Global Borrowing Costs and Firms' Risk in Open Economies*

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Abstract

We study the role of firm heterogeneity for economic transmission in open economies. Using firm-level data from a panel of emerging markets, we document that increases in the global price of risk are followed by heterogeneous investment dynamics, with contractions for risky firms and expansions for risk-free firms. By developing a quantitative heterogeneous-firm open economy model, we show that these cross-sectional empirical patterns can be explained by the presence of indirect channels that mitigate the negative response to external shocks. We use the model to assess macroeconomic transmission during external crises and sudden stops. Our findings indicate that allowing the exchange rate to depreciate during downturns plays a stabilizing role, by reducing risk exposure and facilitating the reallocation of economic activity across firms through larger relative price adjustments.

Keywords: Investment dynamics, sudden stops, global financial cycle, default risk, firm heterogeneity, exchange rates, international transmission.

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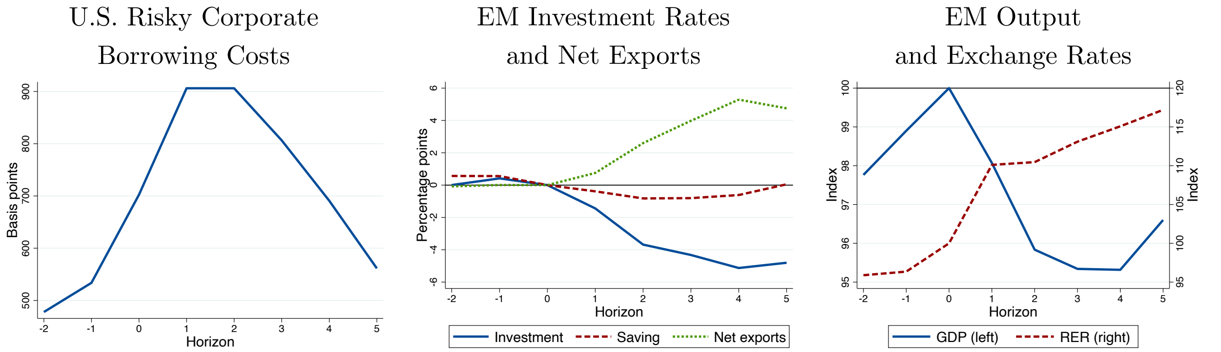
1. Introduction

Systemic crises in emerging economies tend to display a classic pattern. As external risky borrowing costs surge, the economy exhibits a sharp contraction of aggregate investment, mirrored by current account adjustment or "sudden stops" in capital flows; economic activity declines and currencies depreciate. Salient examples, illustrated in Figure 1, include the Latin American debt crises in the early 1980s, the East Asian/Russian crisis in the late 1990s, and the Global Financial Crisis that started in 2008. Based on the recurrence of these patterns, a classic question for academics and policymakers in emerging markets is what drives investment adjustments and sudden stops. This is often grounded in the "bad luck vs. bad policy" debate (Calvo, 2005). Do exogenous surges in the global price of risk primarily drive investment adjustments? Or are these adjustments amplified by currency depreciations and other macroeconomic policies observed in these episodes?

In this paper, we reassess these questions by studying the micro patterns of external borrowing costs and investment adjustments in emerging markets. To do so, we combine a heterogeneous-firm open-economy model with new evidence on firms' responses to fluctuations in the global price of risk. Our analysis reveals two main takeaways. First, "bad luck" plays a central role during external crises: The adjustment of aggregate investment is driven by the response of the subset of firms exposed to default risk, reflecting strong direct channels induced by surges in the global price of risk and their effects on firms' financing costs. Second, our analysis indicates that luck can be influenced. Indirect channels mitigate the negative response to external shocks and can be heavily influenced by macroeconomic policies. For instance, allowing the exchange rate to depreciate during downturns reduces the risk exposure of firms and facilitates the reallocation of economic activity across firms through larger relative price adjustments. More broadly, policies that reduce firms' risk can go a long way mitigating investment adjustments and sudden stops.

The paper begins by documenting the empirical relationship between the global price of risk and firms' investment in emerging markets. For this, we combine data on firm-level balance sheets and external borrowing costs. Using the decomposition of borrowing costs by

Figure 1: Systemic External Crisis Patterns



Note: This figure shows selected variables for a set of emerging-market crisis episodes (described in Appendix Table A.1). Data are quarterly and horizon 0 indexes the peak in GDP. Panel (a) shows the average Barclays U.S. Corporate High Yield Spread. Panel (b) plots the difference in percentage points between investment-to-GDP (solid blue line), savings-to-GDP (dashed red line), and net-exports-to-GDP (dotted green line) in each horizon, relative to horizon 0. Panel (c) reports GDP relative to its peak (solid blue line) and the real exchange rate relative to the peak in GDP (dashed red line).

Gilchrist and Zakrajšek (2012), we document that during external crises (such as those in Figure 1), the bulk of increases in firms' borrowing costs can be accounted for by increases in the global risk premium, i.e., the component of firms' spreads orthogonal to their default risk (measured with Merton (1974)'s default model). We then show that increases in the global risk premium tend to be followed by heterogeneous investment dynamics across firms, with contractions for risky firms and expansions for risk-free firms. These heterogeneous dynamics are observed within different sectors, using alternative measures of risk, and cannot be accounted for by other firm-level characteristics or changes in global economic activity.

We then construct a quantitative model that is consistent with the micro-level patterns to study macroeconomic transmission during sudden stops. The model structure is that of a canonical open-economy framework, in which households consume goods produced by the home economy and the rest of the world. In this framework, we introduce heterogeneity and financial frictions for domestic firms in the open economy, that finance their investment with debt subject to default risk. External credit is provided by risk-averse foreign investors, leading to external fluctuations in the required premium for risk. In this environment, fluctuations in the global risk premium affect economic activity through two channels. One is a direct channel, by which changes in the global risk premium affect firms' marginal cost of finance and their investment. The other is an indirect channel, which stems from the feedback between firms' responses, domestic aggregate demand, and exchange rate policy.

Our model analysis indicates that the cross-sectional patterns observed empirically can be explained by the presence of strong direct channels combined with indirect channels that mitigate the effects of the global risk premium. Since risk-free firms are not affected by direct channels—their borrowing costs remain invariant to changes in the risk premia—their investment expansion following increases in the global risk premium is indicative of the presence of expansionary indirect channels. In our model this is because the decline in labor demand from risky firms induces contractions in real wages and the price of capital goods, which stimulates the investment of risk-free firms through increases in cash flows and the marginal revenue product of capital. During sudden stops, we estimate that the contraction of aggregate investment would be roughly twice as large in the absence of the price changes induced by general equilibrium effects.

Lastly, we use our model as a laboratory to analyze how exchange-rate policy can stabilize/amplify fluctuations in the global risk premium. Our model highlights the role of flexible exchange rates as risk stabilizers. Allowing for exchange rate depreciations in response to increases in the global price of risk mitigates the negative effects in economic activity for two reasons. First, by facilitating the adjustment of factor inputs prices (i.e., speeding up the contraction on wages and the price of capital) currency depreciation free-up firm cash flows during bad times and reduces their default risk. Second, these relative price adjustments facilitates the reallocation of factors toward risk-free firms, which are less financially constrained and increase their scale when the global price of risk increases.

Related literature Our paper contributes to various strands of the literature. First, our paper is related to the literature that studies the global financial cycle and imperfect international capital markets (see, e.g., Rey, 2015; Maggiori, 2021, and references therein). We contribute to this literature by studying the channels of transmission of fluctuations in the global price of risk and their implications for macroeconomic policies. In this sense, our work complements two strands of literature. One that studies the transmission of the shocks in global capital markets to open economies (see, e.g., Baskaya, di Giovanni, Kalemli-Ozcan and Ulu, 2017; Hassan, Schreger, Schwedeler and Tahoun, 2021; Akinci, Kalemli-Özcan and Queralto, 2022). Another is the closed-economy literature that stresses the relevance of risk premia and agents' risk-bearing propensity in macroeconomic fluctuations (see, e.g., Bernanke, Gertler and Gilchrist, 1999; He and Krishnamurthy, 2013; Kekre and Lenel, 2022).[1]

Second, our paper contributes to the literature on international business cycles and sudden stops (see, for example, Backus, Kehoe and Kydland, 1992; Aguiar and Gopinath, 2007; Mendoza, 2010). A strand of this literature analyzes the role of fluctuations in external borrowing costs on business cycles in open economies (see, for example, Neumeyer and Perri, 2005; Garcia-Cicco, Pancrazi and Uribe, 2010). We contribute to this literature by using a "micro-to-macro" approach, which uses firms' bond and investment data and a heterogeneous-firm framework, to study business cycles in open economies.

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Third, our paper is related to the literature on exchange rates and the macroeconomy. The classic Mundellian view is that currency fluctuations mitigate the effects of nominal rigidities and act as shock stabilizers (see, for example, Gali and Monacelli, 2005; Schmitt-Grohé and Uribe, 2016). Another strand of the literature highlights the tight connection between exchange rates and international capital markets (Gabaix and Maggiori, 2015; Itskhoki and Mukhin, 2021). Our paper connects these views by highlighting the stabilizing role of flexible exchange rates in reducing firms' risk exposure to fluctuations in international

[1] A related literature in asset pricing studies the role of fluctuations in the risk premium (see Cochrane, 2011, for a survey). In the international asset pricing, risk premium fluctuations have been relevant in explaining cross-sectional currency and sovereign risk (see, for example, Lustig and Verdelhan, 2007; Longstaff, Pan, Pedersen and Singleton, 2011; Gilchrist, Yue and Zakrajsek, 2012).

capital markets. In this sense, our paper provides an additional channel for the expansionary effects of currency devaluations that have been documented empirically (e.g., Fukui, Nakamura and Steinsson, 2023).

Finally, we build on the literature that analyzes the link between firm dynamics and macroeconomic fluctuations (see, for example, Khan and Thomas, 2008; Ottonello and Winberry, 2020). In open economies, firm heterogeneity has been shown to play a central role during crises and sudden stops (examples include Gopinath and Neiman, 2014; Blaum, 2019; Ates and Saffie, 2021; Castillo-Martinez, 2020). Methodologically, our work is related to Arellano, Bai and Bocola (2020) and Aruoba, Fernandez, Lopez-Martin, Lu and Saffie (2022), who analyze how heterogeneity in firms' leverage informs the channels of transmission of sovereign risk and monetary policy, respectively.

2. Empirical Evidence

This section studies the relationship between external borrowing costs and firms' investment at micro level. Section 2.1 describes our data and methodology to measure external borrowing costs and global risk premium. Section 2.2 documents the heterogeneous investment dynamics following changes in the global risk premium.

2.1. External Corporate Borrowing Costs

Data and measurement Our empirical analysis uses micro-level data on individual corporate bonds and balance-sheet information. We obtain details on corporate bond issuances and their prices from Bloomberg for a set of 12 emerging market economies.[2] For each country, we gather information on all corporate bonds denominated in U.S. dollars, with available price information for the period 1997 to 2021, which results in a sample of 561 bonds issued by 173 firms. Table A.2 describes the number of observations in our sample by country. For each bond, we obtain information on its daily price, amount issued, coupon

[2]The countries in our bond sample are Argentina, Brazil, Chile, Colombia, India, Korea, Mexico, Peru, the Philippines, Thailand, Turkey, and Ukraine. These are the countries for which we were able to obtain at least 100 observations using the download and merging procedure described in Appendix A.

structure, maturity, and other characteristics. We use common identifiers to link each bond to its issuing firm, which enables us to link the bonds to balance sheet data from Global Compustat and ORBIS.

We measure firms' external borrowing costs as the time-varying spread in their U.S. dollar-denominated bonds relative to a synthetic risk-free security with the same coupon structure. The median bond in our sample has a nominal yield of 5.1 percentage points and a credit spread of 282 basis points. Additional summary statistics are reported in Tables A.3 and A.4.

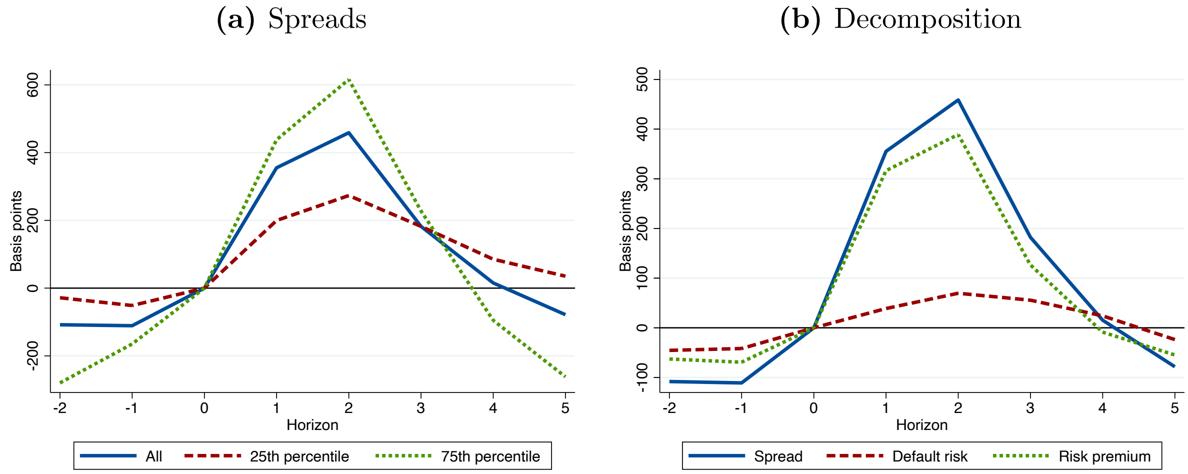
Figure 2 shows that external borrowing costs increase during external crisis periods.[3] Corporate bond spreads exhibit a large and short-lived increase, peaking at 459 basis points above pre-crisis levels and remaining high throughout a year. Panel (a) shows that there is substantial heterogeneity around the increase in external borrowing costs across bonds with different initial spreads. Bonds that had spreads at or below the 25th percentile in the quarter before the onset of the crisis saw their spreads increase by 273 basis points at the peak. Meanwhile, bonds that were priced at or above the 75th percentile experienced a 616 basis point increase in spreads.

Decomposing external borrowing costs The observed increase in external borrowing costs during crises reflects two forces: First, firms face higher risk of default, which leads to an increase in spreads to compensate for this increase in risk; second, foreign lenders may have reduced appetite for risk, which leads them to charge higher premiums, conditional on the same level of risk. We disentangle these forces by residualizing bond spreads on bond-specific characteristics and distance to default as a measure of firm-level risk, as in Gilchrist and Zakrajšek (2012). In particular, we estimate the following regression:

$$\log S_{ijkt} = \beta \mathrm{dd}_{jkt} + \gamma' \boldsymbol{Z}_{it} + \epsilon_{ijkt}, \tag{1}$$

[3]We focus on the subset of systemic sudden stop episodes (described in Appendix Table A.1) for which we observe at least two bonds in each of the 2 quarters leading up to the peak and the 5 quarters that follow, which gives us a sample of 53 bonds across six episodes: Argentina 1998Q2, Argentina 2008Q3, Brazil 2008Q3, Mexico 2008Q2, Korea 2008Q3, and Thailand 2008Q1.

Figure 2: External crises and external borrowing costs



Note: Panel (a) shows the average change in corporate bond spreads for all bonds and those below the 25th or above the 75th percentiles by spreads at horizon -1. The spreads are measured as the difference between the bond yield-to-maturity and a synthetic risk-free security with the same yield structure. Panel (b) shows the average change in spreads, decomposed into the portion predicted by default risk and the risk premium portion. The risk premium is defined as in equation (2), where the default risk component is the term subtracted from the total spread. The x-axis indexes quarterly time relative to the peak in GDP. The y-axis units are basis points relative to time 0. The sample includes Argentina 1998Q2, Argentina 2008Q3, Brazil 2008Q3, Mexico 2008Q2, Korea 2008Q3, and Thailand 2008Q1.

where S_{ijkt} is the spread of bond i for firm j from country k in period t; dd_{jkt} measures the default risk for each firm, using the Merton (1974)'s "distance-to-default" defined as $\text{dd}_{jkt} = \frac{\log(\frac{V_{jkt}}{D_{jkt}})+(\mu_{jt}-0.5\sigma^2_{jkt})}{\sigma_{jkt}}$, where V_{jkt} denotes the total value of firm j from country k in period t, μ_{jkt} the firm's annual expected return, σ_{jkt} the annual volatility of its value, and D_{jkt} the firm's debt.[4]; $\boldsymbol{Z}_{it}$ is the vector of bond-level characteristics; and ϵ_{ijkt} denotes a random error term. The bond-level characteristics included in the vector $\boldsymbol{Z}_{it}$ are duration, amount issued, coupon rate, and age of issue, all meausured in logs; an indicator for whether the bond is callable; and fixed effects by sector, type of first coupon issued, and quarter interacted with coupon frequency and first coupon month. The logic behind this approach is to extract the component of bond spreads due to default risk in order to obtain fluctuations in the component due to the risk premium. Appendix Table A.5 reports the results from estimating

[4]The interpretation of this measure is the number of standard deviations by which $\log V_{jkt}$ must deviate from its mean for the firm to default within a year (assuming the firm defaults when $V_{jkt} < D_{jkt}$). Appendix A.2 provides details about the iterative procedure used to impute the total value of the firm and construct this measure.

(1). As expected, firms with larger distance to default have lower bond spreads. However, there is significant variation in bond spreads that is not explained by these covariates; the R^2 of the regression is 49%. We use these estimates to construct the bond-specific risk premium as

$$\hat{RP}_{ijkt} = S_{ijkt} - exp\left(\hat{\beta} dd_{jkt} + \hat{\gamma}' Z_{ijkt} + \frac{\hat{\sigma}^2}{2}\right), \tag{2}$$

where $\hat{\sigma}$ is the mean-squared error of the estimated ϵ_{ijkt} shocks.

The dashed and dotted lines in Figure 2 Panel (b) show the behavior of the predicted bond spreads and the bond-specific risk premia around sudden stop periods. Both the portion of the spread predicted by default risk and the portion attributed to bond-specific risk premia increase in the quarters following the peak in GDP. However, the increase in risk premia is quantitatively most important, accounting for roughly 86% of the increase in average spreads at its peak.

