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# Emerging markets' spreads and global financial conditions

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**Abstract**

In this article, we analyze how much of the reduction in emerging markets' spreads can be ascribed to specific factors—linked to the improvement in a given country's fundamentals, rather than to common factors—linked to global liquidity conditions and agents' risk aversion. By means of factor analysis, we find that a single common factor is able to explain a large part of the co-variation in emerging market economies' (EMEs) spreads observed in the last 4 years; in turn, this common factor can be traced back mainly to financial market volatility. Due to the particularly benign global financial conditions of recent years, spreads seem to have declined to below the levels warranted by improved fundamentals. As a consequence, EMEs do remain vulnerable to sudden shifts in financial market conditions.


*JEL classification:* C10; C22; F34; G15

*Keywords:* Emerging markets; Spreads; Factor analysis

> "(. . .) *Narrow credit spreads, like other financial market prices, may partly reflect the low overall level of volatility in financial asset prices in recent years. Any increase in actual or expected market volatility could thus lead to wider spreads by raising the risk premia demanded by investors* (. . .)"[1]

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## 1. Introduction

Spreads between foreign-currency denominated bonds issued by emerging market economies (EMEs) and equivalent bonds issued by advanced countries have been declining over the last 4 years, reaching the lowest levels since the onset of the Asian banking and financial crisis in 1997. Two sets of motivations have been considered to be at the root of the phenomenon under scrutiny, i.e. the favorable conditions in global financial markets, or 'pull' factors, and the improvement in EMEs' macroeconomic 'fundamentals', or 'push' factors. In this article, we seek to analyze how much of the observed reduction in EMEs' spreads can be ascribed to the former or to the latter. Finding an answer to this question is relevant not only from a research perspective *per se* but also, and above all, from a policy standpoint. In fact, if the observed compression were attributed essentially to the improvement in macroeconomic 'fundamentals', it could be regarded – in some sense – as structural and permanent, therefore implying a generalized lower probability of default throughout the EMEs. Alternatively, if this reduction were determined essentially by the favorable conditions in global capital markets, swift and unexpected variations in these conditions – such as an abrupt increase in international investors' risk aversion – could seriously endanger the seemingly higher creditworthiness of EMEs.

In the literature, global factors are often proxied by a large set of variables, individually or jointly assessed in different econometric specifications. We refer specifically to the level of short- and long-term interest rates in advanced economies (mainly the US), as a measure of global liquidity conditions (Eichengreen and Mody, 1998a, 1998b; Kamin and Kleist, 1999; Arora and Cerisola, 2001; Ferrucci, 2003; Garcia-Herrero and Ortiz, 2005; Rozada and Levy Yeyati, 2005; Hoggarth and Yang, 2006); their volatility, as a measure of the uncertainty surrounding the path of monetary policy in advanced economies (Arora and Cerisola, 2001; Culha et al., 2006); the yield spread between low- and high-rated corporate bonds or US long-term Treasury bonds, as a measure of international investors' appetite for risk (Ferrucci, 2003; Garcia-Herrero and Ortiz, 2005; Rozada and Levy Yeyati, 2005; Culha et al., 2006); the US stock market index, as a measure of a general market risk (Ferrucci, 2003) and the OECD leading indicator of economic activity, as a measure of growth prospects in advanced economies (Garcia-Herrero and Ortiz, 2005). The overall conclusion is that these global factors do represent economically and statistically significant explanatory variables for the dynamics of EMEs' spreads.

Moving from this result, our approach improves upon the existing literature in that we use factor analysis to find out the common force that drives the co-movement of EMEs' spreads: by doing so, we think we are able to capture more information rather than appealing simply to one – or more – of the variables previously mentioned. The common factor, in fact, could ideally be thought of as a summary measure for the above variables, as well as for other less measurable events such as excess co-movement and episodes of contagion. In order to implement this general idea, we draw largely on McGuire and Schrijvers (2003), who were the first – to our knowledge – to try to link the common factor to the conditions present in global capital markets. We extend their approach in two important directions: on the one side, by giving a more robust analysis of the variables that might explain the common factor; on the other side, by using the latter as an explicit determinant of EMEs' spreads.

With regard to the first level of analysis, implementing factor analysis to a sample of EMEs' sovereign spreads reveals that a single common factor is significant in explaining the co-variation (correlation) between spreads for the whole estimation period (January 1998–December 2006). More importantly, this single common factor can be traced back to the developments in international financial market conditions: in fact, by means of the Phillips and Hansen procedure (1990), we are able to estimate a long-run relationship between the common factor, the volatility in mature stock markets (which should capture international investors' degree of risk aversion) and an index for commodity prices.

As regards the second level of analysis, a set of idiosyncratic macroeconomic 'fundamentals' – measuring the burden of public and external indebtedness, the resources allocated to their service, the ability to generate foreign-currency revenues, the domestic monetary and financial conditions – act as significant 'pull' determinants of EMEs' spreads, largely confirming the results obtained by the empirical literature reported above. The single common factor – used here to summarise the effects stemming from global financial market conditions – turns out to play a very significant role as a 'push' factor for both the long-run equilibrium relationship and the short-run dynamics of EMEs' spreads. Moreover, the comparison between the actual spread series and the series estimated by resorting only to the idiosyncratic factors seems to suggest that financial markets have gone 'too far' in their evaluation of EMEs' creditworthiness: in fact, the former series are always significantly lower than the latter. Finally, it is shown how a shock to financial market volatility and agents' degree of risk aversion can determine – through its impact on the common factor – a significant widening in EMEs' spreads.

The main policy conclusion that can be derived from this analysis is that although the accomplishment of suitable macroeconomic policies, along with the resulting improvement in 'fundamentals', has had positive effects on the reduction of the yield differentials, EMEs do remain vulnerable to sudden shifts in global financial conditions, especially if these shifts take the form of rises in market volatility and agents' degree of risk aversion.

The paper is organized as follows: Section 2 reports the stylized facts on EMEs' sovereign spreads observed over the period 1998–2006, along with possible explanations and causes; Section 3 presents the quantitative results based on factor analysis technique, while Section 4 shows how it is possible to link the common factor to a small sample of financial variables. Taking stock of these results, Section 5 deals with the determinants of EMEs' spreads; Section 6 concludes.

## 2. Tendencies in EMEs' spreads

During the last four years, EMEs' yield differentials have followed a declining trend. By January 2007, the spread implicit in the EMBI Global index was 170 b.p. (724 b.p. by end-2002),[2] a level last observed before the onset of the Asian financial crisis in 1997 (the record low was 174 b.p.). Moreover, this compression has been common to all the emerging areas and seems to be still under way. Two sets of causes are reported to be at the roots of the phenomenon under scrutiny. The first one relates to the favorable conditions in global financial markets, characterized by both low long-term interest rates – a result of the loose monetary policy implemented by the Federal Reserve for most of our sample period – and low volatility in advance economies' stock markets, as measured by the VIX index.[3] The abundant liquidity in international financial markets, along with a reduced degree of risk aversion, have been responsible for a strong 'search for yield', which has led to a significant increase in the global demand for EMEs' assets. The second order of reasons

[2] The EMBI Global index, produced by JP Morgan-Chase, tracks total returns for US dollar-denominated debt instruments issued by emerging market sovereign and quasi-sovereign entities, such as Brady bonds, loans, Eurobonds. Currently, the EMBI Global covers 191 instruments across 32 countries.

