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International Pricing of Emerging Market Corporate Debt: Does the Corporate Matter?

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Abstract

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We examine risk spreads charged on corporate bonds placed by emerging market borrowers on international exchanges. While global developments have an important effect on spreads, changes in firm-level default risk also matter significantly in a way consistent with theory and experience in mature markets. In contrast, except during periods of financial crisis, country factors play a limited role. These findings go against the supposition that limited information on emerging market firms or significant agency problems prevent firm-level credit discrimination by international investors. The firm-level information capitalization into spreads possibly reflects protection afforded by the exchange listing on international markets.

JEL Classification Numbers: F3; G1; G3

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I. INTRODUCTION

The pricing of emerging market assets is thought to principally reflect changes in global sentiments and country risk. In turn, country risk is a reflection of a lack of sufficient information, agency problems (inability of a foreign lender to monitor a distant borrower), and sovereign risk. For these reasons, it is generally believed that foreign investors and lenders will tar all operations within a country with the same brush. Exceptions are known to exist—firms with strong "hard" currency earnings escape the country embrace. Yet the evidence on the importance of country-level factors in emerging markets asset pricing is considerable. Brooks and Del Negro (2002) decompose stock returns into industry and country components, concluding that country returns are salient, particularly for emerging markets. Morck, Yeung and Yu (2000) find a high degree of synchronicity of stock prices in emerging economies, from which they infer that individual variations in firm-specific return and risks are not actively priced. For bond markets, Eichengreen and Mody (2000) find that country growth, debt, and volatility explain differences in spreads across countries, though they do not sufficiently differentiate corporate issuer characteristics.

Thus, despite significant reductions in barriers to cross-border investment and increased financial globalization, country factors remain important in asset pricing. Stulz (2005) suggests that the risk of expropriation by the state (the traditional country risk) and by corporate insiders could account for the continued importance of country effects. A similar view is supported by Morck, Yeung and Yu (2000), who argue that weak protection of property rights against corporate insiders raises market-wide noise trading and discourages informed risk arbitrage and the capitalization of firm-specific information into stock prices. In emerging markets, pyramidal structures allow corporate insiders control rights in excess of cash flow rights, aggravating the agency problem (Durnev and Kim, 2005). Johnson, Boone, Breach and Friedman (2000) argue, for example, that the protection of minority shareholders and measures of corporate governance are important in understanding the severity of the stock market decline during the Asian crisis.

Can emerging market firms bypass their domestic markets and institutions and receive credit for their distinguishing characteristics? This question has received some attention in the case of stocks. Analyses of American Depository Receipts (ADRs) find that cross-listing on the U.S. exchange decreases the local market beta, suggesting a reduced role for country factors in firm equity returns when securities are placed on the international market and are bound by the more stringent disclosure and enforcement framework of the U.S. Securities and Exchange Commission (SEC) (Foerster and Karolyi, 1999).

Little, however, is known regarding the role of firm-level characteristics for a comprehensive sample of emerging market corporate bonds issued on the international market. This paper is a first effort to fill that gap. Peter and Grandes (2005) examine spreads on local currency bonds, highlighting the central role of country risk relative to firm-level factors, yet their analysis is limited to bonds issued in South Africa. Durbin and Ng (2005) study the specific question of "sovereign ceiling." This is the proposition that a firm cannot have a rating higher than, and a spread lower than, that of the sovereign since sovereign risk dominates the risk of a corporate from that country. They find exceptions to this proposition: in particular, firms with substantial export earnings and relationships to strong foreign entities do break through the sovereign ceiling. Like Durbin and Ng (2005), we examine the factors that matter for secondary market spreads on U.S. dollar-denominated bonds of emerging market firms issued on the international market. We go beyond their study, however, in important respects. Rather than restricting ourselves to the industry identity of the firm, we consider firm-specific factors motivated by an option-pricing framework. Having established the relevance of this approach for emerging market firms, we examine how the salience of the corporate characteristics is conditioned by a variety of country features.

For our study, we assemble a new data set that identifies 224 bonds issued by emerging market borrowers on the international market. Using a number of data sources, we link the bonds to the corresponding equity and balance sheet information of the issuer. Nine emerging market countries are represented, located in Latin America, Asia and Eastern Europe. With the exception of economic growth figures (which are available at quarterly frequency), our data are a panel of monthly frequency spanning September 1993 to December 2003.

In order to mitigate the omitted variable bias due to unmodelled firm- and country-specific fixed effects in the level of spread, we use three estimators that allow for time-invariant effects. While the Fixed Effects (FE) estimator is frequently used in the literature, concerns regarding endogeneity of regressors and bias arising from the dynamic specification of the model lead us to employ the instrumental variable (IV) estimator and a simplified generalized method of moments (GMM) estimator.

The specification of the econometric model of spreads incorporates regressors at the level of the borrower to reflect idiosyncratic effects, but also includes country-level variables and global factors. Models of default risk using contingent-claims analysis suggest that default is triggered when the value of the firm declines below a certain threshold. The probability that this default threshold is reached is positively related to the firm's leverage (debt-to-firm value ratio) and the firm value volatility (proxied by volatility of equity returns) and is negatively related to the firm's equity return. We augment the model to include economic indicators at the country and global level that may reflect recovery expectations in the event of default. Furthermore, we examine the sensitivity of emerging market bond spreads to systematic risk, as captured by the Fama-French risk factors.

We find that spreads are strongly correlated with global equity returns, which are highly correlated with the Fama-French risk measures, reflecting a premium related to systematic risk. A rise in U.S. interest rates is associated with narrower spreads, contradicting a widely held view in the emerging market literature, but confirming findings in the U.S. corporate bond literature (Campbell and Taksler 2003; Collin-Dufresne, Goldstein and Martin, 2001; and Longstaff and Schwartz 1995). Importantly, a significant part of the spreads on emerging market corporate bonds is related to issuer characteristics in predictable ways reflecting idiosyncratic risk. Firm leverage, idiosyncratic volatility, and the firm's equity returns matter in a way that is consistent with the findings in mature markets. In contrast, country-level factors contribute only little to spreads.

It is important to be clear on what we do and do not achieve. We do not explain the cross-sectional difference (or the difference across countries) in bond spreads. Rather, we rely on the time variation in bond spreads. The question we ask is whether the time-variation in firm-level default risks explains, in part, the movement in corporate bond spreads. As our sample consists of internationally issued bonds in U.S. dollar, bondholders largely bypass weak domestic institutions of the issuer's home country with tighter international disclosure and accounting requirements. In most cases, the contractual agreement is for the default process to be overseen in courts in the U.K. and the U.S., although exceptions are possible: the legal jurisdiction can remain in the home country and new arrangements can emerge at the time of the default. Thus, by controlling for the relatively stable structure of corporate governance in a country (through country fixed-effects or by taking first-differences in spreads), we ask if changes in firm-level default risk are recognized and priced in a manner resembling their pricing in mature markets. However, we allow for variations in country macroeconomic and financial factors—and our finding is that these variations are less important in explaining movements in spreads than are variations in corporate characteristics.

Our result does not necessarily imply the violation of the sovereign ceiling. We do not focus on the level of spreads, but rather on its time variation. Our goal is to show that the informational content of the firm's risk profile is read and priced by the market. When country characteristics deteriorate significantly, the sovereign ceiling becomes more potent and country characteristics do gain in relative importance as drivers of corporate spreads.

We also consider whether measures of investor rights in the country of origin matter. The results suggest that when firms choose to issue bonds on the international market and commit themselves to increased monitoring by investors and compliance requirements associated with the listing, firm-specific and market-wide information is capitalized in a similar way and is independent of the degree of investor rights in the home country.

Do country factors matter more in countries where Morck et al. (2000) find a more pronounced role for local market factors and reduced importance of firm-specific information? For example, risk arbitrage exploiting firm-level information can be less attractive in markets where political and other market-wide events unrelated to fundamentals are prevalent and difficult to predict. Based on their synchronicity measure, we find that strong returns on the local equity market tend to lower spreads for low-synchronicity countries, yet this effect is not present in countries with high stock price synchronicity. This supports the view that when variations in market returns are weakly related to fundamentals—as is argued to be the case in countries with high stock market synchronicity—bondholders place less weight on the information, reducing the capitalization of local market equity returns into bonds spreads.

Finally, we ask if there is evidence of a structural break, indicating a changing importance assigned to certain regressors in the post-Asian and Russian crisis period. There is also some support for the thesis that firm-level characteristics have become more important in the second half of the time period under consideration. This could reflect market learning or simply the fact that the period following the Asian and Russian crises was calmer with less attention to sovereign risk.

The rest of this paper is organized as follows. The next section briefly reviews the contingent claim based approach of bond spreads, as well as some of the empirical findings in the U.S. corporate and emerging market bond literature. We set out the data and methodology used in section III, reviewing in particular the relevant properties of the estimators. We report our principal results using the FE and GMM estimator in section IV, providing a quantitative interpretation of these results, and take a closer look at specific country features in the subsequent section. Finally, we test for structural breaks and use alternative specifications to examine the robustness of the results in sections V and VI respectively. A final section concludes.

II. Theoretical and Empirical Framework

A. Structural Models of Credit Spreads

The structural approach to pricing risky debt in an option-pricing framework (or contingent-claims analysis)—based on the contributions by Black and Scholes (1973), Merton (1974), and Black and Cox (1976)—suggests that the main determinants of credit risks are the firm's leverage ratio, its value volatility, equity returns, and the time to maturity of the debt. A firm defaults on its debt if, at maturity, its asset value falls below the default boundary. In Merton's (1974) model, this default boundary is equated to the debt level, but Black and Cox (1976) allow for the possibility, as empirical studies confirm is the case, that default often occurs before the value of the firm falls to its debt level. The default risk is the risk that the firm value is less than the default threshold and is determined by the stochastic process specified for the asset value of the firm and the firm leverage, defined as the discounted face value of debt relative to the firm value. Furthermore, a higher volatility of the firm value increases the probability that the firm's asset value will cross the default boundary.

Consequently, higher leverage ratios and firm value volatility raise default risk and, hence, widen spreads. Similarly, a longer time to maturity raises the risk of default and increases spreads. In contrast, high equity returns raise the expected value of the firm relative to the default threshold and, hence, lower the risk of default. A number of extensions have been proposed. In particular, Longstaff and Schwartz (1995) relax the assumption of constant risk-free interest rates, suggesting that the risk spread and risk-free interest rate are negatively related. This is because an increase in the risk-free rate accelerates the risk-neutral drift of the process for the firm value away from the default threshold, thereby decreasing the probability that the default boundary will be reached. The suggested negative relation between risk spreads and risk-free interest rates is stronger for firms with higher default probability, and Longstaff and Schwartz establish this result empirically.

