Contagion in Emerging Countries' Sovereign Bonds*

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Abstract

The paper tests empirically the existence of contagion in emerging countries' sovereign bond markets. Contagion is defined as a causally related dynamic co-movement between two emerging countries' sovereign bond excess returns, after taking into account general market factors and changes in countries' economic situations. Using the pricing errors of excess returns for 11 emerging countries in the period between January 1995 and November 2001, we find empirical support for granger-causality between pricing errors for a number of countries and, thus, for contagion, on the basis of our definition. Among others, this is the case between Argentina and Mexico as well as between Brazil and Mexico, Argentina and Brazil being the source of contagion and Mexico the recipient in both cases.

*The views expressed in this paper are those of the authors and do not necessarily represent those of the Banco de España or Banco de España policy.

1 Introduction

In the last few years, the economic literature has devoted substantial efforts to explain the phenomenon of contagion between countries. The possibility of separating contagion from fundamental (or also global market)-related changes in financial variables is crucial for a better design of the international financial architecture.

In fact, in the ongoing process towards a new international financial architecture, a clear distinction is made between countries suffering crises because of contagion or creating contagion due to their systemic importance, and those suffering crises because of their own fundamentals. The first group of countries appears to be in a better position to receive funds from the IMF[1] than the second group. In fact, the first -which are those with large trade or financial links with the country in crisis or those with a large enough exposure to the international markets- can obtain emergency financial assistance from the international community as long as their debt dynamics are sustainable.

The fact that the amount and speed to which international financial assistance is granted to a country hinges on the existence of contagion is, by itself, a good reason to improve on the knowledge of the phenomenon. This is particularly the case if we consider that there is no consensus in the empirical literature on when contagion takes place and how to measure it.

In this paper, we concentrate on that contagion that may occur between emerging countries sovereign bonds. We, thus, do not assess empirically whether contagion exists in other financial asset markets (such as the stock or the foreign exchange market) or between countries as a whole. Sovereign bonds are particularly relevant financial assets for emerging countries because they are closely associated with country risk and have been frequently used in the literature to study contagion.

Nevertheless, the analysis of contagion in emerging countries' sovereign bonds has two main difficulties: Firstly, the determinants of sovereign risk are harder to assess

[1] More specifically, the IMF Supplementary Reserve Facility (SRF) is designed for countries which "may create a risk of contagion that could pose a potential threat to the international monetary system", while the Contingent Credit Line (CCL) is designed for those countries who suffer from contagion (IMF, 1997).

in emerging markets than in developed ones. Traditional risk factor models -while reasonably successful in characterizing the expected risk-return trade-off in developed markets- fail when applied to emerging ones. The reasons are several, among which measurement and data problems (Erb, Harvey and Viskanta, 1997). Secondly, not all co-movements stem from contagion. In fact, they could reflect an unrelated worsening of macroeconomic and political conditions in two countries at the same time.

The existence of contagion conveys the idea that economic models based exclusively on fundamentals or channels of international transmission (i.e., trade or financial links) exclude important issues, such as asymmetric information, learning, indeterminacy of equilibrium and the like. These are all potentially different explanations for contagion, which we take as given in our analysis and whose relative relevance we do not attempt to test. Another important issue to take into account is that a high correlation does not necessarily imply contagion. In fact, internationally integrated markets exhibit a large correlation in asset prices. Hence, tests for contagion versus interdependence should be based on differentiating between correlation dynamic co-movements, which have a causal relation.

Given our above described interest, we define contagion as the dynamic co-movement, for which a causal relation can be found, between two emerging countries' sovereign bond excess returns, after taking into account general market factors and changes in countries' economic situations. It is important to note that the definition focuses on a causal dynamic co-movement and not on simple correlation.

The objective of this paper is, thus, to test empirically, using high frequency data, whether contagion, as defined above, exists between excess returns of emerging sovereign bonds. In addition, we test whether the reduction in the sovereign rating of another country helps explain this Granger-causal co-movement.

To this end, we use the framework of the dynamic version of the Arbitrage Pricing Theory proposed by King, Sentana and Wadhwani (1994), and estimate a multifactor asset pricing model of bond excess returns. To assess empirically whether contagion exists and from which country to which other country it spreads, we test whether the pricing errors -that is, the residuals of the estimation of the multifactor asset pricing model- Granger cause residuals of another country. The fact that we focus on cross auto-covariances between pricing errors and that we conduct Granger causality tests, allows us to say something on the direction of the transmission of pricing errors and, thus, on which countries are sources of contagion and which are contagion recipients.

This test becomes even more relevant when we include changes in other countries' sovereign ratings.

The paper is organized as follows. Section 2 reviews the results found in the empirical literature as regards contagion in emerging markets' sovereign bonds. Section 3 describes the empirical methodology. Section 4 describes the data and estimation methodology. Finally Section 5 describes the results and conclusions.

2 Review of the literature

In the literature, there is a considerable amount of debate concerning the precise definition of contagion, and how we should measure it (Pericoli and Sbracia, 2001, and Rigobon, 2001). Among the most widely known definitions, the most similar to the one used in our analysis is Claessens, Dornsbush and Park (2001)'s definition, namely "a significant increase in cross-market asset linkages after a shock to an individual country or group of countries". Cross-market asset linkages can be analyzed for several markets and in several ways. Diez de los Rios (2002) focus on excess comovements between different asset markets (currency, bond and stcok returns). We shall concentrate on same asset. Within this category, Edwards (1998) focuses on the transmission of volatility across Latin American bond markets after the Mexican crisis in 1995 through the estimation of a univariate GARCH model. He finds that the increase in volatility in Mexico's bond market had a significant impact on the volatility of the bond market in Argentina, but not in that of Chile. As previously mentioned, we shall focus on the same asset market but with a very different methodology, which looks at causality rather than at correlation.

In order to determine empirically whether contagion - as defined above- exists, let us first recall what are the main sources of risk for investors in emerging countries' sovereign bonds, based on the existing financial literature[2]. These are market risk, currency risk and country risk. The first hinges on the interest rate structure (and maturity) of sovereign bonds as compared to other bond portfolios. The second is related to global exchange rate developments (and also to domestic exchange rate developments if sovereign bonds are denominated in local currency, which is not the case in our data choice). The third should be closely related to a country's economic fundamentals, and in particular those which determine the (un)sustainability of a country's public debt (Min, 1998).

One of the main difficulties in measuring credit risk in sovereign bonds is the choice of the variables which determine it. Several authors have used credit ratings together with other fundamental variables as a proxy of credit risk (Cantor and Packer, 1996, and Eichengreen and Moody, 1998). Others have used only sovereign credit ratings (Erb, Harvey and Viskanta, 2000, and Kamin and Von Kleist, 1999), as a summary of a country's fundamentals. We follow the latter line for two main reasons: First the simplicity of sovereign ratings, being a single variable summarizing many fundamentals. The second is the lack of a specific frequency, which would make a high-frequency analysis virtually impossible. In fact, rating agencies can decide to change a rating at any point in time. There are, however, disadvantages in using ratings as a proxy for credit risk, in particular, their very high degree of first order positive auto-correlation, as compared with the evolution of sovereign bond yields[3], as well as the fact that sovereign ratings may change due to factors different than those suggested by the literature (Mulder and Perrelli, 2001, and Sy 2001) and there may be an overshooting of ratings downgrades in crisis periods (Ferri, Liu and Stiglitz, 1999).

[2] For example, Kamin and Von Kleist (1999) include measures of interest rate, exchange rate and credit (sovereign) risk to assess empirically the determinants of emerging market credit spreads

[3] Monfort and Mulder (2000) attribute such autocorrelation to the fact that ratings should only respond to new information. This corresponds well to the professed objective of rating agencies to limit changes in grading.

3 Benchmark Model

In order to test whether a causal relation exists (an thus contagion in the way we have defined it) in the dynamic co-movement between sovereign bond excess returns of two emerging countries, we use the framework of the dynamic version of the Arbitrage Pricing Theory proposed by King, Sentana and Wadhwani (1994), and we estimate the risk premia of emerging bond markets that are consistent with equilibrium in a world in which idiosyncratic risks are not priced. We estimate a multifactor model with time-varying volatility in the underlying factors, in which the idiosyncratic components of returns are (almost) uncorrelated across countries, but their correlation structure is arbitrary within each country. In particular, we make use of the estimation method proposed by Sentana (2002), who measures the impact of the European Exchange Mechanism (ERM) on the cost of capital for European firms.

