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Country and industry effects in corporate bond spreads in emerging markets☆

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ABSTRACT

We use corporate bond data from firms belonging to 13 emerging markets and eight industries from 2007 to 2013 to study whether and how country and industry effects determine the spread between their yield and the respective sovereign debt yield. Existing models ignore country and industry effects as they implicitly assume that firm, bond issues, local, and global factors capture these effects. We find that country and, especially, industry effects are significant in explaining corporate bond spreads. From a practitioner's point of view, our results are important as ignoring country and industry effects causes bonds to be mispriced in emerging markets, particularly in the energy, basic materials, and communications and technology sectors. We also find country effects for bonds from firms from Chile, Indonesia, and the Philippines, although with lower significance levels. Finally, and consistent with other recent papers, we also find violations of the sovereign ceiling rule.

1. Introduction

One of the most significant developments in the economics of emerging markets (EMs) in the 21st century has been the increasing reliance of firms from these countries on the issuance of foreign debt (Caballero, Fernández, & Park, 2016). According to data reported by these authors, the stock of international debt issued by these economies quadrupled from an outstanding balance of approximately $600 billion in the early 2000s to $2.4 trillion by 2014. And while an extensive literature exists on the determinants of sovereign spreads in emerging markets (the difference between the yields on sovereign bonds from emerging markets and developed markets), we know relatively little about the determinants of yield spreads between corporate and sovereign bonds in these economies (a spread that we term the “net spread” thereafter in this paper).

Another string of the literature has studied the impact of country risk and the sovereign ceiling on corporate debt yields for firms from EMs. In this paper, however, we focus on the determinants of the spread between the yield of corporate debt issued by firms from emerging markets against the yield of the respective sovereign debt. In particular, we examine whether country and industry effects can explain this spread after controlling for firm, bond issue, local, and global factors.

Existing models ignore country and industry effects as they implicitly assume that firm, bond issued, local, and global factors capture these effects. However, we find that country and, especially, industry effects are indeed important in explaining corporate bond spreads. From a practitioner's point of view, our results are relevant as ignoring country and industry effects could cause bond mispricing in emerging markets.

According to Peter and Grandes (2005), there exists an extensive empirical literature on the determinants of government debt yield spreads (with respect to a benchmark from a developed country) in EMs. However, as previously mentioned, the study of the determinants of the spread between corporate and government debt yields in emerging markets is still a relatively understudied subject. Earlier research (Briceño & Rivero, 2012; Peter & Grandes, 2005) finds the most important determinant of corporate default for firms from emerging markets is sovereign risk. However, these authors also demonstrate that there are other determinants, including firm specific factors.

We use a dataset of corporate and sovereign bonds to find the

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determinants of these spreads for countries included in the MSCI Emerging Markets Index. Our data on the spread benefits from the use of the Yield Adjusted Spread (YAS) allowing us to control for the term structure of debt. The main finding is that there are persistent country and specially industry effects that explain the spread. This is a new result contrasting with the existing literature (Durbin & Ng, 2005) and allows us to gauge a better understanding as to how country and industry risk affect corporate bond pricing in emerging markets.

Our results can be explained as follows. We find a firm in the energy industry (where a large portion of the revenues is expected to come from abroad in U.S. dollars) that issues U.S. dollar denominated bonds will have a natural currency hedge and, as such, be less risky to investors, thus enjoying a smaller spread over sovereign debt. Alternatively, for basic materials and communications and technology, which are primarily industries with local revenues, we find positive and significant coefficients causing a wider net spread. Country effects are also found for firms issuing debt from Chile, Indonesia, and the Philippines albeit with lower statistical significance.

The article is organized as follows. The second section reviews the literature on the determinants of spreads on sovereign bonds and on the influence of sovereign debt on corporate debt yields. Section 3 describes the data and the methodology employed, while Section 4 presents the main results obtained. Section 5 is devoted to various robustness checks that were performed on the main results. The final section provides our conclusions and discusses the main findings.

2. Literature review

2.1. Determinants of spreads on sovereign bonds

Sovereign bond spreads are a measure of country risk and are usually defined as the spread between the yield to maturity of debt issued by the government of a certain country and the yield to maturity of debt issued by a benchmark country (e.g., the U.S. when the debt is issued in U.S. dollars). We briefly review the literature regarding the determinants of sovereign bond spreads.

Baldacci, Gupta, and Mati (2011) measure political risk and introduce fiscal variables into a model of spreads for a sample of 30 emerging market economies. They find that fiscal and political variables are the key determinants of country risk. Bellas, Papaioannou, and Petrova (2010) find macroeconomic variables are the main determinants of sovereign spreads in the long run and that financial volatility is the main determinant in the short run. They reach this conclusion after analyzing data from 14 emerging markets in a panel dataset from 1997 to 2009. In the same line, Hilscher and Nosbusch (2010) examined 32 emerging markets and found the effects of a number of macroeconomic fundamentals on sovereign credit spreads by using panel data from 1994 to 2007. More specifically, they determined that the terms of trade volatility (measured using a country-specific commodity price index) and country fundamentals have substantial explanatory power. Furthermore, Ferrucci (2003) finds that along with macroeconomic factors, external liquidity conditions are also a significant determinant of sovereign spreads in emerging markets.

Baek, Bandopadhyaya, and Du (2005) find that both macroeconomic variables and the risk attitude of the market are significant determinants of sovereign risks. They constructed their own measure, called the Risk Appetite Index, in order to assess the impact of the market attitude toward risk on the spread for Brady bonds (a group of government bonds issued by emerging markets in the early 1990s). Their sample started with 34 emerging and developed markets in 1992 and ended with 47 in 1996 in an unbalanced panel. Ludvigson and Ng (2009) studied the impact of macroeconomic factors in a dynamic framework and found a cyclical behavior of these factors in returns and long-term yield predictions for U.S. T-Bonds.

In a recent and related paper, Carletti, Colla, Gulati, and Ongena (2016) study the degree to which financial markets price contract terms. They take advantage of the natural experiment created by the Venezuelan debt crisis in 2016 (when the six-month credit default spread contract traded at close to 7000 basis points and the probability of default was above 90%) and consider that the outstanding sovereign bonds of Venezuela have a unique set of contractual features. The authors argue that this near default scenario represented an ideal setting to determine what legal terms should be most important to market participants. The authors find that in such a stressful scenario, markets seem to differentiate between bonds that allow for a greater ability to hold out (i.e., a holdout problem ensues when a bond issuer is in, or close to, default and proposes an exchange offer to restructure the debt held by current bond holders) and the rest of the bonds.