B. Corporate Bond Spread Literature

A well-established empirical literature on corporate risk spreads in industrial countries largely supports the predictions of the option-pricing framework. A rise in leverage, in idiosyncratic (firm) volatility, and in market volatility tends to widen spreads, due to the higher risk premium required; higher firm equity returns are linked to narrower spreads (Avramov, Jostova and Philipov, 2004; Campbell and Taksler, 2003; Collin-Dufresne, Goldstein and Martin, 2001; and Duffee, 1998). A negative relationship is found between the benchmark treasury yield and spreads. The effect of changes in the benchmark yield and changes in leverage on the spread is found to be larger in magnitude and statistically more significant for poorly rated bonds (Duffee, 1998; and Collin-Dufresne, Goldstein and Martin, 2001).

However, a significant share of the time-series movement and level of spreads remains unexplained by factors reflecting leverage, volatility, equity returns, and benchmark yield. Collin-Dufresne, Goldstein and Martin (2001) find that changes in default and recovery risk can account for only one-fourth of the changes in spreads, and a principal components analysis indicates that the residuals are driven mainly by a single factor. A possible explanation for this behavior is suggested by Elton et al. (2001). If bond returns are sensitive to systematic risk factors, causing much of the movement in spread over time, then investors require a risk premium for this exposure to systematic, rather than diversifiable, risk. The subsequent empirical analysis of Elton et al. (2001) supports this hypothesis, as unexplained variation in returns to bonds that remain after accounting for default risk on spreads move with the Fama-French risk factors and an increased sensitivity to these systematic risk factors appears to be compensated for by higher returns.

Only a few studies have examined spreads on corporate bonds in non-industrialized countries. These include Durbin and Ng (2005) and Peter and Grandes (2005), which focus on the question of a country's sovereign credit-rating ceiling. Such a ceiling implies that corporate spreads cannot be lower than sovereign spreads and are likely to rise with sovereign spreads one-for-one. Peter and Grandes (2005) examine a panel of 12 local currency-denominated South African bonds, controlling for the factors suggested by the option-pricing framework, while Durbin and Ng (2005) examine 116 hard-currency bonds and indirectly control for firm-specific and other factors by taking the first differences of spreads. Both studies conclude that the country ceiling does not strictly apply.

In addition to bond spreads on the secondary market, launch spreads of emerging market sovereign bonds have also been studied (Min, 1998; Kamin and von Kleist, 1999; and

Eichengreen and Mody, 2000). Eichengreen and Mody point out that in poor market conditions, the composition of borrowers may change with a drop in the issuance of bonds by high-risk borrowers. They specify a Heckman correction model to address the sample selection problem and apply this to a set of sovereign and corporate bonds. The results confirm that bond issuance is sensitive to current market conditions. While the model does include information on the size of the bond issue, as well as the time to maturity of the bond, the data set does not allow control for the remaining firm-level regressors suggested by the structural model. Eichengreen and Mody conclude that although launch spreads are related to a set of country characteristics, considerable unexplained variation remains, reflecting "market sentiment."

C. Stylized Facts

In order to place the more formal analysis in context, Figure 1 plots the average credit spread (in logarithm) for the period under consideration. We distinguish between emerging market bonds of investment and non-investment grade. A sharp increase in spreads is observed in 1995 following the crisis in Mexico. Spreads subsequently narrowed rapidly, and investment-grade bonds, in particular, benefited from a strong compression. Spreads widened again at the time of the Asian crises in 1997 and spiked in 1998, reflecting the effects of the Russia and Long-Term Capital Management (LTCM) crises. Average spreads for non-investment grade bonds remained wide, increasing between 2001 and 2003 due to concerns in Latin America before narrowing again. Overall, the behavior of the spreads in our set of bonds issued by emerging market corporate borrowers is consistent with well-established movements in emerging market bond spreads over the past decade.

From Figure 2, we note that the spreads on emerging market bonds are likely linked to global factors. In particular, emerging market spreads and spreads on U.S. high-yield corporate bonds exhibit similar time-series movements after 1999. U.S. bonds spreads did not rise significantly during the 1995 emerging market crisis and experienced only a limited increase in late 1998. Yet, in the post-1999 period, the spreads on high-yield U.S. bonds behaved much the same as our emerging market bonds, both in direction and in magnitude of movement.

While a direct link between U.S. high-yield spreads and emerging market bond spreads has at times been attributed to changes in the price of risk or (unobserved) risk appetite, in this paper we focus on the links between U.S. high-yield spreads and emerging market spreads arising due to common exposure to the economic environment and asset markets. For example, Figure 2 plots global equity market volatility. Structural models based on the contingency-claim approach posit wider spreads when market volatility increases and this is evident from Figure 2, particularly in the post-1995 period. Furthermore, we note that spreads appear to move inversely with the yield on U.S. treasuries (Figure 3). This holds not only for emerging market spreads, but also for spreads on U.S. corporate bonds more generally.

Firm-level characteristics that have a bearing on credit risk, and hence on spreads, show considerable variation among issuers and over time (Figure 4). We examine information on the leverage ratio of the issuing firm, idiosyncratic volatility, and the equity return offered by the firm's stock over a 12-month period. For each of these three variables, the mean spread is graphed for each quartile of firm-specific variables. The first set of four observations in Figure 4 illustrates that the mean spread of the 25 percent of observations with the lowest equity returns is 2.2 percentage points (or 48 percent) wider than the spread on bonds with higher equity returns, suggesting an inverse relationship between equity returns and spreads. We repeat the exercise for idiosyncratic firm volatility and note a strong positive relationship. The mean spread for the 25 percent of observations with the largest idiosyncratic firm volatility is almost twice that for the bottom quartile of firm volatility observations. Last, we note a positive relationship between leverage and spreads. The set of observations corresponding to the first and second quartile of observations of firm-level leverage, shows a mean spread that is 1.75 and 0.95 percentage points—or 32 and 17 percent, respectively—narrower than that of observations in the upper 50 percent of leverage data.

III. Data and Methodology

This section details the procedure used to identify the 224 bonds issued by emerging market borrowers. We then explain the source of the data for our explanatory variables. The section concludes with a discussion of the methodology used throughout the paper and briefly reviews the properties of the estimators.

A. Data

We use the BondWare database of Dialogic to identify the list of bonds issued by emerging market borrowers on the international market since 1992. Only bonds issued in hard-currency are considered, in order to abstract from the currency risk premium. Almost all relevant hard-currency bonds are issued in U.S. dollars. For ease of comparability, we, therefore, restrict our sample to dollar-denominated bonds. After we identify the country of residence for each issuer, we are left with bonds issued by the following countries: Argentina, Brazil, Indonesia, Malaysia, Mexico, Korea, Philippines, Russia and Thailand. The BondWare identifier is mapped to the unique International Securities Identification Number (ISIN) for each bond, which is used to create a link to Bloomberg. Based on the issuer information listed on Bloomberg, the equity data associated with each issuer of a bond or parent company of the issuer are tracked. Using the ISIN for each bond, the spread over the U.S. treasury rate with corresponding maturity on the last business day of each month is downloaded from Datastream. This information is available for 339 bonds.

Our analysis uses the following regressors at the bond level: time to maturity, leverage, idiosyncratic volatility, and return on equity. Time to maturity is obtained directly from Datastream. Leverage is defined as the ratio of total debt to firm value, where firm value is the sum of the market value of equity plus total debt. The data for the computation of the firm's market value of equity and equity returns are directly from Datastream. Total debt figures are based on the balance sheet information of the issuer, available for 224 bonds in our sample, and are obtained from WorldScope. Total firm volatility is calculated as the sum of the squared daily returns for the last 22 days of each month. Market volatility is similarly defined, based on the Datastream global market index. We subtract global market volatility from total firm volatility to obtain a proxy for idiosyncratic firm volatility. The return on global equity is the percentage changes in the total return index based on monthly data, obtained from DataStream's global market index.

Quarterly real domestic GDP and U.S. GDP growth come from the IMF's internal database for each country. From this, we compute annual economic growth rates. The yield on the ten-year U.S. treasury rate, the U.S. high-yield corporate spread, and the swap spread are obtained from Bloomberg. The financial ratios for the computation of the Z-score (see Bankruptcy Risk subsection) are derived from the balance sheet information of the issuer from WorldScope, while the data on domestic industrial production and U.S. leading indicators are from the IMF's internal database.

B. Pooled OLS, Fixed-Effects and GMM Methodology

The literature on corporate spreads has favored static models, employing the Pooled OLS (POLS) and FE estimators. The FE estimator allows for time-invariant unobserved heterogeneity that can arise when time-invariant (or slow-changing) issuer characteristics are difficult to measure or are unobservable. The inclusion of bond-specific fixed effects allows us to account for these omitted time-invariant effects, thereby reducing the omitted variable bias. Furthermore, fixed effects specified at the issuer level simultaneously control for country-specific fixed effects, as country dummies are a perfectly linear function of issuer dummies.

Little attention has so far been paid to the dynamic specification of the model and possible endogeneity issues in the corporate spreads literature, which may invalidate the use of the above-mentioned estimators. When the specification of the model is dynamic and the lagged dependent variable is included as a regressor, controlling for fixed effects comes at the cost of introducing a downward bias on the coefficient of the lagged dependent variable. The size of this bias is decreasing in the time dimension of the panel and is of order O(1/T) (Nickell, 1981). While for a significant share of our data sample T is less than 10, the average size of our panel is 39 and hence the bias is likely to be small but may remain a concern. A further potential drawback of the Fixed-Effects estimator is the implicit assumption of the strict exogeneity of regressors with respect to the error term. This assumption requires that shocks to spreads are uncorrelated with contemporaneous or future observations of regressors in the model. If regressors are endogenous, the results may not be reliable.

We therefore use a set of IV and GMM estimators to verify the results obtained by the FE estimator. These estimators provide consistent estimates for dynamic panels, while allowing us to relax the assumption of the strict exogeneity of regressors. The IV and GMM estimators eliminate the fixed effects by applying the first-difference or forward orthogonal deviations transformations to the equation in levels. Lagged levels of the endogenous regressors are then used to instrument for the transformed equation (Arellano and Bond, 1991). Arellano and Bover (1995) and Blundell and Bond (1998) have proposed a GMM-system estimator that uses additional instruments, combining level equations with the transformation equation to provide an efficient estimator.