The analysis is based in a world with a large number of countries $j = 1, ..., N$, and assume that for each country there is one long-term bond portfolio, whose random gross holding return over period t, and denominated in US$, is R_{jt}. Let $R_{c\$t}$ be the gross return on a safe asset during period t, also denominated in US$. The excess return of the bond portfolio for each country in terms of US$ is, thus, given by:

$$r_{jt} = \log R_{jt} - \log R_{c\$t}$$

Provided that excess returns consist of a risk premia (μ) and an unanticipated (η) (as of $t-1$) component, r_{ajt} can be expressed as:

$$r_{jt} = \mu_{jt} + \eta_{jt}$$

If the relevant model for investors were an international CAPM and the global market bond portfolio were mean-variance-efficient, the expected return on any security or portfolio would be fully explained by its loading on the global market bond portfolio excess return. But, as pointed earlier, traditional risk factor models perform very poorly when applied to emerging financial markets, given that there are other substantial risks not captured in the CAPM. It seems, therefore, reasonable to include additional factors, other than the global market bond portfolio, to explain the returns of a country's sovereign bonds, summarized in the EMBI index, by means of an APT model.

Therefore, we propose a three factor model to capture the systematic risk in emerging bond returns:

$$\eta_{jt} = \underbrace{\beta_{ej} f_{et} + \beta_{wj} f_{wt} + \beta_{rj} f_{rt}}_{\text{Systematic Risk}} + \underbrace{v_{jt}}_{\text{Idiosyncratic Risk}} \tag{1}$$

where the first factor -f_{et}- is a currency risk component due to the deviations from Purchasing Power Parity, that is, changes in nominal exchange rates not compensated by opposite inflation differentials. This risk is independent of the fact that most sovereign bonds are denominated in US dollar and exists even in a perfectly integrated global market given that not all currency movements can be diversified away.

On the other hand we have included a world factor -f_{wt}- in order to capture the international comovements in bond returns, and an asset-class factor -f_{rt}- in order to capture comovements within the asset class of emerging markets bonds.

Furthermore we will assume that:

- Common and specific factors are unpredictable on the basis of past information, to guarantee that the η's are innovations.
- The common factors are orthogonal to each other and for the idiosyncratic terms, which by definition are orthogonal to $\mathbf{f}_t = (f_{et}, f_{wt}, f_{rt})'$, assume that they are orthogonal to one another for a given country j,
- The idiosyncratic covariance matrix has the approximate zero factor structure introduced by Chamberlain and Rothschild (1983), in which v_{jt} may be correlated across countries, but only mildly so in order to guarantee that full diversification applies.

Using an International APT pricing relationship, as in Solnik (1983)[4], we find that the risk premia have the following structure:

$$\mu_{jt} = \beta_{ej}\pi_{et} + \beta_{wj}\pi_{wt} + \beta_{rj}\pi_{rt} \tag{2}$$

[4] See Sentana (2002) for an extended discussion of the pricing relationship.

where π_{kt} is the risk premia that corresponds to the factor k. Note that this benchmark model implies that country specific risk should not be priced, as long as risk premia depend on the common factors, not on the assets.

Combining (1) and (2) we obtain:

$$r_{jt} = \beta_{ej} f_{et}^R + \beta_{wj} f_{wt}^R + \beta_{rj} f_{rt}^R + v_{jt} \tag{3}$$

or in matrix notation $r_{jt} = \mathbf{b}_j \mathbf{f}_t^R$, where $\mathbf{b}_j = (\beta_{ej}, \beta_{wj}, \beta_{rj})$, $f_{kt}^R = \pi_{kt} + f_{kt}$ $(k = e, w, r)$ and can be interpreted as the excess returns of three portfolios, $\mathbf{f}_t^R = (f_{et}^R, f_{wt}^R, f_{rt}^R)'$, that mimic the proposed factors, as long as π_k represents the risk premia and f_{kt} the unanticipated component (as of $t-1$) associated to the common factor k. Note estimation would be an easy task if $\mathbf{f}_t^R$ were observed directly, though that is not our case.

Instead, as proposed by Sentana (2002) we can construct three fully diversified portfolios of currency deposits *(c)*, a global bond portfolio *(g)* and an emerging-local bond portfolio *(l)*, with excess returns given by $\mathbf{r}_{pt} = (r_{ct}, r_{gt}, r_{lt})'$, that captures the systematic risk structure:

$$\begin{aligned} r_{ct} &= f_{et}^R \\ r_{gt} &= \beta_{eg} f_{et}^R + f_{wt}^R \\ r_{lt} &= \beta_{el} f_{et}^R + \beta_{wl} f_{wt}^R + f_{rt}^R \end{aligned} \tag{4}$$

or in matrix notation $\mathbf{r}_{pt} = \mathbf{B}_p \mathbf{f}_t^R$, and where the scaling of the common factors are set to $\beta_{eg} = \beta_{el} = \beta_{wl} = 1$. Therefore we can obtain estimates of $\boldsymbol{\pi} = (\pi_e, \pi_w, \pi_r)'$, $\mathbf{B}_p$ and $\mathbf{b}_j$ if we employ the Generalised Method of Moments (GMM) based on the just-identifying moment conditions implicit in the following estimation procedure:

(a) π_e from the OLS regression of r_{ct} on a constant.

(b) π_e and β_{eg} from the OLS regression of r_{gt} on a constant.and r_{ct}

(c) π_r, β_{el}, and β_{wl} from the OLS regression of r_{lt} on a constant, r_{ct} and $(r_{gt} - \widetilde{\beta}_{eg} r_{ct})$ where $\widetilde{\beta}_{eg}$ is the estimation of the parameter β_{bpe} obtained in (b)

(d) $\beta_{ej}, \beta_{wj}, \beta_{rj}$ from the OLS regression of r_{jt} on $\widehat{f_{et}^R}$, $\widehat{f_{wt}^R}$ and $\widehat{f_{lt}^R}$

where $\widehat{\mathbf{f}}_t^R = (\widetilde{\mathbf{B}}_p)^{-1} \mathbf{r}_{pt}$, and $\widetilde{\mathbf{B}}_p$ is the estimate of the matrix of coefficients for the marginal model of "world" portfolios obtained through (a)-(c). The use of Hansen

(1982)'s GMM allow to handle with conditional heteroskedasticity, seral correlation and the generated regressor problem implicit in the estimation of this asset pricing model.

Once we have estimated the asset pricing model, we use the residuals of the equation (3), which can be understood as the pricing errors under our model, and form the following equation:

$$v_{it} = \gamma_{ij} v_{jt-1} + \varepsilon_{ijt} \tag{5}$$

As a first step we are interested in testing the null hypothesis that there is no dynamic co-movement between pricing errors $\gamma_{ij} = 0$, that is that pricing errors are not cross-autocorrelated. Note that (5) should be estimated jointly with (3) and (4) using GMM techniques in order to avoid the generated regressors problem and to obtain the appropiate standard errors.

Second, we want to test whether the co-movements we find stem from contagion or not, namely whether a causal relation can be found the co-movements of two countries' pricing errors. We, thus, include downgrades in a country's sovereign rating, to account for changes in the credit risk for that country's sovereign bonds and downgrades in other countries' sovereign ratings to account for the worsening of general macroeconomic conditions in other countries. The hypothesis to test is whether a worsening of other countries' macroeconomic conditions contributes to explaining the Granger causal dynamic co-movement between the pricing errors of two countries sovereign bond returns. Note that the downgrade does not necessarily have to be that of the country against which we measure the extent of dynamic co-movement but also a third country. This is to be able to assess empirically the shock in a third country which is transmitted through another country, in terms of the co-movements of excess returns in pricing errors of both countries' sovereign bonds.

Let $DownOwn_{it}$ be a dummy variable that takes the value of 1 in the 4 weeks before and after a downgrade for country i; and let $DownOther_{it}$ be a dummy variable that takes the value of 1 in the 4 weeks before and after a downgrade in any other country $j \neq i$.