[3] The VIX index is the Chicago Board Options Exchange Volatility index and is a market estimate of future volatility; it is calculated as a weighted average of the implied volatilities of eight put and call options written on the S&P 500 index. The VIX index is considered a good measure of international investors' risk appetite.

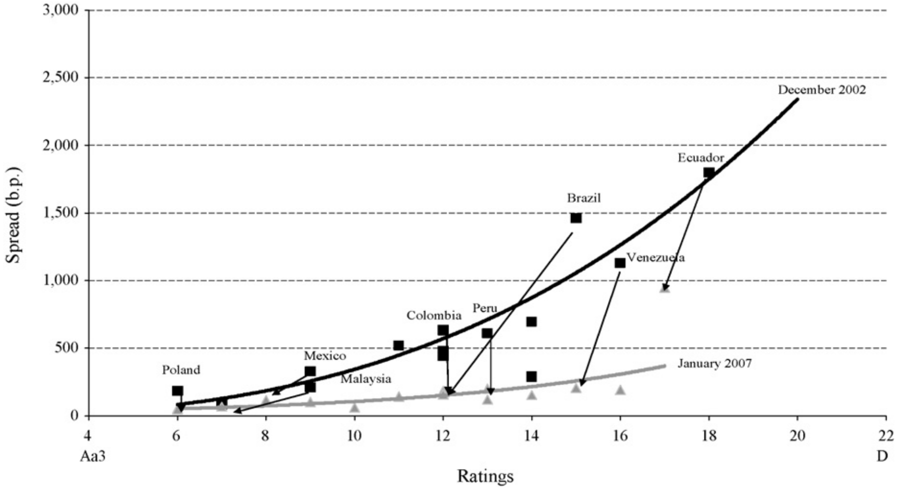


Fig. 1. Rating on long-term foreign-currency debt and sovereign spreads. *Note*: Moody's ratings have been given a numerical value from 1 (Aaa) to 22 (Default). The countries considered in the sample are: Argentina, Brazil, Bulgaria, China, Colombia, Ecuador, Hungary, Indonesia, Malaysia, Mexico, Panama, Peru, Philippines, Poland, Russia, Thailand, Turkey and Venezuela. The 'investment' grade corresponds to a rating equal to, or better than, Baa3 (to a numerical score equal to, or lower than, 10 in the numerical scale).

can be traced back to the improvement in EMEs' macroeconomic 'fundamentals' observed over the last 4 years, especially the widespread reduction in the weight of foreign indebtedness and the improved ability to generate the foreign currency required to service it. The clear improvement in macroeconomic 'fundamentals' has been translated into a lower probability of default and, consequently, into a more favorable evaluation of creditworthiness: as a consequence, between 2002 and 2006, many EMEs were upgraded by specialized rating agencies.

The combined effect of both the push and pull factors mentioned above can be observed in Fig. 1, which displays spread-rating pair, for each country in the sample, recorded in 2002 and by end-2006; the two curves are tendency lines that minimize the mean square error.[4]

First of all, it is easy to see how the sample observations shifted towards the lower left-hand side of the scatter plot, confirming that EMEs have witnessed a series of rating upgrades alongside a contemporaneous compression in sovereign spreads. Most importantly, the graph also shows that the tendency curve underwent a downward shift between December 2002 and January 2007: this suggests that international investors' degree of risk aversion may have declined during the last four years, and that this phenomenon may have contributed to a further compression of sovereign spreads beyond that granted by rating improvements. External conditions, rather than those specific to any given country, could have accounted for the fall in agents' risk aversion: in fact, for a given set of 'fundamentals' – and, therefore, for a given rating – by end-2006 international capital markets were demanding a lower risk premium than that required by end-2002.[5]

[4] These two dates have been chosen to capture, on the one side, the moment in which sovereign spreads reached a local maximum and, on the other, the most recent situation, resulting from the prolonged contraction of sovereign spreads.

[5] The case of Colombia is illustrative: against a rating that remained unchanged at Ba2 during the sample period, the yield differential between Colombian sovereign bonds and US Treasuries decreased from 633 to 164 b.p.

## 3. Factor analysis

Factor analysis is a statistical technique that provides a parsimonious explanation of the observed variation and co-variation (or correlation) of a set of phenomena detected amongst a given set of sample elements (Tucker and MacCallum, 1997). Central to factor analysis is the postulate that there exist unobservable 'latent variables': *common*, which contemporaneously affect more than one of the observed phenomena; and *specific*, which influence only one of them. Factor analysis, therefore, postulates that the variation of a given phenomenon, recorded for an *i*th element of the sample, will be due in part to the influence of the common factors, the so-called *communality*, and in part to the influence of the specific factors, the so-called *uniqueness*; the co-variation (or correlation) recorded among the *n* elements of the sample, instead, will be due exclusively to the influence of common factors.

In our particular case, the phenomena under scrutiny are the series of the monthly (log) levels of sovereign spreads,[6] while the sample elements are given by the emerging economies for which such spreads were available from January 1998 to December 2006.[7] We execute both the Phillips-Perron (PP) and the Augmented Dickey-Fuller (ADF) tests on the log-levels of these series, which turn out to be I(1).[8]

The first step in factor analysis technique is to come up with an estimate of the number of factors by calculating the eigenvalues associated with the correlation matrix.[9] There are different methods that can be used in order to perform this task: we have chosen the 'principal factor' (also referred to as 'principal axis factoring').[10] This approach starts with a preliminary estimate of the communalities, which are then entered into the diagonal of the correlation matrix before factors are extracted. Among the different possible estimates of the initial communalities, we use the $R^2$ from a multiple regression of a variable onto all the others. In order to chose the number of underlying factors – since by construction there would be as many eigenvalues as variables in the sample – the most common approach requires to generate a scree-plot, i.e. a two-dimensional graph with factors on the *x*-axis and eigenvalues on the *y*-axis,[11] and then to take the number of factors corresponding to the last eigenvalue before they start to level-off. The obtained scree-plot, not reported here for the sake of brevity, suggests the existence of a single significant factor underlying the co-variation (correlation) in EMEs' sovereign spreads. A complementary method is to look at the percentage of the explained variance, by keeping as many factors as are required to explain a pre-determined share of the total variance of the spread series. There is no general consensus about the ex ante 'optimal' amount of variance that should be explained in order to

[6] The choice of monthly data is based on two orders of motives: on the one side, it is based on a desire to circumvent problems with day-of-the-week, as well as time zone, problems; on the other side it is based on the need to reach a coherency between the time frequencies of the series of spreads with those of the macroeconomic variables used in the following econometric specifications. The choice of log-levels is coherent with the approach generally followed by the empirical literature on the subject.

