4/2008 over US Treasury. Source: Bloomberg (50064FAB0).

Thailand: Kingdom of Thailand yankee bond spread over US Treasury. Source: US Federal Reserve.

Bulgaria: Bulgarian discount stripped Brady bond yield spread over US Treasury. Source: US Federal Reserve.

Poland: Poland par stripped Brady bond yield spread over US Treasury. Source: US Federal Reserve.

Russia: Government of Russia 9.25% 11/2001 over US Treasury. Source: Bloomberg (007149662).

Netherlands: Akzo Nobel NV 8% 12/2002 yield spread over NETHER 8.25% 6/2002. Source: US Federal Reserve.

United Kingdom: UK industrial BBB corporate 5-year bond spread over gilt. Source: Bloomberg (UKBF3B05).

United States: US industrial BBB1 corporate 10-year bond spread over US Treasury. Source: Bloomberg (IN10Y3B1).

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