

3. Understanding Corporate Vulnerabilities in Latin America

Firms in Latin America are facing tighter financial market conditions at the global level amid lower potential growth and challenging macroeconomic adjustments at home. This chapter quantifies the impact of company-specific, country-specific, and global factors in driving nonfinancial corporate risk. The analysis suggests that all three factors play a role, albeit to varying degrees and with different implications across countries in the region. Overall, macroeconomic domestic factors, such as the pace of currency depreciation and higher sovereign spreads, have contributed to an increase in corporate risk since 2011, underscoring the importance of robust policy frameworks. The analysis also finds that external conditions—in particular measures of global risk aversion (such as the Chicago Board Options Exchange Volatility Index, VIX)—constitute a dominant driver of corporate risk. Thus, a sustained reversal of the still benign global market conditions could place significant added pressure on firms in the region. Finally, weak firm fundamentals, such as high leverage and low profitability, are also associated with elevated corporate risks. All things considered, solid macroeconomic policy frameworks must be complemented by appropriate monitoring of systemic risks in the corporate sector and, when needed, by policies that facilitate corporate balance sheet repair that will help limit financial spillovers from corporate woes in the coming years.

High commodity prices and robust global growth, in a setting of favorable financial conditions, have powered growth in Latin America and the Caribbean (LAC) for much of the past decade, but there is now consensus that this twin-engine growth process has come to an end. As the region adjusts to a harsher external reality, characterized by lower commodity prices, tighter financial conditions, and weaker external demand, several challenges and risks have surfaced. A key risk relates to the health of nonfinancial firms. This chapter quantifies the relative contributions

of firm-specific fundamentals, domestic macroeconomic conditions, and global factors to corporate risk dynamics. Findings shed light on conjunctural policy questions—such as how much corporate vulnerabilities can rise owing to different factors. The results also inform medium-term policies conducive to corporate sector growth and investment, which are at the core of reigniting vigorous growth in the region.

Setting the Stage

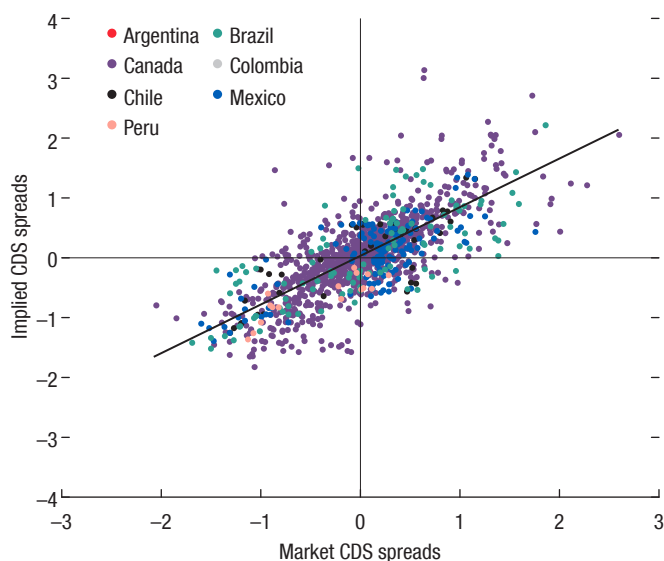
Firms from financially integrated LAC economies have benefited from a favorable funding environment over the past decade, weathering well a brief period of acute pressure during the global financial crisis. In particular, enhanced access to international capital markets in the context of relaxed global financial conditions allowed the lengthening of debt maturities while lowering borrowing costs. This has enabled companies to pursue new investment plans, improve cash buffers, and pay down more expensive debt. In principle, all of these are positive developments for a savings-scarce region characterized by low investment rates. However, the favorable funding environment also bred risks.¹ Corporate leverage has increased, often fueled by foreign currency bond debt, which increased from US\$170 billion (4.3 percent of combined GDP) in 2010 to more than US\$380 billion (10.5 percent of combined GDP) in 2015 in five major economies of Latin America (LA5—Brazil, Chile, Colombia, Mexico, and Peru).

The macroeconomic adjustment unfolding across the region has implied persistently weaker domestic currencies and lower potential growth, complicating balance sheet adjustments—such as deleveraging and reducing foreign exchange mismatches—in the corporate sector. Against

Note: This chapter was prepared by Carlos Caceres and Fabiano Rodrigues Bastos, under the guidance of Marcos Chamon. Box 3.1 was prepared by Jorge Antonio Chan-Lau, Cheng Hoon Lim, Daniel Rodríguez-Delgado, Bennett Sutton, and Melesse Tashu. Steve Brito, Christina Daniel, and Irina Sirbu provided excellent research assistance. See Caceres and Rodrigues Bastos (2016) for technical details.

¹See Rodrigues Bastos, Kamil, and Sutton (2015).

Figure 3.1. Market CDS and Implied CDS Spreads
(Log basis points; demeaned)



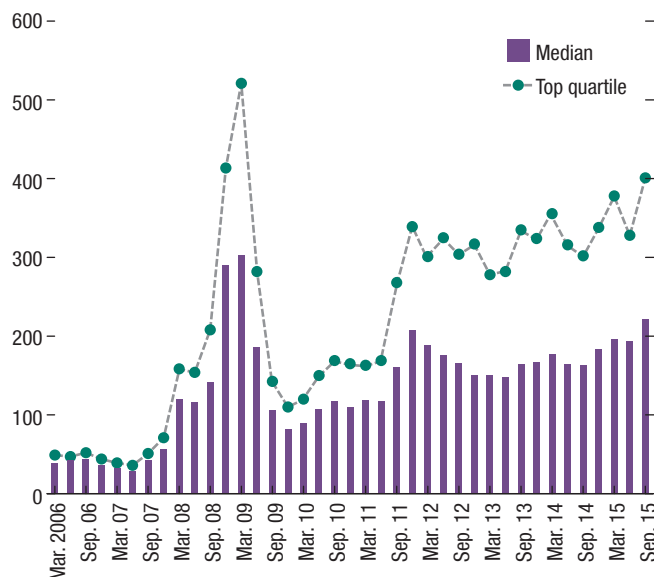
Sources: Bloomberg, L.P.; Markit Ltd.; and IMF staff calculations.
Note: Period 2005–15. Implied CDS spreads available for approximately 1,200 firms. Each point represents, for each company, the difference of the log of credit default swap (CDS) spreads at the end of each quarter and its corresponding average over the period 2005:Q1 to 2015:Q3.

this backdrop, vulnerability concerns are coming to the fore. It is, therefore, important to develop a systematic understanding of the drivers of corporate risk.