The assumption of no serial correlation in the error term is required for the consistency of the GMM and GMM-system estimator, as variables are instrumented for by lags of the same variables. This assumption is tested by evaluating first-order and second-order serial correlation in the first-differenced residuals, here referred to as the m1 and m2 statistics. If the residuals in levels are not serially correlated, the first-differenced residuals should exhibit negative first-order but no second-order serial correlation. More generally, the validity of instruments is tested using the Sargan test of over-identifying restrictions. We use the Sargan test statistic as obtained by the two-step heteroskedasticity-consistent GMM-system estimator.

When the variables under consideration are highly persistent over time, the GMM estimator may suffer from a weak instrument problem, resulting in a potentially sizable finite sample bias (Blundell and Bond, 1998). This arises as lagged levels instrument less well for subsequent first differences. By exploiting additional moment conditions based on a stationarity restriction on the initial conditions, the GMM-system estimator generally displays better finite sample properties than the GMM estimator when the data is highly persistent, though the increase in the number of instruments may not be desirable when T is large relative to N.

In our application we do not utilize all moment conditions proposed by the GMM estimator for the following reason. When the time dimension (T) is not negligible relative to the cross-sectional dimension (N), it is important to consider the behavior of the above estimators when T/N tends to a non-zero constant. In the case of the simple univariate autoregressive model, Alvarez and Arellano (2003) show that the GMM estimator remains consistent, yet has a negative asymptotic bias of order 1/N, while the FE estimator is asymptotically biased with a negative asymptotic bias of order 1/T. However, consistency and lack of asymptotic bias is generally maintained if the instrument matrix does not rise with T, and consequently not all available instruments are used.

IV. Determinants of Spreads

A. Background

We first consider the basic option-pricing specification, before evaluating further factors at the country and global level. Due to the property of the data we specify an autoregressive distributed lag model of order one, where spreads are regressed on lagged spreads as well as contemporaneous and lagged regressors. In order to mitigate the impact of outliers, we identify time periods when regression residuals exceed twice the standard error. Time dummies are hence added to the model specification for the following five months: December 1994, January 1997, August 1997, August 1998, and September 1998. With the exception of January 1997, which was a moment of "irrational" exuberance, the other dates largely coincide with emerging market crisis—from Mexico in December 1994 to the Russia and LTCM crisis in the fall of 1998. This section focuses on the results obtained by the Within-Groups, IV, GMM and GMM-system estimator using forward orthogonal deviations as first-step transformation. This first-step transformation generally provides us with more robust results than a first-difference transformation.

Table 2 displays the results for our initial specification. Though we employ different estimation methods, note the considerable similarities in the results obtained. While the Fixed-Effects estimator (column 1) ignores endogeneity issues, the IV estimator in column 2 uses the twice-lagged spreads to instrument for lagged spreads in the transformed equation. Based on the Difference Sargan test, we examine the endogeneity of regressors and find that firm-level equity returns are endogenous and need to be instrumented in the model. This is consistent with earlier results by Kwan (1996) who finds that stocks lead bonds in reflecting firm information. Hence we use one additional lag of firm equity returns to instrument for contemporaneous equity returns, leading to a just-identified IV estimator. The results for the IV estimator in column 2 show that the coefficient estimate on the lagged dependent variable, denoted α, lies below that of the Fixed-Effects estimator, despite the downward bias of the Fixed-Effects estimator in dynamic models. This suggests possible finite-sample bias when the data are highly persistent and instruments are weak.

The GMM estimator in column 3 exploits additional moment conditions, leading to a total of 244 over-identified moment conditions. The Sargan test statistics obtained by the heteroskedasticity-consistent two-step estimator suggest overall validity of the instrument set used. Furthermore, the assumption of no serial correlation in the error process is satisfied, as indicated by the significantly negative first-order serial correlation and the lack of second-order serial correlation in the differenced residuals (denoted m2). Estimates of the GMM estimator are in line with those obtained by the FE estimator, while the weak instrument problem with regard to the endogenous variables (lagged dependent variable and firm equity return) appear reduced.

Lastly, we use a GMM-system estimator (column 4), where the transformed equation of the GMM estimator is complemented by a levels equation. First-differenced lagged regressors are used as instruments for the equation in levels. Again, as all regressors other than the lagged dependent variable and firm equity returns are exogenous, no instruments are used for these in the first-differenced equation. However, while the Sargan test does not reject the validity of the instrument set, we use two Difference Sargan test statistics to increase the power of the tests and find that one of these does reject the validity of the additional instrument set at the 5 percent level. Hence the GMM estimator in column 3 remains our preferred estimator, while in subsequent specification the FE results are also shown for comparative purposes.

Overall, the results in Table 2 (column 3) suggest that firm-level variables such as leverage, idiosyncratic volatility, and return on equity matter for spreads in the way predicted by the theoretical framework. This is in line with the literature on U.S. corporate bonds, though Avramov, Jostova, and Philipov (2004) do not confirm these findings for non-U.S. bonds. Option-pricing theory suggests that the leverage ratio captures the distance to default, with a high leverage suggesting a short distance to the default threshold, thereby increasing the risk of default. We confirm the expected positive relationship between leverage and spreads. Based on our results in column 3 of Table 2, a leverage equal to the median of the sample distribution (61 percent) is associated with a spread that is 49 basis points higher than with leverage set at the first quartile of the sample distribution (40 percent). To place this in context, the median spread of the sample distribution is 430 basis points.

Second, a higher volatility of the firm value return, as proxied by the volatility of equity return, increases the probability that the default threshold will be reached and, hence, raises the risk premium. As we have decomposed total firm volatility into idiosyncratic volatility and market volatility, theory suggests that both measures of volatility should matter. We find that idiosyncratic volatility has a statistically significant effect and the size of the estimated effect is considerable. An increase in idiosyncratic volatility from the first to the second quartile of the sample distribution raises spreads by 100 basis points. Note that our results do not suggest a correspondingly important role for market volatility on spreads. The coefficient estimate is not significant differently from zero and is incorrectly signed, suggesting a one quartile increase in volatility reduces spreads by only 6 basis points. Lastly, a higher equity return increases the firm value, thereby reducing the leverage and risk of default (Collin-Dufresne, Goldstein and Martin, 2001; and Avramov, Jostova and Philipov 2004), and this inverse relationship is also supported by our results. A firm with equity returns at the first quartile of the sample distribution is associated with a 113 basis point increases in spreads compared to firms with equity returns at the median.

In terms of aggregate factors, theoretical models rooted in the option-pricing framework that relax the assumption of a constant risk-free interest rate posit the counterintuitive effect that a rise in the risk-free interest rate narrows spreads. As noted above, empirical studies of U.S. corporate bond spreads support this result, and we similarly find that a rise in U.S. treasury rates narrows spreads. Studies on launch spreads of emerging market bonds have also found the same negative relationship between U.S. interest rates and emerging market spreads (see Eichengreen and Mody, 1998). Note that as the yield on bonds is the composite of the corresponding risk-free interest rate and the spreads, a rise in the risk-free interest rate generally is associated with a rise—though less than a one-for-one—in the yields of risky bonds. A 100 basis point increase in the yield on U.S. bond (corresponding to the increase from the first quartile to the median) raises emerging market yields by 38 basis points, thereby reducing spreads by 62 basis points.

We extend the initial specification to include country and global variables. The inclusion of these factors is sometimes justified as reflecting the expected recovery rate in the event of default (Avramov, Jostova and Philipov, 2004), though the theoretical and empirical strength of this argument is as yet uncertain. More rapid domestic and U.S. GDP growth is seen to narrow spreads (columns 7 and 8), as in Eichengreen and Mody (2000), yet the economic effect overall is relatively modest. Comparing the sample distribution at the first quartile (0.6 percent) and at the median (2.6 percent), higher annual domestic growth is associated with a 29 basis point drop in spreads, while a corresponding one-quartile increase in U.S. growth from 2.2 percent to 3.7 percent leads to an 18 basis point reduction in spreads. Global equity returns, though not equity returns on the domestic stock market, add further explanatory power to the theoretically specified model. This suggests that global market returns impact on spreads even after controlling for firm-level and country-level equity returns, though statistically this effect is only significant at the 10 percent level. To quantify the economic effect, we note that increasing global returns from the first to the second quartile of the sample distribution is associated with a 26 basis points drop in spreads. In contrast domestic market returns appear to only play a small role (an estimated reduction in spreads of 6 basis points when comparing the first and second quartiles).

Last, we find that the high-yield spreads on U.S. bonds and the swap rate, proxying for the liquidity premium, are not statistically significant in our model once we have controlled for the other regressors (columns 10). While the high-yield U.S. spreads may reflect changes in the price of risk, there is considerably empirical evidence that these spreads are predictors of economic growth in the U.S. (Zhang, 2002; and Mody and Taylor, 2003). The inclusion of the high-yield spreads lowers the size of the coefficient on U.S. economic growth, and their separate effects may not be well-identified. An increase in high-yield U.S. spreads from the first to the second quartile (a 100 basis points increase) raises emerging market spreads by 22 basis points, while the corresponding effect of the swap rate is estimated at an increase of 13 basis points.

Our results in this section suggest that firm-level factors do play an important role in understanding corporate spreads in emerging markets. When combining the sample distribution of regressors with our results in Table 2 (column 8) we find the difference in spreads when regressors are set at the first quartile compared to the median is a combined 190 basis points for firm-level factors, while country and global regressors contribute 35 basis points and 98 basis points respectively. When calculations are repeated for the second and third quartile of the respective sample distributions, the corresponding break-down is estimated at 189, 36 and 75 basis points respectively, and hence increasing regressors from the first to the third quartile leads to a corresponding estimated change in spreads of 379, 71 and 173 basis points respectively with the median spread given at 430 basis points.

B. Bankruptcy Risk

A criticism of the structural model based on the contingency-claim analysis used above is that it may not adequately reflect the overall risk of default. If default risk is systematic, and if appropriate measures of default risk have been omitted, our previous analysis may have overstated the dependence on the international equity market returns and country-level factors.

We construct Altman's Z-score as a predictor of bankruptcy. To preview, and despite several studies that have confirmed the success of the Z-score in predicting bankruptcy, we find that this measure based on financial ratios for the risk of default holds only marginal additional explanatory power for spreads. At the same time, the coefficients on global market returns and domestic growth remain unaffected.