We can test whether or not the autocorrelation changes in periods associated to downgradings:

$$v_{it} = \gamma_{ij} v_{jt-1} + \varsigma_{ij} v_{jt-1} DownOwn_{it} + \xi_{ij} v_{jt-1} DownOther_{it} + \varepsilon_{ijt} \quad (6)$$

just verifying whether $\gamma_{ij} = \xi_{ij} = 0$. We let the own downgrading affect the transmission mechanism, but we expect that other downgradings do not affect. Then again, (6) should be estimated jointly with (3) and (4) using GMM.

4 Data

We take information from sovereign bond returns for the largest number of emerging countries possible for which there is comparable data for a relatively long time series. J.P. Morgan Securities offers a number of different daily indices of emerging market bond returns, among which we choose the EMBI+, which includes dollar-denominated Brady bonds and other non-local currency-denominated bonds starting from January 1995. J.P. Morgan also produces an index of local currency-denominated bond paper (the Emerging Local Currency Index) but prefer to use foreign-currency denominated bonds since credit risk and local exchange rate risk are many times closely intertwined.

In addition, the relatively early starting point of the EMBI+ allows us to account from the largest number possible of turbulence periods in emerging countries, which is where contagion is most likely to occur. In addition, there is an advantage of using a country's EMBI+ index rather than single sovereign bonds, which is the assurance that minimum liquidity criteria are satisfied[5], so that there is no large liquidity risk premia.

We, thus, use the JPMorgan EMBI+ index, without missing observations from January 1995 onwards, for eleven countries: Argentina, Brazil, Ecuador, Mexico, Morocco, Nigeria, Panama, Peru, Poland, Russia and Venezuela[6], in order to calculate weekly returns that avoid week-of-day effects.

We calculate the weekly excess return for country j sovereign bond portfolio (r_{jt}) by subtracting the weekly U.S. Federal Fund rate to the EMBI+ index for country

[5] Instruments in the EMBI+ must have a minimum \$500 million of face value and must be available and liquid.

[6] There was daily data available for the Philippines as well from January 1995 onwards but, unfortunately, there was a period close to the Asian crisis with missing observations.

j. Although J.P. Morgan offers readably calculated EMBI spreads, which control for potential distortions in US Treasuries, such as floating coupons, principal collateral and rolling interest rate guarantees, we prefer to calculate the excess returns, rather than use the EMBI+ spreads for homogeneity with other asset returns used in the asset pricing model described in the previous section. Table 1 present summary statistics of the weekly excess returns.

As regards market risk, we include two measures. The first is world market risk, which captures international co-movements in bond returns. We use weekly data on the MSCI World Index and subtract the weekly U.S. Federal Fund rate. The second measure of market risk concentrates on the emerging countries' asset class, and intends to capture co-movements in the asset class. Weekly excess returns are calculated for the EMBI+ Index[7] subtracted of the weekly U.S. Federal Fund rate. Finally, for the exchange rate risk, we calculate an aggregate equally weighted portfolio using weekly data on currency deposits excess returns for Australia, Canada, Japan, and ten European countries (Belgium, Denmark, France, Germany, Italy, Netherlands, Spain, Sweden, Switzerland and UK).

Our sample starts on January 18, 1995 and ends on November 4, 2001 (326 observations per country). The starting data is also conditioned by the limited availability of the short interest rates needed to build the currency deposits excess returns.

Finally, we use the sovereign ratings history for each country from January 1995 onwards from Moody's foreign currency sovereign ratings (2002).

In the next section, we present the GMM estimates of our benchmark (three-factor) model. Robust standard errors are calculated using the Newey-West approach with a bandwidth of 7 lags.

5 Results and Final Remarks

We first look at the estimates of the three-factor asset pricing model (Appendix I shows the results for a two-factor asset pricing model, which excludes the asset class market risk

[7] JP Morgan calculates the EMBI+ Index as an aggregation of single indices for 24 countries.

as a robustness exercise[8]). Table 2 presents the estimates of the diversified portfolios. It shows that the excess returns of the MSCI portfolio and those of the currency portfolio are significantly and positively correlated, in the same way as those of the MSCI portfolio and the EMBI+. This implies that world and emerging market risks have a positive reward, being π_w and π_r both positive (although both are estimated imprecisely). On the other hand, we have found that π_c is negative, that is, an investment on the currency portfolio presents a negative expected return, which can be explained by the continuous appreciation of the US$ with respect to the Euro.

The results for the estimation of the factor loadings of the asset pricing model are presented in Table 3. The coefficient of the bond excess returns on the exchange rate factor -β_{ej}- is negative for every country, although it is only significant at a 5% level for Nigeria. This implies that sovereign bond returns in some emerging countries suffer when there is a generalized appreciation of other currencies against the dollar. Sensitivities of the bond returns to common world -β_{wj}- and asset class factors -β_{rj}- are both positive. Therefore, an increase in world and emerging excess returns lead to increases in individual country returns. Finally, note that the estimated pricing error (α_j), where $\alpha_j = E(v_{jt})$, is not significantly different from zero, which shows that the three factors in our model perform very well in explaining excess returns of an emerging country's sovereign bonds.

As a second step, we extract the pricing errors from the three factor model for each of the eleven countries and conduct bilateral Granger causality tests (see Table 4). We find that the pricing errors of Argentina's sovereign bonds granger cause those of Ecuador, Russia but with the opposite sign is. This could be interpreted as a portfolio shift from Argentina to Ecuador and Russia, rather than contagion, in the way we have defined it. Note, however, than when changes in sovereign ratings are included as an additional regressor, the significant of this (negative) Granger causality disappears in the case of Ecuador (Table 5). On the other hand Argentina appears to granger-cause pricing

[8] Taking out the asset-class market risk probably implies a misspecification of the model and, thus, larger pricing errors. The results of the Granger causality are much weaker than for the three-factor model.

errors in Mexico with a positive sign. This can be read as Argentina's sovereign bond excess returns affecting (namely Granger causing) those of Mexico, when other factors are considered (global and emerging market risk, as well as exchange rate risk). In other words, Argentina sovereign bond developments appear to be a source of contagion for Mexico's, sovereign bonds, given our definition of contagion. It is interesting to note that the level of significance increases (from at 10% to a 1% level) when changes in sovereign ratings are included in the regression and that no reversed causality - from Mexico's sovereign bond returns to those of Argentina - is found in either of the two cases (with and without sovereign ratings). In addition, when we test whether a change in Argentina's or another country's rating explains the contagion from Argentina to Mexico, we find it significant, at a 1% level (Table 6).

In the same vein, Brazil sovereign bond returns positively granger cause those of Mexico (at a 1% confidence level), when changes in ratings are included. In addition, the Wald test shows that a reduction in other countries' ratings (other Brazil's or other countries') has a significant explanatory power on the causal relation of co-movements in sovereign bond excess returns. The same result is found between Morocco and Argentina. Finally, a positive and significant Granger causality between pricing errors can be found between Ecuador and Nigeria, although the Wald test does not confirm the significance of the sovereign rating downgrades in explaining the result. The same is true between Panama and Brazil.

In conclusion, we find empirical evidence of granger causal dynamic co-movements between pricing errors of some countries' sovereign bond returns and, thus, of contagion on the basis of the definition chosen. This is the case between Argentina and Mexico as well as between Brazil and Mexico, Argentina and Brazil being the source of contagion and Mexico the recepient in both cases and no reversed causality is found.

References

[1] Cantor, R. and F. Packer (1996): "Determinants and Impact of Sovereign Credit Ratings", J*ournal of Fixed Income*, December 1996, pp.76-91

[2] Claessens, S., R. Dornbusch and Y.C. Park (2001): "Contagion:Why Crises Spread and How This Can Be Stopped", in Claessens,S and Forbes,K (Eds), *"International Financial Contagion"*,Kluwer Academic Publishers.

[3] Diez de los Rios, A. (2002): "Globalisation and the Cost of Capital in Emerging Markets", CEMFI Mimeo

[4] Edwards, S. (1998): "Interest rate volatility, capital controls and contagion", NBER Working Paper 6756.

[5] Eichengreen B. and A. Mody (1998): "What Explains Changing Spreads on Emerging Market Debt: Fundamentals or Market Sentiment", NBER Working Paper 6408.

[6] Erb C. Harvey C. and T. Viskanta (2000), "Understanding Emerging Market Bonds", *Emerging Markets Quaterly*, Spring 2000, pp. 7-23

[7] Ferri, G., L. Liu. and J. Stiglitz (1999): "The Procyclical Role of Rating Agencies: Evidence from the East Asian Crisis," *Economic Note*s, vol. 28, No 3.