Credit default swap (CDS) spreads would be an ideal candidate to measure corporate risk, because they provide a comparable yardstick across firms, but they are available only for a small number of firms in LAC. Thus, this chapter uses implied CDS spreads as proxy for corporate risk, which closely track their market counterpart and are available for a much larger set of companies (Figure 3.1).²

²The implied CDS spreads used in the analysis are calculated by Bloomberg, based on a theoretical framework proposed by Merton (1974) that uses observable information to calculate a company's distance to default. Bloomberg augments the frameworks' basic inputs (share price, market capitalization, and share price volatility) with financial information on total debt and interest coverage. In addition, Bloomberg applies statistical tests to evaluate and calibrate its model accuracy in predicting actual defaults. Data on market CDS spreads and actual default probabilities are used to back out the market-assumed recovery rate—see Bloomberg Credit Risk: Framework, Methodology and Usage (2015). The search for “implied measures”

Figure 3.2. Implied CDS Spreads: Nonfinancial Corporates in Latin America
(Basis points)



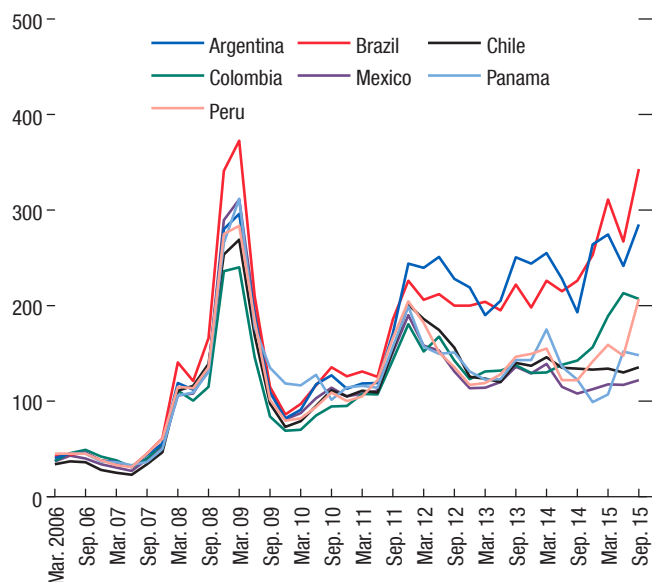
Sources: Bloomberg, L.P.; and IMF staff calculations.
Note: Implied credit default swap (CDS) spreads from Bloomberg, L.P. Chart based on approximately 500 companies from Argentina, Brazil, Chile, Colombia, Mexico, Panama, and Peru.

Implied CDS spreads show that corporate risk for the median Latin American firm has been on the rise in 2014–15 (Figure 3.2), but this increase was not particularly different from other episodes observed in the past four years. In contrast, the global financial crisis of 2008–09 caused a more acute but short-lived spike in corporate risk. Furthermore, 2011—the peak year in most commodity prices—marks the start of growing heterogeneity in risk evolution across countries; Argentina and Brazil have since started to persistently display higher corporate risk levels, accompanied by concerns regarding their policy frameworks. This heterogeneity has also grown among the other countries over the past couple of years (Figure 3.3), in line with country-specific macroeconomic shocks.

Firm fundamentals—leverage, profitability, capitalization, and liquidity—have deteriorated alongside indicators of rising corporate risk since

that can capture intrinsic corporate risk has become fairly common given the limited number of market-based CDS spreads and other difficulties such as low liquidity and lack of homogeneity in other instruments, including corporate bonds.

Figure 3.3. Implied CDS Spreads: Nonfinancial Firms in Latin America by Country
(Basis points, median)



Sources: Bloomberg, L.P.; and IMF staff calculations.
Note: CDS = credit default swap.

2010 (Annex Table 3.1), with a marked weakening in recent years, particularly with regard to higher leverage and lower profitability. This is possibly attributed to strong exchange rate depreciations, the widespread issuance of foreign currency debt, and dimmed growth prospects across the region.

Many would have considered the combination of exchange rate depreciations, commodity price declines, and deceleration in economic activity observed in the region during 2015 as being sufficient to trigger widespread corporate distress. Although there has been some stress across firms in LAC countries, the impact has not been systemic. This could reflect high levels of international reserves providing policy ammunition to central banks and reassurance to markets that foreign exchange liquidity would not suddenly dry up. In addition, corporate cash buffers were sizable in recent years, and at the same time Latin America firms might be making more active use of financial hedges.³ However,

³Other conditions have also played a role. A significant part of the dollar debt buildup has been accumulated in the tradable sector and by quasi-sovereigns, so natural hedges and implicit government

margins have been stretched thin, and future risks are elevated.

Data and Empirical Strategy

The analysis in this chapter is based on a large dataset covering the period 2005–15 and containing company-specific financial information, along with country and global variables.⁴ The sample includes more than 500 nonfinancial firms from seven Latin American countries—Argentina, Brazil, Chile, Colombia, Mexico, Panama, and Peru. Furthermore, we perform additional analysis by including a similar number of firms from Canada. Although the analysis centers on Latin American firms, the inclusion of Canadian companies allows the investigation of the role of common regional shocks by providing a benchmark of a commodity-exporting advanced economy located in the same hemisphere.

Simple correlations among key variables suggest the presence of important relationships (Annex Table 3.2). An increase in corporate risk is associated with an increase in leverage, share price volatility, sovereign CDS spreads, the VIX, and the pace of exchange rate depreciation. Lower implied CDS spreads are associated with higher profitability, capitalization, liquidity, share price, and price-to-book ratios, as well as with higher commodity prices.⁵

Annex Table 3.2 also shows significant cross-correlation among several variables in the data set, pointing to potential issues of multicollinearity. Hence, it is critical to adopt empirical strategies that rely on a relatively small number of explanatory variables while still covering key dimensions of the data. One approach is thus to

backing have been important mitigating factors (see Caceres and Rodrigues Bastos 2016).

⁴The sources are Bloomberg, L.P., Thomson Reuters Datastream, Haver Analytics, Markit Ltd., and the World Economic Outlook database. The frequency is quarterly and we consider different ways of consolidating daily and monthly data. The sample is mainly composed of publicly listed firms.

⁵These pair-wise correlations are broadly consistent whether we consider implied CDS spreads (more than 1200 companies) or actual CDS spreads (less than 50 companies) as our measure of corporate risk, notwithstanding the significant differences in data availability.

group data along blocks of variables that capture different dimensions of corporate risk, and to consider them simultaneously in econometric estimations. This allows one to balance parsimony and representativeness, which is used to generate a historical decomposition of *direct* sources of corporate risk. Another approach is to selectively exclude blocks of variables, generating more compact models, which enable us to capture the *direct and indirect* impact from specific variables of interest (for instance, exchange rate).⁶ We use this approach for scenario analysis later on.

The core econometric specification is a panel-data model similar to what has been used in the literature for studying corporate risk dynamics.⁷ The dependent variable, log of implied CDS spreads, is treated as a function of four different dimensions included in the following blocks of explanatory variables: (1) firm-specific fundamentals (accounting-based), (2) firm-specific market-based measures, (3) country-level macroeconomic factors, and (4) global conditions.⁸ Algebraically:

$$Y_{i,t} = \alpha + \beta_1 F_{i,t} + \beta_2 M_{i,t} + \beta_3 C_{j,t} + \beta_4 G_t + \beta_5 D_{it} + \mu_i + \epsilon_{i,t}$$

where $Y_{i,t}$ denotes the log of implied CDS spread of company i at time t , our measure of corporate risk; $F_{i,t}$ and $M_{i,t}$ denote, respectively, firm-specific accounting-based variables (that is, “fundamentals”) and market-based variables; $C_{j,t}$ denotes macroeconomic variables in country j at

⁶Caceres and Rodrigues Bastos (2016) provide a detailed discussion of the analysis presented in this chapter.

⁷See, for instance, Das, Hanouna, and Sarin (2009), Doshi and others (2013), Tang and Yan (2013), and Cavallo and Valenzuela (2007).