Dahlquist and Hasseltoft (2013) used a dataset covering monthly zero coupon interest rates for Germany, Switzerland, the U.K., and the U.S. from 1975 to 2009. They employ maturities of one month, three months, and one to five years for each country. They use a dynamic factor analysis methodology, also proposed by Cochrane and Piazzesi (2009), to study the influence of local factors in bond risk premiums across international bond markets and find not only global, but also local factors explain the spreads. These findings contrast with those of Westphalen (2001), who considers a systematic risk factor further than merely country risk, termed the “sovereign bond market factor” (Westphalen, 2001, pg. 22). The author remarks that whether the corporate bond market influences this factor needs to be tested.

In another branch of the literature, sovereign credit ratings are considered to be an important determinant of sovereign risk premiums (Kaminsky & Schmukler, 2002; Klein & Stellner, 2013; Remolona, Scatigna, & Wu, 2008). In this same line, Cantor and Packer (1996) examine the determinants of sovereign credit ratings for 42 developed and emerging countries. Although this strand of research is beyond the scope of our study, they find credit ratings have independent influence on credit spreads and are also positively correlated with macroeconomic factors.

Martinez, Terceño, and Teruel (2013) and Terceño, Sorrosal, Martinez, and Barberà (2013) study the determinants of the sovereign spread for seven Latin American countries by using a panel data framework. They test for the possible existence of the effects of the international financial crisis of 2008–2009 on the spreads, and find the existence of contagion effects across spreads during the crisis.

In general, the literature on sovereign spreads finds macroeconomic fundamentals are the most important determinants of the spread. Along these findings, some researchers also consider country specific factors as being determinants of the spread, as well as fiscal and political factors, investor's risk attitude, and the terms of trade volatility. Another string of the literature has found credit ratings to be significant in explaining the sovereign spread.

2.2. The influence of sovereign debt on corporate debt yields

In theory, private debt should be riskier than sovereign debt. This implies that the credit rating of a sovereign bond issue should, in principle, be a ceiling for the bond of a firm incorporated in that country (Cuadra, Sanchez, & Sapriza, 2010). However, existing evidence suggests that this is not always the case in the bond markets (Durbin & Ng, 2005). According to Borensztein, Cowan, and Valenzuela (2013), prior to 1997, no credit rating agency gave higher ratings to corporate debt issues than to the respective sovereign debt issues. This policy was termed the “sovereign ceiling” rule. However, this practice was relaxed in 1997. In fact, Lee, Naranjo, and Sirmans (2013) studied 2364 companies in 54 countries from 2004 to 2011 and observed violations to the sovereign ceiling rule. In the same vein, and more recently, Krylova (2016) also found a break up in the existence of country ceilings for corporate bond ratings during the recent global financial crisis (2008–2009). We also explore the possible existence of sovereign ceilings in our sample.

Borensztein et al. (2013) employ a panel dataset of 123 banks from

32 countries from 1995 to 2004 and find that public debt affects private sector debt as sovereign ratings are one of the main determinants of the ratings assigned to corporate debt. Cáceres, Guzzo, and Segoviano (2010) argue that the sources of risk have changed from global risk aversion to country specific factors, contrary to what Westphalen (2001) found. This argument is particularly important for this research as our main objective is to verify not only the extent to which country risk affects net spreads, but also the role of industry risk as an important potential determinant of net spreads.

Christopher, Kim, and Wu (2012) examine 19 emerging markets from 1994 to mid-2007 in a panel data framework, and consider not only the effect of sovereign rating changes on bonds, but on stocks, as well (20 years earlier, Hsueh & Liu, 1992, conducted a similar study in the U.S.). They found the existence of a contagion effect regarding changes in sovereign debt ratings in the regions studied and that this effect was not present in the case of stocks.

Ağca and Celasun (2009) analyze syndicated loans from 38 emerging markets and apply a panel data framework from 1990 to 2006. They argue that a rise in public debt affects the private sector by increasing the overall risk of the country, making the private sector less attractive to foreign creditors. This phenomena is more critical in countries with low creditor rights. Thereafter, Celasun and Harms (2011) assessed the influence of corporate debt on the probability of any government defaults, and found that the greater the proportion of private debt in a country, the lower the probability a country would default. In both cases, the conclusions lead to an argument regarding the importance of management of public debt. Their dataset covered 65 emerging markets for the years 1980–2005. Finally, Panizza, Sturzenegger, and Zettelmeyer (2009) find more relevance in theories treating sovereign debt management from a country specific perspective (institutions) than from a global point of view (enforcement).

We can summarize the literature concerning the influence of sovereign debt over corporate debt yields with the following two main conclusions. First, credit ratings of sovereigns affect corporate debt issues directly, a finding in line with the previous section summary. Additionally, the amount of public debt should increase the country risk and, as such, it should also affect private debt issues.

Durbin and Ng (2005) and Borensztein et al. (2013) contend that there are at least three channels through which the creditworthiness of a government may affect that of private companies:

1) The negative impact a sovereign default has on the domestic economy as a whole;
2) A sovereign default may lead the government to resort to substantial tax increases and to inflationary financing; and
3) The government may impose direct capital controls, thus preventing private borrowers from servicing their external debt (this effect is called “transfer risk”).

As explained previously, there are several papers based on the theory of the sovereign ceiling. From this perspective, researchers have tried to find, as one of the determinants of the net spread, the yield of sovereign debt of a certain country against a benchmark.

Findings in the literature on corporate over sovereign debt yields have sparked a discussion regarding the determinants of such spread. In spite of the increasing research efforts regarding this issue, those findings are still not conclusive. Several papers have focused on spreads in emerging markets (Peter & Grandes, 2005; Durbin & Ng, 2005; Vieira dos Santos & Ferreira, 2009, Cavallo & Valenzuela, 2010; Grandes, Panigo, & Pasquini, 2016; Garay & Molina, 2014) without a final conclusion as to what the determinants of the spreads are. Moreover, the literature from developed markets also enters in the debate with inconclusive results (Durbin & Ng, 2005; Elton, Gruber, Agrawal, & Mann, 2002; King & Khang, 2005).