[8] International Monetary Fund (1997): "Supplemental Reserve Facility and Contingent Credit Line, Decision 11627-97/123", *Selected Decisions of the International Monetary Fund and Selected Documents*, Twenty-Sixth Issue

[9] Kamin S. and K. Von Kleist (1999): "The Evolution and Determinants of Emerging Market Credit Spreads in the 1990s", International Finance Discussion Papers, Number 653, Board of Governors of the Federal Reserve System

[10] King, M., E. Sentana and S. Wadhwani (1994): "Volatility and Links Between National Stock Markets", *Econometrica*, 62, 4, 901-933.

[11] Min H. (1998): "Determinants of Emerging Market Bond Spreads: Do Economic Fundamentals Matter?", World Bank Development Research Group, mimeo

[12] Moody's (2002): "Sovereign Rating History: Special Comment", Moody's Investor Service, Global Credit Research

[13] Mulder C. and R. Perrelli (2001): "Foreign Currency Credit Ratings for Emerging Market Economies", IMF Working Paper WP/01/191.

[14] Pericoli M. and M. Sbracia (2001): "A Primer on Financial Contagion", Temi di Discussione del Servizio Studi, No 407, Banca d'Italia

[15] Rigobon (2001): "Contagion: How to measure it?", NBER Working Paper 8118

[16] Sentana, E. (2002): "Did the EMS Reduce the Cost of Capital?", *Economic Journal*, vol 112, no 482, pp 786-809.

Table 1
Summary Statistics Weekly Returns (%)

Portfolio	Mean	Std Dev
Currency	-0,119	0,997
MSCI	-0,020	0,813
EMBI+	0,230	2,477
Argentina	0,195	2,672
Brazil	0,220	3,170
Ecuador	0,197	4,599
Mexico	0,219	2,102
Morocco	0,218	2,512
Niegria	0,263	2,949
Panama	0,350	2,696
Peru	0,288	3,427
Poland	0,251	1,803
Russia	0,274	6,312
Venezuela	0,302	2,935

Table 2
Risk premia and factor loading for diversified portfolios
Three Factor Model

World Portfolios	Common Exchange Rate Risk			Common World Market Risk			Common asset-class Market Risk	
Currency	βec=	1,000						
MSCI	βes=	0,616	***	βws=	1,000			
		(0,040)						
EMBI	βer=	-0,235		βwr=	0,566	**	βgr=	1,000
		(0,207)			(0,259)			
	πe=	-0,119	**	πw=	0,053	*	πr=	0,172
		(0,059)			(0,031)			(0,140)

GMM estimates of the following system of equations:

$$r_{ct} = p_{et} + f_{et}$$
$$r_{st} = p_{wt} + b_{es} f_{et}^{R} + f_{wt}$$
$$r_{gt} = p_{rt} + b_{eg} f_{et}^{R} + b_{wg} f_{wt}^{R} + f_{rt}$$

where: $p_{e} = E(p_{et}), p_{w} = E(p_{wet}), p_{r} = E(p_{rt}),$

(***), (**), (*) indicates coefficient significantly different from zero at the 1%, 5% and 10% level respectively

S.E. in parenthesis

Table 3
Factor Loadings for Bond Returns: Three Factor Model

Countries	Common Exchange Rate Risk (βej)	Common World Market Risk (βwj)	Common A. Class Market Risk (βrj)	Idiosyncratic Risk Pricing (αj)
Argentina	-0,330	0,788 **	0,973 ***	-0,054
	(0,265)	(0,322)	(0,058)	(0,065)
Brazil	-0,303	0,326	1,202 ***	-0,040
	(0,225)	(0,292)	(0,089)	(0,054)
Ecuador	-0,485 *	1,004 **	1,340 ***	-0,144
	(0,267)	(0,466)	(0,107)	(0,179)
Mexico	-0,196	0,599 ***	0,744 ***	0,035
	(0,146)	(0,204)	(0,057)	(0,055)
Morocco	-0,229	0,241	0,877 ***	0,027
	(0,180)	(0,234)	(0,059)	(0,063)
Nigeria	-0,456 **	0,543	0,765 ***	0,048
	(0,220)	(0,383)	(0,101)	(0,086)
Panama	-0,495 *	0,951 ***	0,815 ***	0,100
	(0,278)	(0,274)	(0,079)	(0,106)
Peru	-0,267	0,950 ***	1,045 ***	0,026
	(0,311)	(0,316)	(0,108)	(0,096)
Poland	-0,259	0,789 ***	0,490 ***	0,094
	(0,183)	(0,191)	(0,083)	(0,066)
Russia	-0,055	0,366	1,597 ***	-0,027
	(0,367)	(0,842)	(0,289)	(0,401)
Venezuela	-0,180	0,693 ***	0,942 ***	0,082
	(0,192)	(0,267)	(0,093)	(0,102)

GMM estimates of the following system of equations:

$$r_{jt} = b_{ej} f_{et}^{R} + b_{wj} f_{wt}^{R} + b_{rj} f_{rt}^{R} + v_{jt}$$

where: $a_j = E(v_{jt}) = E(r_{jt} - b_{ej} f_{et}^{R} - b_{wj} f_{wt}^{R} - b_{rj} f_{rt}^{j})$

(***), (**), (*) indicates coefficient significantly different from zero at the 1%, 5% and 10% level respectively

S.E. in parenthesis

Table 4
Granger Causality Tests: Three Factor Model

Countries i\j	Argentina	Brazil	Ecuador	Mexico	Morocco	Nigeria	Panama	Peru	Poland	Russia	Venezuela
Argentina	0,096 *	0,070	-0,005	-0,015	0,133 ***	-0,021	-0,053	-0,045	-0,073	-0,019 **	-0,023
	(0,058)	(0,065)	(0,016)	(0,085)	(0,039)	(0,035)	(0,045)	(0,031)	(0,072)	(0,008)	(0,037)
Brazil	0,019	-0,215 *	0,020	0,032	-0,035	0,079	0,071 **	0,037	0,030	0,018	0,018
	(0,107)	(0,124)	(0,031)	(0,079)	(0,057)	(0,055)	(0,031)	(0,028)	(0,044)	(0,020)	(0,048)
Ecuador	-0,290 **	0,374 *	-0,108	-0,102	-0,278 ***	0,040	-0,213 **	-0,028	-0,155	0,027	0,045
	(0,126)	(0,195)	(0,083)	(0,179)	(0,098)	(0,106)	(0,104)	(0,098)	(0,149)	(0,034)	(0,099)
Mexico	0,127 *	-0,087	-0,001	0,029	0,042	-0,021	0,003	0,010	0,086	-0,012	-0,033
	(0,066)	(0,094)	(0,013)	(0,083)	(0,055)	(0,026)	(0,038)	(0,028)	(0,095)	(0,014)	(0,031)
Morocco	0,045	-0,086	-0,026	-0,036	0,002	-0,008	0,018	-0,019	0,084	0,014	0,008
	(0,066)	(0,082)	(0,018)	(0,052)	(0,065)	(0,027)	(0,053)	(0,031)	(0,067)	(0,014)	(0,034)
Nigeria	-0,111	0,274 **	-0,029	-0,053	-0,163	-0,144 **	-0,064	0,060	-0,033	-0,006	-0,038
	(0,084)	(0,112)	(0,045)	(0,104)	(0,115)	(0,069)	(0,067)	(0,051)	(0,076)	(0,022)	(0,065)
Panama	0,144	0,129 *	-0,048	0,014	-0,001	-0,011	0,085	-0,083	-0,174	-0,027	-0,030
	(0,096)	(0,073)	(0,047)	(0,164)	(0,102)	(0,039)	(0,054)	(0,076)	(0,148)	(0,020)	(0,060)
Peru	0,122	0,204 **	-0,094 **	-0,192	-0,060	0,017	-0,019	-0,153	-0,144	-0,017	-0,014
	(0,109)	(0,103)	(0,042)	(0,166)	(0,115)	(0,059)	(0,064)	(0,063)	(0,132)	(0,024)	(0,072)
Poland	0,074	0,131 *	0,003	-0,044	-0,087	-0,021	0,018	0,036	0,084	-0,019	-0,104 **
	(0,094)	(0,069)	(0,017)	(0,078)	(0,061)	(0,024)	(0,039)	(0,036)	(0,052)	(0,020)	(0,045)
Russia	-0,866 ***	0,403	0,090	0,016	-0,406	-0,221	-0,200	0,006	-0,041	0,132 *	-0,123 **
	(0,322)	(0,265)	(0,108)	(0,259)	(0,298)	(0,149)	(0,173)	(0,125)	(0,210)	(0,078)	(0,238)
Venezuela	0,010	0,055	-0,030	-0,242 ***	0,076	0,025	-0,008	-0,054	-0,090	0,006	0,133 *
	(0,112)	(0,151)	(0,041)	(0,088)	(0,132)	(0,062)	(0,054)	(0,050)	(0,079)	(0,030)	(0,079)