Altman (1968) proposed a measure comprising five financial ratios derived from the balance sheet and income statements of companies. This measure has been shown to be a relatively powerful predictor of bankruptcy for more recent time periods (Dichev, 1998; Sun and Shenoy, 2003; and Begley, Ming, and Watts 1997). The various subcomponents of the Z-score capture aspects of liquidity, productivity of assets, the capital turnover ratio, and the solvency of the company. The Z-score is composed as follows: $Z = .012X1 + .014X2 + .033X3 + .006X4 + .999X5$ where X1 is the ratio of working capital to total assets, X2 is the ratio of retained earnings to total assets, X3 is the ratio of earnings (before interest and tax) to total assets, X4 denotes the ratio of the market value of equity to the book value of total debt, and X5 is the share of sales in total assets. An improvement in the firm's liquidity would, for example, translate into an increase in the Z-score, and, hence, the probability of bankruptcy is inversely related to the Z-score. In particular, Altman suggests that firms with a score less than 1.91 are likely to face bankruptcy, firms with a score of less than 2.99 fall into a gray area where bankruptcy is possible but less clearly predicted, and a score exceeding 2.99 suggests that the company is not at risk.

We find that Altman's Z-score does not hold significant explanatory power in a cross-sectional setting (columns 1-4 in Table 3). The estimates in Table 3 (columns 5 through 7) suggest that the relationship between the Z-score and the risk of default is nonlinear in a panel setting. While the Z-score is not statistically significant, we find that issuers in our sample with the lowest Z-scores do have a wider spread even when fixed effects are taken into account. This suggests that if over the lifetime of the bonds, the issuing firm's Z-score falls below a certain threshold—in our sample a Z-score of 1.17—the spread widens correspondingly. The converse implication holds for a rise in the score above the threshold. Our results suggest that observations of the Z-score in the first and second percentiles are respectively associated with a widening in spreads of 107 and 178 basis points. As most of the data constituting the Z-score is available at an annual basis, the Z-score is slow moving and much of it may be absorbed in the fixed effects. Hence, though alternative measures of default risk appear relevant for an analysis of spreads, our coefficient estimates on U.S.

growth, global market equity returns and domestic economic growth are only marginally affected.

C. Recovery Rate and Economic Fundamentals

As noted above, while structural models do not suggest a role for market equity return in the risk of default, empirically much of the movement in spreads is linked to market equity returns, as is also partly the case in our study. While higher firm equity returns can be thought to lower future leverage and, hence, are in the spirit of the structural model, the interpretation of the role of market equity return is more contentious. Could unmodelled current and future economic conditions reflect the expected recovery rate in the event of default and, hence, be the source of our finding that global equity returns play a role in determining bond spreads of emerging market borrowers? This may occur if global market equity returns reflect changes in the expected recovery rate (Avramov, Jostova, and Philipov, 2004). As the economic conditions in emerging markets and, hence, the profitability of their firms, are likely to be less correlated with world economic growth than those of industrialized countries, we can expect the role of global equity markets to decline once local economic growth is better controlled for. In this subsection we consider whether market equity returns matter considering that they reflect the expected recovery rate and the current and future economic climate. We also explore an alternative explanation of systematic risk, using the Fama-French risk factors.

In Merton's (1974) "first-generation" structural model, the recovery rate is endogenous and implicitly determined by the same factors that describe the risk of default, namely, volatility of firm value and leverage. This essentially arises because the risk of default is driven by the firm's assets, while the recovery rate is determined by the residual value of assets at default (Altman et al., 2003) and, hence, is similarly sensitive to changes in the firm's assets. In contrast, more recent theoretical models, adopting a reduced-form framework, propose that default risk and the recovery rate are determined by a single systematic factor representing the state of the economy, as the value of collaterals depends on economic conditions. These models suggest that the recovery rate is largely unrelated to the firm's asset volatility and leverage. Empirically, however, support for the more recent models has been mixed, and Altman et al. (2003) overall find little evidence that economic conditions—as captured by economic growth—explain changes in the recovery rate.

We examine whether the explanatory power of global market equity returns for spreads may be due to their proxying of current and future domestic economic conditions. Hence, we include additional measures of the domestic and international economic climate in our model, based on monthly frequency: annual growth in domestic industrial production, domestic industrial production one year ahead, annual growth in U.S. industrial production and a quarterly leading indicator of U.S. growth.

Our results in Table 4 do not suggest these economic variables have additional explanatory power. Indeed, growth in local industrial production is incorrectly signed. This suggests that global market equity returns matter for reasons other than the current and future economic climate and the systematic expected recovery rate.

D. Global Factors and Systematic Risk

Following Elton et al. (2001), we test whether the responsiveness of spreads to global market equity return is symptomatic of systematic risk by including the Fama-French risk factors in our model. These three risk factors measure the excess market return on stocks on the New York Stock Exchange (NYSE), the American Stock Exchange (AMEX), and National Association of Securities Dealers Automated Quotations (NASDAQ) over treasury bills (Fama-French 1), the average return of three small portfolios minus three large portfolios (the small-minus-big factor, labeled Fama-French 2), and the difference in return between value portfolios and growth portfolios (Fama-French 3). These factors have empirically been linked to the return on stocks: stocks that are more sensitive to these risk factors compensate investors with a higher expected return on equity for the systematic risk exposure. If bond returns are sensitive to these similar risk factors, then a similar risk premium is required and reflected in bond spreads.

The empirical results in the literature are mixed. Elton et al. (2001) conclude that these risk factors are a key determinant of the level and changes in spreads on U.S. bonds. Avramov, Jostova, and Philipov (2004), however find that, for their sample of industrialized U.S. and non-U.S. bonds, these factors are not significant once conventional regressors have been included, with the exception of the small-minus-big factor, which remains significant. Our results (Table 4) indicate that the Fama-French risk factors do have explanatory power for spreads; hence, compensation for systematic risk is likely to play an important role in understanding the level and changes in spreads. The correlation coefficient on global market returns and the Fama-French factor representing excess market returns is 0.95. Global market returns are therefore no longer included in the specification once the Fama-French factors have been controlled for. As the size and significance of our other regressors remain largely unchanged, the Fama-French factors appear to capture information not reflected in regressors suggested by the structural model or by those representing the value of recovery. An increase in the three Fama-French factors from the first to the second quartile of the sample distribution is associated with an increase in spreads of 39, 3 and 35 basis points respectively. Whether seen from the perspective of global equity returns or from the Fama-French factors, emerging market bond spreads appear to be at least somewhat affected by systematic risk.

V. Conditioning on Country Features

A. Measures of Investor Protection

We construct an index of investor protection based on measures of creditor rights, anti-director rights, and judicial efficiency (see La Porta et al. 1998). The indicator is set to one if the index exceeds the median for at least two of these three measures. We interact this index with the explanatory variables and re-estimate the model. We find that all interaction variables are statistically insignificant, suggesting that for firms choosing to issue bonds on the international market and committing themselves to increased monitoring by investors and compliance requirements associated with the listing, firm-specific and market-wide information is capitalized in a similar way and is independent of the degree of investor rights in the home country.

B. Synchronicity

Morck et al. (2000) examine synchronicity in equity prices and highlight some of the striking differences between financial markets in emerging and developed economies. Stock price synchronicity—measured as the average proportion of stock prices that move in the same direction—is significantly higher in poorer countries. In particular, market-wide price fluctuation unexplained by the volatility of macroeconomic fundamentals and diversification measures is higher in emerging markets. The relative importance of the systematic component of returns variation and the lower capitalization of firm-specific information in equity prices is consistent with the hypothesis that weaker protection of property rights reduces informed risk arbitrage and increases market-wide noise trading.

We use the median of the synchronicity variable reported in Morck et al. (2000) to generate a binary variable and re-specify our model allowing for the interaction of the synchronicity dummy with all other regressors. High synchronicity appears to matter only for the influence that local market equity returns exert on spreads. While strong returns on the local equity market tend to lower spreads for countries with a low synchronicity measure, local equity returns do not matter for spreads for firms in countries with high stock price synchronicity (the coefficient on the interaction term is positive and of similar absolute size as the effect of local market equity return for all bonds, column 6 in Table 4). Our interpretation of this result is that when variations in market returns tend to be unrelated to fundamentals, investors of bonds place less weight on the information, reducing the capitalization of local equity returns into bonds spreads.

C. Country Risk during Financial Crises

Although our analysis indicates that country-level variables have little effect on internationally issued bonds, country risk may play a more pronounced role during periods of financial stress. During a financial crisis, country-level variables not only capture the macroeconomic environment in which the firm operates, but also affect transfer risk and thereby impact on the ability of the firm to meet its financial obligations. Transfer risk refers to the risk that a government with debt service difficulties imposes prohibitive foreign exchange payment restrictions on companies, often effectively forcing corporate defaults. This type of risk has frequently been used to rationalize the sovereign ceiling policy of rating agencies, although the policy has been considerably relaxed since 1997 (Durbin and Ng, 1999). It is therefore possible that a financial crisis leads to an increased capitalization of country-level factors in bond spreads by investors.

We construct a crisis index variable that takes on the value of one for a crisis country during a specified time period. Here, we focus on the financial crises in East Asia (July 1997 to July 1998), Russia/LTCM (August and September 1998) and Brazil/Argentina (January 2001 to December 2002). When interacting the index with the explanatory variables previously used we find (in unreported results) that interaction effects are statistically insignificant with the exception of firm equity returns and domestic economic growth. We retain the interaction of the crisis index with firm equity returns and country growth in our specification of the model and display the results in column 5 of Table 4. Our findings tentatively support the view that spreads are more sensitive to changes in economic growth during a financial crisis.

Furthermore, when interacting the crisis index with firm equity returns the coefficient is of similar size and opposite sign to that of firm equity returns. This suggests that while firm equity returns matter for spreads in general, investors put less emphasis on firm-specific information during a financial crisis.

VI. Structural Breaks

In this section we briefly consider whether the role of covariates of spreads could have changed over the years. In particular, we ask whether in the aftermath of the Asian, Russian and LTCM crises potential learning in the market may have resulted in a more fundamental role attached to firm-specific information in the post-crisis period. Such learning could for example arise after observing varied performances and default rates among corporates within a country or a region despite similar spreads during a crisis period. An increased reflection of firm-level information may also occur if the second period exhibits fewer crisis periods, reducing the focus on sovereign risk, with indicator dummies not fully capturing the impact of outliers during a crisis. We transformed the frequency of the data from monthly to quarterly as the two break detection methods are better suited to shorter panels, i.e. when T/N is small.[i] The large number of moment conditions when the data is of monthly frequency also generated problems during estimation as more parameters are introduced into the model when allowing for a break.