[7] The sample comprises the following countries: Brazil, Bulgaria, China, Colombia, Ecuador, Malaysia, Mexico, Panama, Peru, Poland, Philippines, Russia, Turkey and Venezuela.

[8] Factor analysis is generally based on a finite variance–covariance matrix, which is not the case when the data are I(1). However, assuming that the nonstationarity of the series comes from the fact that the common factors as well have a unit root, standard techniques have been applied (Dufrenot and Yehoue, 2005).

[9] Eigenvalues can indeed be interpreted as the standardized variance associated with a particular factor.

[10] Other extraction methods are: principal component, iterated principal factor, maximum likelihood, alpha factoring, image factoring, un-weighted least squares and generalized least squares.

[11] "Scree" is the rubble on the slope or at the bottom of the mountain.

Table 1
Results of factor analysis (monthly observations; 1998–2006)

| Country | Factor loading | Uniqueness | Communality |
|---|---|---|---|
| Brazil | 0.90 | 0.19 | 0.81 |
| Bulgaria | 0.93 | 0.13 | 0.87 |
| China | 0.80 | 0.36 | 0.64 |
| Colombia | 0.90 | 0.19 | 0.81 |
| Ecuador | 0.79 | 0.37 | 0.63 |
| Malaysia | 0.90 | 0.19 | 0.81 |
| Mexico | 0.95 | 0.11 | 0.89 |
| Panama | 0.95 | 0.09 | 0.91 |
| Peru | 0.96 | 0.08 | 0.92 |
| Philippines | 0.71 | 0.50 | 0.50 |
| Poland | 0.91 | 0.17 | 0.83 |
| Russia | 0.91 | 0.18 | 0.82 |
| Turkey | 0.88 | 0.23 | 0.77 |
| Venezuela | 0.92 | 0.15 | 0.85 |
| Average | 0.89 | 0.21 | 0.79 |

make a factor 'significant'; this problem, however, is easily overcome in our case since the first common factor alone explains almost 85% of the variance in the underlying monthly spread series, thus confirming the results obtained by the graphical analysis of the scree-plot. All these considerations lead us to conclude that, over the whole period under scrutiny, there is only a single common factor that is able to explain a significant percentage of the correlation in the underlying spreads.[12]

Once the number of significant common factors has been decided, factor analysis provides: (a) numerical coefficients of the factor loadings, i.e. the partial correlation of a given spread series with the common factor; (b) a measure of the communality, i.e. the percentage of the recorded variance in each phenomenon accounted for by the common factor; and (c) a measure of the uniqueness, i.e. the percentage of the recorded variance in each phenomenon accounted for by idiosyncratic factors. Table 1, which displays all these elements, clearly shows that for the whole period January 1998–December 2006 the weight of the common factor has been indeed quite high for all the countries in the sample.[13]

## 4. The common factor

Following our previous reasoning, the common factor – despite not having a precise economic meaning – can be considered a determinant of the variability of EMEs' sovereign spreads that

[12] We have also used two other methods of factor extraction, i.e. the iterated principal factor and the maximum likelihood, which have confirmed the conclusion in the text regarding the existence of a single significant common factor. These results are available from the authors upon request.

[13] The only exception is Argentina. The results of factor analysis technique applied on a sample containing also this country (available from the authors upon request) show that the factor loading is negative (−0.23) and that the Argentine uniqueness is much greater than its communality (95% vs. 5%). This conclusion obviously signals that the behavior of the Argentine spread has been primarily determined by the evolution of its macroeconomic fundamentals rather than by variations in international capital markets; and it is not difficult to understand why it should be the case, given the macroeconomic evolution that lead and lagged the crisis in 2001.

is not directly linked to the specific macroeconomic characteristics of any given country but rather to the developments in the international economic and financial system. In order to give an immediate intuition regarding the above statement, we calculate the correlation coefficient between the common factor and a set of variables that reflect global financial conditions. To our knowledge, there is no established theory that supports the choice of the listed financial variables: we just rely on intuition and on experience drawn from both the academic literature and market participants' views in order to select the indicators that are expected to exert a significant influence on the dynamics of EMEs' spreads. The variables are, in fact, those reported in Section 1: the level of short- and long-term interest rates in advanced economies as a measure of global liquidity conditions; the slope of the yield curve as a measure of growth prospects in the US; the VIX index as a measure of international investors' appetite for risk; and the stock market indices as a measure of a general market risk. Since many indebted EMEs are commodity exporters, we add two indices developed by Bloomberg, the first tracking the price of a basket of commodities and the second the evolution of oil prices. The results, not reported here for the sake of brevity, suggest that the common factor is statistically correlated with some of the variables reported and, for this reason, can indeed be interpreted as a summary measure of the effects that global economic and financial conditions have on the observed variation in EMEs' spreads. Very interesting patterns of influence have been found out. First of all, the correlation between EMEs' monthly spreads and the US long-term yield is statistically different from zero, indicating that variations in US long-term interest rates can have, through the common factor, a significant effect on spreads. This result should be taken with a pinch of salt, especially considering the rather inconclusive literature on the relationship between US monetary policy and developing countries' spreads (Dooley et al., 1996; Kamin and Kleist, 1999; Eichengreen and Mody, 1998a; Arora and Cerisola, 2001; McGuire and Schrijvers, 2003).[14] The result that, in our opinion, is the most interesting of all is the strong positive correlation between the common factor and the VIX index, that effectively measures the expectations of international investors about the future volatility of US stock markets. Rises in the expected volatility induce agents to liquidate their positions in risky assets in favor of more secure ones (i.e. the 'flight to quality'). Risk aversion can also explain the negative correlation between spreads and stock market indexes, as highlighted in the empirical literature reported in Section 1.

These conclusions are obtained by looking at simple pair-wise correlations; a more comprehensive and thorough analysis of the common factor should resort to an explicit econometric procedure. We address the issue in the rest of this section.

Given that the series appear to be non-stationary, we first execute the PP and ADF tests for unit root on the log-levels of the common factor along with the mentioned financial variables: these tests show that all of the series are I(1) regardless of both the type of the test and the specification of the deterministic component. We then test for the existence of a cointegrating relationship that links the variables under study.

The underlying econometric model is given by the following long-run relationship:

$$y_t = \alpha + \beta^{\mathrm{T}} x_t + \varepsilon_t \tag{1}$$

[14] Contrary to what is suggested by McGuire and Schrijvers (2003), we do not find out a negative relationship between EMEs' spreads and the slope of the US yield curve. This inverse relationship may stem from its informational content, since it has always been used as a proxy for expected economic growth. An upward-sloping yield curve is normally associated with positive growth prospects for the US, bringing about favorable fallouts for the emerging economies, especially the export-dependent.