GMM estimates of:

$$v_{it} = g_{ij} v_{jt-1} + e_{ijt}$$

where: $v_{kt} = r_{kt} - b_{ej} f_{et}^{R} - b_{wj} f_{wt}^{R} - b_{rj} f_{rt}^{R}$

(***), (**), (*) indicates coefficient significantly different from zero at the 1%, 5% and 10% level respectively

S.E. in parenthesis

Table 5
Granger Causality Tests: Three factor Model with Ratings
Estimates

Countries	Argentina		Brazil		Ecuador		Mexico		Morocco		Nigeria	
i\j	γij	γij + ζij + ξij	γij	γij + ζij + ξij	γij	γij + ζij + ξij	γij	γij + ζij + ξij	γij	γij + ζij + ξij	γij	γij + ζij + ξij
Argentina	0,072	0,204	0,061	0,191	0,004	-0,100	-0,020	0,422	0,101 **	0,411 ***	-0,035	0,242 ***
	(0,064)	(0,197)	(0,074)	(0,190)	(0,017)	(0,029)	(0,098)	(0,455)	(0,045)	(0,117)	(0,039)	(0,060)
Brazil	-0,010	-0,653 *	-0,272 *	0,013	0,025	-0,160	0,002	0,244	-0,017	-0,234 **	0,084	0,010
	(0,120)	(0,368)	(0,151)	(0,245)	(0,037)	(0,132)	(0,099)	(0,288)	(0,063)	(0,097)	(0,068)	(0,057)
Ecuador	-0,271 *	-0,752	0,526 **	-0,848	-0,106	-0,226 **	-0,066	-0,282	-0,266 **	-0,353 *	0,012	0,182 *
	(0,141)	(0,815)	(0,209)	(0,699)	(0,095)	(0,096)	(0,201)	(0,508)	(0,109)	(0,208)	(0,124)	(0,105)
Mexico	0,116	0,185 ***	-0,142	0,276 ***	0,003	-0,033	0,013	0,182	0,058	-0,025	-0,016	-0,052
	(0,078)	(0,067)	(0,103)	(0,094)	(0,015)	(0,023)	(0,086)	(0,189)	(0,066)	(0,052)	(0,029)	(0,058)
Morocco	0,061	-0,039	-0,063	-0,239	-0,031	0,014	-0,045	0,045	-0,013	0,065	-0,012	0,015
	(0,067)	(0,105)	(0,077)	(0,215)	(0,020)	(0,046)	(0,056)	(0,177)	(0,076)	(0,073)	(0,027)	(0,089)
Nigeria	-0,078	-0,281	0,350 **	-0,223	-0,051	0,149 ***	-0,054	-0,043	-0,158	-0,188	-0,126 *	-0,248 ***
	(0,094)	(0,212)	(0,121)	(0,369)	(0,047)	(0,049)	(0,118)	(0,293)	(0,127)	(0,254)	(0,075)	(0,075)
Panama	0,151	0,107	0,144 *	0,033	-0,047	-0,064	-0,042	0,533	0,030	-0,135	-0,033	0,109
	(0,108)	(0,171)	(0,073)	(0,230)	(0,051)	(0,122)	(0,174)	(0,389)	(0,118)	(0,110)	(0,039)	(0,093)
Peru	0,075	0,367	0,224 **	0,073	-0,114 ***	0,064	-0,227	0,130	-0,051	-0,097	-0,019	0,223
	(0,130)	(0,243)	(0,096)	(0,463)	(0,044)	(0,101)	(0,167)	(0,419)	(0,112)	(0,373)	(0,052)	(0,210)
Poland	0,078	0,052	0,151 **	0,000	0,002	0,004	-0,083	0,315	-0,077	-0,128	-0,018	-0,037
	(0,104)	(0,081)	(0,075)	(0,086)	(0,019)	(0,056)	(0,082)	(0,197)	(0,067)	(0,101)	(0,026)	(0,044)
Russia	-0,498 **	-4,155 ***	0,612 **	-1,531	0,011	2,420 ***	0,197	-3,244 **	-0,152	-1,450 *	-0,116	-0,838
	(0,229)	(0,652)	(0,311)	(1,565)	(0,125)	(0,650)	(0,245)	(1,486)	(0,255)	(0,752)	(0,159)	(0,531)
Venezuela	0,035	-0,160	0,194	-1,051 ***	-0,032	-0,146	-0,116	-1,787 ***	-0,054	0,759 ***	-0,034	0,541 ***
	(0,103)	(0,630)	(0,148)	(0,244)	(0,044)	(0,434)	(0,077)	(0,342)	(0,101)	(0,244)	(0,059)	(0,100)

GMM estimates of:

$$v_{it} = g_{ij} v_{jt-1} + z_{ij} v_{jt-1} \cdot DownOwn_{it-1} + x_{ij} v_{jt-1} \cdot DownOther_{it-1} + e_{ijt}$$

where $v_{kt} = r_{kt} - b_{ej} f^{R}_{et} - b_{wj} f^{R}_{wt} - b_{rj} f^{R}_{rt}$

(***), (**), (*) indicates coefficient significantly different from zero at the 1%, 5% and 10% level respectively

S.E. in parenthesis

Table 5
Granger Causality Tests: Three factor Model with Ratings
Estimates (cont.)

Countries	Panama		Peru		Poland		Russia		Venezuela	
i\j	γij	$\gamma ij + \zeta ij + \xi ij$	γij	$\gamma ij + \zeta ij + \xi ij$	γij	$\gamma ij + \zeta ij + \xi ij$	γij	$\gamma ij + \zeta ij + \xi ij$	γij	$\gamma ij + \zeta ij + \xi ij$
Argentina	-0,064	0,176	-0,071 **	0,096	-0,099	0,405 ***	-0,011	-0,063	-0,024	-0,051
	(0,050)	(0,293)	(0,033)	(0,133)	(0,077)	(0,147)	(0,011)	(0,050)	(0,039)	(0,260)
Brazil	0,058 *	0,280 ***	0,021	0,177 ***	0,007	0,364	0,038	0,017	0,062	-0,068
	(0,034)	(0,077)	(0,032)	(0,028)	(0,044)	(0,246)	(0,030)	(0,030)	(0,073)	(0,064)
Ecuador	-0,213 *	-0,044	-0,033	-0,101	-0,157	-0,672	-0,017	0,114	0,054	0,067
	(0,111)	(0,362)	(0,112)	(0,169)	(0,152)	(0,811)	(0,045)	(0,081)	(0,137)	(0,146)
Mexico	0,008	-0,050	-0,001	0,075	0,091	-0,021	-0,008	-0,020	0,007	-0,149
	(0,039)	(0,106)	(0,030)	(0,052)	(0,099)	(0,162)	(0,018)	(0,021)	(0,034)	(0,034)
Morocco	-0,016	0,418 *	-0,039	0,097	0,057	0,584 *	0,022	0,000	-0,016	0,081
	(0,044)	(0,250)	(0,035)	(0,081)	(0,066)	(0,328)	(0,018)	(0,022)	(0,036)	(0,067)
Nigeria	-0,044	-0,292	0,063	0,042	0,000	-0,655 *	-0,009	0,000	-0,110	0,175 *
	(0,071)	(0,247)	(0,057)	(0,087)	(0,072)	(0,379)	(0,030)	(0,064)	(0,080)	(0,104)
Panama	0,082	0,124	-0,094	-0,021	-0,200	0,314	-0,028	-0,023	0,012	-0,155
	(0,057)	(0,182)	(0,087)	(0,120)	(0,149)	(0,311)	(0,026)	(0,027)	(0,071)	(0,114)
Peru	0,007	-0,335	-0,119	-0,354 ***	-0,149	-0,039	-0,010	-0,033	-0,030	0,031
	(0,066)	(0,218)	(0,074)	(0,121)	(0,133)	(0,620)	(0,030)	(0,040)	(0,084)	(0,165)
Poland	0,021	-0,018	0,038	0,025	0,085	0,049	-0,027	-0,002	-0,104 *	-0,106 **
	(0,041)	(0,091)	(0,039)	(0,045)	(0,055)	(0,141)	(0,025)	(0,013)	(0,056)	(0,040)
Russia	-0,044	-2,395 ***	0,122	-0,160	0,184	-5,434 ***	-0,005	0,580 ***	-0,243	0,645
	(0,134)	(0,902)	(0,126)	(0,422)	(0,132)	(1,636)	(0,084)	(0,081)	(0,256)	(1,014)
Venezuela	0,001	-0,105	-0,010	-0,374 **	-0,077	-0,513	0,003	0,002	-0,022	0,658 ***
	(0,060)	(0,327)	(0,044)	(0,164)	(0,085)	(0,752)	(0,034)	(0,081)	(0,076)	(0,097)