Elton et al. (2002) find corporate over sovereign debt spreads are explained by three main factors: 1) the expected default losses, 2) local and federal taxes, and 3) a risk premium due to systematic risk. For these authors, credit ratings only explain a small fraction of the spread. The systematic risk is the same as in the stock market. However, regarding the latter factor, King and Khang (2005) argue that the Elton et al. (2002) work is incorrectly specified and, as such, it fails to explain the effect of systematic risk on the spread. A contrary conclusion was found by Krylova (2016), where it was confirmed using a sample of Euro-denominated bonds that “rating effects” were the major driver of corporate bond spreads prior to the 2008–2009 financial crisis.

Durbin and Ng (2005) find corporate risk is positively correlated with sovereign default risk. Additionally, they find no evidence that sector (industry) factors affect the corporate spread in their regression results. Their data consists of 116 corporate (with sovereign counterpart) bonds from 14 emerging markets from 1995 to 2001. Contrary evidence was noted in Krylova (2016) where, after the recent financial crisis, the spreads were characterized by increased cross-country and cross-sector heterogeneity.

Cavallo and Valenzuela (2010) employ firm specific, country specific, and industry specific variables for 139 corporate bonds in 10 emerging markets. They use the Option Adjusted Spread data from Bloomberg in a panel data framework from 1999 to 2006. Moreover, they decompose the variance and find firm specific factors represent the largest fraction of the overall variance. In the same line, Klein and Stellner (2013) find a similar behavior by using credit ratings and zero volatility spreads for 11 European countries.

Alternatively, Peter and Grandes (2005) and Grandes et al. (2016) argue sovereign risk is the most important determinant of corporate spread. While Peter and Grandes (2005) employ seven corporate bonds from South Africa, Grandes et al. (2016) use information on Latin American corporate bonds for the same countries in our sample, plus Venezuela, from 2006 to 2009. They also test for the sovereign ceiling rule application and find a rejection of up to 90%.

Jaramillo and Weber (2013) use a sample of local bonds and find fiscal variables affect bond yields depending upon the global risk aversion. They construct an unbalanced panel dataset of monthly observations for 26 emerging economies from January 2005–April 2011. Feyen, Ghosh, Kibuuka, and Farazi (2015) analyze bond issues (instead of bond spreads) and determine global factors are important both in developed and emerging economies.

Finally, Colla, Gelpern, and Gulati (2016) extend the analysis of Carletti et al. (2016) and study the spread between the bond yields of PDVSA (the Venezuelan oil state company, which is a major state-owned corporate borrower in international markets with an outstanding debt of $34 billion) and the Venezuelan sovereign bond yields. They find that while some PDVSA bond issues had a positive spread over the sovereign, others revealed the counterintuitive result that the spread was negative, thereby violating the sovereign ceiling rule. However, one must caution that, in this case, one is dealing with a state-owned company. The authors find the sign and magnitude of the spread can be explained by legal, liquidity, and maturity variables.

As stated previously, results regarding the determinants of the net spread differ depending upon the sample and the period considered. Some of these works contend the sovereign risk is the main determinant of corporate spreads. Others find firm specific factors are the most important determinants. What is remarkable for our objective in this paper is the findings of Durbin and Ng (2005). They note there are not specific industry (sector) factors determining the corporate spread. We seek to determine whether these specific factors actually exist. We find industry factors (measured using dummy variables for industries) are also important in explaining this spread, apart from country effects.

2.2.1. A note on the corporate-sovereign debt spread estimation

Many of the papers reviewed here estimated the yield spread between corporate and sovereign debt issues using a matching methodology in which bonds were selected and matched according to their maturity date. Thus, the authors searched for bonds with similar maturities that had been classified in the same risk category. In this form, the spread is calculated by comparing bonds with similar characteristics.

However, this matching of similar bonds does not control for the influences of the coupon rate and the term structure of the debt over the spread. The spread must be calculated as the difference between the yield to maturity of a zero coupon corporate bond and the same measure for a sovereign bond (Duffie & Singleton, 1999; Elton et al., 2002). By calculating the spread as the difference between the spot rates, one avoids any potential bias of the risk related to coupons.

In order to control for the term structure of debt, Cavallo and Valenzuela apply the Option Adjusted Spread Analysis – OAS (Miller, 2010).[1] This analysis calculates the spread using an embedded options approach and controls for potential pre-payments or changes in interest rates. As we comment in the next section, in our analysis, we use the Yield Adjusted Spread (YAS) feature calculated by Bloomberg to control for the effect of the term structure of the debt on the net spread.

3. Data and methodology

In this section, we describe the data and the methodology used in this study. We began by selecting the emerging markets to be considered from the MSCI (Morgan Stanley Capital International) emerging markets list. Its constituents include 21 countries: five from Latin America, eight from Asia, five from Europe, and three from Africa. They are Brazil, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Korea (South), Malaysia, Mexico, Morocco, Peru, Philippines, Poland, Russia, South Africa, Taiwan, Thailand, and Turkey.

We retrieve bond data information, including all of the corporate bonds issued by firms from these countries and denominated in U.S. dollars, to allow direct comparisons from 2004 to 2013. The source of the data is Bloomberg. We exclude bonds with maturities below two years as these bonds exhibit a convergence effect on their prices to their face values as the date of redemption becomes closer. Furthermore, we consider only bonds without special redemption covenants (e.g. callable, putable, and sinkable) or variable coupons (e.g. index-linked).

We find reported data on spreads in Bloomberg's database was scarce prior to 2007. As a result, we have to discard bond data from 2004 to the third quarter of 2007. We employ the Yield Adjusted Spread (YAS) feature calculated by Bloomberg. By using this methodology, we control for the effect of the term structure of the debt. More specifically, YAS' tool provides the interpolated spread between the yield of a corporate bond issue and the government yield curve of the respective country by taking a corporate bond with x years to maturity left and then interpolating and subtracting the x years point in the government yield curve. Previous works have presented problems when matching bonds due to the existence of a scarce number of issues in emerging markets and the low probability of finding bonds with similar maturities (Peter & Grandes, 2005).

We also discard markets having very few corporate bonds and missing information on the spread. Additionally, we filter the data and eliminate outliers.[2] The final database includes corporate bonds from 13 emerging markets. We are left with a total of 5493 quarterly observations (see Tables 1 and 2).

We retrieve information on the benchmark debt spread and the sovereign debt spread, starting in the fourth quarter of 2007 and ending in the last quarter of 2013, using quarterly frequency. The *benchmark spread* is calculated as the difference between the yield to maturity of a corporate bond and the yield to maturity of a benchmark bond (i.e., an automatically selected risk-free bond, usually an U.S. T-Bond with similar time to maturity).[3] The *sovereign spread* is the difference in the sovereign curve of the country of incorporation of the firm issuing the bond and an automatically selected risk-free bond (usually an U.S. T-Bond with similar time to maturity) used as a benchmark and available on Bloomberg. Additional information related to the issuer features, a country's macroeconomics variables, and other control variables was retrieved from Datastream.