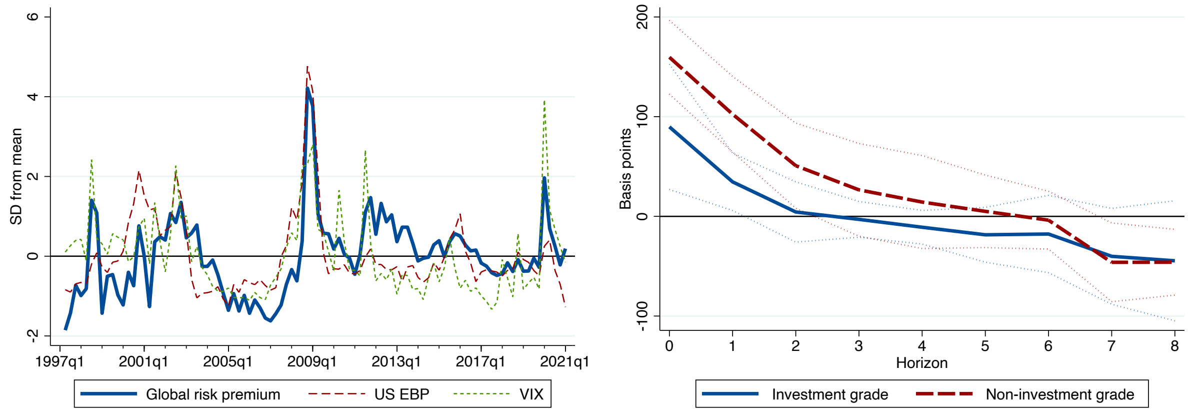
Global risk premium To make full use of our data, we expand our analysis outside of specific crisis periods. We construct a measure of the global risk premium that captures the systemic fluctuations in borrowing costs over time. We decompose fluctuations in the risk premium into systemic and idiosyncratic components. We estimate

$$\hat{RP}_{ijkt} = \rho_k + \rho_t + v_{ijkt}, \tag{3}$$

where ρ_k and ρ_t denote country and time fixed effects. We refer to ρ_t as the systemic component of the risk premium, or global risk premium, and to v_{ijkt} as the idiosyncratic component of the risk premium. Figure 3 shows the time series of the global risk premium, which is correlated with other common measures of risk such as the VIX or the U.S. excess bond premium. Our earlier emphasis on external crises, and in particular on the Global Financial Crisis, is consistent with the large spike in the global risk premium in the fourth quarter of 2008. However, there is meaningful variation in other periods as well. Appendix Table A.6 reports the country averages of risk premia. The R^2 of this regression is 0.19 for the full emerging market sample and rises to 0.29 for the Latin America subsample, which

Figure 3: Global Risk Premium

(a) Evolution of the global risk premium **(b)** Spread dynamics



Note: Panel (a) shows our measure of the global risk premium (ρ_t) and compares it to the U.S. excess bond premium (EBP) and the VIX. Units are standard deviations from the mean. Correlations are reported in Table A.7. Panel (b) shows the dynamics of bond spreads with movements in the global risk premium for investment grade and non-investment grade firms. We use the following specification:
$S_{ijt+h} = \alpha_{hi} + \beta_h^I \times \rho_t \times \mathbb{I}_{j\in\mathcal{R}_{t-1}^I} + \beta_h^N \times \rho_t \times \mathbb{I}_{j\notin\mathcal{R}_{t-1}^I} + \gamma_h \mathbb{I}_{j\in\mathcal{R}_{t-1}^I} + \omega_h' Z_{ijt-1} + \epsilon_{jth}$,
where S_{ijt+h} is the spread of bond i issued by firm j at horizon $t+h$, α_{hi} are horizon-bond fixed effects, ρ_t is the global risk premium estimated on the Latin America sample, R_{t-1}^I is the set of investment-grade firms in $t-1$, and Z_{ijt-1} is a vector of standard firm-level controls and the lagged bond spread.

indicates that a sizable portion of the variation in bond-level risk premia can be explained by common country and time components, particularly within Latin America. Appendix Figure A.1 shows additional estimates of the global risk premium by region and country-level estimates for the largest countries in Latin America.

Increases in the global risk premium reflect rises in corporate borrowing costs. Figure 3 Panel (b) shows that these increases are less severe for highly-rated firms.[5] Firms with an investment-grade or higher credit rating exhibit a 90-basis-point increase in spreads when the global risk premium is 1 standard deviation higher. Meanwhile, firms with a credit rating below investment grade or not rated at all exhibit a 160-basis-point increase. This figure looks similar if we show the dynamics of bond-level risk premia instead of spreads. Appendix

[5] We have ratings data for the sample of Latin American firms. We use the following specification: $S_{ijt+h} = \alpha_{hi} + \beta_h^I \times \rho_t \times \mathbb{I}_{j\in\mathcal{R}_{t-1}^I} + \beta_h^N \times \rho_t \times \mathbb{I}_{j\notin\mathcal{R}_{t-1}^I} + \gamma_h \mathbb{I}_{j\in\mathcal{R}_{t-1}^I} + \omega_h' Z_{ijt-1} + \epsilon_{jth}$, where S_{ijt+h} is the spread of bond i issued by firm j at horizon $t+h$, α_{hi} are horizon-bond fixed effects, ρ_t is the global risk premium estimated on the Latin America sample, R_{t-1}^I is the set of investment-grade firms in $t-1$, and Z_{ijt-1} is a vector of standard firm-level controls and the lagged bond spread.

Figure A.2 shows the distribution of credit ratings across firms in our sample.

2.2. External Borrowing Costs and Investment

We have shown that high-risk firms exhibit more fluctuations in borrowing costs as external conditions develop. In this section we will show that the investment dynamics across high- and low-risk firms differ as well. The main balance-sheet data for our analysis come from Global Compustat. We use standard definitions to construct measures of firms' investment, debt, and other characteristics. Full details and sample restrictions are described in Appendix A.2. Appendix Table A.8 reports summary statistics for the Latin America sample of firms. We observe 736 unique firms across Argentina, Brazil, Chile, Colombia, Mexico, and Peru, for roughly 29,000 firm-quarter observations.[6] We define low- and high-risk firms on a quarterly basis using distance to default, as described in the appendix. Table A.9 reports additional summary statistics by firm risk and Table A.10 by country. We merge quarterly balance-sheet data with the global risk premium from the previous section, which we estimate on the Latin America subsample.

We use the following local Jorda (2005) projection model:

$$\Delta_h log(k_{jt+h}) = \alpha_{hj} + \underbrace{\beta_h^R \times \rho_t \times \mathbb{I}_{j\in\mathcal{R}_{t-1}}}_{\text{Risky Firms}} + \underbrace{\beta_h^F \times \rho_t \times \mathbb{I}_{j\in\mathcal{R}^f_{t-1}}}_{\text{Risk-Free Firms}} + \omega_h' Z_{jt-1} + \epsilon_{jth}, \quad (4)$$

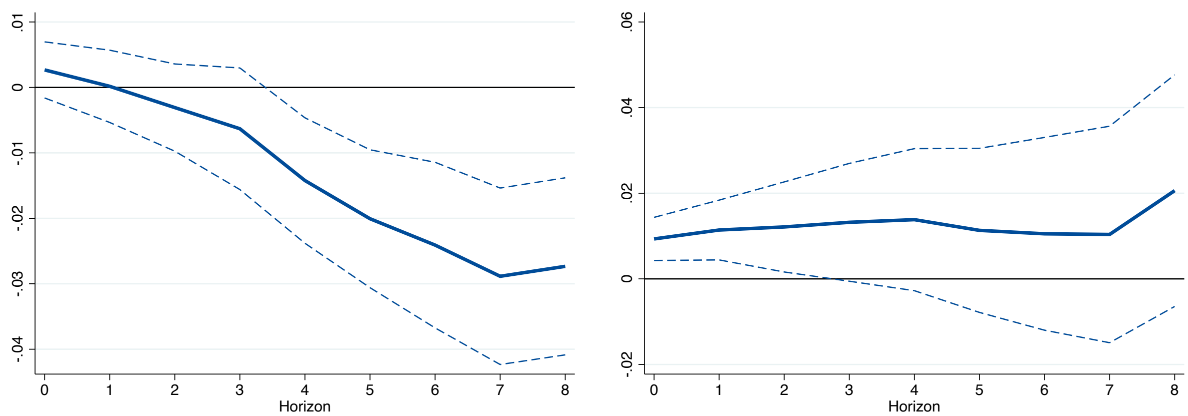
where $\Delta_h \log(k_{jt+h}) \equiv \log(k_{jt+h}) - \log(k_{jt-1})$ denotes period t log cumulative change for h quarters in firm j's capital; α_{hj} denotes firm fixed effects; ρ_t measures the global risk premium in period t; $\mathcal{R}_t$ denotes the set of risky firms and $\mathcal{R}^f_t$ the set of risk-free firms; and Z_{jt} is a vector of firm-level covariates, which includes firms' size (measured as log total assets), capital growth, sales growth, fiscal quarter, and current assets relative to total assets. Standard errors are clustered by time.

Figure 4 reports the results from estimating equation (4) and highlights two main results

[6] We focus on Latin America because we have the best coverage across datasets for this region. We have bond-price data for about 9% of Latin American firms in our Global Compustat sample and credit ratings for about 14%.

Figure 4: Heterogeneous Dynamics and the Global Risk Premium

(a) Risky firms **(b)** Risk-free firms



Note: The figure shows the estimated β_h^R and β_h^F coefficients of Equation (4), which correspond to the cumulative log change in capital stock in response to the global risk premium in period t for risky and risk-free firms. The variable ρ_t is standardized so that the units are standard deviations. The x-axes show the horizon h (quarterly frequency). The vector of controls includes firms' sales growth, investment, fiscal quarter, size, and share of current assets. All controls are standardized. Standard errors are clustered by time. Dashed lines represent 90% confidence intervals.

in particular. First, Panel (a) shows that increases in the global risk premium are associated with an average contraction in risky firms' investment, which is large and persistent: A 1-standard-deviation increase in the global risk premium is associated with a 2.7% cumulative decline in the capital stock, which peaks 8 quarters after the shock. Second, Panel (b) shows that increases in the global risk premium are not associated with declines in investment for risk-free firms. A 1-standard-deviation increase in the global risk premium is associated with a 2% cumulative increase in the capital stock—which also peaks 2 years after the shock, though the effects are statistically indistinguishable from zero at later horizons. Thus, the aggregate decrease in capital appears to be driven by risky firms and somewhat attenuated by risk-free firms.

The finding that the negative effects of the global risk premium shock on investment are concentrated among risky firms is robust to alternative specifications. Table 1 summarizes some of these specifications, with full details and figures showing the dynamics in Appendix A.3. First, the results are remarkably consistent across measures of risk-free firms using credit ratings rather than distance to default, reported in Figure A.3. This is interesting, because our baseline risk-free measure has approximately zero correlation with the credit-rating measures, as reported in Appendix Table A.11, which suggests that they are measuring different aspects of firms' risk. To alleviate concern that our results are picking up heterogeneous responses to aggregate conditions generally, we include interactions between firm risk and contemporaneous U.S. macroeconomic indicators (Figure A.4). Next, we interact the risk premium with other firm characteristics in addition to risk to ensure that our results are not picking up other characteristics that could be correlated with risk (Figure A.5). We use alternative model specifications that allow for interactions between the controls and firm risk (Figure A.6), time fixed effects (Figure A.7), and a continuous measure of firm risk (Figure A.8). We examine heterogeneity by sector (Figure A.9), exchange-rate regime (Figure A.10), or sample of countries (Figure A.11). Finally, we use alternative measures of the global risk premum. We show that results are similar for the global risk premium measured across the full sample of emerging markets rather than just Latin America. We allow for alternative specifications of the first stage of the risk premium estimatation: a nonlinear relationship between default risk and credit spreads and heterogeneity in the relationship between default risk and credit spreads by country or by credit rating. Tables A.12 and A.13 report details on the estimation of these measures and Figure A.12 shows the resulting time series. Our results are similar across all of these measures (Figure A.13).

Table 1: Sensitivity of results to alternative specifications

	Risky		Risk-free		
	Peak	SE	Peak	SE	R^2
Baseline	-0.029	(0.007)	0.013	(0.008)	0.304
Measures of risk					
A- or higher	-0.024	(0.005)	0.013	(0.006)	0.270
Investment grade	-0.026	(0.005)	0.010	(0.005)	0.270
Interaction with U.S. variables					
GDP growth	-0.026	(0.007)	0.011	(0.006)	0.305
Inflation	-0.023	(0.006)	0.026	(0.013)	0.311
AAA bond yields	-0.035	(0.013)	0.019	(0.008)	0.305
Interactions of ρ_t with (lagged)					
Size	-0.031	(0.008)	0.011	(0.006)	0.305
Sales growth	-0.028	(0.007)	0.013	(0.008)	0.304
Capital growth	-0.029	(0.008)	0.013	(0.007)	0.304
Controls interacted with risk	-0.029	(0.007)	0.016	(0.009)	0.305
Sector					
Tradable	-0.026	(0.008)	0.036	(0.016)	0.327
Nontradable	-0.024	(0.010)	0.043	(0.023)	0.327
Exchange rate regime					
Flexible	-0.026	(0.007)	0.029	(0.014)	0.317
Fixed	-0.031	(0.013)	-0.021	(0.025)	0.317
Alternative ρ_t specifications					
Emerging market risk premium	-0.020	(0.006)	0.025	(0.015)	0.304
Nonlinear model	-0.030	(0.008)	0.015	(0.008)	0.304
Heterogeneity by country	-0.027	(0.008)	0.017	(0.010)	0.304
Heterogeneity by rating	-0.030	(0.008)	0.013	(0.008)	0.305

Note: This table summarizes the robustness exercises described in detail in Appendix A.3. Peaks are defined as the β_h^R and β_h^F from equation (4) with the highest absolute value among the set of β_h's with p-values of less than 0.1. For example, the risky peak in the baseline specification corresponds to the point estimate from horizon $h = 8$, as shown in Panel (a) of Figure 4, and the risk-free peak in this row corresponds to the point estimate from horizon $h = 1$, as shown in Panel (b). For exercises in which there are no horizons with point estimates that meet this statistical significance criterion, the point estimate with the lowest p-value is reported. The corresponding standard error of each point estimate is reported in parentheses. R^2 is the average across all horizons.

3. The Model

We consider a world economy composed of a domestic small open economy and the rest of the world. Among these economies, there is trade of goods (home and foreign) and international lending. The domestic economy is the main focus of the model and is populated by a representative household, a set of heterogeneous firms, and a government. Firms produce the home good using capital and labor as inputs, and finance their investment by borrowing from investors in the rest of world subject to endogenous default risk. The global economy is subject to two sources of aggregate risk: productivity and global risk premium shocks. The latter capture fluctuations in the premium for risk required by global investors and is the main focus of our analysis.

In Subsection 3.1, we start by describing the heterogeneous firms' problem. In Subsection 3.2, we summarize the households' problem. Subsection 3.3 describes the rest of the world and characterizes the stochastic discount factor of global investors, which allows us to introduce global risk premia. Lastly, Subsection 3.4 introduces nominal rigidities, which allows us to study different exchange-rate policies.

3.1. Heterogeneous Firms

There is a unit mass of heterogeneous firms, which are owned by households. Firms have access to a decreasing returns-to-scale technology to produce home goods (H) using capital and ($k_{i,t}, l_{i,t}$) as inputs:

$$y_{i,t} = (A_t z_{i,t})^{\varsigma} \left(k_{i,t}^{\alpha} l_{i,t}^{1-\alpha}\right)^{\chi} \tag{5}$$

where $\chi \in (0,1)$ governs the degree of decreasing returns; $\alpha \in (0,1)$ is the value-added share of capital; $\varsigma \equiv 1-(1-\alpha)\chi$; $z_{i,t}$ and A_t denote idiosyncratic and global productivity, which are assumed to follow first-order autoregressive processes; and $\ln(z_{i,t+1}) = (1-\rho_z)\ln(z^{\star}) + \rho_z \ln(z_{i,t}) + \sigma_z \epsilon^{z}_{i,t+1}$ and $\ln(A_{t+1}) = (1-\rho_A)\ln(A^{\star}) + \rho_A \ln(A_t) + \sigma_A \epsilon^{A}_{t+1}$, where $\epsilon^{z}_{i,t+1}$ and ϵ^{A}_{t} are standard Gaussian shocks. Firms have also access to a technology to accumulate capital by investing out of the final good subject to convex adjustment costs:

$$k_{i,t+1} = (1-\delta)\, k_{i,t} + I_{i,t} - \Psi_k\left(k_{i,t+1}, k_{i,t}\right) \tag{6}$$

where $I_{i,t}$ denotes investment expenditure in terms of the home good; $\delta \in (0,1)$ is the depreciation rate; and $\Psi_k(k_{i,t+1}, k_{i,t}) \equiv \frac{\psi_k}{2}\left(\frac{k_{i,t+1}-(1-\delta)k_{i,t}}{k_{i,t}}\right)^2 k_{i,t}$.

Firms sell their home-good output and hire labor inputs in competitive markets. For a given choice of labor, firms' real profits (in terms of the H-good) are given by $\pi_{i,t} = y_{i,t} - w_t l_{i,t}$, where $w_t \equiv W_t/P_{H,t}$ denotes the real wage. From the firms' static first-order condition with respect to $l_{i,t}$, the demand for labor is given by

$$l^d_{i,t} = A_t\, z_{i,t}\, \left(k_{i,t}\right)^{\frac{\alpha\chi}{\varsigma}} \left(\frac{1-\varsigma}{w_t}\right)^{\frac{1}{\varsigma}}. \tag{7}$$

After replacing $l^d_{i,t}$ in the profit function, we get that real profits are given by $\pi_{i,t} = A_t\, z_{i,t}\, k_{i,t}^{\frac{\alpha\chi}{\varsigma}}\, \iota_t$, where $\iota_t \equiv \varsigma\left(\frac{1-\varsigma}{w_t}\right)^{\frac{1-\varsigma}{\varsigma}}$. Since $\varsigma \in (0,1)$, profits are increasing in capital input $k_{i,t}$ and decreasing in real wage w_t.