⁸In the specification shown in this chapter, firm fundamentals include profitability, capitalization, leverage, and liquidity, each derived as the first principal component of alternative measures such as debt to equity, debt to assets, return on equity, return on assets, different cash ratios, and others. The firm’s relative size is also included as an additional control. Firm’s market-based measures include share price, share price volatility, and price-to-book ratio. Domestic macroeconomic conditions include inflation, sovereign CDS spreads, and exchange rate. Global variables include the commodity terms of trade (CTOT—Gruss 2014) and the VIX—though we treat the former separately. The implied corporate CDS spread is taken at the last business day of the quarter to mitigate endogeneity concerns while the other daily-frequency variables included in the right-hand side are averages for the respective quarter. See Caceres and Rodrigues Bastos (2016) for further details.

time t , whereas G_t represents the global variables; μ_i denotes the company-specific fixed effects; and $\epsilon_{i,t}$ is the error term. D_{it} represents time dummies for two different subperiods: financial crisis (2008:Q1 to 2010:Q4) and the subsequent period (2011:Q1 to 2015:Q3). They capture changes in dynamics induced by “level shifts,” beyond what could be explained by variables in our data set. In addition, these dummies are allowed to be different between Canada and the group of LAC countries (thus the subscript for the region r), allowing one to investigate common LAC-regional factors driving risk.

Results

The econometric results (Annex Table 3.3) confirm that all four dimensions matter for corporate risk dynamics. In block 1 (firm fundamentals), higher capital ratios, higher liquidity ratios, and higher profitability all lead to a reduction in corporate risk. Conversely, leverage is positively associated with risk at the firm level. Block 2 (market-based variables) indicates that higher share price volatility and lower price-to-book ratios increase risk. Even though these variables are linked to the calibration of the implied CDS spreads itself, including them in the core regression is not tautological. In fact, the variables in block 2 are also relevant in explaining actual CDS spreads dynamics. Moreover, these variables are incorporated with a lag in the estimation model and, most importantly, these market-based variables help us gauge how much other blocks influence corporate risk after accounting for them.⁹

Block 3 (macroeconomic conditions) suggests that higher sovereign CDS spreads and sharp currency depreciations lead to higher corporate risk. Moreover, the negative impact of such sharp depreciations is stronger for companies that exhibit higher levels of leverage. Importantly, we found that year-over-year changes in the exchange rate play a more important role in explaining

⁹Finally, the exclusion of block 2 does not alter in any meaningful way the elasticities obtained for the variables in other blocks (see Annex Table 3.3 and Caceres and Rodrigues Bastos 2016).

corporate spreads than the exchange rate level per se. This suggests that companies are not necessarily affected by underlying trends in the level of the exchange rate (for instance, when the exchange rate is continuously depreciating, albeit smoothly), as balance sheets would tend to adjust. Instead, corporate risk tends to suffer from a sharp and sudden depreciation.

We also find that higher inflation is associated with higher corporate risk, possibly reflecting the quality of policy frameworks. However, other domestic factors such as real GDP growth does not appear to play a *direct* role in driving risk, suggesting that its impact is possibly embedded in other channels such as profitability or share prices which, in fact, are shown to matter for risk.¹⁰ In block 4 (global factors), higher global risk aversion proxied by the VIX and lower commodity prices are found to matter for corporate risk. Other global measures such as global output growth are not found to play a *direct* role in driving risk which, once again, could be linked to its correlation with commodity prices and the VIX.^{11,12} The findings are robust to alternative grouping strategies and explanatory variable choice, as discussed in Caceres and Rodrigues Bastos (2016).

The time dummies for the two periods (2008:Q1–2010:Q4 and 2011:Q1–2015:Q3) are significant and statistically the same for all countries in our sample, except for Canada. This result suggests that all countries experienced a repricing of risk—not attributable to any of our explanatory variables—during these periods. Moreover, this risk premium is larger for the LAC region compared with Canada.^{13,14}

¹⁰Indeed, the estimated elasticity derived from a simple regression of corporate spreads on real GDP growth (alone) is negative and highly significant.

¹¹We use a country-specific index of net commodity terms of trade (CTOT) produced by Gruss (2014).

¹²Magud and Sosa (2015) also found a key role of macroeconomic variables in explaining investment in LAC, particularly commodity prices, even after controlling for firm-specific fundamentals.

¹³Note that the estimation results pertaining to blocks 1, 2, 3, and 4 remain broadly the same whether we exclude or not the Canadian firms from the sample (see Annex Table 3.3).

¹⁴Based on our measure of corporate risk, sectors such as energy, consumer (discretionary), and industrials have shown higher levels of risk over the past couple of years. However, our core model appro-

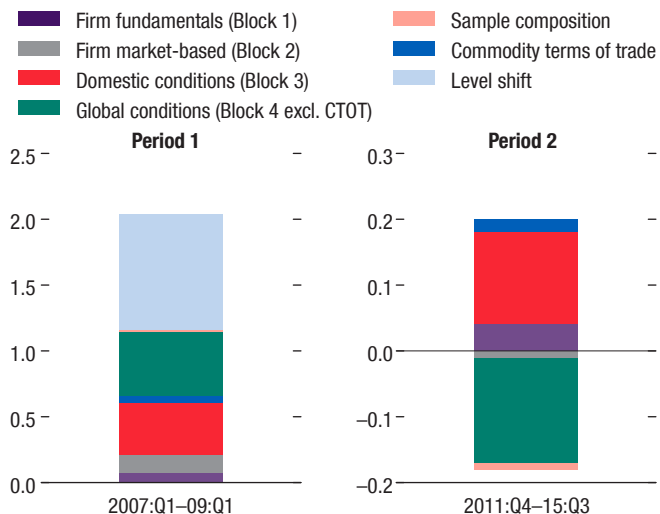
Next, the estimated model for LAC firms is used to quantify and compare the role of the various underlying driving factors in explaining the *changes* in corporate risk (Figures 3.4 and 3.5). The goal is not to understand the *equilibrium level* of corporate risk. This would call for disentangling structural determinants such as corporate governance, judicial quality, and other slow-moving determinants, which are controlled through fixed effects in our estimation. Instead, we would like to identify and compare the main time-varying components that have been triggering changes in risk during recent years. To that end, we contrast two subperiods: (1) the global financial crisis (2007:Q1–2009:Q2), and (2) the period of economic deceleration that LAC has been facing, partly led by weakening commodity prices (2011:Q4–2015:Q3). The choice of these two periods is based on the observed dynamics of corporate risk. Period 1 reflects a sharp, albeit short-lived, impact from the global financial crisis. The starting point for period 2 marks the onset of a more gradual but sustained increase in risk that has lasted through 2015.¹⁵

The crisis period points to the dominant role of common, global factors driving up corporate risk. Average corporate risk increased by more than 350 basis points in period 1. As shown by our decomposition exercise (see Figures 3.4 and 3.5), the increase in the VIX alone contributed to about one-fourth of the total increase in risk, a similar result across different countries in our sample. Country-specific factors also contributed importantly to the increase in risk: the increase in sovereign CDS spreads explained about 11 percent on average (ranging from 6 percent in Brazil to 33 percent in Panama). However, the

privately accounts for this heterogeneity, and the estimation results do not exhibit any systematic sectoral differences. Company fixed effects capture both industry and country-time invariant features. Furthermore, risk evolution among a handful of large commodity-related quasi-sovereign firms in Latin America appear broadly in line with corresponding country and sectoral trends, with the exception of Brazilian quasi-sovereign firms, which have experienced a larger increase in corporate risk in recent years.

¹⁵Chapter 2 features the same decomposition applied to a shorter period of time (2014:Q3–2015:Q3). That analysis showed that both global and domestic factors have put upward pressure on corporate risk over the most recent period.