We utilize two alternative break detection procedures to help us pinpoint a possible break point, the classical approach of De Wachter and Tzavalis (2004) implemented in Ox (Doornik 1999) and the model and moment selection criteria (MMSC) explored by Andrews and Lu (2001). De Wachter and Tzavalis (2004) adapted the classical testing approach to a panel set-up and developed a break detection procedure for dynamic models with exogenous or predetermined regressors. The test statistic is the difference in the Sargan test statistic under the null hypothesis of no break and the alternative hypothesis of a break in the fixed effects and coefficients of the regressors at a particular point in time. The breakpoint test can be used to test for statistical significance with a known break point or assist in the searching for a breakpoint without prior knowledge of the timing of a break, though the distribution of the test statistic differs when the breakpoint is known versus unknown. When the breakpoint is known, the distribution of the test statistic is a standard chi-squared while when we use the method as a break detector for an unknown breakpoint the distribution of the same statistic is a correlated chi-squared which needs to be simulated from the dataset. The model and moment selection method of Andrews and Lu (2001) and Andrews (1999) is also based on the Sargan statistic for testing over-identifying restrictions, but awards bonus terms for the use of fewer parameters and mimics the well-established Bayesian Information Criterion, Akaike's Criterion and Hannan and Quinn's Criterion for model selection in a non-panel setting. The selection criteria method in the panel set-up—referred to as MMSC-BIC, MMSC-AIC and MMSC-HQIC—can be used to determine the endogeneity of regressors, to evaluate the correlation between regressors and the individual effects as well as to detect the number and location of structural breaks. Note that MMSC-AIC is not consistent and will select too few over-identifying restrictions, similar to the lack of consistency of the AIC model selection procedure. When evaluating the relative performance of the classical testing and the MMSC approach to detect a break, De Wachter and Tzavalis (2005) find that the classical testing approach is superior while the GMM-HQIC performs best among the MMSC approaches. The GMM-AIC detected structural breaks most frequently, but at the cost of too many type I errors, while the GMM-BIC was found to be generally unresponsive to breaks.

We use the two methods to search for a break-point using our dataset; the break-point test based on the classical approach suggests the end of 1999 or 2000 as possible break-points (Table 5) and this finding of a break-point around the end of 1999 is confirmed when using the MMSC. In contrast to the previous chapters, the test statistics suggest that the break is not in the form of an intercept shift, i.e. break in the fixed effects, but rather affects the coefficients on some or all variables. Column 1 of Table 6 displays the results for the baseline model without a structural break using two-step GMM estimation based on quarterly data. The results overall correspond well with our earlier estimates based on monthly data. The second and third columns jointly display the estimates when we allow for a break in all coefficients in 1999, the year after the Russian/LTCM crisis. While the second column shows the long-run effect of variables throughout the whole sample period, the subsequent column highlights the additional effect present from 1999 onwards. From the results we infer that, in terms of firm-specific variables, a given change in leverage or excess firm volatility had a far greater impact from 1999 onwards. The Wald test suggests that the additional effect of the variables is not only large, but also significant, though for leverage only at the 10 percent significance level. Regarding country variables, the tests indicate a reduced role for economic growth in the post-break period. Last, with regard to global variables, we find that only for global equity returns and U.S. growth is the impact of these variables between the pre- and post-break period significantly different. In both cases the impact of a given change appears to have decreased and the size of the change is large.

VII. Robustness Testing and Extensions

A. Cross-sectional Dependence and Principal Component Analysis

While our model specifications in the previous sections have considered a wide range of factors, significant omitted variable bias may still be present. If these omitted variables are common factors influencing bond spreads generally, their omission can induce cross-sectional dependence in the residuals and will lead to inconsistent estimates of standard errors. Furthermore, to the extent that the common factors are correlated with country regressors, the consistency of regression coefficients can also be affected. In order to address this concern, this section considers how results change with the use of time dummies and we perform a principal component analysis on the residuals.

The model specification in the previous section has included some time dummies in specific periods to reduce the risk that outliers drive our results, yet we have abstained from using time dummies in all time periods due to our particular interest in global (common) regressors. While it is no longer possible to examine the effect of e.g. U.S. economic growth on spreads once time dummies are included, we aim to compare the standard errors of firm-level factors in the models with and without the use of time dummies. Columns 1 and 2 in Table 7 present the results, corresponding to our earlier estimates presented in Table 2 (columns 8 and 3 respectively). Estimates of standard errors are not significantly affected by the use of time dummies and coefficient estimates are of similar size, with the notable exception of firm-level and local market equity returns.

Second, we performed a principal component (PC) analysis on spreads and compared it to a PC analysis on the regression residuals PC. Due to the unbalanced nature of our panel, the analysis is performed using a 12-month moving window, with an average of 60 bonds per time period. The results of the PC analysis, summarized in Figure 5, highlight the substantial comovement in spreads, with the first principal component capturing 57 percent of the variation in log spreads. These findings are in line with Bordo and Murshid (2002), whose sample contains 23 industrialized and emerging market sovereign spreads.

Despite the extensive set of global regressors in our model specification a common component remains in the regression residuals. The first principal component of the regression residuals is reduced to 33 percent, comparable to the contribution of the subsequent principal components. This issue of remaining common variation is well established in the related literature (Collin-Dufresne, Goldstein, and Martin, 2001; and Avramov, Jostova, and Philipov, 2004). Possible sources of common variation in residuals are noncredit factors, such as a time-varying liquidity premium, uncaptured expectations regarding the global economic climate, and the effect of financial crisis spillovers, as well as changes in investors’ risk appetite not captured by our regressors (Kumar and Persaud, 2002).

B. Systematic Component of Firm-level Factors

Columns 3 and 4 in Table 7 consider the specification when firm-level factors are omitted altogether. Comparing these results with our earlier estimates (columns 7 and 8 in Table 2) suggests that the local and global environment also affects spreads indirectly via their effect on firm-level factors. Therefore the overall effect of country-level and global regressors when we do not condition on firm-level variables is predictably larger. An increase in U.S. annual growth from 2.2 percent to 3.7 percent is now associated with a reduction in spreads of 30 basis points (compared to the 18 basis points effect estimated earlier), while a corresponding one-quartile increase in global market returns decreases spreads by 42 basis points (versus a 26 basis points change estimated earlier). The results caution that mis-specification and omission of firm-level factors may lead one to overstate the direct effect of global factors and possibly undermine the role of factors suggested by the option-pricing framework.

C. Omitting Time Dummies for Outliers

So far, we have used five time dummies in order to reduce the distortion in our analysis generated by outliers. Not surprisingly, these periods have tended to coincide with periods of financial turmoil and hence it is of interest to examine whether our results are significantly changed by the treatment of these observation periods. Columns 5 to 8 in Table 7 present the coefficient estimates when no time dummies are used to control for outliers. The results are broadly in line with earlier results with the exceptions of U.S. growth and the swap spread. The latter suggests that the liquidity premium can be an important component of spreads during particular time periods, such as the liquidity crunch in 1998.

VIII. Conclusion

Using a contingent-claim approach, we consider the determinants of spreads paid on internationally-issued corporate bonds over the benchmark U.S. treasury rate on the secondary market for the period 1993-2003. To our knowledge, this is the first such effort and besides enhancing our understanding of the risk factors in emerging market corporate bonds, we also provide a comparison with determinants of corporate bond spreads in industrialized countries, particularly the United States.

Our results are clear and robust. We find that the cost of borrowing by emerging market corporates on the international market is related to those characteristics of the borrower's that reflect the risk of default. A higher leverage ratio and idiosyncratic volatility raise the spread on the bond and strong stock returns are associated with a narrower spread. Our results suggest that the difference in spreads when regressors are set at the first compared to second quartile of the sample distribution of regressors is approximately 190 basis points. The relative importance of firm-level factors contrasts to findings in the literature on U.S. spreads, where default risk may only account for a small fraction of the level of spreads (Elton et al., 2001). In contrast, although the earlier literature has emphasized the importance of country factors in determining emerging market bond spreads, we find that such factors as economic growth and local market equity returns are considerably less important than firm-specific factors in explaining the movement of a firm's spreads over time.

We show that the coefficient estimate on global market equity returns is significantly different from zero, even after controlling for firm and country-level factors. This suggests that in addition to any indirect effects of global factors on spreads via regressors capturing the risk of default, global factors also have a direct effect on spreads. The role of global factors may be overstated in our analysis due to uncaptured default risk at the firm level if firms share a significant common default risk that comoves over time with aggregate economic activity. We consider Altman's Z-score of bankruptcy risk as a measure of firm-level default risk and find that this indicator carries only limited additional explanatory power in the panel and does not reduce the role of global stock markets.

A second potential explanation for the role that global equity returns play in our analysis is that the expected recovery rates are not appropriately captured by the firm-level and country-level regressors. We thus include a set of additional regressors, based on current and future industrial production for the emerging market countries, as well as a leading indicator of industrial production for the U.S. Nevertheless, our earlier results remain unchanged. Last, we evaluate a set of systematic risk factors—the Fama-French factors—one of which is by construction linked to global market equity returns. We find these systematic factors to be significant. We read this to suggest that investors are exposed, to some degree, to systematic risk in the returns on bonds.

We examine if country factors condition the responses of our explanatory variables. Investor protection rights apparently do not matter, presumably because investors are protected by rules and institutions outside of the country of the originating issuer. In contrast, synchronicity of stocks in the domestic market—reflecting opaqueness of domestic firm-specific information—reduces the effect of a firm's equity returns on reducing spreads. Finally, while country effects are more significant during financial crises, the relative size of the effects in our analysis supports the finding of credit discrimination by investors and the capitalization of firm-specific information into bond prices, highlighting the importance of default risk factors at the firm level in emerging markets. In this context, we also find evidence of a structural break: following the Russian crisis, the importance of firm-specific factors increases. This could reflect investor learning. We cannot, however, rule out the possibility that result simply reflects reduced frequency and intensity of emerging market crises after the events in the late 1990s. Thus, although Brazil and, especially, Argentina, faced serious challenges in 2001-2002, the crises tended to be localized and the extent of emerging market contagion was limited.