On the financing side, firms face frictions from default risk (as in Khan, Senga and Thomas, 2014; Ottonello and Winberry, 2020). We consider long-term debt contracts denominated in foreign currency that mature probabilistically (e.g., Chatterjee and Eyigungor, 2012).[7] Each bond matures in the next period with probability m and, if it does not mature, the firm pays a constant coupon υ. Let $q^\star_t(k_{i,t+1}, b_{i,t+1}, z_{i,t})$ denote the unit foreign-currency price of a bond for a firm with productivity $z_{i,t}$ and whose next-period stock of capital and debt is $(k_{i,t+1}, b_{i,t+1})$. Let $\Delta B^\star_t\left(b_{i,t+1}, b_{i,t}\right)$ denote the foreign-currency proceeds from issuing new debt, net of debt payments that are due today.[8] This is given by

$$\Delta B^\star_t\left(b_{i,t+1}, b_{i,t}\right) = q^\star_t(.)\left[b_{i,t+1} - (1-m)b_{i,t}\right] - \left[(1-m)\upsilon + m\right] b - \Psi_b\left(b_{i,t+1}, b_{i,t}\right), \tag{8}$$

[7]In Appendix B.6, we consider an economy in which debt is denominated in terms of the H-good and we show that our main quantitative results hold. We do not consider the more realistic scenario in which firms have both foreign- and local-denominated debt for tractability (to reduce the state space).

[8]$B_t\left(b_{i,t+1}, b_{i,t}\right)$ is also a function of $k_{i,t+1}$ and $z_{i,t}$, since they affect the pricing kernel $q^\star_t(.)$. We omit this dependency for ease of exposition.

where the term $q_t^\star(.)\left[b_{i,t+1}-(1-m)b_{i,t}\right]$ denotes the proceeds from issuing new bonds and $\left[(1-m)\upsilon+m\right]b_{i,t}$ denotes current debt services. The $\Psi_b\left(b_{i,t+1},b_{i,t}\right)$ function captures debt adjustment costs, which are defined as $\Psi_b(b_{i,t+1},b_{i,t})\equiv\frac{\psi_b}{2}\left(\frac{b_{i,t+1}-(1-m)b_{i,t}}{b_{i,t}}\right)^2 b_{i,t}$. As an alternative source of finance, firms can raise equity, which features a cost $\mathcal{C}(d_{it})=-\mathbb{I}_{\{d_{it}<0\}}\varphi d_{it}$, where d_{it} denotes dividends paid by firms (as in Cooley and Quadrini, 2001; Gilchrist, Sim and Zakrajšek, 2014).

Firms' Recursive Problem

A firm's state space can be written as the n-tuple $(k,b,z,\boldsymbol{S})$, where $\boldsymbol{S}$ denotes the aggregate state, which includes the firm distribution, Ω, and all other aggregate states. Firms lack commitment and they can default on their debt obligations. Conditional on repaying, the equity value of a firm solves the following Bellman equation:

$$
\begin{aligned}
V^r\left(k,b,z,\boldsymbol{S}\right) &= \max_{k',b'}\; d+\mathbb{E}_{\left(z',\boldsymbol{S}',\epsilon'^d\right)|(z,\boldsymbol{S})}\left[\Lambda\left(\boldsymbol{S},\boldsymbol{S'}\right)\times V\left(k',b',z',\boldsymbol{S}',\epsilon'^d\right)\right] \qquad (9)\\
\text{s.t. }\; d(1-\mathcal{C}(d)) &= (1-\tau)\,\pi(k,z,\boldsymbol{S})-I\left(k',k\right)+\varepsilon(\boldsymbol{S})\times\Delta B^\star(b',b,\boldsymbol{S})\\
\boldsymbol{S}' &= \Upsilon\left(\boldsymbol{S}\right),
\end{aligned}
$$

where $\Lambda\left(\boldsymbol{S},\boldsymbol{S'}\right)$ denotes households' stochastic discount factor; d are firms' dividends; τ is a fixed tax rate on firms' profit; $I\left(k',k\right)$ denotes investment expenditure; $\varepsilon(\boldsymbol{S})$ is the real exchange rate; $\Delta B^\star(b',b,\boldsymbol{S})$ are net proceeds of debt issuance; and $\Upsilon\left(\boldsymbol{S}\right)$ denotes the conjectured law of motion for all of the aggregates and for the firm distribution, Ω.[9] The firm's continuation value is $V\left(k,b,z,\boldsymbol{S},\epsilon^d\right)=\max\left\{V^r\left(k,b,z,\boldsymbol{S}\right),\epsilon^d\right\}$, where ϵ^d is the exogenous value of default (i.e., an outside option) with $\epsilon^d\sim_{iid}N(0,\sigma^d)$.[10] By integrating across the ϵ^d shock, we can obtain the ex ante default probability:

$$
h\left(k,b,z,\boldsymbol{S}\right)=\int_{V^r(k,b,z,\boldsymbol{S})}^{\infty}\mathrm{d}\Phi_{(0,\sigma^d)}(\epsilon^d)=1-\Phi_{(0,\sigma^d)}\left(V^r\left(k,b,z,\boldsymbol{S}\right)\right), \qquad (10)
$$

[9] In Appendix B.7, we consider the case in which firms discount their payoffs using foreigners' stochastic discount factor.

[10] Introduction of the ϵ^d shock allows us to smooth the default decision, which helps with the convergence of our algorithm. It also allows us to target the observed credit spreads.

where $\Phi_{(0,\sigma^d)}(\epsilon^d)$ is the cumulative density function of a normal distribution with zero mean and standard deviation σ^d. In the case of a default, the firm liquidates all of its assets and permanently exits the economy (after production takes place). The recovery rate, per unit of bond, is given by

$$\mathbb{R}_f^d(k, z, \boldsymbol{S}) = \lambda \frac{(1-\tau)\pi(k, z, \boldsymbol{S}) + (1-\delta)k}{b} \frac{1}{\varepsilon(\boldsymbol{S})}, \tag{11}$$

where λ captures the share of resources recovered by the lender in the event of a default. Firms that exit are replaced by an equal mass of new entrants. The initial stocks of capital, debt, and productivity for all entrants are drawn from a uniform distribution with supports $\{\underline{x}, \bar{x}\}$ for $x = \{k, b, z\}$.

Firms' debt is priced by global investors. Let $\Lambda_F^\star(\boldsymbol{S}, \boldsymbol{S'})$ be investors' stochastic discount factor (further described below). Given a firm's current choice of k' and b', the debt price schedule faced by firms is given by

$$q^\star(k', b', z, \boldsymbol{S}) = \mathbb{E}_{(z', \boldsymbol{S'})|(z, \boldsymbol{S})}\left[\Lambda_F^\star(\boldsymbol{S}, \boldsymbol{S'})\mathbb{R}_f(k', b', z', \boldsymbol{S'})\right], \tag{12}$$

where $\mathbb{R}_f(k', b', z', \boldsymbol{S'})$ is the next-period firm's repayment, given by

$$\mathbb{R}_f(k', b', z', \boldsymbol{S'}) \equiv [1 - h(k', b', z', \boldsymbol{S'})] \times \mathbb{R}_f^r(k', b', z', \boldsymbol{S'}) + h(k', b', z', \boldsymbol{S'}) \times \mathbb{R}_f^d(k', b', z', \boldsymbol{S'}),$$

with $\mathbb{R}_f^r(k', b', z', \boldsymbol{S'}) \equiv (1-m)(\upsilon + q(k'', b'', z', \boldsymbol{S'})) + m$, and $k'' \equiv k'(k', b', z', \boldsymbol{S'})$ and $b'' \equiv b'(k', b', z', \boldsymbol{S'})$ denote the next-period firm's optimal policy functions.

3.2. Households

We assume a representative household with preferences over consumption (c) and labor (l) described by the lifetime utility function:

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t u(c_t, l_t), \tag{13}$$

where $\beta \in (0,1)$ denote the subjective discount factor; $u(c_t, l_t) = c - \psi_l \frac{l^{1+\theta}}{1+\theta}$, where θ is the inverse of the Frisch elasticity. The consumption good is a composite of home and foreign goods, with a constant elasticity of substitution aggregation technology

$$c_t = \mathbb{C}\left(c_{H,t}, c_{F,t}\right) = \left[\omega_H^{1/\eta}\left(c_{H,t}\right)^{1-1/\eta} + \left(1-\omega_H\right)^{1/\eta}\left(c_{F,t}\right)^{1-1/\eta}\right]^{\frac{\eta}{\eta-1}}, \tag{14}$$

where $c_{H,t}$ and $c_{F,t}$ denote consumption of home and foreign goods; $\eta > 0$ is the elasticity of substitution; and ω_H measures the home bias. For tractability, we assume that households do not have direct access to international lending. Their budget constraint (in terms of the H-good) is given by

$$\frac{P_t}{P_{H,t}} c_t = w_t l_t + d_t + t_t, \tag{15}$$

where P_t is the price aggregator given by $P_t = \left[\omega_H P_{H,t}^{1-\eta} + \left(1-\omega_H\right) P_{F,t}^{1-\eta}\right]^{\frac{1}{1-\eta}}$; $w_t l_t$ denotes the labor income; $d_t = \int_i d_{i,t}$ is the aggregate dividend paid by the heterogeneous firms (net of equity issuance); and t_t denotes the government's lump-sum transfers. Under our assumption on preferences, the optimal allocation of expenditures between domestic and foreign goods can be expressed as

$$c_{H,t} = \omega_H \left(\frac{P_{H,t}}{P_t}\right)^{-\eta} c_t \tag{16}$$

$$c_{F,t} = \left(1-\omega_H\right)\left(\frac{P_{F,t}}{P_t}\right)^{-\eta} c_t, \tag{17}$$

where $P_{H,t}$ and $P_{F,t}$ are the prices of the home and foreign goods denominated in local currency. Households' labor supply, in turn, is given by

$$l_t^S = \left(\frac{1}{\psi_l} w_t \frac{P_{H,t}}{P_t}\right)^{\frac{1}{\theta}}. \tag{18}$$

3.3. The Rest of the World

The rest of the world provides a perfectly elastic supply of the foreign good at a fixed price in terms of foreign currency ($P_F^\star$) and downward-sloping foreign demand for the home good given by

$$C_{H,t}^\star = \left(\frac{P_{H,t}^\star}{P_F^\star}\right)^{-\eta} \mathbb{C}^\star(\boldsymbol{S}_t), \tag{19}$$

where $\mathbb{C}^\star(\boldsymbol{S})$ denotes consumption by the rest of the world in state $\boldsymbol{S}$, and $P_{x,t}^\star$ is the foreign-currency price of good $x = \{H, F\}$. We assume a constant price for the foreign good $P_F^\star$, which we normalize to one. Both the home and foreign good satisfy the law of one price, i.e., $P_{F,t} = P_F^\star \, \xi_t$ and $P_{H,t}^\star = P_{H,t}/\xi_t$, where ξ_t denotes the nominal exchange rate.

The rest of the world also provides a perfectly elastic supply of international credit to domestic firms. To study fluctuations in the risk premium of global investors, we parameterize their stochastic discount factor as

$$\Lambda_{F,(t,t+1)}^\star = \beta^\star \times \exp\left(-\kappa_t \, \epsilon_{t+1}^A - \frac{1}{2}\kappa_t^2 \, \sigma_A^2\right), \tag{20}$$

where $\beta^\star$ is the rest of the world's discount factor; κ_t is a stochastic exogenous variable that captures the market price of risk; and ϵ_{t+1}^A are the innovations of the global productivity process. This type of formulation of foreign investors' stochastic discount factor has been used in the sovereign debt literature (Arellano and Ramanarayanan, 2012; Bianchi, Hatchondo and Martinez, 2018) to provide a tractable representation that captures changes in the global risk premium. Under this formulation, global investors value bond payoffs more in states in which firms are more likely to default. To see this, after replacing equation (20) in the bond pricing kernel of equation (12) and based on a first-order Taylor approximation, we can rewrite the pricing kernel as

$$q^\star\left(k', b', z, \boldsymbol{S}\right) = \beta^\star \, \mathbb{E}_{(z',\boldsymbol{S'})|(z,\boldsymbol{S})}\left[\mathbb{R}_f\left(k', b', z', \boldsymbol{S'}\right)\right] - \beta^\star \, \kappa \, \mathbb{C}ov_{(z',\boldsymbol{S'})|(z,\boldsymbol{S})}\left[\epsilon_A', \mathbb{R}_f\left(k', b', z', \boldsymbol{S'}\right)\right]. \tag{21}$$

For risky firms, the covariance term is positive since these firms are more likely to default in bad times (i.e., in states in which the aggregate productivity shock is smaller). Whenever $\kappa > 0$, lenders thus require a premium in excess of the default risk, which implies higher borrowing costs for risky firms. For risk-free firms, on the other hand, the covariance term is zero and their borrowing costs are not (directly) affected by changes in κ.

3.4. Nominal Rigidities

We assume that the labor market is characterized by nominal wage rigidities, which give rise to involuntary unemployment and a Mundellian role for exchange-rate stabilization. We follow a formulation similar to that of Schmitt-Grohé and Uribe (2016) by assuming that the nominal wage faces downward rigidity, i.e., $W_t \geq \alpha_W \times \bar{W}$, where $\alpha_W \geq 0$ captures the degree of nominal rigidities and $\bar{W}$ is the equilibrium wage in the stationary equilibrium. A higher α_W implies that nominal wages have a smaller margin to adjust in the event of a negative shock, which may lead to involuntary unemployment.

From Equation (7), we can integrate across firms to compute the aggregate demand for labor, which is given by

$$l_t^d \equiv \int_i l_{i,t}^d = A_t \, \tilde{K}_t \left(\frac{1-\varsigma}{w_t} \right)^{\frac{1}{\varsigma}}, \tag{22}$$

where $\tilde{K}_t \equiv \int_i z_{i,t} \, (k_{i,t})^{\frac{\alpha\chi}{\varsigma}}$ captures the productive capacity of the economy. In any equilibrium, it must be the case that $l_t^d \leq l_t^s$. Because of the presence of rigid nominal wages, the labor market may not clear. At any point in time, wages and employment must thus satisfy the following slackness condition:

$$\left(l_t^s - l_t^d\right)\left(W_t - \alpha_W \bar{W}\right) = 0. \tag{23}$$

That is, in periods of unemployment, the wage constraint binds. If the constraint does not bind, then it must be the case that the economy is in full employment. Combining Equations (18) and (22), the full-employment (FE) real wage can be expressed as

$$w_t^{FE} = \left((1-\varsigma) \, A_t \tilde{K}_t \right)^{\frac{\theta\varsigma}{\varsigma+\theta}} \left(\psi_l \frac{P_t}{P_{H,t}} \right)^{\frac{\varsigma}{\varsigma+\theta}}, \tag{24}$$

where $\frac{P_t}{P_{H,t}} = \left[\omega_H + (1-\omega_H)(\varepsilon_t)^{1-\eta}\right]^{\frac{1}{1-\eta}}$ and $\varepsilon_t \equiv \xi_t / P_{H,t}$ is the equilibrium real exchange rate (i.e., the exchange rate at which the H-good market clears). Under wage rigidities, the full-employment real wage may not be attained. Instead, for a given nominal exchange rate ξ_t, the economy's real wage is given by

$$\frac{W_t}{P_{H,t}} = max\left\{w_t^{FE}, \frac{\alpha_W \bar{W}}{\xi_t} \times \varepsilon_t\right\}. \tag{25}$$

3.5. Domestic Government

We assume that the government follows an exogenous policy rule for the nominal exchange. In particular, we consider a flexible exchange rate regime in which the government reacts to the two exogenous shocks of the economy: $\xi_t = \xi(A_t, \kappa_t)$. We then compare this policy to a fixed exchange-rate case with $\xi_t = 1$ for every period t. Regarding its fiscal policy, the government collects taxes on firms and uses those proceeds to purchase the H-good (government spending) and to give lump-sum transfers to households. For simplicity, the government does not have debt. Its (static) budget constraint is thus $t_t + G_t = \tau \times \int_i \pi_{i,t}$.[11]

3.6. Equilibrium

***Definition* 1.** *Let $\boldsymbol{S} = (A, \kappa, \Omega)$ denote the aggregate state, where A is the global TFP component, κ is the market price of risk, and Ω is the distribution of firms across the idiosyncratic states (k, b, z). Let Ω^{ND} and Ω^{D} denote the distribution of non-defaulting and defaulting firms, respectively. Given a nominal exchange-rate policy $\xi(\boldsymbol{S})$ and a fiscal policy $G(\boldsymbol{S})$, a recursive competitive equilibrium is a set of*

1. *Value functions for firms $\{V(k,b,z,\boldsymbol{S}), V^r(k,b,z,\boldsymbol{S})\}$,*
2. *Policy functions $\{k'(k,b,z,\boldsymbol{S}), b'(k,b,z,\boldsymbol{S}), h(k,b,z,\boldsymbol{S}), l^d(k,b,z,\boldsymbol{S}), l^s(\boldsymbol{S}), c(\boldsymbol{S})\}$,*
3. *A bond pricing kernel $q^\star(., \boldsymbol{S})$,*
4. *A real wage $w(\boldsymbol{S}) = W/P_H(\boldsymbol{S})$ and a real exchange rate $\varepsilon(\boldsymbol{S}) = \xi/P_H(\boldsymbol{S})$, and*

[11] If $G_t > \tau \times \int_i \pi_{i,t}$, then $t_t < 0$, which means that the government must levy a lump-sum tax on households.