Figure 3.4. Decomposition of Corporate Risk in Latin America
(Log basis points, median)

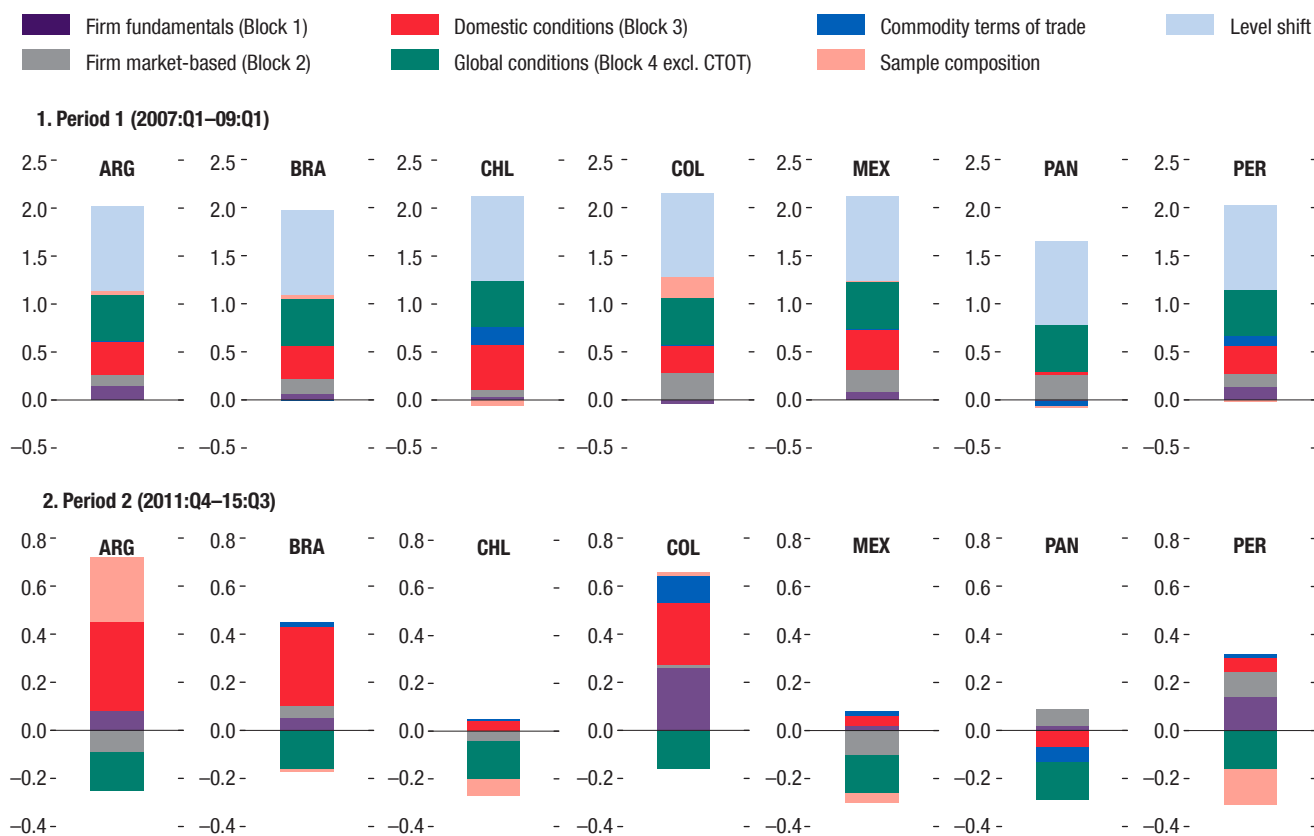


Sources: Bloomberg, L.P.; and IMF staff calculations.
Note: CTOT = commodity terms of trade. This decomposition is based on the estimation results for the sample of Latin American firms only (see Model (2) in Annex Table 3.3).

direct contribution of firm-specific factors has been more limited: explaining less than 10 percent (roughly equivalent to 35 basis points) for the entire sample, and as little as 4 percent (about 10 basis points) in the case of Chile.

The postcrisis period (period 2), from 2011:Q4 to 2015:Q3, paints a much different and more heterogeneous story, with deteriorating country fundamentals playing a more prominent role. Global factors, in particular the VIX, have generated a downward pressure on corporate risk in the region, unlike in period 1. The decline in commodity prices since 2011 has not been a major direct factor pushing up corporate risk, despite the important negative impact of lower commodity prices on overall economic prospects. In Panama, the only net commodity importer in our sample, lower commodity prices are pushing

Figure 3.5. Contribution to Changes in Implied CDS Spreads in Selected Countries over Periods 1 and 2
(Log basis points, median)



Sources: Bloomberg, L.P.; and IMF staff calculations.
Note: CDS = credit default swap; CTOT = commodity terms of trade. This decomposition is based on the estimation results for the sample of Latin American firms only (see Model (2) in Annex Table 3.3). Data labels use International Organization for Standardization (ISO) country codes, see page 108.

corporate risk down. Overall, deteriorating country-specific conditions have been a key factor increasing corporate risk in LAC, particularly through rapid exchange rate depreciations and increases in sovereign CDS spreads, though the relative importance varies across countries. The deterioration in firm-specific fundamentals has played some role in pushing corporate risk upward, though not to the same extent across all the countries.

Examining the risk decomposition during period 2 across countries yields important insights into their specific challenges at the current juncture. Deterioration in domestic macroeconomic conditions in Argentina and Brazil has played a leading role in pushing corporate risk higher. In Chile, Mexico, and Panama, changes in corporate risk during this period are rather muted. Colombia's corporate risk has been pressured on multiple fronts, including commodity prices, macroeconomic conditions (including sharp exchange rate depreciation), and also by firm fundamentals. In Peru, firm-specific variables explain the lion's share of upward pressure on measures of corporate risk.

To assess the potential pressure on corporate risk arising from shocks to selected variables, we reestimate the panel leaving only fixed effects, time-period dummies, and the individual variable of interest. This way, rather than comparing the *direct* contribution of different drivers, we allow the estimated coefficients to reflect more fully both the *direct* and *indirect* impact on corporate risk. Then we use these coefficients to construct scenarios to explore the sensitivity of corporate risk to hypothetical shocks as shown in Annex Table 3.1.

The results highlight the potentially severe impact of an extreme, though historically plausible, scenario. A crisis scenario is constructed using the estimated LAC dummies for the two subperiods, and assuming a new level-shift deterioration in the CDS spreads similar to the one observed during the global financial crisis, in addition to any deterioration caused by the other variables in the model. Corporate risk increases would range from

about 180 basis points in Mexico to 500 basis points in Brazil.¹⁶

A VIX shock of 30 points—about half of what took place during the global financial crisis—would also lead to substantial stress among firms, once again with the strongest impact in Brazil (280 basis points) and the mildest in Mexico (100 basis points). To construct scenarios for domestic macroeconomic conditions, we arbitrarily set stressed levels for the exchange rate and sovereign CDS spreads across different LAC economies as shown in Annex Table 3.1. The results suggest that slippages in domestic policy frameworks can be costly for firms in several countries.