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Figure 1. Spread on Emerging Market Bonds

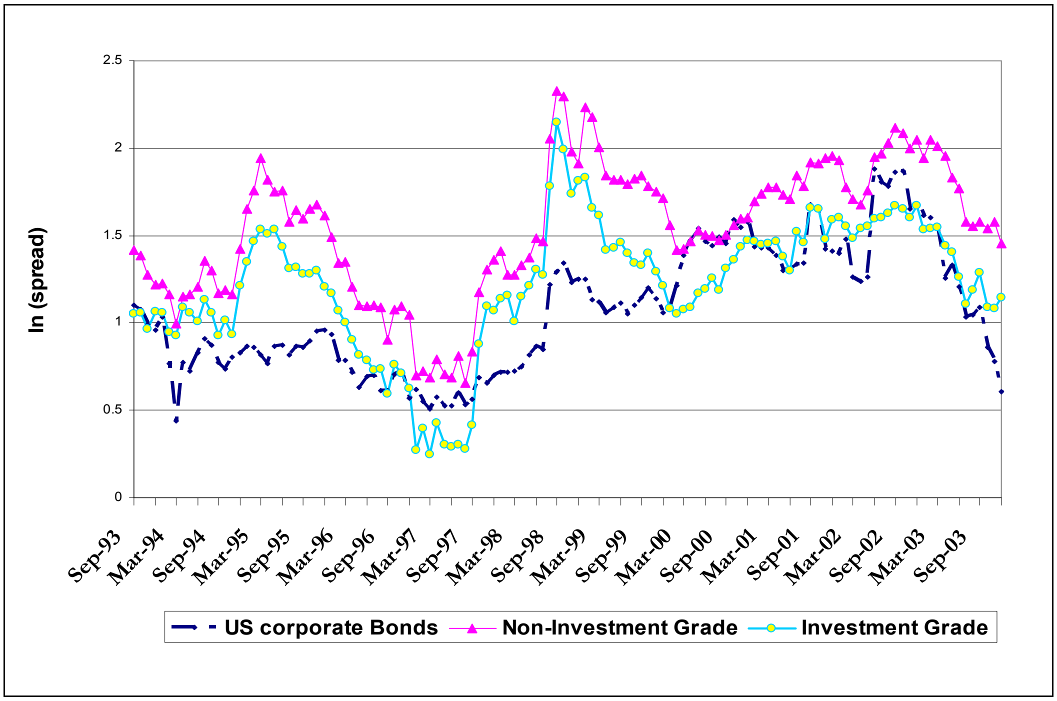

Figure 2. Global Equity Market Volatility and Spreads

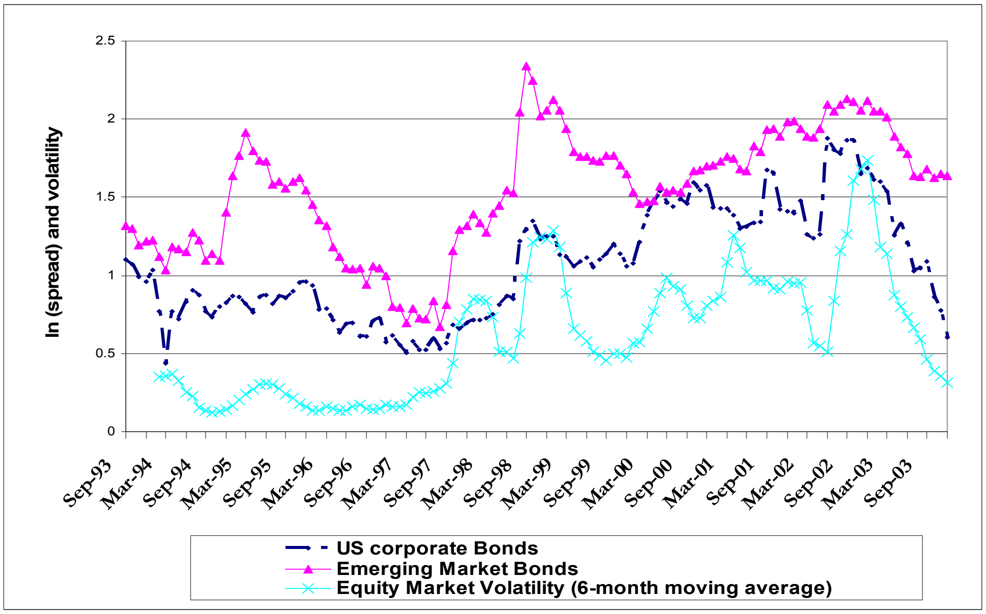

Figure 3. U.S. Treasury Yield and Emerging Market Spreads

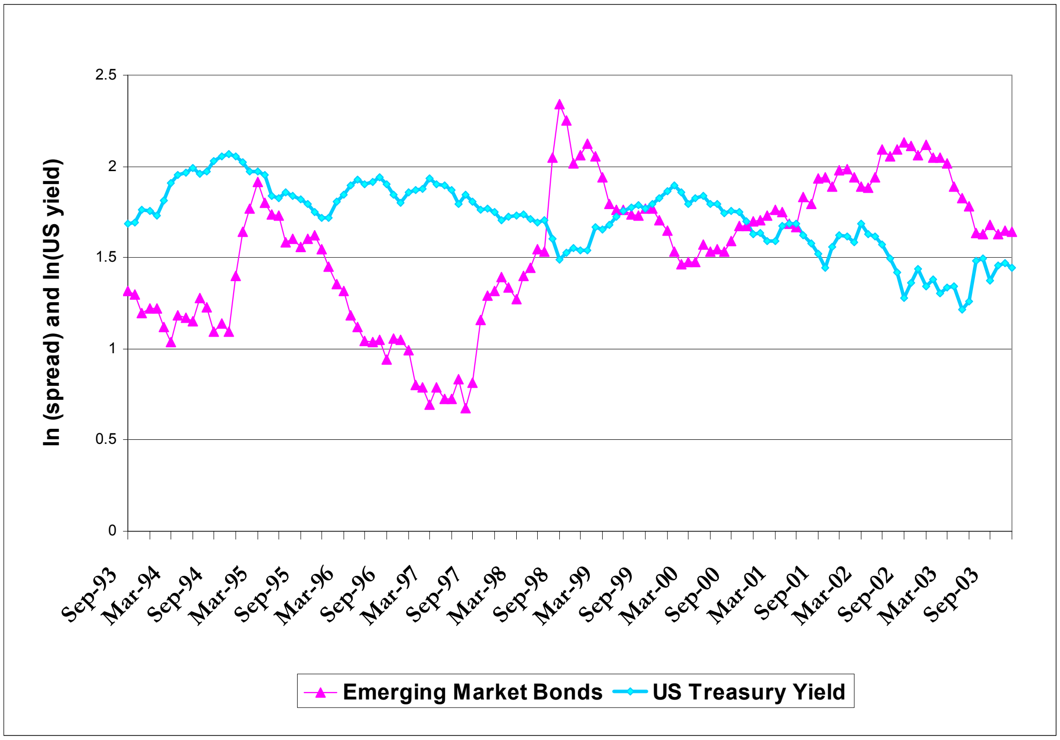

Figure 4. Firm-level Volatility, Leverage and Equity Returns

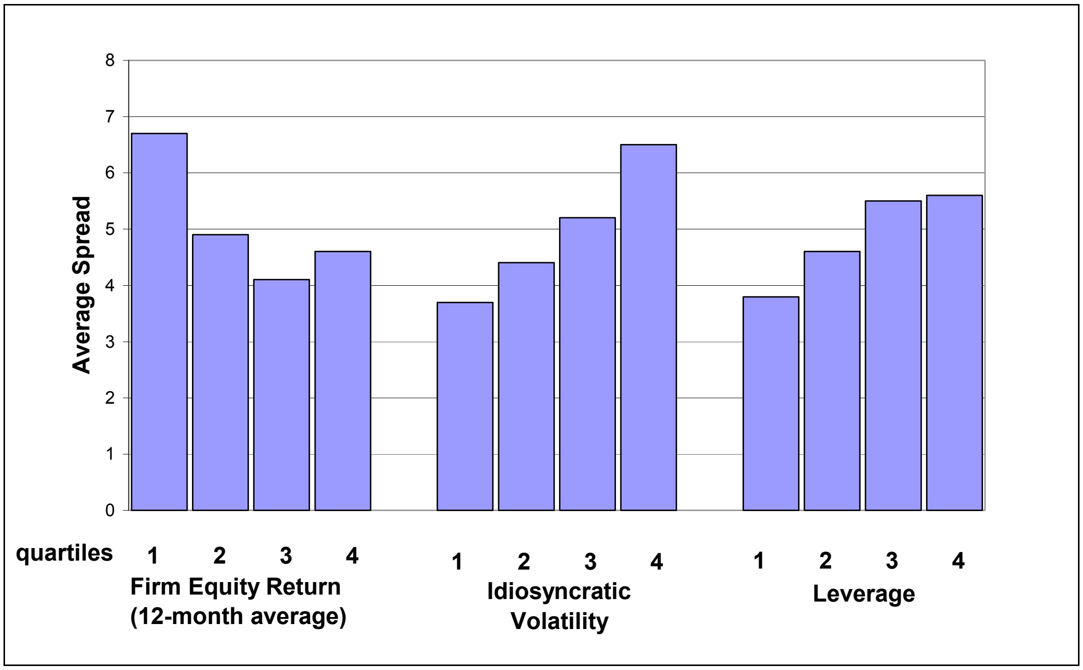

Figure 5. Principal Component Analysis on Log-spreads and Regression Residuals

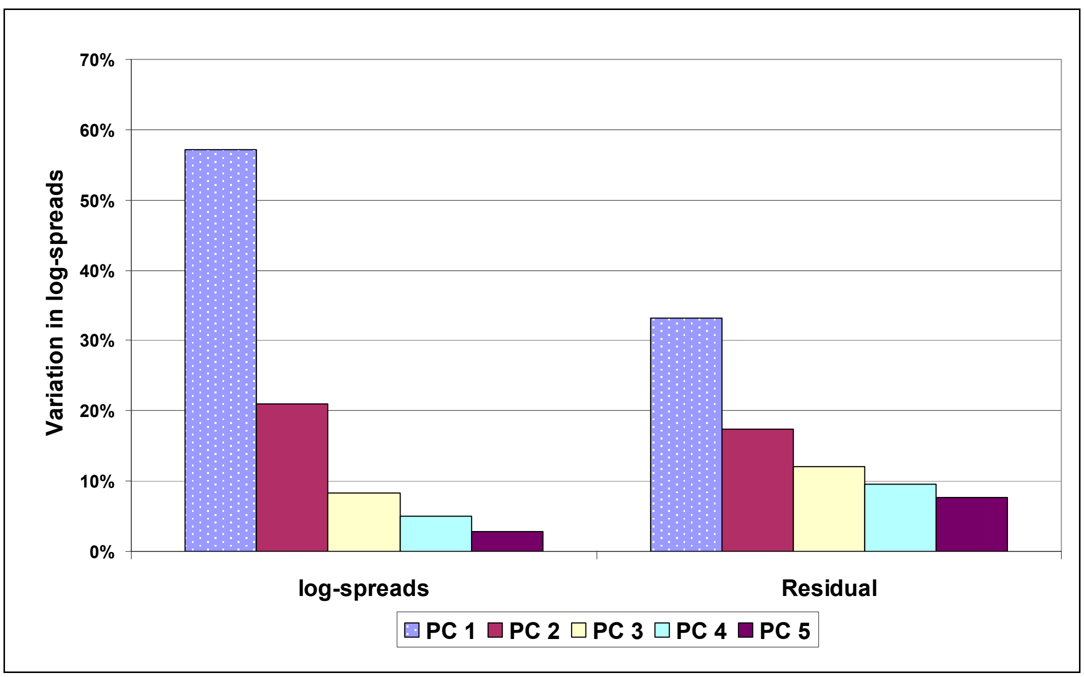

Table 1. Descriptive Statistics of Data Sample

Investment Grade – Yes/No	Country	Number of Bonds	Total number of observation points	Average Spreads
Yes	Argentina	17	715	5.6
No	Argentina	23	746	5.4
Yes	Brazil	27	1016	3.8
No	Brazil	60	2205	5.3
No	Indonesia	3	172	5.8
Yes	Korea	23	891	3.4
No	Korea	3	64	2.6
Yes	Malaysia	3	77	2.9
Yes	Mexico	19	750	4
No	Mexico	17	736	5.1
Yes	Philippines	4	281	4.6
No	Philippines	17	576	6.2
No	Russia	2	28	6.9
Yes	Thailand	6	326	5.7
Total		224		

Table 2. Within-Group, IV and GMM Estimates

	FE	IV	GMM	GMM system	FE	GMM	FE	GMM	FE	GMM
Leverage	0.333	0.321	0.279	0.207	0.331	0.287	0.234	0.21	0.226	0.211
	[0.143]	[0.123]	[0.134]	[0.062]	[0.135]	[0.13]	[0.121]	[0.122]	[0.118]	[0.113]
Idiosyncratic Volatility	0.34	0.2	0.385	0.334	0.338	0.37	0.286	0.305	0.262	0.271
	[0.046]	[0.037]	[0.055]	[0.047]	[0.045]	[0.052]	[0.039]	[0.047]	[0.038]	[0.042]
Firm Equity Return	-1.941	2.153	-3.632	-3.101	-1.543	-2.763	-1.078	-2.404	-0.916	-1.91
	[0.411]	[1.653]	[0.851]	[0.862]	[0.364]	[0.707]	[0.325]	[0.817]	[0.3]	[0.72]
Life to Maturity	0.071	-0.105	-0.112	0.044	0.087	-0.09	0.081	-0.092	0.103	-0.04
	[0.025]	[0.029]	[0.048]	[0.013]	[0.025]	[0.049]	[0.025]	[0.049]	[0.025]	[0.053]
Local market equity return							-0.917	-0.238	-0.914	-0.18
							[0.453]	[0.588]	[0.418]	[0.488]
Country growth							-3.107	-3.357	-2.839	-2.874
							[0.739]	[0.733]	[0.711]	[0.653]
U.S. yield	-0.457	-0.944	-0.745	-0.429	-0.721	-0.848	-0.45	-0.644	-0.748	-0.982
	[0.268]	[0.21]	[0.272]	[0.223]	[0.263]	[0.266]	[0.259]	[0.272]	[0.287]	[0.283]
Global market volatility	0.103	0.028	-0.025	0.094	0.056	-0.043	0.039	-0.05	-0.06	-0.087
	[0.053]	[0.04]	[0.067]	[0.044]	[0.054]	[0.066]	[0.052]	[0.064]	[0.055]	[0.05]
U.S. growth							-7.997	-2.885	-4.751	-1.997
							[2.217]	[2.41]	[2.128]	[2.033]
Global equity return					-4.995	-2.808	-2.693	-1.895	-1.752	-1.481
					[1.184]	[1.256]	[1.077]	[1.081]	[1.027]	[0.941]
U.S. corporate spread									0.356	0.142
									[0.155]	[0.179]
SWAP spread									0.092	0.096
									[0.131]	[0.124]
α	0.874	0.642	0.881	0.858	0.871	0.875	0.863	0.864	0.854	0.838
	[0.015]	[0.078]	[0.022]	[0.03]	[0.015]	[0.022]	[0.016]	[0.024]	[0.017]	[0.03]
R^2 within-groups	75.10%				75.20%		75.40%		75.50%	
m1 (p-value)		-5.60	-7.67	-7.58		-7.66		-7.68		-7.53
		(0)	(0)	(0)		(0)		(0)		(0)
m2 (p-value)		0.79	1.36	1.35		1.32		1.38		1.29
		(0.43)	(0.17)	(0.18)		(0.19)		(0.17)		(0.20)
Sargan			0.9	1		0.9		0.94		0.94
Diff-Sargan1				1						
Diff-Sargan2				0.02						

Notes: Dependent variable is the logarithm of spreads. Standard errors are in brackets. FE refers to the Fixed Effect estimator, IV is the Instrumental Variable estimator and GMM refers to the Generalized Method of Moment estimator. Forward orthogonal deviation transformation is used in the IV and GMM analysis to eliminated fixed effects. Model is estimated in autoregressive distributed lag (ADL) form, where the logarithm of spreads is regressed on lagged logarithm of spreads as well as contemporaneous and lagged regressors. Coefficient estimates and standard errors reported are of long-run effect of regressors on log-spreads. All regressors are in logarithms except firm equity returns, life to maturity, local market equity returns, country growth rate, U.S. growth rate, and global equity returns. IV estimator (column 2): lagged log-spreads and contemporaneous firm equity returns are endogenous; twice-lagged log-spreads and twice-lagged transformed firm equity returns are instruments. GMM estimator (columns 3, 6, 8, 10): lagged log-spreads and contemporaneous firm equity returns