5. *A conjectured law of motion for the aggregates* $\Upsilon(\boldsymbol{S})$,

such that:

i *Given prices and the perceived* $\Upsilon(\boldsymbol{S})$, $l^d(.,\boldsymbol{S})$ *is given by Equation* (7)*; the policies* $\{k'(.,\boldsymbol{S}), b'(.,\boldsymbol{S}), h(.,\boldsymbol{S})\}$ *solve the maximization problem in Equation* (9)*; and* $V(.,\boldsymbol{S})$ *and* $V^r(.,\boldsymbol{S})$ *are the associated value functions.*

ii *Given firms' optimal policies, the bond pricing kernel* $q^\star(.,\boldsymbol{S})$ *satisfies Equation* (12).

iii *Given prices and* $\Upsilon(\boldsymbol{S})$, $\{c(\boldsymbol{S})\, l^s(\boldsymbol{S})\}$ *solve the households' problem, as defined in Equations* (13)-(18).

iv *The conjectured law of motion* $\Upsilon(\boldsymbol{S})$ *is consistent with agents' policies.*

v *The* H*-good market clears:*

$$Y(\boldsymbol{S}) = I(\boldsymbol{S}) + c_H(\boldsymbol{S}) + c_H^\star(\boldsymbol{S}) + G(\boldsymbol{S}),$$

where $Y(\boldsymbol{S})$ *denotes aggregate output, which is given by* $Y(\boldsymbol{S}) = \int y(.,\boldsymbol{S})\, d\Omega(.,\boldsymbol{S})$, *where* $y(.,\boldsymbol{S})$ *is defined in Equation* (5).[12] *The term* $I(\boldsymbol{S})$ *denotes aggregate investment:* $I(\boldsymbol{S}) = \int (I(.,\boldsymbol{S}) + \mathcal{C}(d))\, d\Omega^{ND}(.,\boldsymbol{S}) + \int \left(\bar{k} - (1-\delta)k\right) d\Omega^D(.,\boldsymbol{S})$, *where* $I(.,\boldsymbol{S})$ *is the investment function of non-defaulting firms, as defined in Equation* (6)*;* $\mathcal{C}(d) \equiv -\mathbb{I}_{\{d<0\}}\varphi \times d$ *captures equity issuance costs; and* $\bar{k} - (1-\delta)k$ *is the (net) investment of a new entrant that replaces a defaulting firm. Lastly,* $c_H(\boldsymbol{S})$ *and* $c_H^\star(\boldsymbol{S})$ *denote private domestic and foreign consumption of the* H*-good, as defined in Equations* (16) *and* (19)*, respectively.*

vi *The balance of payment (BOP) is satisfied:*

$$Y(\boldsymbol{S}) - I(\boldsymbol{S}) - P/P_H(\boldsymbol{S})\, c(\boldsymbol{S}) - G(\boldsymbol{S}) = (-)\xi/P_H(\boldsymbol{S}) \left(\int \Delta B^\star(.,\boldsymbol{S})\ d\Omega^{ND} - \int \mathbb{R}_f^d(.,\boldsymbol{S})\, b(.)\ d\Omega^D \right),$$

where $\Delta B^\star(.,\boldsymbol{S})$ *denotes net debt payments to the rest of the world for non-defaulting firms, as defined in Equation* (8)*, and* $\int \mathbb{R}_f^d(.,\boldsymbol{S})\, b(.)\ d\Omega^D$ *denotes the payments of defaulting firms, where* $\mathbb{R}_f^d(.,\boldsymbol{S})$ *is defined in Equation* (11).

vii *The condition* $l^d(\boldsymbol{S}) \leq l^s(\boldsymbol{S})$ *and the slackness condition of Equation* (23) *are both satisfied.*

[12] The timing assumption is such that firms that default at time t also produce.

4. Quantitative Analysis

This section builds a quantitative version of the model, consistent with the empirical evidence presented in the previous section, to study the transmission of the global risk premium and implications for exchange-rate policies. Section 4.1 describes the parameterization of the model and compares model predictions with their empirical counterparts. Section 4.2 uses the calibrated model to analyze the channels of transmission of the global risk premium. Section 4.3 compares the dynamics of alternative exchange-rate regimes.

4.1. Parameterization and Model Fit

We calibrate the model to a prototypical emerging market economy. In our calibration, we target both macro and micro moments to capture heterogeneity across domestic firms. The calibration is done at quarterly frequency. Appendix B.2 summarizes the computational algorithm used to solve the model.

We calibrate the model in three steps. First, we fix a subset of parameters to standard values in the literature. These are reported in Table 2. Panel 1 shows the parameters that govern domestic firms' problem. The value-added share of capital α is set to 0.30 and the decreasing returns-to-scale parameter χ to 0.85, as in Gilchrist, Sim and Zakrajšek (2014). The quarterly depreciation rate δ is set to 0.025. We fix tax parameter τ to target a corporate tax rate of 27.5%. Regarding firms' bonds structure, we set m to match the median average maturity of the nonfinancial firms in our sample. We set υ to target the (annualized) observed coupon yield. We fix θ, the inverse of the Frisch elasticity, to 0.5, which is a common value in the literature. Lastly, we consider a home bias of 0.66 and a trade elasticity of 3. For foreign lenders (Panel 2), we fix the discount factor $\beta^\star$ to target a 3% annual risk-free rate. We also fix foreign lenders' Markov transition matrix, Π_κ, to capture a quarterly probability of a global crisis of 2.5% and a crisis duration of 5 quarters.

In the second step, we calibrate the parameters that govern a set of firms' cross-sectional moments (Table 3, Panel 1). We set firms' discount factor β and the volatility of the outside option, σ^d, to match the average leverage and credit spread observed in the data. We

Table 2: Fixed Parameters

Parameter	Description	Value
Panel 1. Domestic Economy		
α	Capital share	0.3
χ	Dec. returns to scale	0.85
δ	Depreciation rate	0.028
τ	Corporate tax rate	0.275
m	Bond maturity	0.052
c	Bond coupon	0.018
$\bar{d}$	Dividend constraint	0.0
θ	Frisch elasticity	0.5
ω_H	Home bias	0.66
η	Trade elasticity	3.0
Panel 2. Rest of the World		
$\tilde{\beta}$	Lenders' discount factor	0.992
$\Pi_\kappa(\kappa_L, \kappa_H)$	Probability of global crisis	0.025
$\Pi_\kappa(\kappa_H, \kappa_L)$	Duration of global crisis	0.2

Note: This table shows the set of parameters that are fixed in our calibration. Panel 1 shows the set of parameters for domestic firms and Panel 2 the parameters relevant to foreign lenders.

calibrate the debt adjustment cost parameter, ψ_b, to match the cross-sectional volatility of leverage. The recovery value parameter, λ, targets an average recovery value of 33%. Parameters related to the idiosyncratic productivity processes, ρ_z and σ_z, are calibrated to match the dispersion of the firm size distribution. In particular, they are set to target the ratios between the 25th and 50th and 50th and 75th percentiles for firms' stock of capital. We set the capital adjustment cost parameter, ψ_k, to match the cross-sectional volatility of investment. Lastly, we calibrate the equity issuance cost parameter to target the annual share of firms that tap equity markets. For our baseline set of results, we compute all these moments based on our Compustat sample of large and publicly traded firms. In Appendix B.8, we show that our results are robust to extending our model to include small private firms that are relevant for the economy and feature different characteristics than the Compustat sample (e.g.,).

In the third step, we calibrate the parameters related to aggregate responses (Table 3, Panel 2). For productivity, we fix the autocorrelation to ρ_A to 0.97 and set σ_A to match the volatility of a typical emerging country's GDP (Neumeyer and Perri, 2005). For the global

Table 3: Calibrated Parameters

Parameter	Description	Value
Panel 1. Parameters that govern cross-sectional moments		
β	Firms' discount factor	0.966
ρ_z	Idiosyncratic TFP, persistence	0.96
σ_z	Idiosyncratic TFP, volatility	0.085
ψ_k	Capital adjustment costs	0.5
ψ_b	Debt adjustment costs	3.0
λ	Recovery rate	0.08
σ_d	Exit value	2.0
φ	Share firms issuing equity	0.5
Panel 2. Parameters that govern aggregate moments		
ρ_A	Aggregate TFP, persistence	0.97
σ_A	Aggregate TFP, volatility	0.029
κ_H	Lenders' risk aversion	100.0
ξ_1	Exchange rate policy	-1.7
ξ_2	Exchange rate policy	0.05
$\bar{G}$	Fiscal Policy	0.15
ϕ_G	Fiscal Policy	0.06

Note: This table shows the set of calibrated parameters. Panel 1 shows parameters for domestic firms that govern the targeted cross-sectional moments and Panel 2 parameters that govern aggregate responses.

risk premium, we assume a two-state Markov process, with values $\kappa_L = 0$ and $\kappa_H > 0$, with a transition matrix Π_κ. We set κ_H to target an (on-impact) increase in the risk premium during a global crisis (i.e., when moving from $\kappa_{t-1} = \kappa_L$ to $\kappa_t = \kappa_H$) of 190 basis points, which corresponds to a 1-standard-deviation increase in the data.

As for the government policies, we consider a nominal exchange policy rule in which the government devalues its currency in "bad times" (i.e., when aggregate productivity is below its mean or when the market price of risk increases). In particular, we assume that $\xi(\boldsymbol{S}) = \xi_0 + \xi_1 \mathbb{I}_{\{\kappa=\kappa_H\}} + \xi_2 min\{A - A^\star, 0\}$. We calibrate $\xi_1 > 0$ so that the nominal exchange rate depreciates 5% upon a 1-standard deviation increase in the model-implied risk premium. We set $\xi_2 < 0$ to match the unconditional volatility of the nominal exchange rate. For government spending, we assume a constant spending rule $G_t = \bar{G}$, where we set $\bar{G}$ to match a government final-consumption expenditure of 11% of GDP. In Appendix B.4, we consider a counter-cyclical fiscal policy in which the government adjusts G_t based on changes in the unemployment rate. In Appendix B.5 we consider a macro-prudential policy in which the government taxes the proceeds from debt issuances.

Table 4: Targeted Moments

Targeted Moments - Flexible XR	Data/Target	Model
Panel 1. Cross-sectional moments		
Credit Spread (avg)	3.0%	3.96%
Leverage (avg)	28.0%	39.84%
Leverage (cs std)	20.0%	22.88%
Recovery Value	33.0%	35.79%
log(k): 25th/50th percentile	0.85	0.87
log(k): 75th/50th percentile	1.15	1.19
Investment/k (cs std)	7.0%	3.74%
Share firms issuing equity	15.0%	11.0%
Panel 2. Aggregate moments		
GDP (std)	3.0%	3.56%
Δ Risk premium (pp)	1.79	1.51
ξ (std)	4.0%	3.87%
$\Delta\xi$ / Δ Risk premium	5.0%	5.0%
G/GDP	11.0%	11.01%

Note: This table shows the targeted moments. Panel 1 shows targeted cross-sectional moments and Panel 2 the set of targeted aggregate moments.

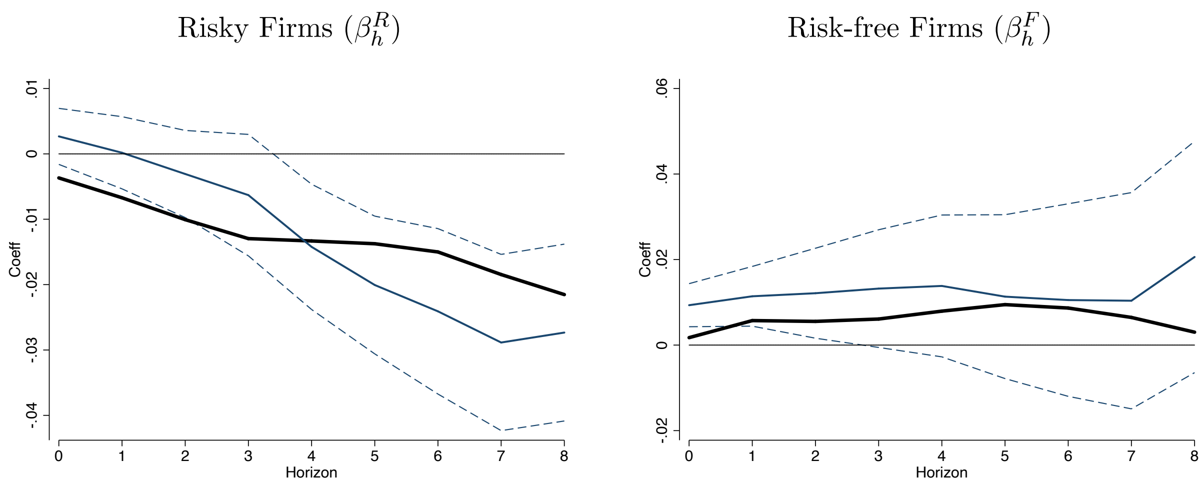
Table 4 shows that the model is able to match all of the targeted cross-sectional and aggregate moments reasonably well. Our calibrated model is also consistent with key untargeted moments. Table 5 shows that the model is able to capture the observed quarterly-to-profits ratio of nonfinancial firms and the cross-sectional volatility of spreads. It also captures the observed negative correlation between corporate spreads and investment and GDP. Lastly, Figure 5 shows that the model is able to replicate the estimates of the local projection of our empirical analysis. That is, the model matches the documented differential response of risky and risk-free firms' investment to a risk-premium shock.

Table 5: Untargeted Moments

Untargeted Moments	Data	Model
Quarterly Profits-to-Capital	10.0%	8.0%
Spreads (cs std)	2.1%	6.0%
Correlation Spreads, GDP	−0.63	−0.52
Correlation Spreads, Investment	−0.59	−0.45

Note: The table shows a set of untargeted cross-sectional and aggregate moments.

Figure 5: Risk-premium Shock and Firm Heterogeneity



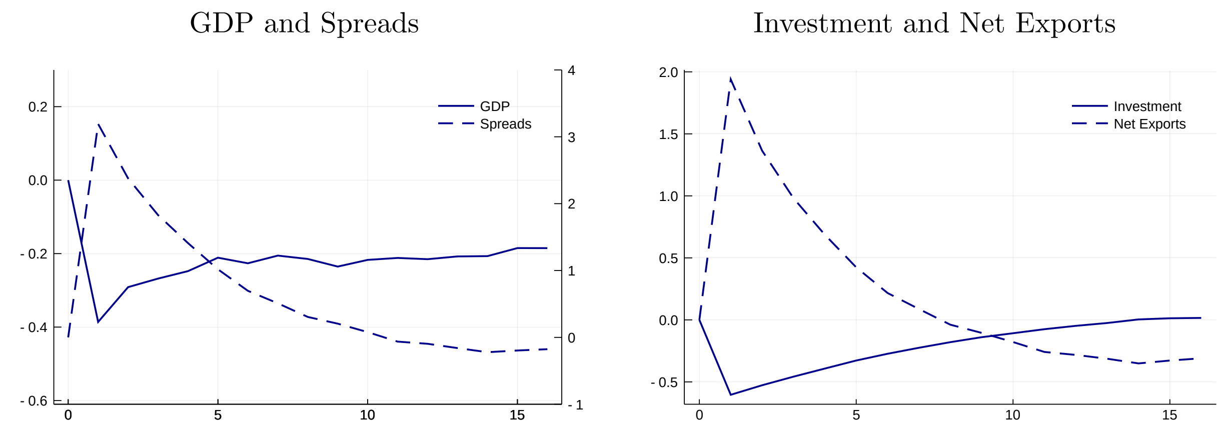
Note: The figure compares the model-implied estimates for the local projections with those of our empirical analysis. It shows the estimated β_h^R and β_h^F coefficients of Equation (4), which correspond to the cumulative log change in capital stock in response to the global risk premium, ρ_t, for risky and risk-free firms. Blue lines show the empirical estimates and the 90% confidence intervals. Black lines show the model-implied estimates. In both cases, the variable ρ_t is standardized based on its empirical standard deviation. For the model-generated data, we only keep periods in which $\Delta\kappa \neq 0$. The x-axes show the horizon h.

4.2. Channels of Transmission of a Global Risk-premium Shock

In this section, we quantify the overall effect of changes in risk premia on firms' optimal policies and aggregate variables and disentangle the channels of transmission (i.e., direct and indirect channels).

Figure 6 shows the impulse response to a 2-standard-deviation risk-premium shock. We assume that at time $t = 1$ there is an increase in global risk aversion ($\kappa_1 = \kappa_H$), and then the $\{\kappa_t\}$ process evolves according to its Markov matrix.[13] The dynamics capture the typical pattern of systemic crises in emerging markets we described in our empirical analysis: borrowing costs increase and output falls. At the same time, investment over output falls and net exports increase.

Figure 6: Aggregate Responses to an Increase in Global Risk Premium



Note: Impulse responses to a risk-premium shock ($\Delta\kappa > 0$). The left panel shows the dynamics for aggregate output and spreads (right axis). The right panel shows the dynamics for investment and net exports rates. The x-axes show the horizon h.

To analyze the channels of transmission, we construct a counterfactual in which prices (and the nominal exchange rate) do not react to changes in κ. This allows us to isolate the direct transmission of a risk-premium shock, absent any price-adjustment mechanism.

Panel (a) of Figure 7 shows the cumulative effect of a 2-standard deviation risk-premium shock on investment. Blue lines show the total effect (direct+indirect channels) and the dotted gray lines show the direct effect. The difference between total and direct effects provides the magnitude of the indirect forces. From the figure, it is clear that indirect channels can significantly reduce the drop in investment. At the peak, absent any price adjustment, the risk-premium shock decreases the aggregate stock of capital by more than 1.30%, compared with the 0.80% drop we observe in our baseline scenario. That is, indirect channels dampen the contraction in firms' cumulative investment by 0.50%.

[13]Our calibration for κ_H targets a 1-standard-deviation increase in the risk premia. To construct a 2-standard-deviation shock, we linearly extrapolate the model-implied dynamics.

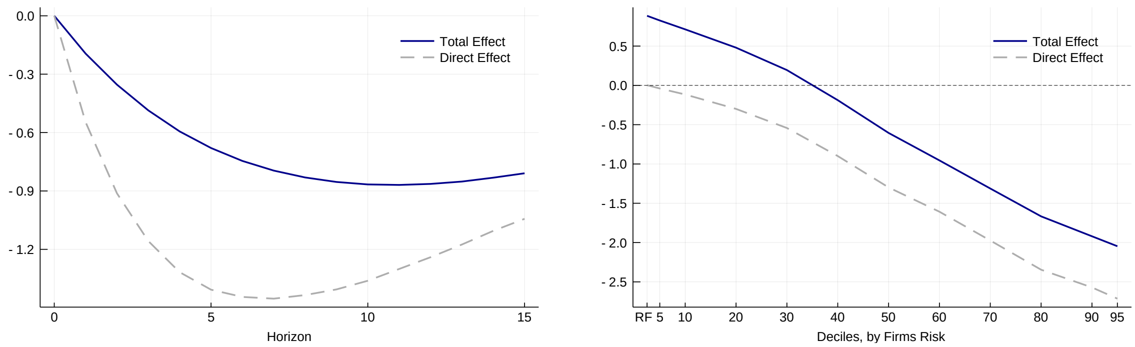
Panel (b) shows the total and direct effect by firms' risk. To construct this figure, we first sort firms according to their pre-shock default probability and then compute the cumulative effect of investment at the peak of the crisis. For the safest firms (i.e., those with default risk close to zero) the direct effects are almost zero, since the risk-premium shock does not affect the borrowing costs for these firms. As the default risk of the firm increases, the magnitude of the direct effect also increases. For the set of riskiest firms, for instance, the direct effect of a risk-premium shock leads to a cumulative 2.5% decline in firms' stock of capital. Interestingly, the indirect effects are similar across firms with different risk profiles: Across all firms, indirect effects attenuate the drop in capital by 0.50%.