Table 1
Number of corporate bonds included by country of incorporation of the firms.

This table includes bonds that matured and bonds that were still outstanding between 4Q-2007 and 4Q-2013. Note: we included individual bonds, even if the same firm issued two or more bonds.

Country	Average
Argentina	10
Brazil	47
Chile	18
China	10
Colombia	12
Indonesia	12
Korea (South)	28
Mexico	39
Malaysia	13
Peru	12
Philippines	8
Thailand	12
Turkey	11

Source: Bloomberg.

Table 2
Panel A. Descriptive bond statistics by country.

Net spread (difference between the benchmark spread and the sovereign spread) by country, in basic points, from 4Q-2007 to 4Q-2013 (quarterly data).

Country	Obs.	Mean	Std. Dev.	Min.	Max.
Argentina	240	742.20	209.08	106.65	1016.95
Brazil	1127	419.50	150.08	90.07	769.80
Chile	429	120.43	275.21	− 254.09	608.54
China	209	569.55	373.35	58.37	1141.77
Colombia	274	251.58	58.14	69.93	427.61
Indonesia	281	443.91	139.85	75.69	731.01
Korea (South)	655	184.79	91.84	3.21	420.19
Mexico	940	246.00	143.36	1.43	793.30
Malaysia	304	296.66	123.40	65.08	513.58
Peru	295	409.45	136.05	109.76	699.69
Philippines	193	353.07	139.10	21.68	574.51
Thailand	284	327.25	141.98	145.12	593.85
Turkey	262	304.89	56.46	142.38	428.90

Table 2 Panel B. Descriptive bond statistics by industry

Net spreads (difference between the benchmark spread and the sovereign spread) by industry, in basic points, from 4Q-2007 to 4Q-2013.

Industry	Obs.	Mean	Std. Dev.	Min.	Max.
Financial	1855	397.45	250.62	− 254.09	1141.77
Basic materials	795	308.20	163.59	− 170.44	741.09
Industrial	61	394.53	166.44	103.62	628.62
Consumer goods	640	316.60	264.23	− 248.03	793.30
Energy	391	307.00	141.75	75.69	731.01
Utilities|	756	301.72	217.17	− 251.17	1010.35
Communications and tech	962	258.56	122.71	1.43	593.14
Diversified	33	412.84	137.72	164.87	501.44

Table 2 Panel C. Descriptive bond statistics by region

Net spreads (differences in yields to maturity between corporate issues and the yield on debt from the respective governments) by region, in basic points, from 4Q-2007 to 4Q-2013 (quarterly data).

Region	Obs.	Mean	Std. Dev.	Min.	Max.
Latin America	3305	339.95	228.43	− 254.09	1016.95
Asia	2188	318.08	196.68	3.21	1141.78

Total number of obs. 5493.
Source: Bloomberg.

[1] OAS analyzes cash flows associated with a bond with the market's interest rates and with the values of the embedded options against market volatility.

[2] First, we eliminated extreme values (those with spreads > 4000 basis points or b.p.) and then discarded bonds having net spreads > 2.5 times the standard deviation from the mean.

[3] YAS automatically selects the sovereign benchmark that better fits the term structure of a corporate bond.

3.1. Variables

Using information on corporate and sovereign spreads, we calculate the *net spread* as the difference between the *benchmark spread* and the *sovereign spread* at the same point to maturity. When calculated, the effect of the risk-free benchmark is eliminated. One is left with the net spread between the yield to maturity of a corporate bond and the yield to maturity of the sovereign curve corresponding to the country of incorporation of the firm issuing the bond. This is our dependent variable of interest in the regressions we use later.

Descriptive statistics indicate the average of the net spread is around 331 basis points (b.p.). This variable exhibits a large standard deviation for pooled data (217 b.p.). It is similar to the "between" standard deviation (209 b.p.) and in contrast with the "within" standard deviation (of around 51 b.p.).

Interestingly, we also find negative net spread minimum values indicating some of the corporate bonds in our dataset violate the sovereign ceiling rule. This is specifically true in the case of Chile. As explained previously, corporate debt should, in theory, be riskier than sovereign debt. However, our findings in the case of Chile represent a violation of the sovereign ceiling rule and are in line with the findings of Durbin and Ng (2005), Lee et al. (2013), and Krylova (2016).

Furthermore, some of the bonds exhibit spreads of > 1000 b.p. This is a large number that reflects deep differences in terms of the risks faced by investors. These spreads are found for some of the debts issued by Argentinean and Chinese firms. The results are separated by country to present a more complete idea of our dataset (see Table 2, Panel A).

We also separate the data by industry (see Table 2, Panel B). The largest spreads correspond to the financial and utilities sectors, where maximum spread values are higher than 1000 b.p. In general, the average net spread tends to decrease throughout the 2007 (Q4)–2013 (Q4) period (see Fig. 1). The highest values were observed in 2008 at the time of the global financial crisis.

When net spreads are plotted by country, we find the differences can be relatively large. For example, Colombia, South Korea, and Turkey exhibit the lowest variances, while Argentina, Brazil, Chile, and China demonstrate the highest spread volatilities (see Fig. 2).

In general, when plotted, the net spread exhibits a relatively high volatility throughout the period of study. See Fig. 3.