Policy Takeaways

Overall, our findings suggest the following:

- Sovereign CDS spreads—thus the soundness of policy frameworks—matter for corporate risk. Macroeconomic stability and credible policies are an important defense against additional upward pressures on corporate spreads. Reining in risks to fiscal sustainability and inflation, particularly in Argentina and Brazil, is crucial to contain spillovers to sovereign CDS spreads, which impacts corporate risk.
- Policies should encompass not only a solid macroeconomic framework but also close monitoring of corporate balance sheets and income flows. Given the dominant role of global factors in driving corporate risk, a reversal of the still benign external environment can increase corporate risks substantially, as evidenced by the recent episodes of market volatility (see Chapter 2). This calls for a comprehensive strategy at both the macroeconomic and microeconomic levels. In addition, supporting firms' capacity to promote medium-term adjustments is

¹⁶Because the dependent variable is in logs and the starting levels of corporate CDS is different across countries, additive shocks will produce a nonlinear effect on the final CDS change. In particular, countries that start out from a higher average corporate CDS level, like Brazil, will experience a stronger deterioration in risk.

essential. In particular, orderly deleveraging through market-based solutions should be the first line of defense in highly indebted companies. Public sector equity should not be used to stave off needed adjustments, but policymakers should stand ready to provide liquidity to solvent firms. In the case of insolvent companies, restructuring and bankruptcy legislation should minimize both administrative costs and economic losses related to default.

- Financial regulators also have a critical role to play. Adequate consolidated supervision, in cases where financial and nonfinancial firms are highly interlinked, is important (Box 3.1). In that context, regulators should ensure adequate bank capital buffers to contain potential spillovers from the corporate sector. Furthermore, the findings suggest that sharp exchange rate depreciations put pressure on corporate risk, particularly if leverage is high and currency exposures not hedged. This

calls for enhanced monitoring of corporate balance sheets and the use of macroprudential tools (for instance, higher capital and liquidity requirements for foreign-currency-related exposures) to contain any potential buildup of risks related to currency mismatches.

- Companies should factor in the new realities in their business and debt management strategies. An uncertain funding environment creates challenges, which calls for an effective debt management approach that balances cash preservation, cost of capital, funding risks, and continuity of profitable longer-term investment opportunities. Measures to incentivize private equity activity and foreign investor participation can be powerful to help firms navigate through the difficult environment. Commodity-based companies, often systemically important, should ensure sound practices and viable business models given their higher spreads and sensitivity to commodity prices.

Box 3.1. Corporate Solvency Risk and Bank Exposure in Latin America

Companies thrive in a healthy economy, and thriving companies are good business for banks. The converse is, of course, also true. In this box, we assess the impact of changes in macroeconomic conditions on *nonfinancial* corporate solvency risk, and its implications for the banking sector in LA5 countries—Brazil, Chile, Colombia, Mexico, and Peru. In particular, we estimate the potential effect on bank provisions and capital from an increase in corporate solvency risk. Banks in LA5 countries have a sizable exposure to corporate lending, ranging from 8 percent of GDP in Mexico to 35 percent of GDP in Chile (Figure 3.1.1).

Using a new database and methodology, this analysis provides further evidence supporting the main results of the chapter. The analysis uses the Bottom-Up Default Analysis (BuDA) tool developed by Duan, Miao, and Chan-Lau (2015) to estimate corporate solvency risk, as measured by the median probability of default in the sector. For a given baseline macroeconomic scenario, the model projects a set of common and firm-specific risk factors that have a good track record of predicting the probability of default.¹ As this varies, there is a corresponding shift in the loss distribution of the loan portfolio, which requires banks to adjust provisions and capital to cushion against changing losses (Figure 3.1.2). Provisions provide buffers against expected

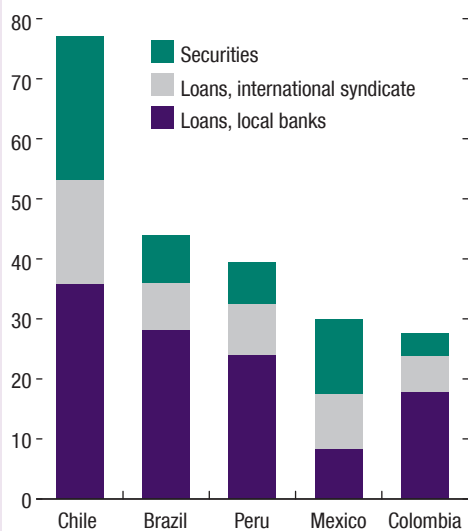
losses and capital against unexpected losses. In the absence of detailed loan data for banks, the loss distribution of the portfolio is calculated assuming each loan is small relative to the entire portfolio and has the same characteristics, with defaults depending on the correlation of firm asset values. Under the one-factor Vasicek (1991) model, and as suggested in BCBS (2011), the asset correlation is set between 12 percent and 24 percent, depending on the probability of default of the loan.

Since 2014, the macroeconomic environment in LA5 has deteriorated. The most acute effects have been felt in Brazil, Colombia, and Peru, where firm probabilities of default have been rising since 2014. Based on the December 2015 *World Economic Outlook* baseline, protracted difficulties in Brazil suggest that probabilities of default will continue to rise through 2016 to levels not seen since 2008. Colombia and Peru see a smaller spike in probabilities of default, while in Chile and Mexico probabilities of default remain low through 2016 and 2017 (Figure 3.1.3).

The macroeconomic drivers of the expected increase in firm probabilities of default can be further decomposed. In Brazil, the sharp contraction in domestic GDP, the decline in metal prices, and the depreciation of the *real* are the key drivers (Figure 3.1.4). In Colombia, it is the fall

in global oil prices and the depreciation of the *peso*, while in dollarized Peru, the dominant macroeconomic factor pushing up firm probabilities of default is the exchange rate depreciation. In Chile and Mexico, good

Figure 3.1.1. Nonfinancial Corporate Debt by Instrument
(Percent of GDP, 2014)

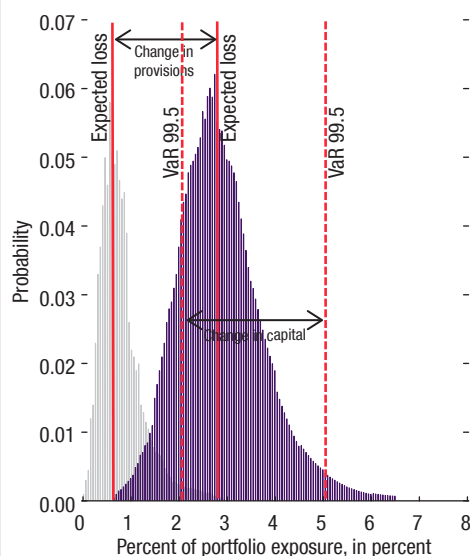


Sources: Bank for International Settlements; Dealogic; IMF, International Financial Statistics database; and IMF staff calculations.

This box was prepared by Jorge Antonio Chan-Lau, Cheng Hoon Lim, Daniel Rodríguez-Delgado, Bennett Sutton, and Melesse Tashu.

¹The model uses two common risk factors (a country's stock index and a representative three-month short-term interest rate) and six firm-specific risk factors, including distance-to-default, liquidity (cash/total assets), profitability (net income/total assets), size (relative to median), market-to-book-value ratio, and idiosyncratic volatility.

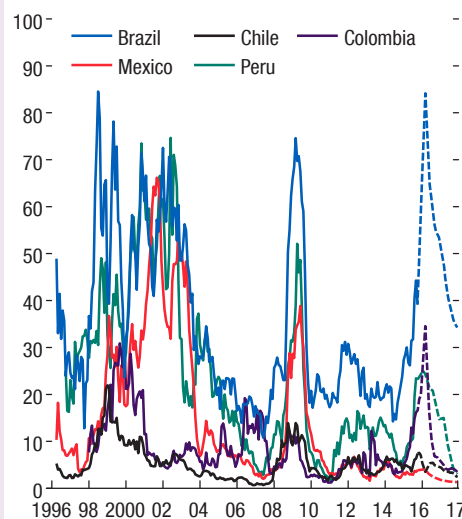
Box 3.1 (continued)

Figure 3.1.2. Credit Loss Probability Distribution

Source: IMF staff calculations.
Note: VaR = value at risk.