In Appendix B.3 we analyze the implications of firm heterogeneity for the aggregates. In particular, we compare our model-implied aggregate dynamics relative to a counterfactual in which all the firms are identical. We show that, after a risk-premium shock, the aggregate contraction in capital in this counterfactual is more than 40% larger than in our baseline model. This exercise, thus, highlights the importance of accounting for firm heterogeneity when assessing the aggregate impact of risk premia.

Figure 8 analyzes the mechanisms behind the indirect channels. It shows the responses of real wages and the real exchange rate upon a risk-premium shock. On impact, real wages decrease, which leads to higher firms' profits and attenuates the drop in investment. On the other hand, the real exchange rate depreciates, which increases the debt burden of the dollar-denominated debt, which, in turn, decreases profits and reinforces the initial drop in investment. Quantitatively, we find that the real wage channel is larger, and thus the indirect channels dampen the contractionary effects of a risk-premium shock.

Figure 7: Direct and Indirect Channels of Transmission

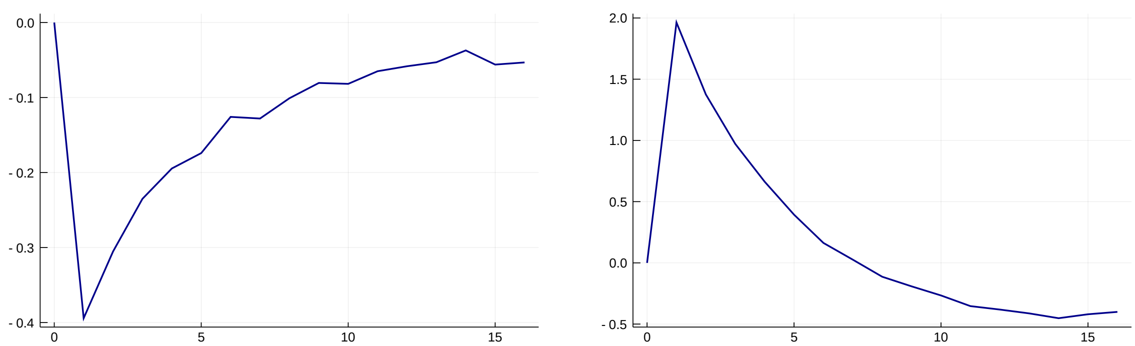
(a) $\Delta \ln$ Capital, aggregate effect　　　**(b)** $\Delta \ln$ Capital, by firm risk



Note: The figure quantifies the direct and indirect effect of a risk-premium shock ($\Delta\kappa > 0$) on capital. The blue lines show the total effect and the gray dashed lines show the direct effect. The left panel depicts the aggregate dynamics for capital for different horizons h. The right panel shows the heterogeneous effects, by firm risk (at a fixed horizon). RF denotes risk-free firm.

Figure 8: Indirect Channels: Real Wages and RER

(a) $\Delta \ln$ W/P　　　$\Delta \ln$ RER



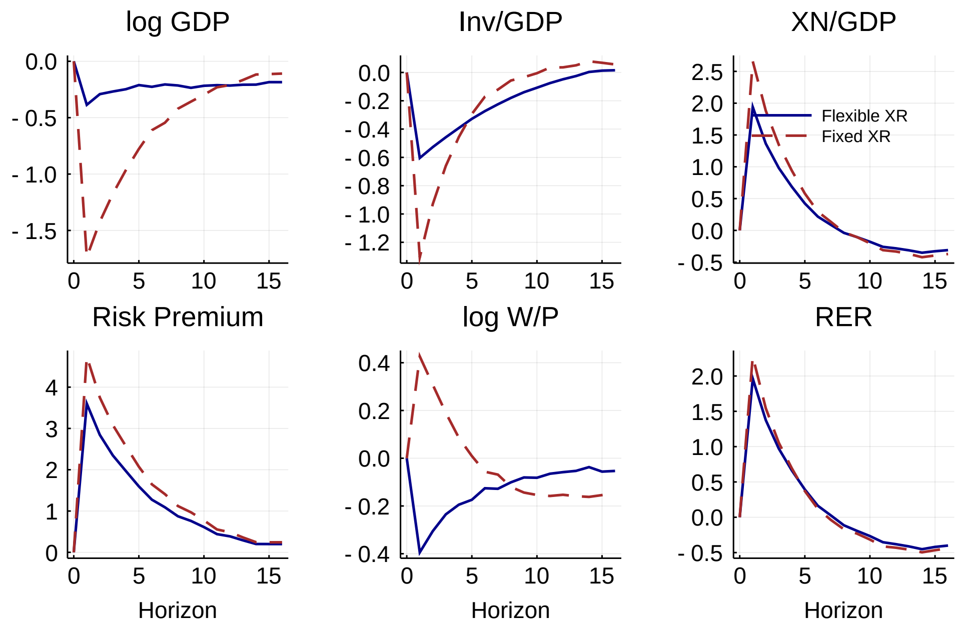
Note: Impulse responses to a risk-premium shock ($\Delta\kappa > 0$). The left panel shows the dynamics for real wages and the right panel the dynamics for the real exchange rate. The x-axes show the horizon h.

4.3. Exchange-rate Regimes and Relative Price Adjustments

Next, we compare the effects of a risk-premium shock under a flexible and a fixed exchange-rate regime. We describe how the presence of a fixed exchange-rate regime attenuates relative price adjustments and dampens the indirect channels.

Figure 9 shows the impulse responses of a 2-standard deviation risk-premium shock. Blue (red) lines show the dynamics under a flexible (fixed) nominal exchange-rate regime.

Figure 9: Flexible vs Fixed Exchange-rate Regimes



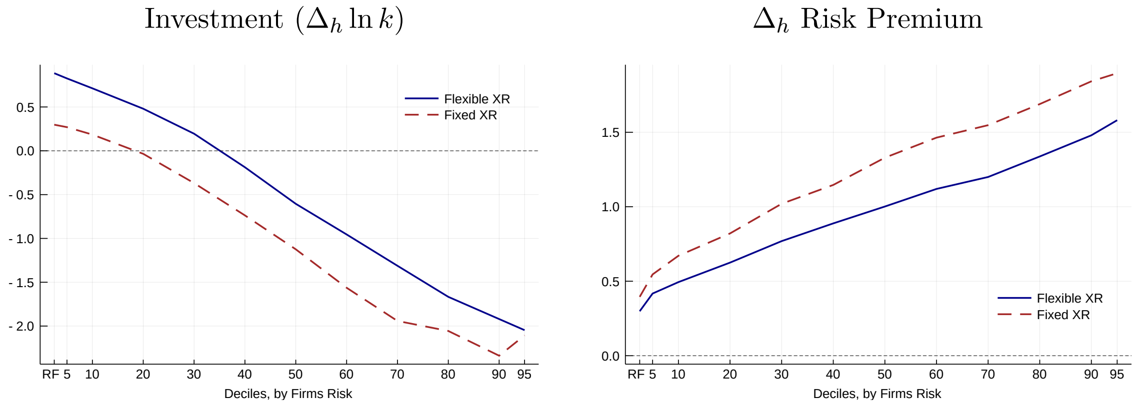
Note: Impulse responses to a risk-premium shock ($\Delta\kappa > 0$). Solid blue lines show the economy's aggregate responses when the government follows a flexible exchange-rate regime. Dashed red lines show the same aggregate responses when the nominal exchange rate is fixed.

The fixed exchange-rate regime significantly amplifies the magnitude of the crisis. Output, for instance, decreases 50% more relative to the flexible regime. This larger contraction is driven by the larger drop in investment and the smaller increase in net exports.

The larger drop in output under a currency peg can be explained by the different adjustment of prices and wages. Upon a risk-premium shock, domestic aggregate demand decreases sharply and the real exchange rate, ξ/P_H, increases so that the H-good market clears. Under a fixed exchange-rate policy, given that ξ is fixed, all of the adjustment comes from a decrease in P_H. Since W is downwardly rigid, this leads to a milder contraction in real wages, which dampens the magnitude of the main indirect channel.

In Figure 10, we analyze the heterogeneous effects of a risk-premium shock for the two exchange-rate regimes. We find that safer firms are the ones that benefit the most from having a flexible exchange rate. For riskier firms, since they have larger leverage, increases in the real exchange rate raise their debt burden, which offsets the benefits of a lower real wage. Overall, the presence of a flexible or fixed exchange rate not only affects aggregate

Figure 10: Flexible vs Fixed Exchange-rate Regimes: Heterogeneous Effects



Note: Impulse responses to a risk-premium shock ($\Delta\kappa > 0$) by firm risk. Firms are sorted into deciles based on their pre-shock default probability. The left panel shows the change in firms' capital and the right panel the change in risk premium. Solid blue lines show the firms' responses when the government follows a flexible exchange-rate regime. Dashed red lines show the same responses when the nominal exchange rate is fixed.

outcomes, but can also have important distributional consequences across nonfinancial firms.

5. Conclusion

In this paper, we study the macroeconomic transmission of fluctuations in external borrowing costs to open economies. We combine a new measurement of firms responses to fluctuations in the global risk premium with an open-economy general-equilibrium model of heterogeneous firms subject to default risk. We describe two channels through which the global risk premium affects economic activity. One is a direct channel, through which changes in the global risk premium affect firms financing costs and their investment. The other is an indirect channel, which stems from the feedback between firms investment policies, domestic aggregate demand, and adjustment of the real exchange rate. Our quantitative analysis reveals that heterogeneity is important for understanding the transmission of external shocks. The direct effects of surges in the global price of risk on risky firms in particular drives the contraction. Price adjustments mitigate this response by reducing the risk exposure of firms and reallocating economic activity within the economy.

Our findings provide multiple avenues for policymakers to influence the pass-through of external crises. Allowing prices to adjust during downturns, such as allowing exchange rate depreciation, can reduce investment adjustments and sudden stops by minimizing the direct transmission channel and strengthening the indirect transmission channel. Other policies that reduce firms' risk, such as macroprudential policies, can also alleviate investment adjustment.

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A. Empirical Appendix

A.1. Sudden stop episodes

We identify sudden stops episodes as those identified by Calvo, Izquierdo and Talvi (2006), update this set to include episodes during the Global Financial Crisis. We merge crisis dates with macroeconomic data from Uribe and Schmitt-Grohé (2017). We index each crisis episode to the peak of GDP and obtain a set of 33 crises, listed in Table A.1.

Table A.1: Sudden stop crisis episodes

Country	GDP Peak	Country	GDP Peak
Argentina	1980q3	Mexico	1981q4
	1994q4		1994q4
	1998q2		2008q2
Brazil	1980q4	Peru	1981q1
	2008q3		1997q2
Chile	1981q3		2008q1
	1998q2	South Africa	1981q4
	2008q2		2008q3
Colombia	1998q2	Thailand	1993q4
	2008q3		2008q1
Ecuador	1981q4	Turkey	1993q4
	1998q4		1998q3
	2008q4		2008q1
Korea	1997q3	Uruguay	1981q4
	2008q3		2008q4
Malaysia	1997q4		
	2008q3		

A.2. Data Description

For our empirical analysis, we combine firm-level data from Global Compustat with corporate bond data from Bloomberg. This section describes the process for cleaning the data and merging across sources.

Corporate Bond Data We collect corporate bond data from Bloomberg and match it to firm-level data using crosswalks to connect identifiers across the datasets. Firms in Compustat are uniquely identified by the gvkey variable. Bonds in Bloomberg are uniquely identified by a Bloomberg ID (bbgid) but are attached to firm identifiers—ISIN, CUSIP, and ticker. We use WRDS Capital IQ to create crosswalks between the Compustat gvkey and the other identifiers available from Bloomberg. Due to limits imposed by Bloomberg on the amount of data that can be downloaded from the terminal each month, we collect data in stages to minimize unnecessary data collection.

1. For each country except the United States, we download a list of corporate bonds that meet the following criteria: denominated in USD, fixed or zero coupon, and have some firm identifier data. We do this by country as a natural way to break the large download into smaller pieces. We exclude local currency bonds because we do not want to capture currency risk in our spreads relative to US treasury yields.

2. For each bond on the list, we match to Compustat gvkey first using ISIN, then CUSIP, then ticker, so we have one firm attached to each bond.

3. For bonds that are successfully matched to firms, we return to the Bloomberg terminal and download end-of-quarter price data (px_last).

4. For bonds that have non-missing price data, we download additional descriptive variables—coupon rate, coupon frequency, call options, etc.

In addition to the criteria listed in step 1, we only keep emerging market economies for which we have at least 100 observations. We limit our sample to bonds with a term to maturity of at least 1 year and no more than 30 years (744 observations). We drop firms in the financial (SIC 6000-6799) and utilities (SIC 4900-4999) industries (1,534 observations). We drop observations that are missing any data on duration, market value of issue, coupon, date of issue, maturity type (i.e. callable), or industry (1,037 observations). We start our sample in 1997q2 (11 observations). Table A.2 describes the coverage of our dataset. We have data from 12 countries in total, covering 561 bonds issued by 172 firms. Almost half of our sample is from Latin America.

Table A.2: Sample Composition

	Observations	Bonds	Firms	Min year
Argentina*	733	49	11	1997
Brazil*	563	37	15	1997
Chile*	547	33	7	1998
Colombia*	180	11	2	2005
India†	1313	101	42	2002
Korea†	1453	111	29	1997
Mexico*	1355	95	23	1997
Peru*	301	15	7	2012
Philippines†	494	29	7	1997
Thailand†	468	34	16	1997
Turkey	563	38	12	2002
Ukraine	115	8	1	2009
Total	8085	561	172	.

* Indicates countries in the Latin America subsample.

† Indicates countries in the Asia subsample.

One limitation of our data is that we observe quarterly prices but not the exact date on which the prices are measured, and we observe the first coupon payment date, but not future dates. These limitations introduce noise when we convert prices to yields. We assume that prices are observed after coupon payments are made for each quarter and that coupons are paid relative to the quarter in which the first coupon payment was made —i.e., if a bond had a semi-annual coupon and the first coupon was paid in the first quarter, we assume it will be paid in the first and third quarters going forward. All of our results are robust to excluding bonds that report either "Long first" or "Short first" for the first period coupon type (17.6% of our sample).

Using price data and bond characteristics, we construct a spread for each corporate bond relative to a risk-free security that accounts for the coupon structure of the bond and its maturity. We follow the methodology of Gilchrist and Zakrajšek (2012) to price a synthetic risk-free security with the same coupon structure and maturity as the corporate bond,

$$P^f_{it} = \sum_{s=1}^{S} C_i(s) D(t+s), \tag{A.1}$$

where P^f_{it} is the price of the risk-free security that corresponds to bond i in quarter t, $C_i(s)$ is the cash flow from the coupon and principal repayment in that quarter, and $D(t) = e^{-r_t t}$ is the discount function in period t. We implement this equation using the continuously compounded zero-coupon Treasury yields estimated by Grkaynak, Sack and Wright (2007). Finally, we construct the spread, $S_{ijt} = y_{ijt} - y^f_{it}$, where y_{ijt} is the yield of corporate bond i issued by firm j in quarter t and y^f_{it} is the yield of the corresponding synthetic risk-free bond with the same cash flow structure.

We drop observations with spreads less than 5 basis points or more than 3,500 basis points (42 observations). Table A.3 provides descriptive statistics for the bonds in our full sample, and Table A.4 describes the Latin America subsample. Characteristics are relatively similar across the samples.

Distance to default We measure firms' time-varying default risk using the measure of distance to default proposed by Merton (1974), defined as $\mathrm{dd}_{jt} = \frac{\log\left(\frac{V_{jt}}{D_{jt}}\right) + (\mu_{jt} - 0.5\sigma^2_{jt})}{\sigma_{jt}}$, where V_{jt} is the value of firm j in quarter t, D_{jt} is the firm's debt, μ_{jt} is the firm's annual expected return, and σ_{jt} is the annual volatility of the firm's value. We measure debt, D_{jt}, as the sum of short-term debt (dlcq) and one-half of long-term debt (dlttq) from Compustat Global. We follow an interative procedure based on Gilchrist and Zakrajšek (2012) to impute the firm's value, V_{jt}. The procedure is as follows:

1. We set an initial value of the firm equal to the sum of debt and equity, $V = D + E$. We measure equity as the firm's stock price times the number of shares, using Global Compustat Security Daily.

Table A.3: Summary Statistics of Corporate Bond Characteristics

	Mean	SD	Min	p50	Max
Number of bonds per firm/quarter	2.31	2.27	1.00	2.00	23.00
Market value of issue (usd mil., 2000)	394	267	5	362	1779
Maturity at issue (years)	10.57	6.97	1.00	10.00	50.00
Term to maturity (years)	6.26	5.09	1.00	5.00	30.00
Duration (years)	5.03	3.10	0.97	4.48	20.36
Callable (pct.)	0.26	0.44			
Credit rating (Bloomberg)			CCC-	BBB-	AA
Coupon rate (pct.)	6.16	2.39	0.25	5.75	13.00
Nominal effective yield (pct.)	5.93	3.73	0.49	5.06	37.18
Credit spread (basis points)	385	357	5	282	3406

The table reports summary statistics for 561 bonds issued by 173 firms across 12 countries over 1997q2 to 2021q1. Callable includes bonds with a maturity type of "CALLABLE," "CALL/PUT," or "CALL/SINK." The Bloomberg composite credit rating is measured at time of data download and is only available for 184 bonds. The countries are Argentina, Brazil, Chile, Colombia, India, Korea, Mexico, Peru, Philippines, Thailand, Turkey, and Ukraine.