Table 6
Granger Causality Tests: Three factor Model with Ratings
Wald Tests

Countries i\j	Argentina	Brazil	Ecuador	Mexico	Morocco	Nigeria	Panama	Peru	Poland	Russia	Venezuela
Argentina	11,570 ***	3,140	0,380	0,110	16,821 ***	1,213	2,044	10,909 ***	9,675 ***	6,957 **	0,402
	(0,003)	(0,208)	(0,827)	(0,946)	(0,000)	(0,545)	(0,360)	(0,004)	(0,008)	(0,031)	(0,818)
Brazil	4,107	6,157 **	0,731	1,995	0,459	2,797	4,068	0,468	2,201	9,569 ***	1,957
	(0,128)	(0,046)	(0,694)	(0,369)	(0,795)	(0,247)	(0,131)	(0,791)	(0,333)	(0,008)	(0,376)
Ecuador	6,632 **	11,272 ***	3,100	2,630	6,063 **	1,674	7,471 **	0,885	1,948	5,305	0,250
	(0,036)	(0,004)	(0,212)	(0,268)	(0,048)	(0,433)	(0,024)	(0,642)	(0,378)	(0,070)	(0,882)
Mexico	10,031 ***	9,139 **	2,129	0,931	0,998	1,116	0,283	2,094	0,899	1,085	19,923 ***
	(0,007)	(0,010)	(0,345)	(0,628)	(0,607)	(0,572)	(0,868)	(0,351)	(0,638)	(0,581)	(0,000)
Morocco	1,326	1,513	2,578	0,698	0,843	0,221	2,997	2,858	4,071	1,487	1,546
	(0,515)	(0,469)	(0,276)	(0,705)	(0,656)	(0,895)	(0,223)	(0,240)	(0,131)	(0,475)	(0,462)
Nigeria	2,914	8,304 **	10,928 ***	0,275	2,025	12,701 ***	1,715	1,422	3,010	0,996	4,232
	(0,233)	(0,016)	(0,004)	(0,872)	(0,363)	(0,002)	(0,424)	(0,491)	(0,222)	(0,951)	(0,121)
Panama	2,231	3,875	1,094	1,937	1,593	2,310	2,595	1,228	2,934	1,839	1,861
	(0,328)	(0,144)	(0,579)	(0,380)	(0,451)	(0,315)	(0,273)	(0,541)	(0,231)	(0,399)	(0,394)
Peru	3,134	5,470 *	7,046 **	2,073	0,280	1,203	2,395	12,361 ***	1,259	0,759	0,152
	(0,209)	(0,065)	(0,030)	(0,355)	(0,869)	(0,548)	(0,302)	(0,002)	(0,533)	(0,684)	(0,927)
Poland	0,701	4,033	0,250	3,252	2,702	1,094	0,296	1,045	2,672	1,289	8,957 **
	(0,704)	(0,133)	(0,988)	(0,197)	(0,259)	(0,579)	(0,862)	(0,593)	(0,263)	(0,525)	(0,011)
Russia	4,771 *	5,128 *	2,280	1,682	3,148	3,915	2,820	11,867 ***	6,754 **	0,749	4,267
	(0,092)	(0,077)	(0,320)	(0,431)	(0,207)	(0,141)	(0,244)	(0,003)	(0,034)	(0,688)	(0,118)
Venezuela	0,706	1,744	0,850	9,403 ***	1,879	2,938	0,687	0,055	0,837	0,669	0,227
	(0,703)	(0,418)	(0,654)	(0,009)	(0,391)	(0,230)	(0,709)	(0,973)	(0,658)	(0,716)	(0,893)

Wald Test of the joint hypothesis that:

$$g_{ij} = 0, x_{ij} = 0$$

in estimated equation:

$$v_{it} = g_{ij} v_{jt-1} + z_{ij} v_{jt-1} \cdot DownOwn_{it-1} + x_{ij} v_{jt-1} \cdot DownOther_{it-1} + e_{ijt}$$

where $v_{kt} = r_{kt} - b_{ej} f^{R}_{et} - b_{wj} f^{R}_{wt} - b_{rj} f^{R}_{rt}$

(***), (**), (*) indicates coefficient significantly different from zero at the 1%, 5% and 10% level respectively

p-value in parenthesis

Appendix I

Table 1

Risk premia and factor loading for diversified portfolios

Two Factor Model

World Portfolios	Common Exchange Rate Risk			Common World Market Risk		
Currency	βec=	1,000				
MSCI	βes=	0,616	***	βws=	1,000	
		(0,040)				
	πe=	-0,119	**	πw=	0,053	*
		(0,059)			(0,031)	

GMM estimates of the following system of equations:

$$r_{ct} = p_{et} + f_{et}$$

$$r_{st} = p_{st} + b_{es} f_{et}^{R} + f_{wt}$$

where: $p_{e} = E(p_{et}), p_{w} = E(p_{wt})$

(***), (**), (*) indicates coefficient significantly different from zero at the 1%, 5% and 10% level respectively

S.E. in parenthesis

Appendix I
Table 2
Factor Loadings for Bond Returns: Two Factor Model

Countries	Common Exchange Rate Risk (βej)	Common World Market Risk (βwj)	Idiosyncratic Risk Pricing (αj)
Argentina	-0,350	0,819 **	0,109
	(0,257)	(0,326)	(0,130)
Brazil	-0,327	0,364	0,162
	(0,216)	(0,297)	(0,155)
Ecuador	-0,512 **	1,046 **	0,081
	(0,261)	(0,473)	(0,264)
Mexico	-0,211	0,622 ***	0,161
	(0,140)	(0,207)	(0,108)
Morocco	-0,246	0,269	0,174
	(0,175)	(0,239)	(0,116)
Nigeria	-0,471 **	0,568	0,177
	(0,218)	(0,387)	(0,136)
Panama	-0,512 *	0,977 ***	0,238
	(0,274)	(0,283)	(0,161)
Peru	-0,288	0,983 ***	0,201
	(0,301)	(0,327)	(0,184)
Poland	-0,269	0,805 ***	0,177 **
	(0,181)	(0,195)	(0,090)
Russia	-0,087	0,417	0,241
	(0,354)	(0,850)	(0,483)
Venezuela	-0,199	0,723 ***	0,240
	(0,187)	(0,272)	(0,173)

GMM estimates of the following system of equations:

$$r_{jt} = b_{ej} f_{et}^{R} + b_{wj} f_{wt}^{R} + v_{jt}$$

where: $a_j = E(v_{jt}) = E(r_{jt} - b_{ej} f_{et}^{R} - b_{wj} f_{wt}^{R})$

(***), (**), (*) indicates coefficient significantly different from zero at the 1%, 5% and 10% level respectively