3.2. Model

Our model uses *Net Spread* (calculated as the difference between the benchmark spread and the sovereign spread and at the same point to maturity) as the dependent variable. The independent variables include a set of characteristics of the issuer, the issue, and local and global factors following the literature related to this study (Cavallo & Valenzuela, 2010; Grandes et al., 2016). The model is defined as follows:

$$NS_{it} = \boldsymbol{\beta}\overrightarrow{F_{it}} + \gamma_1\overrightarrow{B_{it}} + \boldsymbol{\gamma}_1\overrightarrow{BF_i} + \boldsymbol{\delta}\overrightarrow{C_t} + \boldsymbol{\omega}\overrightarrow{G_t} + \varepsilon_{it}$$

where $\overrightarrow{F}$ is a vector of the firm (issuer) time variant characteristics, $\overrightarrow{B}$ is a vector of the bond (issuing) time variant characteristics, $\overrightarrow{BF}$ is a vector of the time invariant bond characteristics, $\overrightarrow{C}$ represents country specific (macroeconomic) variables, and $\overrightarrow{G}$ is a vector of global factors. Each group of variables is described as follows:

- The vector of firm specific characteristics $\overrightarrow{F} = \{DY, LEV, GRW, ROE, SIZ, EV\}$ is completely time variant. The variables include dividend yield (*DY*) measured as the cash dividend per share of the previous year divided by the firm's stock price at the beginning of the previous year, and leverage (*LEV*) measured as total debt over total assets of the previous year for the firm issuing the bond. *GRW* is a growth variable measured as the net profit margin growth of the previous five years. *ROE* is the return on equity measured as net income over the average value of equity during the period. *SIZ* is the size of the firm measured as the logarithm of the firm's market capitalization of the previous year. Equity volatility (*EV*) is measured by the stock price volatility of the previous year. In general terms, *LEV* and *EV* are two variables naturally associated with higher bond issuer risk levels. Thus, each of them should have a positive effect on the net spread. Alternatively, *SIZ*, *DY*, *GRW*, and *ROE* are associated with lower bond issuer risk and, as such, should all have a negative effect on the net spread.
- The vector $\overrightarrow{B} = \{TM, LEV \times TM\}$ contains bond specific features. *TM* is the time remaining to maturity of the bond issue (duration) measured in years. *LEV* × *TM* is an interaction between leverage and time remaining to maturity. This interaction controls for the effect of higher risk levels (when a bond has a longer time to maturity), but also depends on the leverage level of the firm, similar to Cavallo and Valenzuela (2010). The *TM* of a bond should yield a positive coefficient. When *LEV* interacts with the issuing firm's *TM* (*LEV* × *TM*), a higher positive effect should be observed. This means that for a highly leveraged firm, the duration of its bonds should increase the net spread.
- The vector $\overrightarrow{BF} = \{AM\}$ refers to the time invariant characteristics of the issue. *AM* is the logarithm of the debt amount issued. *AM* of debt issued is a measure of bond liquidity and should be negatively related to the net spread.
- A set of country specific (macroeconomic) variables, $\overrightarrow{C} = \{PD, CS, CPI\}$, which correspond to the country in which the firm issuing the bond is based. This vector includes *PD* as the amount of government debt measured by the logarithm of total public debt of the previous year; *CS* as the country size measured as the logarithm of the country's Gross Domestic Product (GDP) of the previous year; and *CPI* as the change in the Consumer Price Index of the previous year. *PD* and *CPI* should cause a wider net spread. While higher levels of *PD* could cause a crowding out effect on the private sector, increases in *CPI* may signal that restrictive monetary policies might have to be implemented in the near future and an economic deceleration is likely with the concomitant negative effect for firms based in that country. On the contrary, the expected sign of the coefficient for *CS* is not obvious. For instance, in the economics and trade literature, Alesina (2003) finds that, when trade is free, country size is not related to either growth or per capita income levels, two variables that have been previously shown to be related to country risk (see, for example, Cantor & Packer, 1996). The theoretical and empirical effects of country size on country risk are issues that deserve further analysis in future research.
- A set of global factors defined by vector $\overrightarrow{G} = \{VIX, USCRV\}$, where

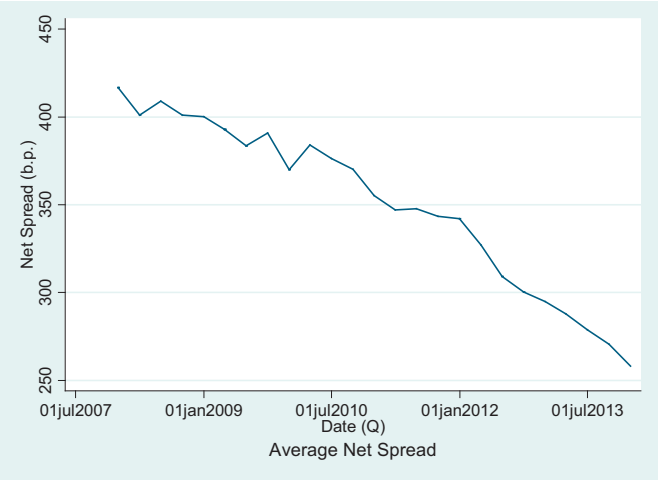

Fig. 1. Average net spread.
Average net spread for the pooled data, by year, in basic points. The net spread is defined as the difference between the benchmark spread and the sovereign spread.
Source: Bloomberg and own calculations.

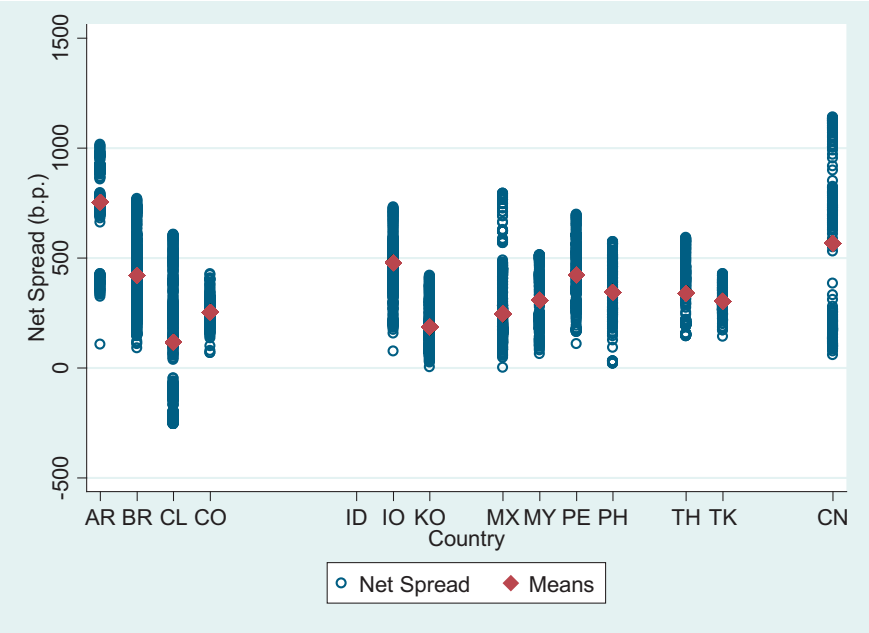

Fig. 2. Net spread by country.
The hollow circle represents individual average observations between countries. Connected diamonds are the average by country. Countries are AR: Argentina, BR: Brazil, CL: Chile, CN: China, CO: Colombia, ID: India, IO: Indonesia, KO: Korea, MX: Mexico, PE: Peru, PH: Philippines, TH: Thailand, and TK: Turkey. The net spread is defined as the difference between the benchmark spread and the sovereign spread.
Source: Bloomberg and own calculations.