Table A.4: Summary Statistics of Corporate Bond Characteristics, Latin America

	Mean	SD	Min	p50	Max
Number of bonds per firm/quarter	2.31	2.27	1.00	2.00	23.00
Market value of issue (usd mil., 2000)	455	325	7	361	1779
Maturity at issue (years)	10.13	5.18	1.00	10.00	40.00
Term to maturity (years)	6.36	4.95	1.00	5.50	30.00
Duration (years)	5.07	2.96	0.97	4.72	19.85
Callable (pct.)	0.44	0.50			
Credit rating (Bloomberg)			CCC-	BB+	A-
Coupon rate (pct.)	7.02	2.21	1.48	6.75	12.75
Nominal effective yield (pct.)	6.79	3.70	0.81	5.96	36.83
Credit spread (basis points)	458	367	6	356	3406

The table reports summary statistics for 238 bonds issued by 64 firms across 6 countries over 1997q2 to 2021q1. Callable includes bonds with a maturity type of "CALLABLE," "CALL/PUT," or "CALL/SINK." The Bloomberg composite credit rating is measured at time of data download and is only available for 184 bonds. The countries are Argentina, Brazil, Chile, Colombia, Mexico, and Peru.

2. We estimate the mean (μ) and variance (σ) of the return on the firm's value over a 250-day moving window.

3. We estimate a new value of V using the Black-Scholes-Merton option-pricing framework

$E = V\Phi(\delta_1) - e^{rT} D\Phi(\delta_2)$, where $\delta_1 \equiv \frac{\log(V/D)+(r+0.5\sigma^2)T}{\sigma^2\sqrt{T}}$ and $\delta_2 \equiv \delta_1 - \sigma\sqrt{T}$. Here, r is the daily 1-year constant maturity Treasury yield and T is equal to 1 because the frequency is daily.

4. We repeat steps (a)-(c) until V converges.

Our methodology requires that firms have positive values for both debt and equity. To exclude extreme outliers, we trim distance to default at 1% and 99% of the global sample (-1.3 and 25.8).

Global risk premium Table A.5 shows the results of the first-stage regression of corporate bond spreads on default risk and other bond characteristics, given by equation 1, for the full emerging market sample as well as the Latin America and Asia subsamples. The coefficient on distance to default is negative across all three samples, though the magnitude varies, with Asia exhibiting the largest sensitivity and Latin America the smallest.

We then estimate 3 for each sample. Country-specific risk premia (ρ_k) are reported in Table A.6 with respect to Argentina (columns (1)-(2)) or India (column (3)) as the omitted country. Argentina has the highest risk premium in Latin America, with an average risk premium that is 184-198 basis points higher than Chile. Figure A.1 Panel (a) shows our estimates of the systemic risk premium using the full sample of emerging markets along with both regional subsamples. Table A.7 reports the correlations among the series. Panel (b) shows estimates by country for the three largest countries in our Latin America sample. Risk premia by country are relatively similar to the aggregate, particularly for Mexico. Argentina experiences the most severe deviations from the aggregate.

Credit Ratings We collect credit ratings from S&P and/or Moodys for the Latin American firms in our sample. We use crosswalks between Compustat ID (gvkey) and ticker symbols to find the firm on Bloomberg and extract long-term foreign issuer ratings and the date on which they took effect. We obtain historical ratings for 74% of firms in our bond sample, which cover 85% of bonds. We use a crosswalk from the BIS to locate the ratings on the same scale and construct an aggregate rating using the worse rating of the two when

Table A.5: Credit Spreads and Distance to Default

	(1) EMEs	(2) Latin America	(3) Asia
Distance to default	-0.073***	-0.056***	-0.099***
	(0.011)	(0.012)	(0.012)
log(Duration)	-0.009	0.084	0.069**
	(0.038)	(0.063)	(0.035)
log(Amount issued)	-0.039	-0.019	-0.140***
	(0.043)	(0.054)	(0.052)
log(Coupon rate)	0.808***	1.037***	0.415***
	(0.095)	(0.132)	(0.093)
log(Age of issue)	-0.054**	-0.017	0.011
	(0.023)	(0.036)	(0.026)
Callable	0.334***	0.308***	0.211
	(0.056)	(0.064)	(0.141)
Observations	8085	3679	3728
R^2	0.488	0.556	0.510
Root MSE	0.527	0.463	0.511
Number of firms	172	65	94
Number of bonds	561	240	275

Standard errors in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

Note: Sample period: 1997q2-2021q1. The table shows the estimated coefficients of Equation (1) for different samples of countries, as defined in Table A.2. The dependent variable is $\log S_{ijkt}$*, the log of the corporate bond spread for bond* i *issued by firm* j *in country* k *and quarter* t*. The model includes fixed effects by sector, type of first coupon issued, and quarter interacted with coupon frequency and first coupon month. Standard errors are clustered by firm and quarter.*

both are available. S&P and Moody's ratings coincide for 91% of observations and are within 2 steps for 80% of the remaining observations. Figure A.2 shows the distribution of ratings.

Table A.6: Country Risk Premia

	(1) All	(2) Latin America	(3) Asia
Argentina	0	0	
	(.)	(.)	
Brazil	-144***	-141***	
	(14.5)	(13.9)	
Chile	-184***	-198***	
	(14.9)	(14.5)	
Colombia	-152***	-194***	
	(21.6)	(20.7)	
India	-101***		0
	(12.2)		(.)
Korea	-199***		-95***
	(11.7)		(9.8)
Mexico	-155***	-100***	
	(12.1)	(11.8)	
Peru	-158***	-124***	
	(17.9)	(17.3)	
Philippines	-160***		-103***
	(15.1)		(14.2)
Thailand	-158***		-66***
	(15.3)		(13.5)
Turkey	-89***		
	(14.8)		
Ukraine	150***		
	(26.0)		
Constant	-109	233	-135
	(105.5)	(243.1)	(110.7)
Observations	8085	3679	3728
R^2	0.188	0.284	0.179

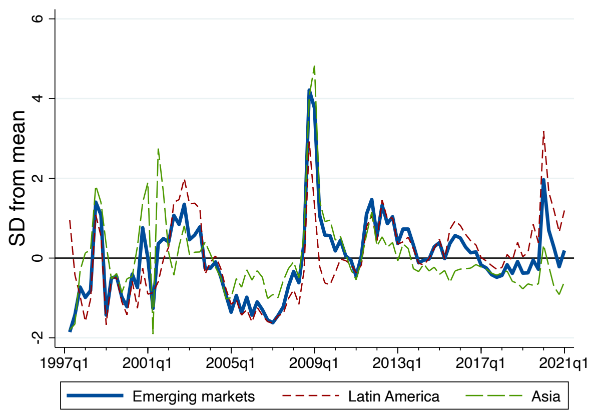
Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

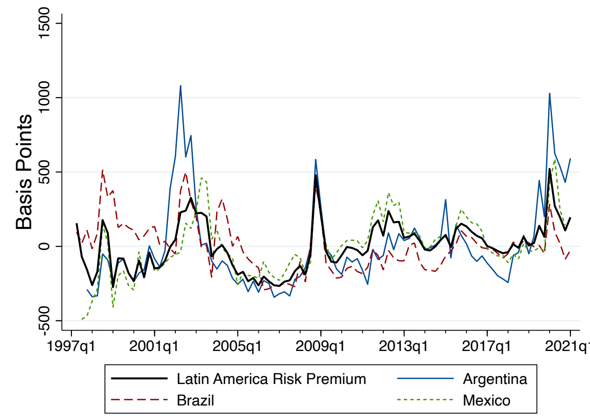
Note: The table reports ρ_k estimates from $\hat{RP}_{ijkt} = \rho_k + \rho_t + \nu_{ijkt}$, where $\hat{RP}_{ijkt} = S_{ijkt} - \exp(\beta dd_{jkt} + \gamma' \mathbf{Z}_{ijkt} + \frac{\hat{\sigma}^2}{2})$. Units can be interpreted as basis points relative to the omitted country, Argentina or India.

Figure A.1: Global Risk Premium: Regional Measures

(a) By region



(b) By Country



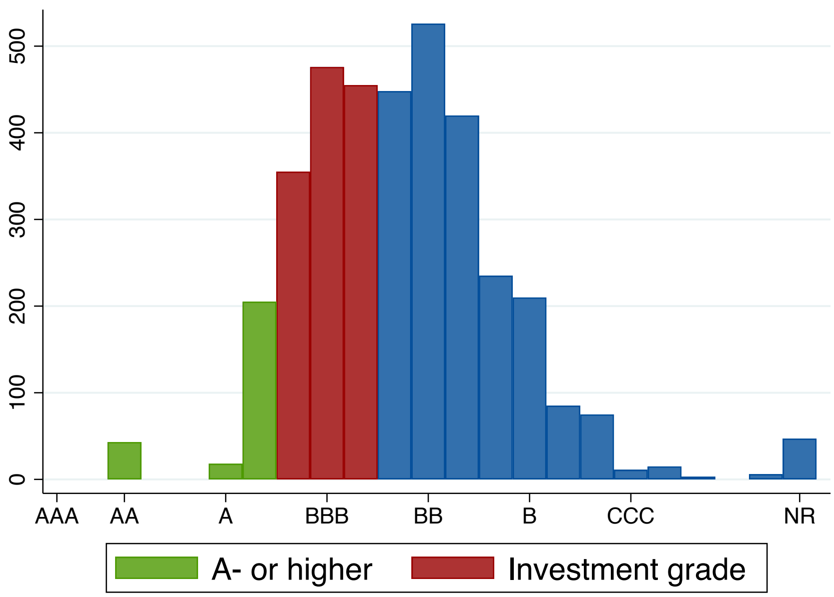
Note: Panel (a) shows global risk premium estimates (ρ_t from Equation 3) for the regions defined in Table A.2. Panel (b) shows the estimates by country for the three largest countries in the Latin America sample.

Table A.7: Risk Premia Correlations

	GRP	Latin America RP	Asia RP	U.S. EBP	VIX
Global Risk Premium	1.000	.	.	.	.
Latin America Risk Premium	0.797	1.000	.	.	.
Asia Risk Premium	0.772	0.329	1.000	.	.
U.S. Excess Bond Premium	0.622	0.323	0.679	1.000	.
VIX	0.570	0.439	0.567	0.594	1.000

Note: The table reports correlations between the global risk premium (ρ_t) estimates from Equation 3 across subsamples of countres (as defined in Table A.2), as well as the U.S. Excess Bond Premium and the VIX.

Figure A.2: Credit Ratings



Note: The figure reports the distribution of credit ratings from S&P and/or Moody's. When both ratings are available, the lower rating is used. y-axis reports the number of firm-by-quarter observations.

Global Compustat We obtain quarterly data on firms' balance sheets from Global Compustat and construct variables using standard methodology in the literature, with some additional adjustments for currency. We only keep observations in which the reporting currency is either local currency or USD (99.8% of sample). For observations denominated in USD (8% of sample), we convert variables to local currency using average quarterly spot exchange rates. When considering changes in variables—e.g., sales growth or changes in the capital stock—we only compare observations reported in the same currency. For real variables, we deflate nominal variables with GDP deflators from each country.

Variable Definitions

1. *Investment:* We define investment as $\Delta \log(k_{jt+1})$, where k_{jt+1} is the stock of capital at firm j at the end of period t. We set the initial value k_{jt+1} to the level of gross plant, property, and equipment (ppegtq) in the first period in which this is available. We then compute the evolution of the capital stock using changes in net plant, property, and equipment (ppentq). This variable measures investment net of depreciation with more observations than ppegtq. We linearly interpolate ppentq if there is one missing observation between two non-missing. We only interpolate between observations reported in the same currency.

2. *Leverage:* We define leverage as the ratio of total debt (dlcq + dlttq) to total assets (atq).

3. *Real sales growth:* We define real sales growth as the percent change in sales (saleq), deflated by the local GDP deflator. We exclude observations if a firm changes reporting currency between consecutive quarters ($< 0.1\%$ of observations).

4. *Size:* We define size as the log of total real assets, converted to USD for comparability across countries. We deflate total assets by the price deflator for the US.

5. *Liquidity:* We define liquidity as the ratio of cash and short-term investments (cheq) to total assets.

6. *Cash flow:* We define operating cash flow as the ratio of operating income before depreciation (oibdp) minus interest (xint) minus taxes (txt) to lagged total assets.

7. *Sector:* We identify firms in tradeable and non-tradeable sectors using 2-digit NAICS codes. Tradeable industries are agriculture (11), mining (21), manufacturing (31-33), wholesale trade (42), retail trade (44-45), and transportation and warehousing (48-49). Non-tradeable industries are information (51), professional, scientific, and technical services (54), administrative services (56), education (61), health and social services (62), arts (71), hospitality (72), and other services (81). We exclude the construction industry (23) and a small number of firms with unclassified industries from our sector definitions.

Sample Construction We restrict our final sample to exclude extreme outliers. We make the following sample restrictions, in this order.

1. We only include firms with balance sheets reported in local currency or USD.

2. We drop firms in the financial (SIC 6000-6799 or NAICS 52-53) and utilities (SIC 4900-4999 or NAICS 22) industries.

3. We exclude firm-quarter observations with negative capital or assets.

4. We exclude firm-quarter observations for which acquisitions are larger than 5% of assets.

5. We exclude firm-quarter observations if net current assets as a share of total assets is higher than 10 or below -10.

6. We exclude firm-quarter observations if leverage is higher than 10 or negative.

7. We exclude firm-quarter observations with negative real sales or liquidity.

8. We trim investment at the 1st and 99th percentiles.

Table A.8: Summary Statistics

	Mean	SD	p10	Med	p90	N
Investment	-0.12	5.92	-4.74	-0.90	4.85	29,383
Real sales growth	1.33	21.58	-20.77	0.82	24.29	29,140
Tradeable sector	0.78	0.41	0.00	1.00	1.00	29,383
Book leverage	0.31	0.34	0.08	0.28	0.52	25,190
Distance to Default	6.57	5.11	1.08	5.38	13.78	17,451
Measures of risk-free						
Above 90th percentile DD	0.10	0.30	0.00	0.00	0.00	17,451
A- or higher rating	0.01	0.09	0.00	0.00	0.00	29,383
Investment grade	0.05	0.22	0.00	0.00	0.00	29,383
Below 10th percentile leverage	0.10	0.30	0.00	0.00	1.00	23,414

Note: The table reports summary statistics for firm investment and default risk data. The sample includes Argentina, Brazil, Chile, Colombia, Mexico, and Peru over the time period 1997q2 to 2019q4. Investment is defined as the log change in capital stock multiplied by 100. Real sales growth is measured in percentage points. Size is log real total assets, measured in USD. Tradeable and nontradeable sectors are defined in Appendix A.2. Credit ratings are long-term foreign issuer ratings from S&P and/or Moodys, obtained from Bloomberg. Where rating are available from both agencies, the lower rating is used.

Table A.8 reports summary statistics for the Latin America Global Compustat sample. We have 29,030 observations across Argentina, Brazil, Chile, Colombia, Mexico, and Peru over the time period 1997q2 to 2019q4, with considerable variation in investment, sales growth, size, and financial position.

Risky firms Using distance to default, we classify firm-by-quarter observations in our sample as either risky or risk-free, where risk-free firms are those with distance to default above the 90th percentile. Table A.9 summarizes the characteristics of each sample. Unsurprisingly, risky firms have higher leverage. They have slightly lower investment and sales growth, but are comparable in size. Table A.10 summarizes the sample by country. Because the threshold for the risk-free variable is uniform across countries, there is variation in the share of risk-free observations from each country, with Chile having the most risk-free observations and Brazil the fewest.

Table A.9: Summary Statistics by Firm Risk

	Mean	SD	p10	Med	p90	N
Risk-free						
Investment	0.39	5.71	-4.03	-0.34	4.81	1,745
Real sales growth	2.38	18.49	-15.85	1.26	22.94	1,736
Book leverage	0.16	0.12	0.02	0.14	0.34	1,502
Distance to Default	17.60	3.00	14.21	16.94	22.16	1,745
Implied default probability	0.00	0.01	0.00	0.00	0.00	1,745
Tradeable sector	0.76	0.43	0.00	1.00	1.00	1,745
Nontradeable sector	0.19	0.39	0.00	0.00	1.00	1,745
Risky						
Investment	-0.26	5.89	-5.00	-0.99	4.69	15,706
Real sales growth	1.27	20.23	-19.57	0.82	22.55	15,594
Book leverage	0.31	0.24	0.10	0.28	0.51	14,724
Distance to Default	5.35	3.61	0.97	4.81	10.74	15,706
Implied default probability	0.05	0.14	0.00	0.00	0.16	15,706
Tradeable sector	0.77	0.42	0.00	1.00	1.00	15,706
Nontradeable sector	0.15	0.35	0.00	0.00	1.00	15,706

Note: The table reports summary statistics for firm investment and default risk data for risky and risk-free firms. Risk-free firms are those with distance to default above the 90th percentile. Investment is defined as the log change in capital stock multiplied by 100. Real sales growth is measured in percentage points. Size is log real total assets, measured in USD. Tradeable and nontradeable sectors are defined in Appendix A.2. Credit ratings are long-term foreign issuer ratings from S&P and/or Moodys, obtained from Bloomberg. Where rating are available from both agencies, the lower rating is used.

Table A.10: Summary Statistics by Country

	Observations	Firms	DD	Risk-free	Investment	Leverage	Tradeable
Argentina	1,703	56	6.50	0.08	-3.15	0.25	0.76
Brazil	7,073	257	5.25	0.07	-0.20	0.33	0.81
Chile	2,985	103	8.47	0.17	0.22	0.29	0.73
Colombia	499	24	8.14	0.13	1.08	0.21	0.83
Mexico	3,443	105	8.04	0.12	0.31	0.28	0.67
Peru	1,748	64	5.43	0.08	0.65	0.24	0.86

Note: The table reports summary statistics for the sample of Latin American firms with non-missing distance to default (DD). The sample period is 1997q2 to 2019q4. DD, risk-free, leverage, tradeable, and non-tradeable are means by country. Risk-free indicates observations with distance to default above the 90th percentile. Leverage is book leverage.