S.E. in parenthesis

Appendix I

Table 3

Granger Causality Tests: Two Factor Model

Countries i\j	Argentina	Brazil	Ecuador	Mexico	Morocco	Nigeria	Panama	Peru	Poland	Russia	Venezuela
Argentina	-0,105	-0,142 **	-0,029	-0,143	-0,109	-0,092	-0,110	-0,086 *	-0,174 *	-0,032	-0,069
	(0,079)	(0,071)	(0,038)	(0,107)	(0,106)	(0,063)	(0,079)	(0,048)	(0,105)	(0,042)	(0,108)
Brazil	-0,194	-0,254 *	-0,044	-0,220	-0,231	-0,082	-0,119	-0,096	-0,198	-0,028	-0,105
	(0,141)	(0,146)	(0,052)	(0,210)	(0,187)	(0,053)	(0,124)	(0,090)	(0,151)	(0,047)	(0,141)
Ecuador	-0,061	-0,025	-0,023	-0,034	-0,123	0,015	-0,077	-0,011	-0,114	0,031	0,055
	(0,081)	(0,070)	(0,071)	(0,121)	(0,107)	(0,084)	(0,106)	(0,086)	(0,142)	(0,056)	(0,114)
Mexico	-0,061	-0,116 *	-0,017	-0,088	-0,088	-0,066	-0,058	-0,041	-0,047	-0,021	-0,051
	(0,076)	(0,061)	(0,032)	(0,111)	(0,091)	(0,037)	(0,063)	(0,050)	(0,099)	(0,027)	(0,069)
Morocco	-0,085	-0,131 *	-0,030	-0,114	-0,112	-0,065	-0,057	-0,058	-0,060	-0,006	-0,039
	(0,087)	(0,068)	(0,042)	(0,113)	(0,108)	(0,050)	(0,078)	(0,057)	(0,103)	(0,037)	(0,094)
Nigeria	0,050	0,055	0,037	0,070	-0,002	-0,040	0,046	0,071 **	0,038	0,028	0,069
	(0,041)	(0,034)	(0,030)	(0,060)	(0,050)	(0,049)	(0,047)	(0,034)	(0,058)	(0,036)	(0,058)
Panama	-0,083	-0,116 *	-0,047	-0,120	-0,127	-0,076	-0,042	-0,095	-0,212	-0,035	-0,065
	(0,081)	(0,068)	(0,051)	(0,121)	(0,096)	(0,054)	(0,089)	(0,069)	(0,133)	(0,034)	(0,080)
Peru	0,024	-0,019	-0,017	-0,037	-0,042	0,012	0,012	-0,057	-0,088	0,004	0,034
	(0,112)	(0,110)	(0,063)	(0,142)	(0,143)	(0,093)	(0,102)	(0,070)	(0,153)	(0,046)	(0,118)
Poland	-0,039	-0,048	-0,010	-0,069	-0,084 **	-0,046	-0,030	-0,013	-0,013	-0,020	-0,064
	(0,042)	(0,032)	(0,020)	(0,051)	(0,034)	(0,028)	(0,043)	(0,031)	(0,058)	(0,022)	(0,042)
Russia	0,171	0,243	0,224 *	0,379 *	0,144	0,075	0,219	0,204	0,267 *	0,197 *	0,268
	(0,159)	(0,167)	(0,125)	(0,196)	(0,184)	(0,166)	(0,169)	(0,124)	(0,148)	(0,115)	(0,267)
Venezuela	0,067	0,016	0,040	0,024	0,053	0,056	0,070	0,023	0,001	0,036	0,137
	(0,092)	(0,084)	(0,059)	(0,101)	(0,136)	(0,091)	(0,091)	(0,057)	(0,105)	(0,056)	(0,127)

GMM estimates of:

$$v_{it} = g_{ij} v_{j\,t-1} + e_{ijt}$$

where $v_{kt} = r_{kt} - b_{ek} f_{et}^{R} - b_{wk} f_{wt}^{R}$

(***), (**), (*) indicates coefficient significantly different from zero at the 1%, 5% and 10% level respectively

S.E. in parenthesis

Appendix I

Table 4

Granger Causality Tests: Two factor Model with Ratings

Estimates

Countries	Argentina		Brazil		Ecuador		Mexico		Morocco		Nigeria	
i\j	γij	γij + ζij + ξij	γij	γij + ζij + ξij	γij	γij + ζij + ξij	γij	γij + ζij + ξij	γij	γij + ζij + ξij	γij	γij + ζij + ξij
Argentina	-0,149 *	0,157	-0,189 ***	0,131	-0,053	-0,109 **	-0,160	0,027	-0,206 **	0,352	-0,146 **	0,142
	(0,085)	(0,163)	(0,066)	(0,151)	(0,037)	(0,047)	(0,117)	(0,360)	(0,103)	(0,245)	(0,068)	(0,154)
Brazil	-0,255	-0,013	-0,323 **	-0,031	-0,079	0,151 **	-0,249	-0,341	-0,349	0,148 ***	-0,134 ***	0,084
	(0,160)	(0,103)	(0,148)	(0,055)	(0,057)	(0,070)	(0,233)	(0,278)	(0,213)	(0,043)	(0,052)	(0,109)
Ecuador	-0,114	0,249	-0,066	0,254	-0,062	0,102	-0,060	0,192	-0,237 ***	0,229 ***	-0,054	0,138
	(0,082)	(0,154)	(0,073)	(0,155)	(0,070)	(0,112)	(0,127)	(0,283)	(0,085)	(0,078)	(0,086)	(0,099)
Mexico	-0,089	0,074	-0,155 ***	0,079	-0,035	0,068 **	-0,100	0,006	-0,146	0,100 *	-0,093 **	0,027
	(0,091)	(0,046)	(0,059)	(0,051)	(0,036)	(0,034)	(0,124)	(0,066)	(0,105)	(0,054)	(0,044)	(0,047)
Morocco	-0,107	0,024	-0,159 **	0,015	-0,054	0,086 *	-0,120	-0,065	-0,183	0,122 ***	-0,098 *	0,051
	(0,101)	(0,087)	(0,070)	(0,060)	(0,045)	(0,051)	(0,125)	(0,191)	(0,118)	(0,040)	(0,046)	(0,104)
Nigeria	0,055	0,026	0,056	0,052	0,015	0,139 **	0,079	-0,001	-0,029	0,089	-0,042	-0,034
	(0,046)	(0,102)	(0,037)	(0,099)	(0,030)	(0,067)	(0,066)	(0,182)	(0,055)	(0,113)	(0,054)	(0,104)
Panama	-0,107	0,032	-0,144 **	0,029	-0,068	0,056	-0,136	0,003	-0,186	0,068	-0,122 **	0,080
	(0,094)	(0,062)	(0,072)	(0,064)	(0,057)	(0,041)	(0,134)	(0,099)	(0,107)	(0,055)	(0,059)	(0,050)
Peru	-0,074	0,502 ***	-0,104	0,416 ***	-0,081	0,289 ***	-0,126	0,660 ***	-0,173	0,385 ***	-0,083	0,338 ***
	(0,102)	(0,098)	(0,095)	(0,073)	(0,052)	(0,067)	(0,130)	(0,140)	(0,122)	(0,075)	(0,078)	(0,090)
Poland	-0,043	-0,020	-0,054	-0,019	-0,017	0,024	-0,071	-0,053	-0,110 ***	-0,002	-0,056 **	-0,013
	(0,051)	(0,037)	(0,036)	(0,037)	(0,023)	(0,024)	(0,057)	(0,061)	(0,040)	(0,033)	(0,033)	(0,032)
Russia	-0,019	1,095 *	0,044	1,309 ***	0,064	1,253 ***	0,152	2,196 **	-0,084	0,950 **	-0,045	0,580
	(0,087)	(0,634)	(0,090)	(0,378)	(0,076)	(0,249)	(0,113)	(0,904)	(0,104)	(0,374)	(0,098)	(0,552)
Venezuela	-0,043	0,726 ***	-0,077	0,528 ***	-0,026	0,482	-0,061	0,815 ***	-0,134 *	0,701 ***	-0,073	0,561 ***
	(0,065)	(0,105)	(0,055)	(0,092)	(0,043)	(0,070)	(0,083)	(0,250)	(0,077)	(0,095)	(0,050)	(0,092)

GMM estimates of:

$$v_{it} = g_{ij} v_{jt-1} + z_{ij} v_{jt-1} \cdot DownOwn_{it-1} + x_{ij} v_{jt-1} \cdot DownOther_{it-1} + e_{ijt}$$

where $v_{kt} = r_{kt} - b_{ek} f_{et}^{R} - b_{wk} f_{wt}^{R}$

(***), (**), (*) indicates coefficient significantly different from zero at the 1%, 5% and 10% level respectively

S.E. in parenthesis

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Table 4

Granger Causality Tests: Two factor Model with Ratings

Estimates (cont.)