Fig. 3. Net spread by date.
The hollow circle represents individual average observations within a quarter. Connected diamonds are the average by quarter, from 4Q-2007 to 4Q-2013. The net spread is defined as the difference between the benchmark spread and the sovereign spread.
Source: Bloomberg and own calculations.

VIX is the Chicago Options Exchange implied volatility index (on the S & P 500 Index) of the previous year and *USCRV* is the historical yield to maturity of the U.S. sovereign bond (10-year bond) that corresponded to the previous year. A positive effect on the net spread should be expected for *VIX* as this index reflects higher international (U.S. equity markets) financial risks. Regarding the second global factor, a higher yield to maturity of U.S. sovereign bonds should cause the net spread to widen, as higher international interest rates (especially when they are historically high) could pose an excessive burden on the debt of some firms from emerging markets.

Hereafter, we include country and industry categorical variables to test whether country and industry factors affect the net spread after controlling for each of the variables just described.

4. Results

We run a Pooled Ordinary Least Squares (OLS) regression of the net spread on the set of independent variables just described. The results are presented in Table 3.

In Table 3, a positive coefficient implies that an increase in the respective variable causes, controlling for all of the other factors, an increase in the corporate over the sovereign yield. Regarding firm level variables, we find that consistent with theory, leverage (0.74; $p < 5\%$), and equity volatility (2.86; $p < 1\%$) have a positive effect on the net spread. For example, an increase in each of these variables increases the risk to bondholders and, as such, investors would require a higher return causing the net spread to widen. On the contrary, size (-9.37; $p < 1\%$), dividend yield (-2.37; $p < 5\%$), and net profit margin growth (-0.65; $p < 1\%$) all have the expected negative effect

Table 3
Determinants of the net spread.

Pooled OLS regression where the dependent variable is the net spread (in b.p.). Column (1) groups all of the countries in the sample. Column (2) reports results for Latin American countries, while Column (3) provides results for Asian countries. The data is from 4Q-2007 to 4Q-2013 (quarterly data).

	(1)	(2)	(3)
Dividend Yield (*DY*)	− 2.37**	− 1.41	− 7.17***
	(− 2.09)	(− 0.84)	(− 3.82)
Leverage (*LEV*)	0.74**	1.38**	1.07*
	(1.98)	(2.25)	(1.82)
5y Growth (*GRW*)	− 0.65***	0.03	− 1.92***
	(− 3.32)	(0.09)	(− 7.92)
R. On Equity (*ROE*)	1.85***	− 0.21	3.95***
	(3.91)	(− 0.29)	(5.39)
Size (*SIZ*)	− 9.37***	− 0.78	− 9.24***
	(− 5.89)	(− 0.25)	(− 2.88)
Equity Vol. (*EV*)	2.86***	7.28***	1.89**
	(4.58)	(6.08)	(2.33)
T. Maturity (*TM*)	− 13.35***	− 10.38***	− 21.46***
	(− 9.89)	(− 5.66)	(− 8.13)
(Lev) (*TM*)	0.06**	0.11***	0.12**
	(2.29)	(2.76)	(2.42)
Amount (*AM*)	− 39.86***	− 45.77***	− 89.66***
	(− 8.81)	(− 7.96)	(− 4.91)
Public Debt (*PD*)	13.50***	8.01*	19.32***
	(4.27)	(1.95)	(3.22)
Country Size (*CS*)	4.61***	1.86	8.73*
	(3.42)	(0.93)	(1.91)
Cons. Price I. (*CPI*)	3.49**	7.33	3.66**
	(2.16)	(1.45)	(2.38)
VIX	0.02	− 0.44	0.57
	(0.05)	(− 0.92)	(1.62)
U.S. 10y Y. (*USCRV*)	9.87**	3.04	7.29
	(1.96)	(0.38)	(1.28)
Moody's Initial (*MI*)			
Moody's His. (*MH*)			
Constant	930.87***	916.34***	1749.74***
	(9.97)	(7.33)	(4.87)
Observations	988	492	496
Adjusted R-squared	0.446	0.476	0.506
F	57.70	32.81	37.26
RMSE	101.88	109.01	82.38

Legend: *p < 0.10; **p < 0.05; ***p < 0.01 (*t*-statistics in parentheses).

on the net spread. That is, larger, more mature and historically more profitable firms are less risky to bondholders causing the net spread to be smaller. Finally, the positive sign of *ROE* (1.85; p < 1%) is harder to interpret if one considers *ROE* only as a profitability measure. However, *ROE* could also be a proxy of the equity holder's expected return and higher expected returns are associated with higher levels of firm risk. In any case, we consider this particular result deserves further study.

In the case of bond issue related variables, the results were as follows. The amount of the debt issue, which is a measure of bond liquidity, is negatively related to net spread (39.86; p < 1%) as expected. However, contrary to our expectations, duration (time-to-maturity) yielded a negative coefficient (− 13.35; p < 1%). Perhaps the presence of an unusually, almost flat U.S. yield curve during portions of our period of study might help explain this counterintuitive result. Nevertheless, when the duration of a bond interacts with the issuing firm's leverage, this negative effect is mitigated (0.06; p < 5%). This means that for a highly leveraged firm, the duration of its bonds increases the net spread, as expected.

In terms of local factors, public debt (13.50; p < 1%) and *CPI* (3.49%; p < 5%), yielded, as expected, positive and significant coefficients. Our findings for the public debt coefficient are in line with those of Ağca and Celasun (2012), who found a higher level of government debt results in higher borrowing costs for local firms in emerging markets. In terms of the *CPI* coefficient, a higher level of inflation could be, as explained previously, a reflection of current and future economic imbalances, which, in turn, affect the risk of local firms. We expected firms located in larger countries would have been less risky as they have access to a larger and more diversified market. However, we find, contrary to our expectations, a positive and significant coefficient for this variable (4.61; p < 1%).