Figure 3.1.3. Probabilities of Default in the Nonfinancial Corporate Sector

(Median probability across firms in each country, basis points)



Sources: Credit Research Initiative at the Risk Management Institute (National University of Singapore), and IMF staff calculations.

performance on domestic GDP offsets the negative effects of the decline in oil prices and the exchange rate to limit the overall increase in firm probabilities of default.

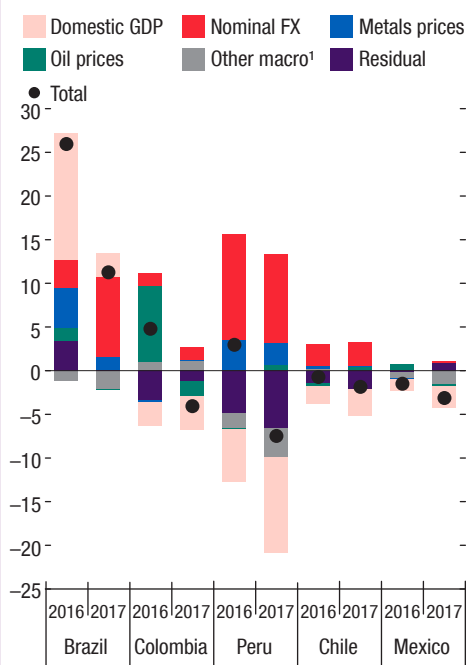
The rise in probabilities of default shifts the distribution of credit losses to the right, making larger losses more likely. Collectively, banks in LA5 may need to raise provisions and capital by about $\frac{1}{2}$ percent of GDP, on average during 2016–17.² There are, however, large variations across countries. Banks in Brazil, for instance, might need to raise provisions and capital by up to a combined $\frac{2}{4}$ percent of GDP, whereas in Peru, the estimate is smaller at about $\frac{1}{4}$ percent of GDP. These estimates are, of course, contingent on the macroeconomic baseline and the initial level of provisions and capital. A weaker macroeconomic baseline would imply higher required provisions and capital. However, the required increase may be less than our estimates if the regulatory capital framework is stringent and banks have set aside buffers consistent with their internal risk management framework, or if current total loss absorbing buffers are higher than calculated in Table 3.1.1

The above analysis offers several policy implications for preserving macrofinancial stability. In line with the results presented in the rest of the chapter, the estimated probabilities of default show that the nonfinancial corporate sector's performance in Brazil, Colombia, and Peru is likely to deteriorate in the near term, leading to the buildup of corporate solvency risk. Under these circumstances, near-term priorities should focus on ensuring the adequacy of buffers in the banking system, in terms of both provisions and capital. Regular stress tests of the banking system, currently performed in central banks and regulatory agencies, could have an important role in guiding the supervisory process.

²Banks are assumed, at the beginning of the projection period (end-October 2015), to hold reserves and capital consistent with the average “through-the-cycle” probability of default over the past 12-month period.

Box 3.1 (continued)

Figure 3.1.4. Contributions to Changes in Projected Corporate Probabilities of Default
(Median probability of default, basis points)



Sources: IMF, World Economic Outlook database; and IMF staff calculations.

Note: Changes compared with the scenario in which the values of macroeconomic variables are fixed at their October 2015 levels. FX = foreign exchange.

¹ Includes effects of advanced economies' growth and U.S. interest rates.

Table 3.1.1 LA5: Required Provisions and Economic Capital
(Percent of GDP)

	Provisions		Economic Capital	
	2015 ¹	2016–17 ²	2015 ¹	2016–17 ²
Brazil	1.3	2.2	3.7	5.1
Chile	1.4	1.1	7.6	6.1
Colombia	1.2	1.3	4.7	4.1
Mexico	0.4	0.3	2.3	1.7
Peru	0.6	0.8	4.4	5.5

Source: IMF staff calculations.

Note: LA5 = Brazil, Chile, Colombia, Mexico, and Peru.

¹Provisions (capital), as of October 2015, against corporate loans, estimated as total provisions (capital) multiplied by the ratio of commercial to total loans.

²Average.

Annex 3.1. Descriptive Statistics and Econometric Results

Annex Table 3.1. Evolution of Implied CDS Spreads and Selected Firm Fundamentals in Latin America and Canada

	ARGENTINA						BRAZIL						CHILE						COLOMBIA					
	2010:Q1		2011:Q3		2015:Q3		2010:Q1		2011:Q3		2015:Q3		2010:Q1		2011:Q3		2015:Q3		2010:Q1		2011:Q3		2015:Q3	
	Obs	Median	Obs	Median	Obs	Median	Obs	Median	Obs	Median	Obs	Median	Obs	Median	Obs	Median	Obs	Median	Obs	Median	Obs	Median	Obs	Median
Implied CDS spreads (basis points)	45	91.0	46	171.0	52	285.0	177	97.0	190	185.5	196	343.0	91	79.0	96	153.5	108	135.5	9	70.0	13	143.0	24	207.0
Debt to equity (percent)	69	28.0	71	35.0	47	54.4	246	59.2	283	57.6	214	76.7	136	42.3	143	46.1	144	53.3	36	16.7	34	18.1	12	70.2
Debt to asset (percent)	70	15.2	71	18.0	49	21.4	277	26.3	312	27.5	236	33.0	136	22.8	144	25.2	147	27.2	36	10.9	34	11.3	12	32.2
Net debt to equity (percent)	69	13.5	71	24.1	47	25.6	239	37.4	278	38.3	214	52.4	133	30.7	141	35.3	143	41.6	36	5.2	34	10.2	12	56.8
Net debt to EBITDA (ratio)	56	0.6	55	0.9	42	1.0	168	1.4	195	1.5	182	2.5	78	2.0	102	1.8	128	2.2	3	0.1	10	2.4	6	3.0
Return on asset (percent, 12-month roll)	67	4.7	71	5.0	49	5.9	256	4.7	270	3.5	250	1.8	136	3.8	133	4.6	149	2.9	21	3.7	31	3.1	17	2.9
Return on equity (percent, 12-month roll)	66	8.5	71	10.2	42	14.7	207	14.4	234	10.4	215	7.6	132	9.9	129	9.6	139	7.1	21	5.7	31	5.3	11	5.8
Cash to current liabilities (ratio)	71	0.3	72	0.2	51	0.2	277	0.4	309	0.4	258	0.4	140	0.3	145	0.2	150	0.2	36	0.3	35	0.4	18	0.3
EBITDA to interest payments (ratio)	62	4.3	62	5.3	41	3.2	227	4.5	237	3.6	197	2.3	116	9.1	123	6.9	141	7.1	14	2.8	19	4.1	6	1.9
Price-to-book ratio (ratio)	56	1.0	61	1.4	53	2.4	195	1.9	215	1.4	197	1.0	131	1.3	133	1.5	133	0.9	15	1.5	14	1.8	29	1.0
	MEXICO						PANAMA						PERU						CANADA					
	2010:Q1		2011:Q3		2015:Q3		2010:Q1		2011:Q3		2015:Q3		2010:Q1		2011:Q3		2015:Q3		2010:Q1		2011:Q3		2015:Q3	
	Obs	Median	Obs	Median	Obs	Median	Obs	Median	Obs	Median	Obs	Median	Obs	Median	Obs	Median	Obs	Median	Obs	Median	Obs	Median	Obs	Median
Implied CDS spreads (basis points)	68	87.5	71	151.0	80	122.0	4	116.5	6	157.0	9	148.0	57	82.0	55	166.0	43	207.0	769	174.0	889	287.0	1084	411.0
Debt to equity (percent)	87	40.9	93	45.8	94	53.6	8	57.7	13	81.4	2	129.0	116	26.7	113	20.4	94	35.5	1105	1.3	1169	2.0	843	19.1
Debt to asset (percent)	90	22.8	94	23.2	96	27.2	8	26.8	13	36.6	2	40.3	117	13.8	114	14.3	94	20.3	1159	1.7	1205	2.0	878	12.8
Net debt to equity (percent)	86	27.8	93	33.0	94	38.9	8	42.5	13	48.5	2	94.3	116	14.1	113	10.1	94	22.8	1087	-6.5	1157	-6.8	839	7.8
Net debt to EBITDA (ratio)	78	1.2	83	1.3	91	1.7	3	2.0	7	2.1	2	3.5	82	0.7	59	0.3	67	1.5	446	1.2	517	1.2	476	1.8
Return on asset (percent, 12-month roll)	83	4.1	88	4.4	95	2.6	3	10.0	8	6.9	2	4.3	102	6.3	111	8.7	99	2.5	1038	-4.9	1132	-4.0	1132	-5.2
Return on equity (percent, 12-month roll)	82	8.7	84	8.7	91	6.7	3	13.1	8	16.3	2	12.3	101	13.9	109	14.7	93	4.2	946	-5.8	1056	-4.7	818	-5.7
Cash to current liabilities (ratio)	89	0.4	94	0.4	97	0.3	6	0.5	11	0.2	2	0.5	118	0.3	116	0.2	99	0.2	1158	0.8	1211	0.9	1151	0.4
EBITDA to interest payments (ratio)	86	6.1	88	6.9	92	7.1	7	2.6	12	6.3	2	6.7	105	10.5	79	14.1	69	7.4	721	1.7	728	3.8	451	2.2
Price to book ratio (ratio)	79	1.5	80	1.5	90	1.9	8	1.7	9	2.1	14	1.7	72	1.3	73	1.3	66	0.8	1048	1.6	1151	1.6	1147	0.9