Table 2
Common factor: long-run regressions (dependent variable: common factor; estimation period 1998–2006; monthly data)

| Regressor | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Constant | −4.20 (−1.08) | −1.42 (−0.30) | 2.05 (0.85) | 1.88 (0.98) |
| VIX index | 1.79 (6.59) | 1.67 (5.56) | 1.53 (5.43) | 1.61 (6.02) |
| Commodities | −1.17 (−5.20) | −1.19 −(4.41) | −1.32 (−4.76) | −1.30 (−5.53) |
| S&P500 | 0.68 (1.83) | | | |
| FTSE | | 0.30 (0.81) | | |
| US10 year yield | | | 0.35 (0.40) | |

*Note*: *t*-Statistics in parentheses; the FM-OLS estimates have been calculated using Bartlett weights with truncation lag $k = 6$; we have also performed the same estimation procedure with different lag structures (i.e. with $k = 1$ and 12), obtaining very similar results.

where $y_t$ is an I(1) variable—the common factor in our case, and $x_t$ is a $k \times 1$ vector of I(1) regressors – the financial variables – that might be potentially endogenous. For the single equation approach, we resort to the fully modified OLS (FM-OLS) procedure proposed by Phillips and Hansen (1990) to estimate Eq. (1) after testing for the existence of cointegration: the Phillips–Hansen procedure, in fact, overcomes most of the problems that might arise in a simple OLS framework.[15]

The estimation results clearly show that the VIX index is strongly significant, and with the expected sign, in explaining the common factor: an increase in the volatility of financial markets leads to an increase in the common factor – and hence in EMEs' spreads – since investors become more risk averse and look for more secure assets. Moreover, EMEs' spreads are negatively correlated with the indices used to measure price developments in the markets for commodities. Most EMEs are open – and export-dependent – economies, so that favorable price developments in the commodity markets are accompanied by higher foreign-currency revenues, strengthened ability to repay debt obligations towards international investors and reduced price of risk required by the latter to hold EMEs' assets. As regards the coefficient of the US10 year yield, though positive, it is not statistically different from zero once controlling for the VIX and the commodity index (Kamin and Kleist, 1999). This result suggests that the ample liquidity conditions of the last four years – proxied by the low levels of long-term bond yields in the US – have been accompanied by a compression of EMEs' spreads only because global capital markets have been characterized, during the same time span, by a very low level of risk aversion.[16] Similarly, stock market indexes cease to be significant regressors. Financial market volatility, therefore, seems more closely related to the common factor and the main determinant of the observed co-movement (correlation) in EMEs' spreads.

Our preferred specification is therefore contained in column 4 of Table 2: the variables $\text{VIX}_t$ and $\text{commodities}_t$ can be thought of as capturing the long-run or permanent components of the common factor, while $\varepsilon_t$ represents the deviations from the long-run equilibrium ($\text{ECM}_t$). Both short- and long-run dynamics can be combined into an error-correction model, which results

[15] The classic assumptions are violated in our case for the following reasons: (a) financial variables might be endogenous with respect to the factor, i.e. simultaneously determined; (b) because all the listed variables have unit roots, the asymptotic distribution of their estimators is no longer Gaussian; and (c) the residuals in the equation might be serially correlated.

[16] Arora and Cerisola (2001) show that once the volatility of financial markets is controlled for in a regression of EMEs' spreads on a given set of potential explanatory variables, the US long-term bond yields cease to be a statistically significant regressor.

Table 3
Common factor: short-run dynamics and error correction (dependent variable: Δcommon factor; estimation period 1998–2006; monthly data)

| Regressor | Coefficient | S.E. | *t*-Statistics | *P*-value |
|---|---|---|---|---|
| $ECM_{t-1}$ [a] | −0.26 | 0.06 | −4.11 | 0.00 |
| ΔVIX | 0.90 | 0.12 | 7.27 | 0.00 |

*Note*: Only the significant variables are reported in the table. Diagnostics: $R^2 = 0.38$, adjusted $R^2 = 0.36$, Durbin Watson = 2.20.
[a] $ECM_{t-1} = \text{common factor}_{t-1} - 1.88 - 1.61\text{VIX}_{t-1} + 1.3\text{commodities}_{t-1}$.

directly from the Granger's representation theorem (1987).[17] The simplest reference model is given by the following equation:

$$\Delta\text{common factor}_t = \psi + \rho\,\text{ECM}_{t-1} + \sum_{j=0}^{p}\theta_j\,\Delta\text{common factor}_{t-j} + \sum_{j=0}^{p}\beta_j\,\Delta\text{VIX}_{t-j} + \sum_{j=0}^{p}\lambda_j\,\Delta\text{commodities}_{t-j} + \xi_t \tag{2}$$

Since all the variables are stationary, OLS can be used to estimate the model; by means of the conventional general-to-specific approach, we are able to reach the parsimonious representation contained in Table 3. The negative – and statistically significant – coefficient $\rho$ measures the adjustment speed of the common factor to the long-run equilibrium: when the common factor is above equilibrium, a negative coefficient reduces its variations and forces it back to its long-run level. More precisely, it implies that 26% of the gap between the equilibrium and the observed level of the common factor is closed each month. As for the other coefficients in the short-run dynamics equation, only changes in risk appetite – measured by the VIX index – turn out to be significant.

## 5. Push and pull factors affecting EMEs' spreads

This section is dedicated to an empirical investigation of the 'determinants' of EMEs' spreads: this heading, of course, should comprise both domestic macroeconomic 'fundamentals' and indicators of the global conditions in financial markets. The objective we have in mind is not only to establish which variables exert a significant effect on EMEs' yield differentials, but also to work out the level of spreads that is 'coherent' with the set of macroeconomic fundamentals for a given country. By doing this, we think we can assess whether financial markets have gone 'too far' in their evaluation of EMEs' creditworthiness.

The conventional reference model for analyzing the determinants of EMEs' spreads is drawn from Edwards (1984), who assumes that the spread over a risk-free interest rate can be expressed as a function of the (subjective) probability of default assigned by international investors to a given particular country. In turn, this (subjective) probability of default is exogenously determined depending on a set of domestic, as well as international, macroeconomic and financial variables

[17] That is for any set of cointegrating variables, error-correction and cointegration are equivalent representations.

that influence the investors' evaluation of a given country's creditworthiness. By assuming risk-neutral banks and perfect competition, Edwards ends up with the following simple reduced form for the (log) level of sovereign spreads:

$$\log \text{spread}_i = \alpha_0 + \sum_j \alpha_{ij} y_{ij} + \xi_i \tag{3}$$

where $\text{spread}_i$ is the yield differential for country $i$, $\alpha_0$ is an intercept coefficient, the $\alpha_{ij}$ are slope coefficients, the $y_{ij}$s are a set of $j$ macroeconomic 'fundamentals' as well as domestic and international financial variables and $\xi_i$ are i.i.d. errors.