are endogenous; twice-lagged log-spreads and twice-lagged firm equity returns are instruments. GMM-system (column 4) uses same instrument as GMM estimator in transformed equation; lagged first-differenced log-spreads are instruments in the levels-equation. α is coefficient estimate on lagged dependent variable. m1 and m2 are the p-values from the test of first-order and second-order serial correlation in the first-differenced equation. Sargan is the p-value for the test of over-identifying restrictions with null hypothesis of valid specification. Diff-Sargan1 and Diff-Sargan2 are p-values for Difference Sargan test. Diff-Sargan1 tests additional instruments used by the GMM-system estimator (column 4) compared to GMM estimator (column 3). Diff-Sargan2 tests the validity of the same additional instruments as does Diff-Sargan1, but has higher power and is based on GMM-system and GMM estimator where twice-lagged firm equity returns are not used as instruments (results of coefficient estimates not displayed). Time dummies added for December 1994, January 1997, August 1997, August 1998 and September 1998 in columns 1-4.

Table 3. Default Risk and Altman's Z-Score

	OLS CROSS-SECTION	OLS	OLS	OLS	GMM PANEL	GMM	GMM
Leverage	0.166	0.127	0.058	0.136	0.23	0.179	0.156
	[0.086]	[0.073]	[0.075]	[0.076]	[0.144]	[0.122]	[0.119]
Idiosyncratic Volatility	0.317	0.326	0.322	0.321	0.301	0.298	0.302
	[0.054]	[0.057]	[0.056]	[0.056]	[0.045]	[0.046]	[0.047]
Firm Equity Return	5.197	5.257	4.913	5.248	-1.743	-2.256	-2.242
	[1.564]	[1.558]	[1.529]	[1.558]	[0.711]	[0.787]	[0.803]
Life to Maturity	4.822	0.043	0.045	0.044	-0.092	-0.087	-0.084
	[2.515]	[0.009]	[0.009]	[0.009]	[0.05]	[0.048]	[0.05]
Local market equity return	-4.822	-4.701	-4.953	-4.732	-0.658	-0.284	-0.32
	[2.515]	[2.509]	[2.457]	[2.508]	[0.569]	[0.56]	[0.58]
Country growth	-9.096	-9.13	-8.564	-9.215	-3.294	-3.153	-3.16
	[1.614]	[1.574]	[1.551]	[1.574]	[0.755]	[0.71]	[0.699]
U.S. yield					-0.622	-0.694	-0.708
					[0.268]	[0.269]	[0.27]
Global market volatility					-0.046	-0.046	-0.046
					[0.064]	[0.063]	[0.064]
U.S. growth					-2.959	-2.445	-2.352
					[2.384]	[2.442]	[2.443]
Global market equity return					-1.982	-1.914	-1.847
					[1.069]	[1.066]	[1.084]
Z-score	0.002				-0.003		
	[0.006]				[0.005]		
Bankruptcy Dummy (Z<1.91)		0.095	0.165			0.214	
		[0.118]	[0.117]			[0.172]	
Grey area Dummy		0.035	0.075			0.309	
(1.91<Z<2.99)		[0.15]	[0.147]			[0.229]	
Z-score 1				0.057			0.257
(first percentile dummy)				[0.13]			[0.171]
Z-score 2				0.003			0.429
(2nd percentile dummy)				[0.133]			[0.176]
Bond Rating (NI)			0.23				
			[0.072]				
α					0.864	0.863	0.864
					[0.024]	[0.024]	[0.024]
R^2	36.40%	36.70%	39.60%	36.50%			
m1 (p-value)					-7.66	-7.68	-7.68
					(0)	(0)	(0)
m2 (p-value)					1.38	1.39	1.38
					(0.17)	(0.17)	(0.17)
Sargan					0.95	0.95	0.96

Notes: Dependent variable is the logarithm of spreads. Standard errors are in brackets. GMM refers to the Generalized Method of Moment estimator. Cross-section refers to a static OLS analysis. Forward orthogonal deviation transformation is used in GMM analysis to eliminated fixed effects. Model for GMM is estimated in autoregressive distributed lag (ADL) form, where the logarithm of spreads is regressed on lagged logarithm of spreads as well as contemporaneous and lagged regressors. Coefficient estimates and standard errors reported are of long-run effect of regressors on log-spreads. All regressors are in logarithms except firm equity returns, life to maturity, local market equity returns, country growth rate, U.S. growth rate, and global equity returns. GMM estimator (columns 5-7): lagged log-spreads and contemporaneous firm equity returns are endogenous; twice-lagged log-spreads and twice-lagged firm equity returns are instruments. m1 and m2 are the p-values from the test of first-order and second-order serial correlation in the first-differenced equation. Sargan is the p-value for the test of over-identifying restrictions with null hypothesis of valid specification. Time dummies added for December 1994, January 1997, August 1997, August 1998 and September 1998 in columns 1-4.