A.3. Additional Results

Alternative risk-free definitions We construct additional measures of risky and risk-free firms to be used for robustness checks. First, we define risk-free firms as those with a rating of A- or higher and those with an investment-grade rating or higher (BBB-). We classify firms with no rating as risky in these measures. Table A.11 Panel (a) reports the number of firms and number of firm-by-quarter observations that meet each of these criteria. Table A.11 Panel (b) shows the correlations across measures. Measures based on credit ratings show little or negative correlation with measures based on distance to default or leverage, which suggests that these are picking up different aspects of firm risk.

Table A.11: Alternative risk-free definitions

(a) Number of Observations

	Firms	h=0	h=4	h=8
A Rating	8	255	222	200
Investment grade	55	1,488	1,305	1,183
90pct dd	257	1,745	1,286	1,144
Any Rating	106	3,577	3,066	2,718
All observations	736	29,383	24,223	21,728

(b) Correlations

	A Rating	Inv Grade	DD	Any rating
A Rating	1.000	.	.	.
Inv Grade	0.405	1.000	.	.
90th Pct DD	0.002	-0.014	1.000	.
Any rating	0.251	0.620	-0.064	1.000

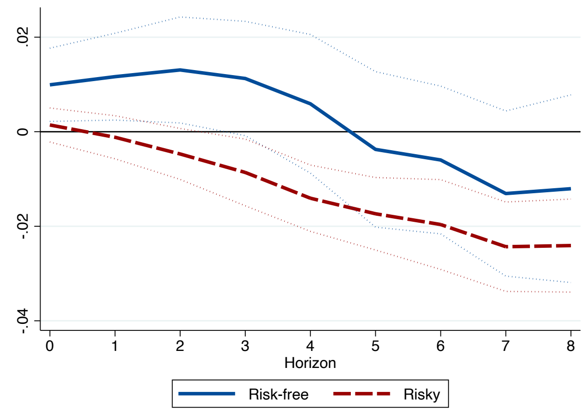
Note: Panel (a) reports the number of observations that meet each criteria. Column (1) reports the number of firms. Columns (2)-(4) report the number of firm-by-quarter observations measured h quarters into the future. Panel (b) reports the correlation across definitions. A rating and investment grade are based on S&P or Moody's credit ratings. 90pct dd indicates distance to default above the 90th percentile. Any rating includes all observations with a rating by S&P or Moody's.

Figure A.3 Panels (a) and (b) shows that the expansionary effects of the global risk premium on risk-free firms are broadly consistent when we measure risk with credit ratings, at least in initial quarters after the shock.

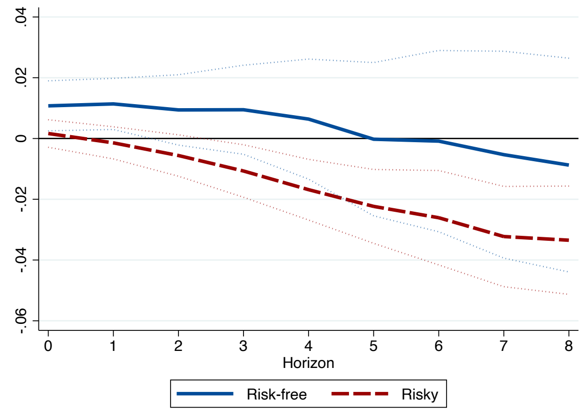
One concern with the ratings data is that these are only available for a small subset

Figure A.3: Risk-free Firms' Investment Responses across Definitions

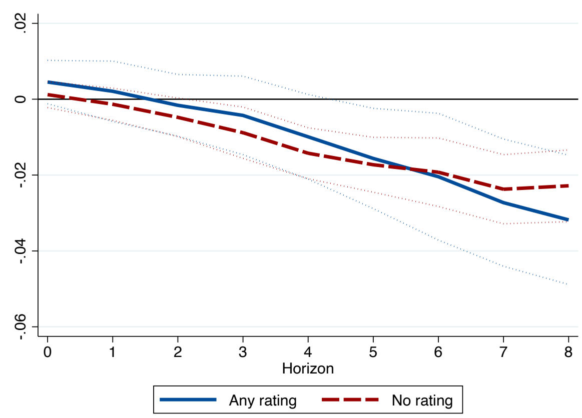
(a) A- rating or higher



(b) Investment-grade rating or higher



(c) Any rating



Note: The figure shows coefficient estimates from Equation (4) with alternative definitions of risk-free firms based on credit ratings.

of firms, so we may be capturing systematic differences between the types of firms that are rated by Moody's and S&P relative to others. Figure A.3 Panel (c) shows that this does not appear to be driving our results, with rated and unrated firms exhibiting similar overall contractions.

Aggregate conditions We address concerns that our results reflect differences in the responsiveness of risky and risk-free firms to aggregate conditions overall. We perform robustness exercises in which we interact risky and risk-free indicators with U.S. macroeconomic indicators, as given by the following specification:

$$\begin{aligned}\Delta_h log(k_{jt}) =& \alpha_{hj} + \underbrace{\beta_h^R \times \rho_t \times \mathbb{I}_{j\in\mathcal{R}_t}}_{\text{Risky Firms} \times \text{RP}} + \underbrace{\beta_h^F \times \rho_t \times \mathbb{I}_{j\in\mathcal{R}_t^f}}_{\text{Risk-Free Firms} \times \text{RP}} \\ &+ \underbrace{\gamma_h^R \times X_t \times \mathbb{I}_{j\in\mathcal{R}_t}}_{\text{Risky Firms} \times X} + \underbrace{\gamma_h^F \times X_t \times \mathbb{I}_{j\in\mathcal{R}_t^f}}_{\text{Risk-free Firms} \times X} + \omega_h' Z_{jt-1} + \epsilon_{jth}.\end{aligned} \tag{A.2}$$

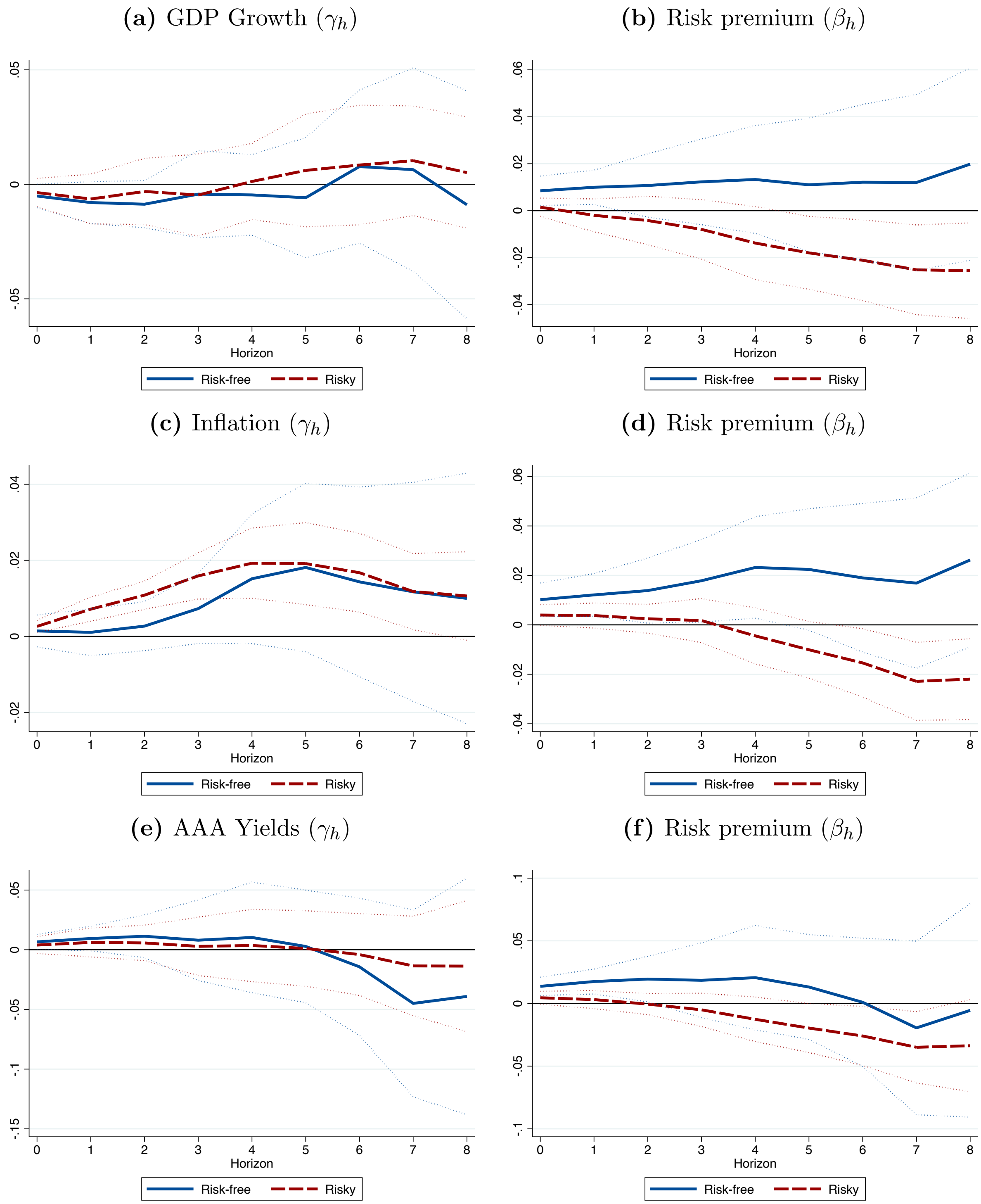
As shown in Figure A.4, risky and risk-free firms respond similarly to U.S. GDP growth, inflation, and movements in AAA yields, whereas responses to the global risk premium are similar to our baseline results with the inclusion of these additional interactions.

Other firm characteristics To ensure that we are not picking up differences in other firm characteristics and attributing them to firms' risk, we conduct multiple specifications in which we introduce interactions between firms' characteristics and global risk premium ρ_t,

$$\Delta_h log(k_{jt}) = \alpha_{hj} + \beta_h^z \times \rho_t \times z_{jt-1} + \underbrace{\beta_h^R \times \rho_t \times \mathbb{I}_{j\in\mathcal{R}_t}}_{\text{Risky Firms}} + \underbrace{\beta_h^F \times \rho_t \times \mathbb{I}_{j\in\mathcal{R}_t^f}}_{\text{Risk-Free Firms}} + \gamma_h \mathbb{I}_{j\in\mathcal{R}_t} + \omega_h' Z_{jt-1} + \epsilon_{jth}, \tag{A.3}$$

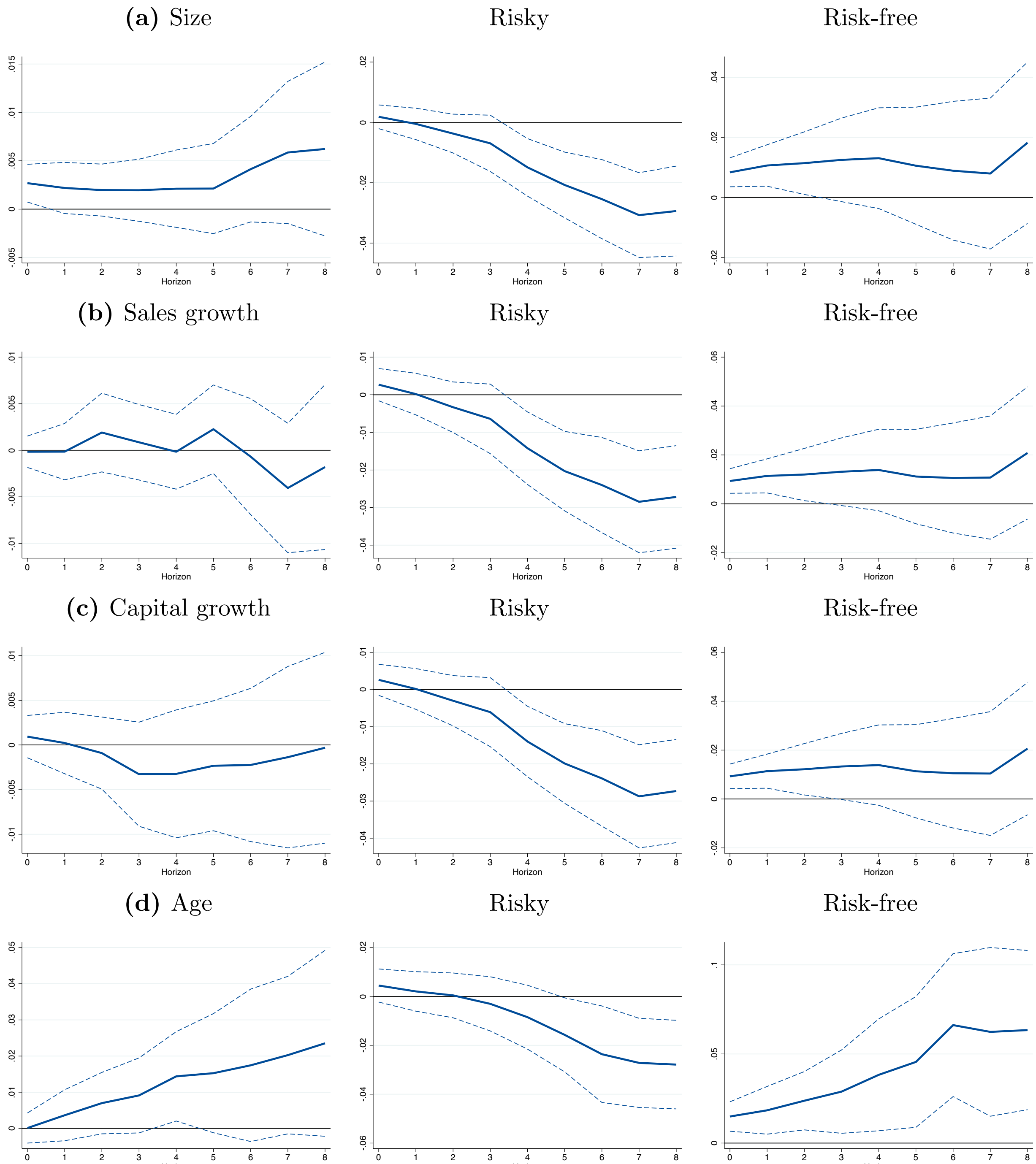
where β_h^R and β_h^F are the coefficients of interest as before, but we add the interaction between variable z_{jt-1} and the global risk premium. Results are reported in Figure A.5 for several choices of z_{jt-1}. Estimated coefficients β_h^R and β_h^F in Panels (a)-(c) are remarkably similar with added controls for size, sales growth, and capital growth. Results in Panel (d) are noisier because the age variable is missing for many observations, but the pattern is nonetheless qualitatively similar, even in this selected sample.

Figure A.4: Firms' investment responses to aggregate variables



Note: The figure shows coefficient estimates from Equation (A.2), in which U.S. macroeconomic variables are introduced. Left panels show coefficients on the macroeconomic indicator and right panels coefficients on the global risk premium from that model.

Figure A.5: Heterogeneous Responses to Movements in the Global Risk Premium with Interactions



Note: The figure shows coefficient estimates from Equation (A.3). The left panel shows the coefficient β_h^z, from interacting the global risk premium (ρ_t) with the variable labeled, and the middle and right panels report coefficients β_h^R and β_h^F, respectively. Coefficients in the left panel can be interpreted as the effect of a 1-standard-deviation higher level of each variable —i.e., size —on the cumulative log change in capital stock in response to the global risk premium shock.

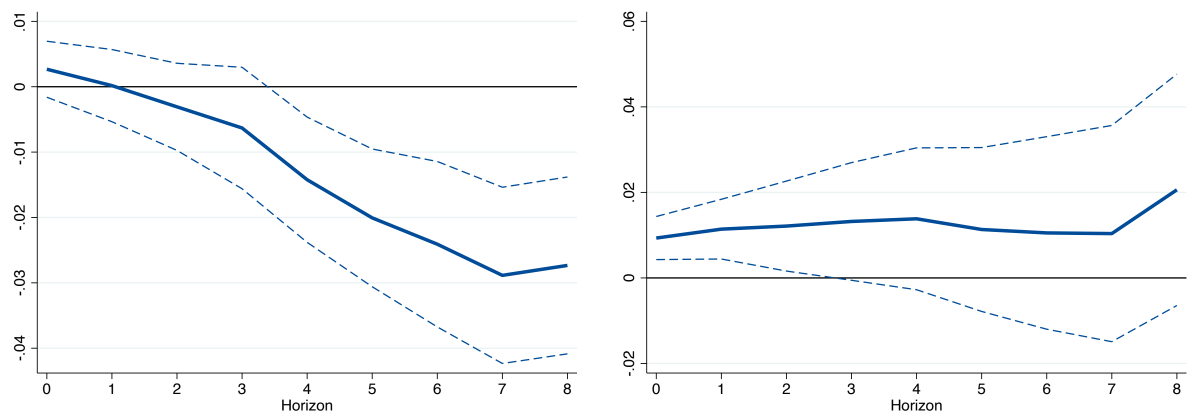
Alternative functional forms To allow for the possibility that risky and risk-free firms also have different patterns of sales growth, size, etc., we allow a version of the model that interacts the risky and risk-free dummies with all of the control variables,

$$\Delta_h log(k_{jt}) = \alpha_{hj} + \underbrace{\left(\beta_h^R \rho_t + \ \omega_h^R Z_{jt-1}\right) \times \mathbb{I}_{j \in \mathcal{R}_t}}_{\text{Risky Firms}} + \underbrace{\left(\beta_h^F \rho_t + \ \omega_h^F Z_{jt-1}\right) \times \mathbb{I}_{j \in \mathcal{R}_t^f}}_{\text{Risk-Free Firms}} + \epsilon_{jth}. \quad \text{(A.4)}$$

Results are shown in Figure A.6, and look very similar to the baseline.

Figure A.6: Heterogeneous Investment Responses with Interacted Controls

(a) Risky firms **(b)** Risk-free firms



Note: The figure shows coefficient estimates from Equation (A.4) with controls fully interacted by risk.