As regards the selection of the covariates, several domestic macroeconomic and financial variables are considered as potential determinants of EMEs' spreads, drawn not only from the empirical models reported in Section 1 but also from the extensive literature on financial, and particularly debt, crises (Ciarlone and Trebeschi, 2004, 2005). Since the spread is a measure of the investors' assessment of the probability that an emerging economy will default on its debt obligations, it seems natural to start with the stock and flow variables relevant for both domestic and external solvency. Domestic solvency underscores the role played by the level of public debt (scaled to GDP), interest rates, output growth rate and government primary balances (scaled to GDP). External solvency, instead, highlights the importance of the stock of foreign-currency denominated debt (scaled to GDP or to exports), the current account balance (scaled to GDP) and liquidity indicators, measured by the amortization or interest payments on external debt (both scaled to total external debt, exports or international reserves) as well as by the total debt service (scaled to exports). In addition, a rising share of external debt with a remaining maturity of less than one year can also pose serious challenges for a borrowing country. The choice of the preceding variables is justified on the grounds that financial markets are supposed to penalize emerging countries with higher spreads not only in the case of an outright default on part or all of the stock of external debt, but also in the case of increasing debt-servicing difficulties determined more by illiquidity than by insolvency. Finally, adverse developments in the exchange rate, which entail an escalating weight of external indebtedness, are expected to lead to higher spreads. The variables measuring EMEs' ability to generate foreign-currency revenues – and therefore to repay external obligations – should also be considered within the set of potential determinants of the yield differentials. From this point of view, an important role is played by variables linked to trade flows as well as by the level of international reserves (scaled to GDP, imports, long- and short-term external debt): a low degree of trade openness, for instance, might make it difficult to attain the trade surpluses necessary to meet future external debt obligations. Finally, as recognized in Section 1, EMEs' spreads are determined not only by the evolution of the former macroeconomic 'fundamentals' specific to a given emerging economy – i.e. idiosyncratic 'pull' factors – but also by the developments in international financial markets and global liquidity conditions – i.e. common 'push' factors – which are summarized by the common factor worked out in Section 3.

Eq. (3) is estimated by resorting again to the Phillips and Hansen FM-OLS procedure. The regressors are recorded at monthly frequency; those with an original lower frequency have been linearly interpolated. Although it is a widely used technique in empirical works, we recognize that it comes at the cost of imposing a (linear) model on the data generating process, which might not necessarily be the case. With this caveat in mind, Table 4 contains the results of the FM-OLS estimation procedure. The equations in the table explain relatively well the fluctuations in EMEs' sovereign spreads: the adjusted $R^2$ is generally above 90%, higher than that obtained in most of the other empirical works. As expected, the common factor exerts a significant and positive

Table 4
Push and pull factors affecting EMEs spreads (dependent variable: log spread; estimation period 1998–2006; monthly data)

| Variable | Brazil | Bulgaria | China | Colombia | Ecuador | Malaysia | Mexico |
|---|---|---|---|---|---|---|---|
| Intercept | 3.975 (0.30)* | 1.475 (1.09) | 4.079 (0.56)* | 5.488 (0.23)* | 5.476 (0.11)* | 3.932 (0.21)* | 4.070 (0.29)* |
| Common factor | 0.508 (0.06)* | 0.559 (0.06)* | 0.330 (0.04)* | 0.439 (0.03)* | 0.382 (0.04)* | 0.324 (0.03)* | 0.275 (0.02)* |
| Interests on external debt/international reserves | | | | | | | |
| Interests on external debt/total external debt | | | 0.071 (0.02)** | | | 0.067 (0.02)* | |
| Total debt service/exports | | 0.035 (0.01)* | | | | | |
| Arrears/total external debt | | | | | 21.182 (1.74)* | | |
| Short-term debt/total external debt | | | 0.075 (0.01)* | | | | |
| Total external debt/exports | | | | | | | |
| Total external debt/GDP | | 0.063 (0.00)* | 0.144 (0.01)* | | | | |
| Government primary balance/GDP | −0.230 (0.06)* | −0.241 (0.05)* | | | −0.057 (0.02)* | −0.046 (0.02)** | |
| Government net debt/GDP | 0.047 (0.01)* | | | 0.022 (0.00)* | | | 0.030 (0.01)* |
| Current account balance/GDP | | −0.050 (0.01)* | | | | | |
| Exports/GDP | | | | | | | |
| Imports/GDP | | | | | | | |
| Openness to trade | | | | | | | |
| Trade balance/GDP | | | | | | | |
| International reserves/GDP | | | | | | | |
| International reserves/imports | | | −0.010 (0.00)* | | | | |
| International reserves/short-term debt | −0.006 (0.00)** | −0.005 (0.00)** | | −0.004 (0.00)*** | | | |
| International reserves/total external debt | | | | | | | |
| Inflation rate (YoY) | | | | | | | |
| Interest rate | 0.009 (0.00)** | | | | | 0.129 (0.02)* | 0.030 (0.00)* |
| Real GDP growth rate | | | 0.036 (0.07)* | | | −0.030 (0.01)* | −0.027 (0.01)* |
| Spot nominal exchange rate | 0.231 (0.07)* | | | | 0.001 (0.00)* | | |
| Adjusted $R^2$ | 0.95 | 0.97 | 0.94 | 0.93 | 0.90 | 0.96 | 0.98 |
| Unit root test on residuals[a] | | | | | | | |
| Augmented Dickey | −2.81* | −3.42* | −2.68* | −2.18** | −1.50 | −3.83* | −2.55** |
| Fuller Phillips Perron | −4.14* | −2.56** | −5.49* | −4.03* | −2.73*** | −4.70* | −5.07* |
| Error-correction coefficient | −0.32 (0.1)* | −0.20 (0.07)* | −0.59 (0.11)* | −0.33 (0.07)* | −0.23 (0.14)*** | −0.46 (0.08)* | −0.34 (0.07)* |