Sources: Bloomberg, L.P.; and IMF staff calculations.

Note: CDS = credit default swap; EBITDA = earnings before interest, taxes, depreciation, and amortization; obs = number of observations.

Annex Table 3.2 Unconditional Cross-Correlation of Variables Included in the Core Estimation Model

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
	Implied CDS spreads (log)	Actual CDS spreads (log)	Profitability (principal component)	Capitalization (principal component)	Leverage (principal component)	Liquidity (principal component)	Size (percent of country's GDP)	Share price	Share price volatility	Price-to-book ratio	CPI inflation (year over year)	Sovereign CDS spread (log)	Exchange rate change (year over year)	Commodity terms-of-trade index (log)	VIX (log)
Implied CDS spreads (log)	1														
Actual CDS spreads (log)	0.713***	1													
Profitability, principal component	-0.440***	-0.263***	1												
Capitalization, principal component	-0.294***	-0.325***	0.352***	1											
Leverage, principal component	0.102***	0.284***	0.030***	-0.406***	1										
Liquidity, principal component	-0.017***	0.090***	-0.224***	0.234***	-0.381***	1									
Size (percent of country's GDP)	-0.086***	0.070**	0.095***	0.005	0.086***	-0.087***	1								
Share price	-0.009*	-0.049*	-0.007*	0.020***	-0.040***	-0.005	-0.005	1							
Share price volatility	0.618***	0.479***	-0.480***	-0.165***	-0.168***	0.223***	-0.136***	-0.038***	1						
Price-to-book ratio	-0.125***	-0.146***	-0.148***	-0.264***	0.008*	0.159***	-0.017***	0.000	0.012**	1					
CPI inflation (y-o-y)	-0.082***	-0.030*	0.212***	-0.045***	0.086***	-0.227***	0.051***	0.002	-0.187***	-0.034***	1				
Sovereign CDS (log)	0.100***	0.025	0.187***	-0.022***	0.083***	-0.242***	0.077***	0.010**	-0.183***	-0.132***	0.648***	1			
Exchange rate change (y-o-y)	0.281***	0.218***	-0.008*	-0.021***	0.057***	-0.058***	0.007*	0.001	0.058***	-0.111***	0.199***	0.295***	1		
Commodity terms-of-trade index (log)	-0.039***	0.125***	0.025***	0.015***	0.002	0.035***	-0.007*	0.006	-0.074***	0.025***	-0.017***	0.008**	-0.124***	1	
VIX (log)	0.187***	0.351***	-0.028***	-0.008*	0.000	-0.011**	-0.003	-0.002	0.159***	-0.062***	0.092***	0.242***	0.209***	-0.069***	1

Sources: Bloomberg, L.P.; and IMF staff calculations.

Note: CDS = credit default swap; CPI = consumer price index; VIX = Chicago Board Options Exchange Volatility Index; y-o-y = year over year.

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.1$.