Finally, the two global factors considered yielded the following results. A higher yield to maturity of U.S. sovereign bonds (9.87; p < 5%), as expected, causes the net spread to widen (Feyen et al., 2015). Higher long-term international rates increase the cost of debt for firms due to the corresponding increase in firms' financial risk. The coefficient for *VIX*, although positive as expected, failed to yield a significant coefficient. In sum, the statistical and economic significance and the expected sign for the majority of the coefficients indicates the basic model is reasonably well specified.[4]

The second and third columns of Table 3 present the results of the pooled OLS regression for the emerging markets of Latin America and Asia, respectively. Overall, the results hold for both regions. However, in the case of bond issuing companies from Latin American countries, the firm factors are no longer significant except for leverage and equity volatility.

Next, we run a regression with country and industry dummy variables in order to determine whether these two sets of effects, which were not considered in the coefficients explained above, can help explain the net spread (see Table 4). Regarding country effects, only three of 11 country dummies are statistically significant (Chile, Indonesia, and the Philippines).[5] In this new regression, still more than half of the control variables are significant and mostly display the expected sign.

While a positive country effect means that the net spread widens as a consequence of the debt issuer belonging to a specific country (i.e., Indonesia and the Philippines), a negative coefficient suggests the net spread diminishes (i.e., Chile). From a practitioner's point of view, a very general interpretation of this results for an international investor is that he would expect corporate yields for bonds from Indonesian firms to be 195 b.p. higher than the sovereign yields for that country, maintaining constant all the remaining variables.

As previously mentioned in the literature review section, here we only corroborate the importance of the country of incorporation of the firm to explain net spreads. However, the literature regarding the effect of industry factors explaining yield spreads between corporate and sovereign debts is scarce. Even after taking into consideration country effects, we find statistically significant coefficients for three of five industries (i.e. basic materials, energy, and communications and technology). A positive industry effect suggests the net spread widens as a consequence of the debt issuer belonging to a specific industry (i.e., basic materials and communications and technology). A negative coefficient implies the net spread decreases (i.e., energy sector). From a practitioner's point of view, an international investor would expect corporate yields in the energy industry to be 55 b.p. lower than the sovereign yields for that industry, maintaining constant all the remaining variables. The intercept captures the dummy effect for Argentina and China and the diversified, industrial, and consumer goods sectors and is statistically significant.

One caveat to our coefficient estimates is they are subject to measurement errors caused by the inherent illiquidity of some of the bonds in our database. This is a recurrent problem in the literature (Durbin & Ng, 2005) where the estimated coefficients tend to be biased

[4] We also run other model specifications, such as a panel data fixed effects with vector decomposition (Greene, 2011), and compare previous results using the maximum likelihood random estimation (REML) with fixed effects estimators. REML is recommended for panels that are strongly unbalanced (Baltagi, 2008). We find the main results remain essentially unchanged. The results are not reported in the paper, but are available upon request.

[5] The econometric software we used (Stata) omitted two countries (Argentina and China) and three industries (Industrial, Basic Materials, and Diversified) from the regression due to the presence of high collinearity.

Table 4
Determinants of the net spread with dummy variables.
Dependent variable is the net spread (in b.p.). Dummies by country and industry are included. The data is from 4Q-2007 to 4Q-2013.

	Panel regression with dummy variables
Dividend Yield	−4.05***
	(−2.97)
Leverage	2.06***
	(4.43)
5y Growth	−0.14
	(−0.70)
ROE	0.52
	(0.92)
Size	2.73
	(0.82)
Duration	−8.36***
	(−4.93)
(Lev) (T. Mat)	−0.06*
	(−1.72)
Amount	−53.03***
	(−10.93)
Equity Volatility	4.58***
	(3.99)
Public Debt	−114.60***
	(−3.95)
Country Size	73.86**
	(2.24)
CPI	0.52
	(0.21)
VIX	−0.30
	(−0.88)
U.S. 10y Yield	−1.15
	(−0.23)
Brazil	53.17
	(0.92)
Chile	−694.72**
	(−2.06)
Colombia	398.53
	(1.38)
Indonesia	195.31*
	(1.73)
Korea	89.21
	(0.37)
Mexico	−65.26
	(−0.65)
Malaysia	−117.25
	(−1.41)
Peru	590.27
	(1.59)
Philippines	195.28*
	(1.72)
Thailand	143.69
	(1.50)
Turkey	−51.69
	(−0.85)
Financial	3.95
	(0.26)
Basic Materials	75.12***
	(4.36)
Energy	−55.45**
	(−2.09)
Utilities	9.84
	(0.54)
Communications & Tech.	73.53***
	(3.60)
Constant	1701.35***
	(3.81)
Observations	988
Adjusted R-squared	0.530
F	38.03
RMSE	93.87

Legend: *p < 0.1; **p < 0.05; ***p < 0.01 (*t*-statistics in parentheses).

toward zero. Another usual concern in the literature is that even when one uses a full set of control variables (in our case firm, issue, local, and global factors), there could still be omitted factors. However, considering the overall results, and with these two caveats in mind, we find the importance of industry factors has been underestimated in the existent literature where typically only country effects have been found. This finding is interesting and important not only for academics, but also for investors in debt instruments in emerging markets as we have explained earlier and as will be discussed in greater detail later.

5. Robustness

In this section, we conduct a robustness check to determine whether credit ratings can explain the net spread and whether the inclusion of credit rating related variables mitigates or eliminates the effect of the other firm, issue, and local variables considered. Firm, issue, and local factors are used by credit rating agencies to assess the riskiness of bond issues. Krylova (2016) finds these to be a major driver of corporate bond spreads in the Eurozone ratings during the pre-crisis period. For example, Cantor and Packer (1996) and Hull, Predescu, and White (2004) find that credit ratings explain the net spread for sovereign yields and Credit Default Swaps, respectively.

Following the previous analysis, Table 5, Column (1) reports an alternative specification to our regression where we include the following two credit rating variables: Moody's Initial (*MI*), which is a time invariant variable representing the initial credit rating assigned by

Table 5
Determinants of the net spread with credit risk variables.
Pooled OLS regression where the dependent variable is the net spread (in b.p.) and considering risk variables. Column (1) groups all of the countries in the sample. Column (2) reports the results for Latin American countries, while Column (3) provides results for Asian countries. The data is from 4Q-2007 to 4Q-2013 (quarterly data).