Countries	Panama		Peru		Poland		Russia		Venezuela	
i\j	γ_{ij}	$\gamma_{ij} + \zeta_{j} + \xi_{j}$	γ_{ij}	$\gamma_{ij} + \zeta_{j} + \xi_{j}$	γ_{ij}	$\gamma_{ij} + \zeta_{j} + \xi_{j}$	γ_{ij}	$\gamma_{ij} + \zeta_{j} + \xi_{j}$	γ_{ij}	$\gamma_{ij} + \zeta_{j} + \xi_{j}$
Argentina	-0,147 *	0,033	-0,117 **	-0,105	-0,203 *	-0,277	-0,079 **	-0,042	-0,210 *	0,095
	(0,081)	(0,343)	(0,046)	(0,216)	(0,111)	(0,319)	(0,037)	(0,041)	(0,111)	(0,180)
Brazil	-0,165	0,184 **	-0,129	0,369 ***	-0,226	0,166	-0,083 **	0,094	-0,273 *	0,223 *
	(0,134)	(0,076)	(0,098)	(0,078)	(0,162)	(0,161)	(0,042)	(0,088)	(0,157)	(0,134)
Ecuador	-0,135	0,640 **	-0,052	0,526 ***	-0,157	0,290	-0,052	0,020	-0,077	0,312 ***
	(0,102)	(0,282)	(0,085)	(0,094)	(0,139)	(0,286)	(0,046)	(0,079)	(0,096)	(0,114)
Mexico	-0,077	0,111 *	-0,059	0,084	-0,051	0,000	-0,054 *	0,023	-0,133 *	0,098 ***
	(0,070)	(0,064)	(0,055)	(0,051)	(0,106)	(0,085)	(0,028)	(0,024)	(0,079)	(0,029)
Morocco	-0,093	0,250 ***	-0,078	0,085	-0,077	0,192	-0,036	0,036	-0,156 *	0,175 ***
	(0,081)	(0,076)	(0,062)	(0,058)	(0,108)	(0,157)	(0,033)	(0,055)	(0,091)	(0,057)
Nigeria	0,043	0,077	0,069 *	0,090	0,055	-0,202	0,020	0,038	-0,005	0,204 ***
	(0,050)	(0,159)	(0,036)	(0,090)	(0,057)	(0,255)	(0,030)	(0,072)	(0,054)	(0,066)
Panama	-0,063	0,134	-0,110	0,013	-0,230 *	0,042	-0,078 **	0,022	-0,159	0,105 ***
	(0,097)	(0,081)	(0,076)	(0,052)	(0,139)	(0,122)	(0,035)	(0,031)	(0,097)	(0,036)
Peru	-0,057	0,617 ***	-0,093	0,205 **	-0,163	0,973 ***	-0,046	0,072	-0,135	0,343 ***
	(0,092)	(0,161)	(0,068)	(0,091)	(0,136)	(0,295)	(0,045)	(0,046)	(0,119)	(0,056)
Poland	-0,032	-0,009	-0,014	-0,005	-0,006	-0,116 *	-0,044 *	0,012	-0,117 ***	0,033
	(0,047)	(0,046)	(0,035)	(0,020)	(0,061)	(0,068)	(0,024)	(0,019)	(0,045)	(0,023)
Russia	0,051	1,957 ***	0,086	1,591 ***	0,143	2,411 **	0,018	0,532 **	-0,082	1,008 **
	(0,106)	(0,726)	(0,077)	(0,310)	(0,104)	(1,062)	(0,057)	(0,095)	(0,155)	(0,455)
Venezuela	-0,036	1,139 ***	-0,037	0,593 ***	-0,100	1,616 ***	-0,026	0,129 *	-0,097	0,595
	(0,065)	(0,188)	(0,050)	(0,125)	(0,085)	(0,252)	(0,036)	(0,078)	(0,066)	(0,050)

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Table 5

Granger Causality Tests: Two factor Model with Ratings

Wald Tests

Countries i\j	Argentina	Brazil	Ecuador	Mexico	Morocco	Nigeria	Panama	Peru	Poland	Russia	Venezuela
Argentina	(11,299) ***	(14,053) ***	(22,314) ***	(1,873)	(13,868) ***	(7,029) **	(9,533) ***	(9,735) ***	(10,744) ***	(4,804) *	(25,508)
	0,004	0,001	0,000	0,392	0,001	0,030	0,009	0,008	0,005	0,091	0,000
Brazil	(5,404) *	(9,148) **	(3,582)	(4,156)	(4,166)	(8,294) **	(5,631) *	(1,927)	(2,925)	(4,017)	(5,109) *
	0,067	0,010	0,167	0,125	0,125	0,016	0,060	0,382	0,232	0,134	0,078
Ecuador	(1,929)	(0,816)	(1,943)	(0,259)	(8,170) **	(1,530)	(1,796)	(1,075)	(1,986)	(15,416) ***	(1,596)
	0,381	0,665	0,378	0,879	0,017	0,465	0,407	0,584	0,371	0,000	0,450
Mexico	3,386	8,688 **	4,632	0,654	5,062 *	5,078 *	3,971	3,764	0,234	4,899 *	0,935 ***
	(0,184)	(0,013)	(0,099) *	(0,721)	(0,080)	(0,079)	(0,137)	(0,152)	(0,889)	(0,086)	(0,334)
Morocco	1,253	5,195 **	4,468	1,032	11,788 ***	4,859 *	12,199 ***	4,056	2,489	1,525	12,846 ***
	(0,535)	(0,074)	(0,107)	(0,597)	(0,003)	(0,088)	(0,002)	(0,132)	(0,288)	(0,466)	(0,002)
Nigeria	1,514	2,694	4,656 *	1,451	0,868	0,706	0,985	4,509	1,570	0,766	9,583 ***
	(0,469)	(0,260)	(0,097)	(0,484)	(0,648)	(0,702)	(0,611)	(0,105)	(0,456)	(0,682)	(0,008)
Panama	1,621	4,386	3,457	1,030	4,954 *	8,169 **	3,010	2,126	3,123	5,330 *	11,179 ***
	(0,445)	(0,112)	(0,178)	(0,597)	(0,084)	(0,017)	(0,222)	(0,345)	(0,210)	(0,070)	(0,004)
Peru	27,647 ***	35,998 ***	23,664 ***	23,774 ***	29,847 ***	16,326 ***	15,624 ***	6,976 **	12,780 ***	3,470	39,332 ***
	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,031)	(0,002)	(0,176)	(0,000)
Poland	1,093	2,552	1,477	2,507	7,691 **	2,853	0,507	0,232	2,871	3,860	9,244 **
	(0,579)	(0,279)	(0,478)	(0,286)	(0,021)	(0,240)	(0,776)	(0,891)	(0,238)	(0,145)	(0,010)
Russia	1,304	2,412	1,727	5,049 *	1,245	0,288	0,304	3,538	2,002	0,275	0,310
	(0,521)	(0,299)	(0,422)	(0,080)	(0,537)	(0,866)	(0,859)	(0,171)	(0,367)	(0,872)	(0,857)
Venezuela	5,301 *	9,699 **	1,048	2,970	12,455 ***	2,117	3,043	16,149 ***	2,306	1,251	7,465 **
	(0,071)	(0,008)	(0,592)	(0,226)	(0,002)	(0,347)	(0,218)	(0,000)	(0,316)	(0,535)	(0,024)

Wald Test of the joint hypothesis that:

$$g_{ij} = 0, x_{ij} = 0$$

in estimated equation:

$$v_{it} = g_{ij} v_{jt-1} + z_{ij} v_{jt-1} \cdot DownOwn_{it-1} + x_{ij} v_{jt-1} \cdot DownOther_{it-1} + e_{ijt}$$

where $v_{kt} = r_{kt} - b_{ek} f_{et}^{R} - b_{wk} f_{wt}^{R}$

(***), (**), (*) indicates coefficient significantly different from zero at the 1%, 5% and 10% level respectively

p-value in parenthesis