Annex Table 3.3 Core Model: Estimation Results

Variables	Core Model			Excluding Block #2			Excluding Blocks #3 and #4			Excluding Blocks #1 and #2		
	LAC + CAN (1)	LAC (2)	LA5 (3)	LAC + CAN (4)	LAC (5)	LA5 (6)	LAC + CAN (7)	LAC (8)	LA5 (9)	LAC + CAN (10)	LAC (11)	LA5 (12)
Block 1: Firm-specific fundamentals:												
Profitability, principal component	-0.100*** (0.006)	-0.080*** (0.006)	-0.080*** (0.007)	-0.130*** (0.001)	-0.134*** (0.008)	-0.129*** (0.010)	-0.095*** (0.007)	-0.070*** (0.010)	-0.066*** (0.012)	0.004 (0.010)	0.0105 (0.014)	0.0416*** (0.009)
Capitalization, principal component	-0.089*** (0.042)	-0.370*** (0.023)	-0.366*** (0.031)	-0.165*** (0.025)	-0.310*** (0.031)	-0.353*** (0.044)	-0.065 (0.043)	-0.398*** (0.040)	-0.384*** (0.045)	-0.0372 (0.062)	0.173*** (0.031)	0.278*** (0.034)
Leverage, principal component	0.112*** (0.01)	0.076*** (0.01)	0.080*** (0.01)	0.093*** (0.00)	0.081*** (0.01)	0.071** (0.02)	0.115*** (0.01)	0.078*** (0.01)	0.083*** (0.02)	0.0122*** (0.001)	0.00765*** (0.001)	0.00721*** (0.001)
Liquidity, principal component	-0.029*** (0.004)	-0.030*** (0.012)	-0.025* (0.011)	-0.055*** (0.009)	-0.035** (0.013)	-0.029* (0.011)	-0.028*** (0.005)	-0.033** (0.013)	-0.032* (0.015)	0.004 (0.009)	0.007 (0.007)	0.009 (0.007)
Size (percent of country's GDP)	0.021 (0.011)	0.005 (0.006)	0.006 (0.006)	0.019 (0.010)	0.007 (0.005)	0.007 (0.005)	0.025** (0.009)	0.009 (0.007)	0.009 (0.007)	-1.36e-05*** (0.000)	-1.43e-05*** (0.000)	-1.36e-05*** (0.000)
Block 2: Firm-specific market variables:												
Share price	-3.60e-06 (0.000)	-4.80e-06 (0.000)	-4.65e-06 (0.000)	0.014* (0.007)	0.010 (0.014)	0.039** (0.009)	-1.55e-05*** (0.000)	-1.43e-05*** (0.000)	-1.36e-05*** (0.000)	0.004 (0.010)	0.0105 (0.014)	0.0416*** (0.009)
Share price volatility	0.008*** (0.000)	0.007*** (0.001)	0.007*** (0.001)	0.0187 (0.059)	0.154*** (0.029)	0.253*** (0.036)	0.010*** (0.000)	0.012*** (0.000)	0.012*** (0.000)	-0.0372 (0.062)	0.173*** (0.031)	0.278*** (0.034)
Price-to-book ratio	-0.050*** (0.001)	-0.050*** (0.003)	-0.047*** (0.003)	0.009*** (0.001)	0.006*** (0.001)	0.006*** (0.001)	-0.055*** (0.003)	-0.066*** (0.004)	-0.067*** (0.004)	0.0122*** (0.001)	0.00765*** (0.001)	0.00721*** (0.001)
Block 3: Domestic variables:												
CPI inflation (year over year)	0.023** (0.008)	0.012 (0.009)	0.031** (0.007)	0.014* (0.007)	0.010 (0.014)	0.039** (0.009)	0.010*** (0.000)	0.012*** (0.000)	0.012*** (0.000)	0.004 (0.010)	0.0105 (0.014)	0.0416*** (0.009)
Sovereign CDS Spreads (log)	0.008 (0.043)	0.115*** (0.029)	0.199*** (0.043)	0.0187 (0.059)	0.154*** (0.029)	0.253*** (0.036)	0.010*** (0.000)	0.012*** (0.000)	0.012*** (0.000)	-0.0372 (0.062)	0.173*** (0.031)	0.278*** (0.034)
Exchange rate change (year over year)	0.005*** (0.001)	0.004** (0.001)	0.004** (0.001)	0.009*** (0.001)	0.006*** (0.001)	0.006*** (0.001)	-0.055*** (0.003)	-0.066*** (0.004)	-0.067*** (0.004)	0.0122*** (0.001)	0.00765*** (0.001)	0.00721*** (0.001)
Block 4: Global variables:												
Commodity terms-of-trade index (log)	-1.568* (0.743)	-1.726*** (0.407)	-0.877* (0.343)	-1.587** (0.618)	-1.938** (0.664)	-0.636 (0.381)	-1.55e-05*** (0.000)	-1.43e-05*** (0.000)	-1.36e-05*** (0.000)	-3.423** (1.154)	-2.195* (1.041)	-0.754 (0.634)
VIX (log)	0.366*** (0.022)	0.378*** (0.051)	0.299*** (0.056)	0.552*** (0.059)	0.461*** (0.059)	0.351*** (0.0444)	0.010*** (0.000)	0.012*** (0.000)	0.012*** (0.000)	0.474*** (0.038)	0.399*** (0.064)	0.284*** (0.018)
Dummy variables:												
Dummy "crisis" (LAC)	0.983*** (0.056)	0.881*** (0.024)	0.853*** (0.042)	0.890*** (0.034)	0.837*** (0.031)	0.811*** (0.049)	1.232*** (0.036)	1.216*** (0.036)	1.223*** (0.041)	1.003*** (0.038)	0.893*** (0.036)	0.869*** (0.049)
Dummy "crisis" (CAN)	0.285** (0.104)	0.285** (0.104)	0.285** (0.104)	0.309** (0.097)	0.309** (0.097)	0.309** (0.097)	0.495*** (0.010)	0.495*** (0.010)	0.495*** (0.010)	0.444*** (0.116)	0.444*** (0.116)	0.444*** (0.116)
Dummy "recent" (LAC)	1.381*** (0.075)	1.290*** (0.043)	1.219*** (0.041)	1.326*** (0.051)	1.253*** (0.038)	1.174*** (0.036)	1.519*** (0.041)	1.506*** (0.038)	1.500*** (0.043)	1.441*** (0.053)	1.324*** (0.044)	1.245*** (0.042)
Dummy "recent" (CAN)	0.463*** (0.105)	0.463*** (0.105)	0.463*** (0.105)	0.412*** (0.107)	0.412*** (0.107)	0.412*** (0.107)	0.556*** (0.00791)	0.556*** (0.00791)	0.556*** (0.00791)	0.569*** (0.121)	0.569*** (0.121)	0.569*** (0.121)
Constant	2.886*** (0.093)	2.029*** (0.066)	1.854*** (0.089)	2.706*** (0.073)	1.803*** (0.084)	1.622*** (0.150)	3.845*** (0.014)	3.438*** (0.035)	3.431*** (0.038)	3.845*** (0.014)	3.438*** (0.035)	3.431*** (0.038)
Number of Observations	24,798	11,237	10,128	30,972	14,396	12,806	24,799	11,238	10,128	24,799	11,238	10,128
R-squared	0.688	0.819	0.822	0.580	0.771	0.777	0.627	0.758	0.753	0.627	0.758	0.753
Number of Firms	1,337	515	454	1,522	593	524	1,337	515	454	1,337	515	454

Source: IMF staff calculations.

Note: CAN = Canada; CDS = credit default swap; CPI = consumer price index; LA5 = Brazil, Chile, Colombia, Mexico, and Peru; LAC = Argentina, Brazil, Chile, Colombia, Mexico, Panama, and Peru; VIX = Chicago Board Options Exchange Volatility Index. Robust standard errors in parentheses.

*** p<0.01; ** p<0.05; * p<0.1.

3. UNDERSTANDING CORPORATE VULNERABILITIES IN LATIN AMERICA

Annex Table 3.4 Scenario Analysis

		Argentina	Brazil	Chile	Colombia	Mexico	Panama	Peru
Exchange rate scenario	Shock							
	Exchange rate in 2016:Q3	16.7	6.2	852.0	4918.5	23.1	1.0	4.2
Exchange rate scenario	Impact							
	Change (bps) in implied CDS spreads between 2015:Q3 and 2016:Q3	133.3	117.2	20.0	61.9	38.6	0.0	58.5
Sovereign CDS spreads scenario	Shock							
	Change (bps) in sovereign CDS spreads in one quarter	5000	300	75	200	150	150	200
Sovereign CDS spreads scenario	Impact							
	Change (bps) in implied CDS spreads in one quarter	43.1	97.2	29.9	63.0	39.0	101.1	76.2
VIX scenario	Shock							
	Change (bps) in the VIX in one quarter	30	30	30	30	30	30	30
VIX scenario	Impact							
	Change (bps) in implied CDS spreads in one quarter	227.8	277.4	109.1	165.4	97.5	270.0	165.5
Crisis scenario	Shock	Unexplained regime-shift change (in log bps) identical to that observed during the global financial crisis						
	Impact							
Crisis scenario	Change (bps) in implied CDS spreads in one quarter	415.9	506.5	199.2	302.0	178.0	493.1	302.1

Source: IMF staff calculations.

Note: bps = basis points; CDS = credit default swap; VIX = Chicago Board Options Exchange Volatility Index.