	(1)	(2)	(3)
Dividend Yield (*DY*)	−1.28	−4.66***	4.16*
	(−1.13)	(−3.13)	(1.95)
Leverage (*LEV*)			
5y Growth (*GRW*)			
R. On Equity (*ROE*)			
Size (*SIZ*)			
Equity Vol. (*EV*)			
T. Maturity (*TM*)			
(Lev) (*TM*)	−0.03	0.30***	−0.13***
	(−1.59)	(7.24)	(−5.64)
Amount (*AM*)	−64.09***	−101.42***	−41.79***
	(−8.56)	(−10.34)	(−2.78)
Public Debt (*PD*)			
Country Size (*CS*)	4.48***	6.16***	0.90
	(3.36)	(2.89)	(0.44)
Cons. Price I. (*CPI*)	−1.03	−3.91	2.50
	(−0.51)	(−0.70)	(1.17)
VIX	−0.47	−1.75***	0.23
	(−1.44)	(−3.60)	(0.61)
U.S. 10y Y. (*USCRV*)	34.21***	33.09***	21.94***
	(6.39)	(4.07)	(3.63)
Moody's Initial (*MI*)	−2.05**	5.64**	−2.28***
	(−2.57)	(2.37)	(−2.79)
Moody's His. (*MH*)	−2.78***	−4.47***	−1.83***
	(−9.12)	(−5.99)	(−5.34)
Constant	2116.83***	2830.93***	1479.87***
	(13.73)	(14.03)	(4.85)
Observations	900	409	491
Adjusted R-squared	0.466	0.586	0.418
F	88.30	65.04	40.12
RMSE	108.79	107.62	89.79

Legend: *p < 0.10; **p < 0.05; ***p < 0.01 (*t*-statistics in parentheses).

Moody's to each bond issued, and Moody's History (*MH*), which is a time variant variable measuring the historical credit rating assigned by Moody's to each bond. As stated previously, these two variables should encompass some of the firm, bond issue, and local factors. For example, a highly leveraged firm should have, after controlling for all of the other relevant variables, a lower credit rating.

The results from Column (1) indicate both higher Moody's Initial and higher Moody's History cause lower net spreads, as expected. Although, in this specification, some of the variables loss statistical significance (e.g., dividend yield), the sign, size, and statistical significance of the rest of the variables included in the regression remained essentially the same as those in Table 3, Column (1). The results presented in Table 5, Columns (2) (Latin American subsample) and (3) (Asian subsample) are also mostly consistent with Table 3, Columns (2) and (3).

Considering the results presented in both specifications (Table 3, Column (1) and Table 5, Column (1)) are largely consistent and the model specified in Table 3 allows us to observe the effect of more firm, bond issue, and local factors on the net spread (compared to the case of the model in Table 5, Column (1)), we decided to use the first specification as the base case of the paper.

6. Conclusions and discussion

We study the determinants of the spread between corporate and sovereign bond yields in 13 emerging markets from Asia and Latin America and eight industries. We find, after controlling for firm issue specific factors, as well as local and global factors, country and industry specific dummy variables are statistically significant determinants of the net spread. Our findings suggest the need to specifically include these effects when studying the net spread between corporate and sovereign bonds. Industry effects were found for the following three sectors: basic materials, energy, and communications and technology. Country effects were found for the following three emerging markets: Chile, Indonesia, and the Philippines. The dataset and the model we employ demonstrate country and industry specific variables persist after controlling for other factors suggesting the need to specifically include these effects when studying the net spread.

It has been shown that fiscal and monetary policies that seek to improve the financial health of a country are mechanisms capable of causing a reduction in country risk as lower financial risk positively impacts private debt issues (Afik & Benninga, 2014; Jaramillo & Weber, 2013). Moreover, Cáceres et al. (2010) consider that an appropriate sovereign balance sheet, necessary for implementing better public debt management, diminishes the sovereign risk and positively affects private firms. These effects should be captured by country and industry variables, after including other controls for firm, bond issue, local, and global factors.

Overall, the results indicate that most of the usual controls we use are consistent with theory, but, more importantly, we find both industry and country effects are significant in explaining the net spread between corporate and sovereign bond yields in EMs. These findings contrast with the related literature for stocks and bonds in which country effects have been found to be more prevalent than industry effects (Bai, Green, & Leger, 2012; Heston & Rouwenhorst, 1995; Lee & Hooy, 2013). However, our findings are more in line with those of other authors, where industry effects were at least as important as country effects (Bai, 2014; Eiling, Gerard, & De Roon, 2012; Ferreira & Ferreira, 2006).

Industry effects were found for the following three industries: basic materials, energy, and communications and technology. For energy, an industry with primarily foreign revenues that enjoys a natural currency hedge, we find, as expected, a negative and significant coefficient (-55.45, $p > 1\%$) to explain the net spread. On the contrary, for basic materials and communications and technology, industries with mostly local revenues, we find, as expected, positive and significant coefficients (75.12, $p < 1\%$ and 73.53, $p < 1\%$, respectively), thus implying a higher net spread.

We were unable to find any research regarding the amount of domestic vs. foreign sales for industries located in emerging markets. However, Wolfe (2013) reports the domestic and foreign sales by industries located in the U.S. in 2010 that performed or funded R & D and finds some of the industries with the highest percentage of domestic sales are also the same industries we found to be significantly positive explaining the net spread including basic materials and communications and technology. Similarly, Wolfe (2013) finds the energy industry had a higher percentage of foreign sales consistent with the negative and significant effect this dummy variable had on the net spread in our study. While these percentages were found for industries located in the U.S., we could infer a similar behavior could be observed in the case of emerging markets, although we admit that a study should be undertaken to confirm this. Similarly, Durbin and Ng (2005) confirm lower spreads for bonds issued by firms that were inclined to have higher exports earnings. Finally, significant country effects were also found in our paper for Chile, Indonesia, and the Philippines, although with lower significance levels than the industry effects. We also found a negative and significant effect between higher credit ratings and net spreads. Credit ratings encompass some of the effects of firm, issue, and local factors.

We contribute to the academic literature in this subject as we find not only country, but also industry effects are economically and statistically significant in determining corporate over sovereign debt spreads in emerging markets. This finding is not consistent with the results presented by Durbin and Ng (2005), where industry effects were not found to be significant in explaining net spreads in emerging markets. Thus, our findings contribute to the academic discussion as to whether and how industries affect corporate bond spreads.

We also contribute to practitioners investing in corporate debt in emerging markets. They are advised to consider that these investments require a deeper analysis concerning the specific industry and country conditions related to such investments. For example, the valuation of bonds issued by firms belonging to the basic materials, energy, and communications and technology industries from emerging markets could be mispriced if they do not incorporate these industry risk factors.

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