Table 4. Expected Recovery Rate Fama-French Factors and Transfer Risk

	FE	GMM	FE	GMM	GMM	GMM
Leverage	0.351	0.352	0.253	0.214	0.216	0.218
	[0.128]	[0.128]	[0.123]	[0.116]	[0.118]	[0.21]
Idiosyncratic Volatility	0.29	0.302	0.305	0.329	0.297	0.294
	[0.04]	[0.046]	[0.042]	[0.052]	[0.049]	[0.046]
Firm Equity Return	-1.425	-2.148	-1.412	-3.052	-2.793	-2.108
	[0.364]	[0.773]	[0.37]	[1.009]	[0.888]	[0.803]
Life to Maturity	0.122	-0.027	0.114	-0.039	-0.081	-0.089
	[0.041]	[0.053]	[0.029]	[0.057]	[0.053]	[0.048]
Local market equity return	-0.616	-0.283	-0.719	0.261	-0.232	-1.068
	[0.464]	[0.595]	[0.487]	[0.655]	[0.602]	[0.802]
Country growth	-4.53	-4.996	-3.985	-4.196	-2.51	-3.193
	[0.927]	[0.945]	[0.767]	[0.785]	[0.902]	[0.717]
U.S. yield	-0.542	-1.199	-0.747	-0.976	-0.667	-0.637
	[0.317]	[0.423]	[0.297]	[0.301]	[0.282]	[0.269]
Global market volatility	0.236	0.169	0.112	0.015	-0.004	-0.046
	[0.06]	[0.068]	[0.057]	[0.072]	[0.068]	[0.063]
U.S. growth	-10.506	-10.621	-9.596	-4.428	-2.274	-3.193
	[4.902]	[5.128]	[2.46]	[2.53]	[2.458]	[2.366]
Global market equity return	-0.616	-1.54			-1.848	-1.972
	[0.464]	[1.208]	[0]	[0]	[1.142]	[1.084]
US industrial production growth	0.016	0.026				
US leading indicator of industrial production growth	-0.025	-0.022				
	[0.011]	[0.011]				
Domestic industrial production growth	0.512	0.867				
	[0.441]	[0.443]				
Domestic industrial production growth	0.141	-0.211				
(one-year ahead)	0.456	0.54				
Fama-French 1			-0.032	-0.025		
			[0.011]	[0.012]		
Fama-French 2			-0.0026	0.003		
			[0.007]	[0.007]		
Fama-French 3			-0.03	-0.031		
			[0.012]	[0.012]		
Crises*					2.097	
Firm Equity Return					[0.891]	
Crises*					-4.021	
Country growth					[2.166]	
Synchronicity*						1.737
Local market equity return						[0.727]
α	0.859	0.859	0.869	0.867	0.872	0.863
	[0.018]	[0.023]	[0.016]	[0.025]	[0.023]	[0.024]
R^2	73.90%		74.30%			
within-groups						
m1 (p-value)		-7.21		-7.51	-7.69	-7.67
		(0)		(0)	(0)	(0)
m2 (p-value)		1.85		1.42	1.41	1.38
		(0.06)		(0.18)	(0.16)	(0.17)
Sargan		0.98		0.95	0.95	0.96

Notes: Dependent variable is the logarithm of spreads. Standard errors are in brackets. FE refers to the Fixed Effect estimator, and GMM refers to the Generalized Method of Moment estimator. Forward orthogonal deviation transformation is used in GMM analysis to eliminated fixed effects. Model is estimated in autoregressive distributed lag (ADL) form, where the logarithm of spreads is regressed on lagged logarithm of spreads as well as contemporaneous and lagged regressors. Coefficient estimates and standard errors reported are of long-run effect of regressors on log-spreads. All regressors are in logarithms except firm equity returns, life to maturity, local market equity returns, country growth rate, U.S. growth rate, and global equity returns. GMM estimator: lagged log-spreads and contemporaneous firm equity returns are endogenous; twice-lagged log-spreads and twice-lagged firm equity returns are instruments. m1 and m2 are the p-values from the test of first-order and second-order serial correlation in the first-differenced equation. Sargan is the p-value for the test of over-identifying restrictions with null hypothesis of valid specification. Time dummies added for December 1994, January 1997, August 1997, August 1998 and September 1998 in column 1-6.

Table 5. Break Dates Using Classical Testing and MMSC in a Panel Set-Up

	Breakpoint	Alternative Breakpoint
De Wachter and Tzavalis:	1999q4	
Unknown breakpoint test	(p=0.06)	
BIC	No break	No break
AIC	2001q1	1999q4
HQIC	2001q1	1999q4

Table 6. Model Estimation When Allowing for Structural Break

	Model 1: Baseline Model	Model 2: Breakpoint 1999		Model 2: Wald-type test statistic: Additional effect in post-break period
	Coefficient estimates	Coefficient estimates		(p-level)
			Additional effect post-break	
Leverage	0.405	-0.2129	0.722	2.65 (0.104)
Excess Volatility	0.135	0.084	0.057	23.99 (0)
Firm equity return	-0.0019	-0.0078	. .006	0.37 (0.54)
Domestic equity return	-0.093	1.324	-1.98	1.09 (0.297)
Domestic economic growth	-0.028	-0.053	0.0236	0 (0)
US yield	-0.464	-0.131	-0.478	2.38 (0.123)
Global volatility	-0.057	-0.033	-0.042	0.49 (0.486)
Global equity return	-0.021	-0.101	0.084	19.05 (0)
US growth	-0.183	-0.707	0.556	9.86 (0.002)
Wald 1 (p-value)				28.65 (0)
Wald 2 (p-value)				20.46 (0)
Wald 3 (p-value)				32.05 (0)

Wald 1 tests the additional effect of firm-variables in post-break period and is distributed chi-squared with 3 degrees of freedom. Wald 2 tests the additional effect of country variables in the post-break period and is distributed chi-squared with 2 degrees of freedom. Wald 3 tests the additional effect of global variables in the post-break period and is distributed chi-squared with 4 degrees of freedom. P-levels are in brackets.

Table 7. Alternative Treatment of Time Effects

	GMM Time Dummies	GMM Time Dummies	FE	GMM	FE No time dummies	GMM No time dummies	FE no time dummies	GMM no time dummies
Leverage	0.183	0.333			0.261	0.219	0.256	0.194
	[0.091]	[0.163]			[0.125]	[0.118]	[0.127]	[0.117]
Idiosyncratic Volatility	0.227	0.29			0.306	0.324	0.269	0.457
	[0.05]	[0.056]			[0.042]	[0.049]	[0.04]	[0.08]
Firm Equity Return	-0.065	-0.36			-1.44	-2.986	-1.196	-1.305
	[0.505]	[0.65]			[0.366]	[0.893]	[0.336]	[0.417]
Life to Maturity	[-0.16]	[-0.183]			0.121	-0.024	0.16	0.017
	[0.043]	[0.056]			[0.028]	[0.055]	[0.029[	[0.057]
Local market equity return	-0.719		-2.162	-2.12	-0.826	0.15	-0.852	-0.565
	[0.513]		[0.554]	[0.824]	[0.496]	[0.631]	[0.446]	[0.405]
Country growth	-3.267		-5.123	-4.835	-4.155	-4.214	-3.393	-2.765
	[0.644]		[0.773]	[0.825]	[0.775]	[0.729]	[0.728]	[0.68]
U.S. yield			0.303	-0.748	-0.842	-1.087	-1.713	-1.852
			[0.302]	[0.352]	[0.285]	[0.292]	[0.348]	[0.382]
Global market volatility			0.193	0.156	0.109	0.03	-0.056	-0.181
			[0.056]	[0.065]	[0.056]	[0.067]	[0.059]	[0.06]
U.S. growth			-5.773	-4.835	-4.155	-3.349	-6.831	-4.572
			[2.337]	[2.327]	[2.351]	[2.425]	[2.353]	[2.262]
Global market equity return			-2.639	-3.027	-3.221	-2.527	-1.391	-1.712
			[1.258]	[1.247]	[1.193]	[1.206]	[1.161]	[1.139]
U.S. corporate spread							0.206	0.071
							[0.183]	[0.209]
SWAP spread							0.443	0.385
							[0.145]	[0.147]
α	0.66	0.754	0.877	0.879	0.87	0.866	0.86	0.847
	[0.086]	[0.063]	[0.015]	[0.025]	[0.015]	[0.024]	[0.017]	[0.03]
R^2 within-groups			75.00%		74.30%		74.40%	
m1 (p-value)	-1	-5.58		-7.65		-7.25		-7.5
	(0.32)	(0)		(0)		(0)		(0)
m2 (p-value)	0.86	-0.2		1.25		1.52		1.63
	(0.39)	(0.84)		(0.21)		(0.13)		(0.10)
Sargan	1	1		0.91		0.92		0.93

Notes: Dependent variable is the logarithm of spreads. Standard errors are in brackets. FE refers to the Fixed Effect estimator, and GMM refers to the Generalized Method of Moment estimator. Forward orthogonal deviation transformation is used in GMM analysis to eliminated fixed effects. Model is estimated in autoregressive distributed lag (ADL) form, where the logarithm of spreads is regressed on lagged logarithm of spreads as well as contemporaneous and lagged regressors. Coefficient estimates and standard errors reported are of long-run effect of regressors on log-spreads. All regressors are in logarithms except firm equity returns, life to maturity, local market equity returns, country growth rate, U.S. growth rate, and global equity returns. GMM estimator: lagged log-spreads and contemporaneous firm equity returns are endogenous; twice-lagged log-spreads and twice-lagged firm equity returns are instruments. m1 and m2 are the p-values from the test of first-order and second-order serial correlation in the first-differenced equation. Sargan is the p-value for the test of over-identifying restrictions with null hypothesis of valid specification. Time dummies specified in every period for GMM in column 1 and 2. Time dummies added for December 1994, January 1997, August 1997, August 1998 and September 1998 in columns 3 and 4. No time dummies specified in columns 5-8.

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[i] One of the challenges of our data is that the sub-sample of the data set with a short time dimension is relatively large, preventing alternative estimation methods designed for panels with a longer time series.