Table 4 (*Continued*)

| Variable | Panama | Peru | Philippines | Poland | Russia | Turkey | Venezuela |
|---|---|---|---|---|---|---|---|
| Intercept | 4.563 (0.14)* | 7.657 (0.54)* | 3.318 (0.34)* | 7.494 (1.00)* | 4.217 (0.234)* | 6.081 (0.29)* | 7.412 (0.16)* |
| Common factor | 0.332 (0.01)* | 0.440 (0.02)* | 0.290 (0.02)* | 0.318 (0.06)* | 0.630 (0.06)* | 0.452 (0.04)* | 0.240 (0.06)* |
| Interests on external debt/international reserves | 0.005 (0.00)* | | | | | | |
| Interests on external debt/total external debt | | | | 0.139 (0.07)** | | | |
| Total debt service/exports | | | | | 0.018 (0.01)*** | | |
| Arrears/total external debt | | | | | | | |
| Short-term debt/total external debt | | | | | | | |
| Total external debt/exports | 0.001 (0.00)* | | | | | | |
| Total external debt/GDP | | | | | 0.023 (0.00)* | | |
| Government primary balance/GDP | | | | | | −0.031 (0.01)* | −0.027 (0.01)* |
| Government net debt/GDP | | | | | | | |
| Current account balance/GDP | | | | | | | −0.208 (0.01)** |
| Exports/GDP | | | | | | | |
| Imports/GDP | | | 0.038 (0.01)* | | | | |
| Openness to trade | | | | | | | |
| Trade balance/GDP | | | | −0.176 (0.03)* | | | |
| International reserves/GDP | | −0.095 (0.03)* | −0.055 (0.02)* | −0.259 (0.06)* | | | |
| International reserves/imports | | | | | | | |
| International reserves/short-term debt | | | | | | | |
| International reserves/total external debt | | | | | | −0.023 (0.01)** | −0.021 (0.00)* |
| Inflation rate (YoY) | | | 0.036 (0.01)* | | | | |
| Interest rate | | | | | 0.026 (0.00)* | 0.003 (0.00)* | |
| Real GDP growth rate | −0.008 (0.00)* | | | −0.056 (0.02)* | | | |
| Spot nominal exchange rate | | | 0.030 (0.00)* | | | 0.425 (0.05)* | |
| Adjusted $R^2$ | 0.98 | 0.94 | 0.90 | 0.94 | 0.97 | 0.93 | 0.91 |
| Unit root test on residuals[a] | | | | | | | |
| Augmented Dickey | −3.03* | −2.25** | −3.92* | −3.07* | −2.98* | −3.04* | −1.90*** |
| Fuller Phillips Perron | −6.57* | −3.91* | −4.22* | −4.41* | −3.57* | −4.02* | −4.03* |
| Error-correction coefficient | −0.63 (0.08)* | −0.28 (0.05)* | −0.22 (0.07)* | −0.39 (0.13)* | −0.19 (0.05)* | −0.30 (0.08)* | −0.24 (0.08)* |

*Source*: World Economic Outlook Database—IMF; Bank for International Settlements; Institute for International Finance, Economist Intelligence Unit. *Note*: The FM-OLS estimates have been calculated using Bartlett weights with truncation lag $k = 6$. Asymptotic standard errors are reported in parenthesis.

[a] Being a test on residuals, we have not considered the constant nor the time trend; 4 lags have been used in order to perform the Phillips Perron test, as suggested by the Newey–West criterion; 12 lags have been used for the Augmented Dickey Fuller test, coherently with the frequency of data.

* Significant at 1% s.l.

** Significant at 5% s.l.

*** Significant at 10% s.l.

effect on all the EMEs' spreads of our sample: shocks to the common factor accompany large variations in yield differentials of the same sign. Overall, this confirms that the developments in global financial markets conditions have indeed been very important in influencing the evolution of EMEs' spreads.

As regards the role played by macroeconomic 'fundamentals', only few turn out to be significant as 'pull' factors: nevertheless, the sign of their coefficients is always as expected. Using the usual tests for unit roots on the residuals of each equation in Table 4, we cannot reject – at conventional significance levels – the null hypothesis that sovereign spreads are cointegrated with the chosen country-specific fundamentals and the common factor,[18] confirming other empirical results (Arora and Cerisola, 2001; Ferrucci, 2003; Hoggarth and Yang, 2006). This means that the estimated equations can be interpreted as long-run equilibrium relationships. In addition, as shown by the large magnitude of the coefficients on the ECM terms displayed at the very bottom of Table 4, the adjustment to the long-run equilibrium occurs quite rapidly.

Starting from these results, it is possible to shed light on other important issues.

First, it is possible to single out the level of EMEs' spreads that is 'coherent' with macroeconomic fundamentals for any given country in our sample. In order to answer this question, we subtract the component due to the common factor from the actual spread, obtaining a new series which we label 'idiosyncratic' spread. The chart in Appendix A gives a graphical representation of our results: the comparison between the actual and the idiosyncratic spread series for each country in the sample shows that recently the latter has in all cases been higher than the former. This suggests that, in the last four years, financial markets have gone 'too far' in their evaluation of EMEs' creditworthiness, pushing the spreads below the levels consistent with macroeconomic fundamentals.[19]

Second, it is possible to assess whether and how a shock to the VIX index might – through its impact on the common factor – influence the spread of an important emerging economy, namely Turkey. A first input of the simulation is given by the relationship describing the short-run dynamics for Turkish spread, which is hosted in Table 5.

The term $ECM_{t-1}$ is none other than the lagged residuals of the long-run equation shown in Table 4: as already mentioned, its negative coefficient measures the speed of adjustment of the spread to the long-run equilibrium. Interestingly, global market conditions are important even in the short-run, as shown by the high and significant coefficient on the changes in the common factor ($\Delta$common factor in Table 5). A second input is given by the relationship describing the short-run dynamics for the common factor, which was hosted in Table 3. In order to evaluate the impact of a shock to the VIX, we first need to devise possible paths for the evolution of the VIX index. Three scenarios have been worked out: (1) the VIX remains at the levels recorded at the end of 2006 (11.6%); (2) the VIX permanently increase to the average of the period between January 1998 and December 2006 (21%); and (3) the VIX undergoes a one-time shock, increasing to its long-run average and then returning to its current level. More importantly, we need to assure that there is no reverse causation from the factor to the VIX and from the spread to the factor, meaning

[18] The only case in which this hypothesis is rejected is that of Ecuador.

[19] The case of Colombia is illustrative: in Section 2, in fact, we report that from January 2002 to December 2006 this country experienced a contraction of the yield differential from 633 to 164 b.p. against a credit rating which remained unchanged at Ba2. The chart relating to Colombia gives further evidence, showing that the idiosyncratic spread did not move much from its long-run average, while the actual spread decreased substantially: this suggests that Colombian macroeconomic fundamentals did not move enough in the sample period to justify a higher credit rating or a decrease in spread.

Table 5
Turkey's spread: short-run dynamics and error correction (dependent variable: Δspread; estimation period 1998–2006; monthly data)

| Regressor | Coefficient | S.E. | $t$-Statistics | $P$-value |
|---|---|---|---|---|
| $ECM_{t-1}$ [a] | −0.30 | 0.07 | −4.01 | 0.00 |
| $\Delta$common factor$_t$ | 0.40 | 0.03 | 13.94 | 0.00 |
| $\Delta$exchange rate$_t$ | 0.69 | 0.15 | 4.61 | 0.00 |
| $\Delta$interest rate$_t$ | 0.01 | 0.00 | 5.45 | 0.00 |

*Note*: Only the significant variables are reported in the table. Diagnostics: $R^2 = 0.74$, adjusted $R^2 = 0.72$, Durbin Watson = 1.84.

[a] $ECM_{t-1}$ = spread$_{t-1}$ − 6.08 − 0.45common factor$_{t-1}$ + 0.03government primary balance/GDP$_{t-1}$ + 0.21current account balance/GDP$_{t-1}$ + 0.02international reserves/total external debt$_{t-1}$ − 0.01interest rate$_{t-1}$ − 0.42exchange rate$_{t-1}$.

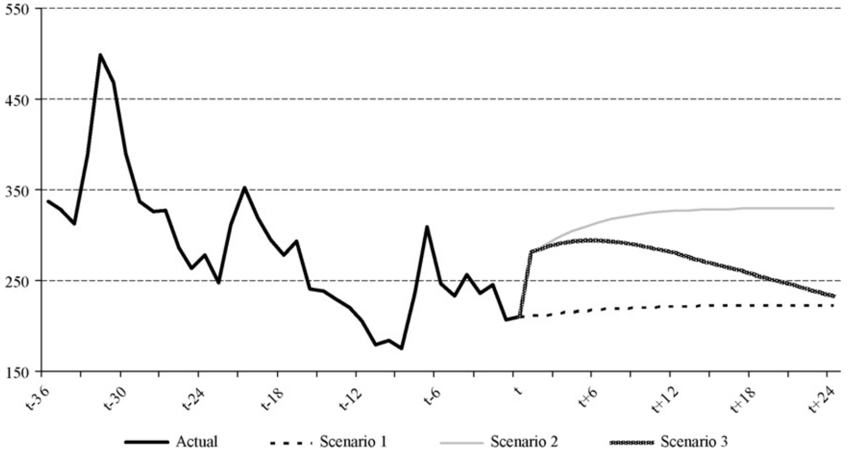


Fig. 2. Turkish spread and shocks on VIX: a scenario analysis (basis points).

that we can treat VIX (factor) as a strictly exogenous variable in the equation describing factor (spread) dynamics.[20] The three scenarios devised for the VIX are used to forecast, by means of the short-run dynamic equation represented in Table 3, three series for the common factor over a 24-month horizon, i.e. from $t$ to $t+24$. Each of these series is then used to forecast, by means of the short-run dynamic equation represented in Table 5, three different paths for the Turkish spread, under each scenario.

As Fig. 2 clearly shows, the impact of a volatility shock has significant effects on Turkey's spread: according to our model, in fact, a permanent reversion of volatility to its long-run average (scenario 2) would see the Turkish spread widen almost 120 b.p. in a 24-month time span. This can be compared with the effect of the one-off correction in global financial markets experienced by end-February 2007: against an increase to almost 20% in the VIX index, the Turkish spread widens by almost 40 basis points.[21]

[20] In order to check this hypothesis, we proved the factor (spread) does not Granger-cause the VIX (factor).

[21] The IMF in its April 2007 Global Financial Stability Report estimated that a reversion in volatility to two standard deviations above the average since 1990 would see spreads (as measured by the JP Morgan EMBI Global index) widen

As a further warning, the tensions in the US subprime mortgage markets experienced in the summer 2007 were accompanied by a reappraisal of risk and an increase in the VIX index above 24%. As a consequence, the spread on the JP Morgan EMBI Global index widened 47 basis points in July. The main conclusion of this analysis, therefore, is that – notwithstanding the unquestionable improvement in macroeconomic 'fundamentals' – EMEs are still vulnerable to sudden variations in financial market conditions and in agents' degree of risk aversion.

## 6. Conclusions

During the last four years, financial markets have witnessed a steady compression in EMEs' sovereign spreads: both global factors, such as ample liquidity and low volatility, and specific factors, such as the improvement in fundamentals, can be cited as determinants of the reduction in yield differentials. Our analysis suggests that a single common factor is significant in explaining the co-variation (correlation) between EMEs' sovereign spreads, and that this single common factor can be traced back to developments in international financial market conditions, especially to the volatility in stock markets and to agents' degree of risk aversion. Although the accomplishment of suitable macroeconomic policies, and the resulting improvement in fundamentals, had positive effects on the reduction of yield differentials, emerging economies do remain vulnerable to sudden shifts in global financial conditions, especially if the shifts take the form of rises in market volatility and increases in agents' degree of risk aversion.

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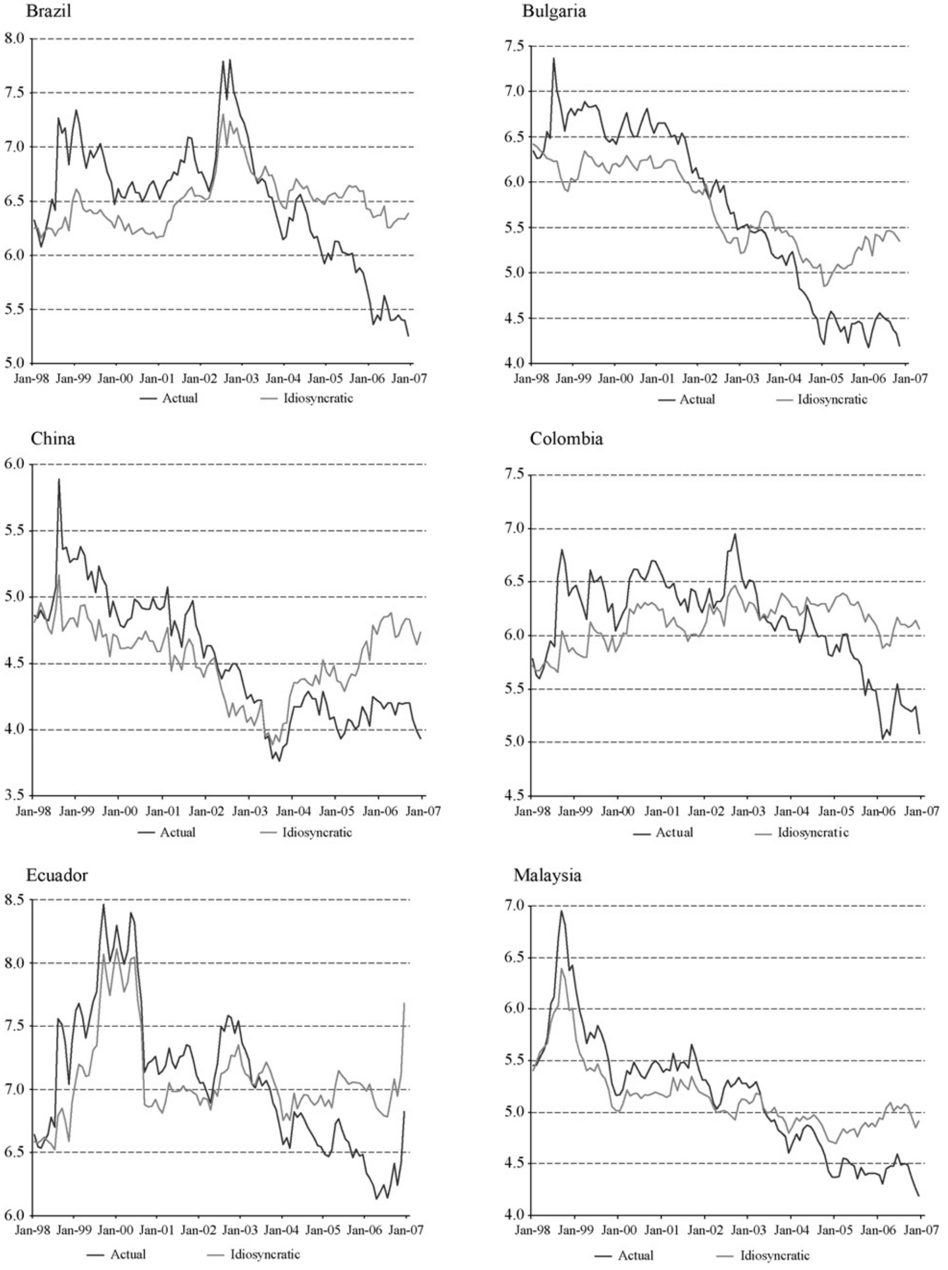
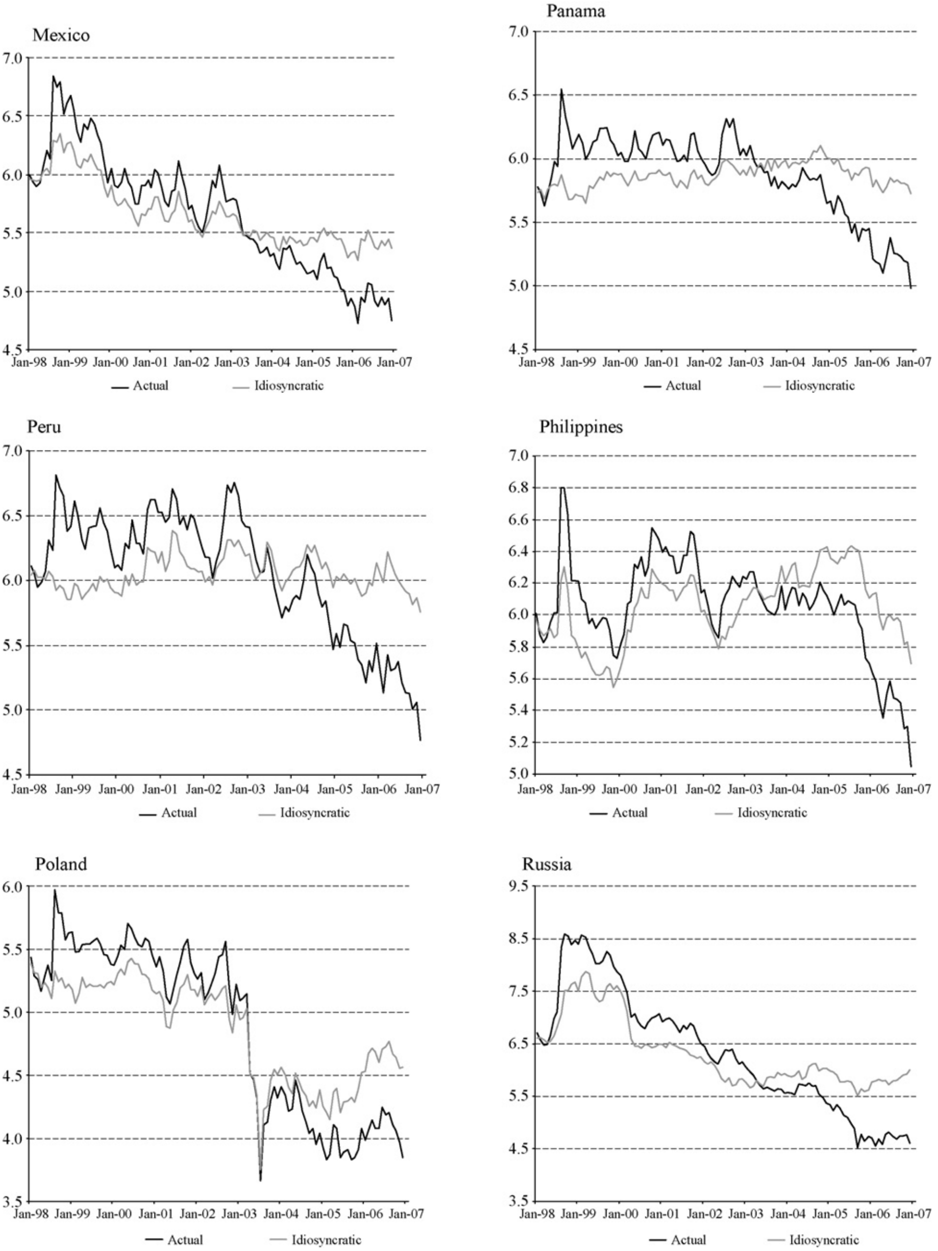
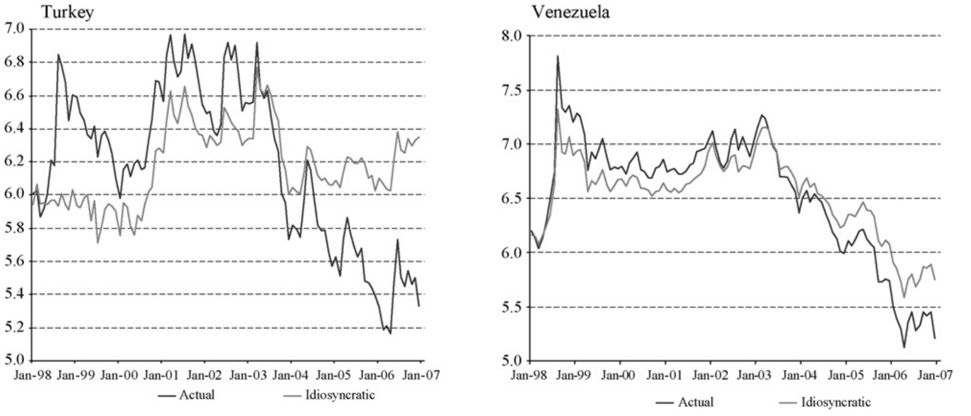
225 b.p. over a 12-month time span. Such rises in volatility are by no means rare: the VIX index has breached this level 10 times since 1997.

## Appendix A

EMEs' Spreads: Actual vs. Idiosyncratic (log spreads)




Mexico
Panama
Peru
Philippines
Poland
Russia
Jan-98 Jan-99 Jan-00 Jan-01 Jan-02 Jan-03 Jan-04 Jan-05 Jan-06 Jan-07
Actual
Idiosyncratic

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