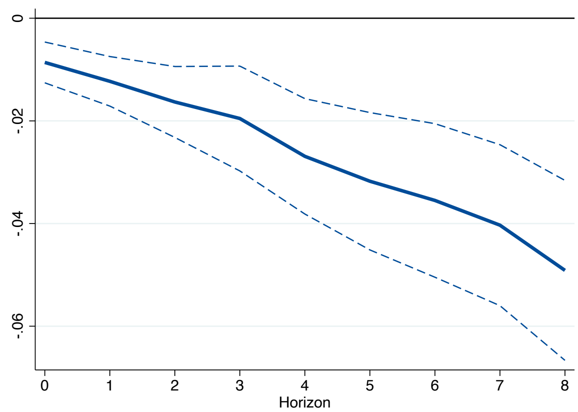
Next, we introduce time-by-country fixed effects to capture any country-specific trends that could be affecting firms' investment with changes in the risk premium,

$$\Delta_h log(k_{jkt}) = \alpha_{hj} + \alpha_{hkt} + \underbrace{\beta_h^R \times \rho_t \times \mathbb{I}_{j \in \mathcal{R}_t}}_{\text{Risky Firms}} + \gamma_h \mathbb{I}_{j \in \mathcal{R}_t} \ + \ \omega_h' Z_{jt-1} + \epsilon_{jkth}, \quad \text{(A.5)}$$

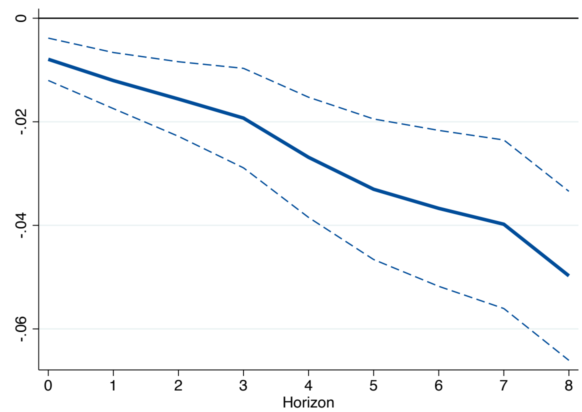
where the coefficient of interest is β_h^R, which captures the cumulative change in capital stock for risky firms relative to risk-free, holding fixed conditions in country k in quarter t. Note that the inclusion of time fixed effects means we can only isolate these relative effects for risky firms, rather than the average effects for each group. Results are shown in Figure A.7. Risky firms have lower cumulative change in capital at all horizons relative to risk-free firms, peaking at 5.4% lower after 2 years.

Figure A.7: Risky Firms' Responses to the Global Risk Premium, with Time Fixed Effects

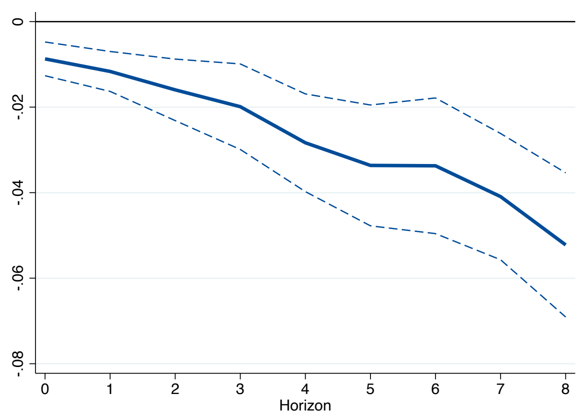
(a) Time fixed effects



(b) Time-Country fixed effects



(c) Time-Industry fixed effects



Note: The figure shows estimated β_h^R coefficients of Equation (A.5), which correspond to the cumulative (log) change in capital stock in response to the global risk premium (ρ_t) for risky relative to risk-free firms, with fixed effect specified in the title.

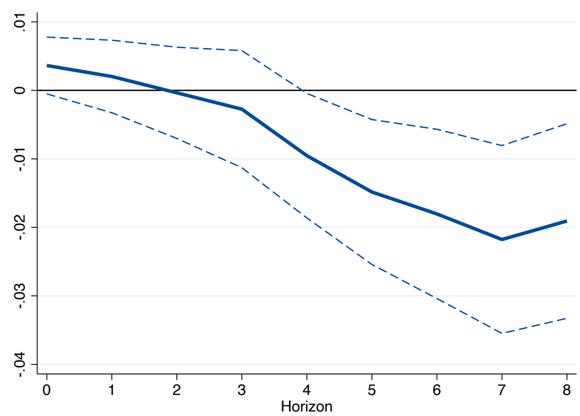
Our baseline specification classifies firms as either risky or risk-free by the quantile of distance to default. We also estimate an interactive model in which we estimate a level effect and an interaction term with distance to default,

$$\Delta_h log(k_{jt}) = \alpha_{hj} + \beta_h \times \rho_t + \beta_h^D \times \rho_t \times \text{dd}_{jt-1} + \gamma_h \text{dd}_{jt-1} + \omega_h' Z_{jt-1} + \epsilon_{jkth}, \quad \text{(A.6)}$$

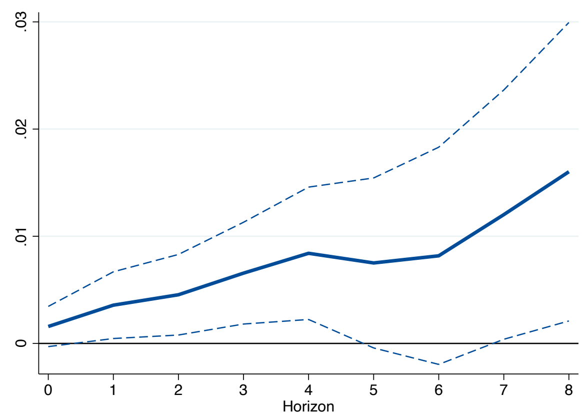
where β_h captures the average cumulative (log) change in capital stock and β_h^D captures the additional change for firms with 1-standard-deviation higher distance to default (less risky). Results are shown in Figure A.8. Consistent with our other baseline, firms with higher distance to default have higher cumulative capital growth. The mean risky firm, as defined in our baseline, has a distance to default of -0.2 standard deviations, relative to 2.2 standard deviations for the mean risk-free firm. Results are similar when we include country-by-time fixed effects, as shown in Figure A.8 Panel (c).

Figure A.8: Heterogeneous Responses to Movements in the Global Risk Premium, Continuous Measure

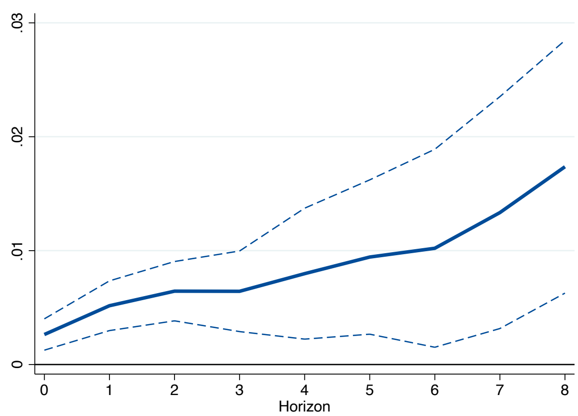
(a) Aggregate effect



(b) Interaction with Distance to Default



(c) Interaction with Distance to Default, Fixed Effects Model

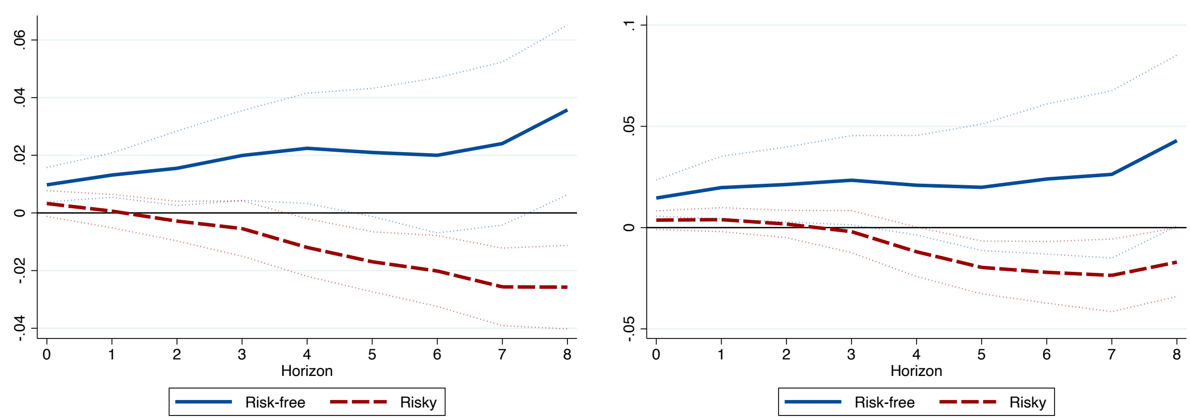


Note: Panels (a) and (b) show the estimated β_h and β_h^D coefficients of Equation (A.6). The first is the cumulative average (log) change in capital stock in response to the global risk premium (ρ_t). The variable ρ_t is standardized so the units are standard deviations. The second is the interaction term with distance to default, which is standardized, so the coefficients can be interpreted as the additional cumulative (log) change in capital stock for firms with 1-standard-deviation higher distance to default (i.e., less risky). Panel (c) shows the estimated β_h^D (right panel) coefficients with the addition of country-by-time fixed effects.

Subsamples Next, we show that our results are not highly sensitive to subsamples of industries or countries. Figure A.9 introduces interactions between risky and risk-free indicators with tradeable and non-tradeable sectors (defined in Appendix A.2). The results are noisier but show that the negative effects of the global risk premium shock are concentrated among risky firms across both sectors. To address concerns about whether our results are driven by particular countries, we re-estimate Equation 4 on a subsample that drops one country at a time. Results are shown in Figure A.11. Negative results for risky firms are persistent across all subsamples. Results for risk-free firms are unsurprisingly much noisier but are generally positive, with the exception of the latter horizons when we drop Brazil, which accounts for 37% of our total sample. We do not estimate effects separately by country due to the low power of our sample size.

Figure A.9: Heterogeneous Responses to Movements in the Global Risk Premium by Sector

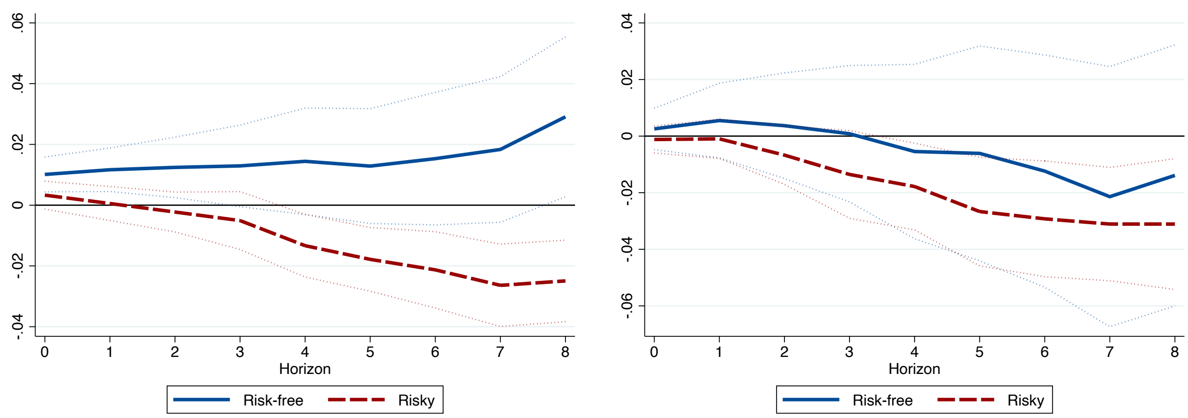
(a) Tradable **(b)** Non-tradable



Note: The figure shows coefficient estimates from Equation (4) with additional interactions between tradeable and non-tradeable sectors.

Figure A.10: Heterogeneous Responses to Movements in the Global Risk Premium by Exchange Rate Regime

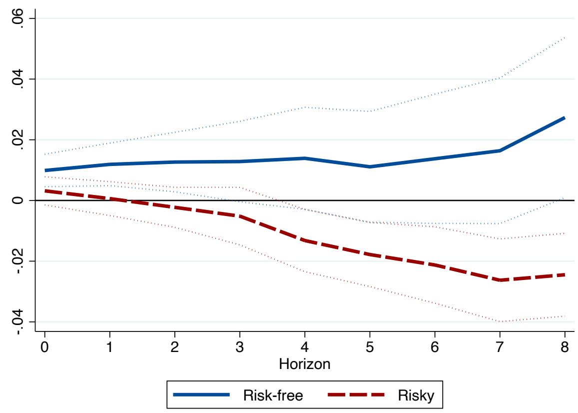
(a) Floating Regime **(b)** Fixed Regime



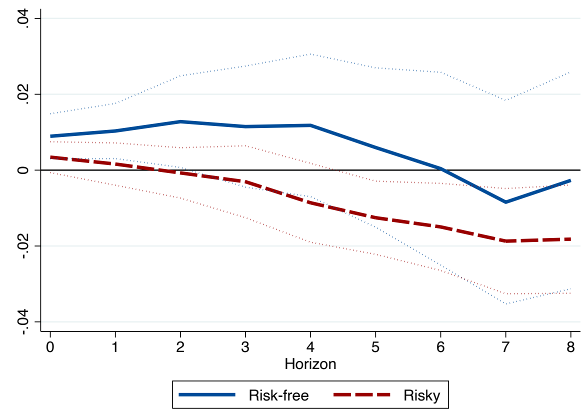
Note: The figure shows coefficient estimates from Equation (4) with additional interactions for exchange rate regime.

Figure A.11: Heterogeneous Responses to Movements in the Global Risk Premium by Country Sample

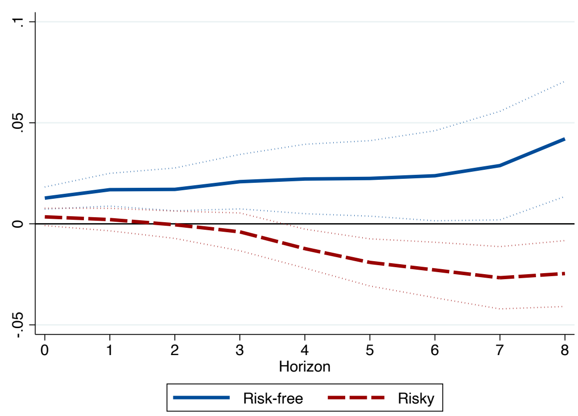
(a) ex. Argentina



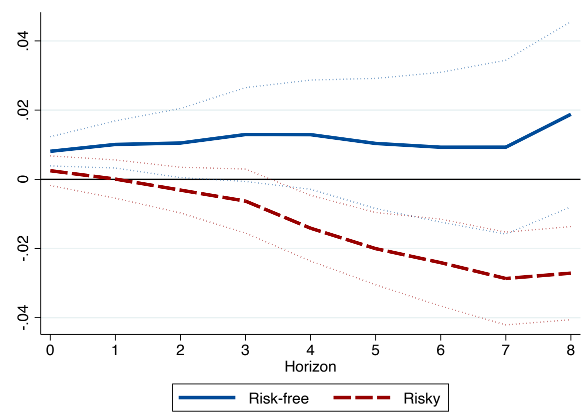
(b) ex. Brazil



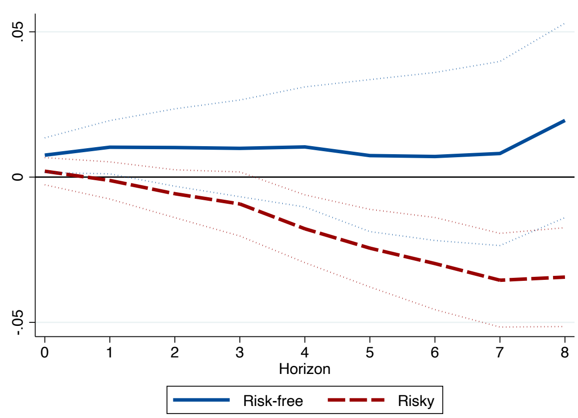
(c) ex. Chile



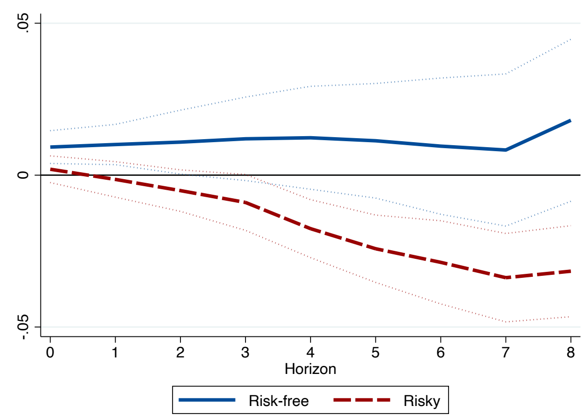
(d) ex. Colombia



(e) ex. Mexico



(f) ex. Peru



Note: The figure shows coefficient estimates from Equation (4), excluding one country at a time.

Alternative risk premium specifications We estimate three additional versions of the global risk premium, in which we modify the model we use for the first stage to allow for the possibility that distance to default affects bond spreads nonlinearly or heterogeneously by country or firm rating. For the nonlinear specification, we modify Equation 1 to include distance to default squared,

$$\log S_{ijkt} = \beta \text{dd}_{jkt} + \omega \text{dd}_{jkt}^2 + \gamma' \boldsymbol{Z}_{it} + \epsilon_{ijkt}. \tag{A.7}$$

Next, we allow heterogeneous effects by firm credit ratings,

$$\log S_{ijkt} = \alpha_l + \beta_l \text{dd}_{jkt} + \gamma' \boldsymbol{Z}_{it} + \epsilon_{ijkt}, \tag{A.8}$$

where l are indices for the following rating groups: no rating, rating below investment grade, and rating investment grade or higher. Finally, we allow heterogeneous effects by country, k,

$$\log S_{ijkt} = \alpha_k + \beta_k \text{dd}_{jkt} + \gamma' \boldsymbol{Z}_{it} + \epsilon_{ijkt}. \tag{A.9}$$

The results for equations (A.7) and (A.8) are reported in Table A.12. Allowing non-linearity and heterogeneity by credit ratings both improve the fit of the model similarly, increasing the R^2 from 0.56 to 0.59 or 0.60. For the ratings heterogeneity specification, addition of the ratings is more important than the interaction with distance to default. This is unsurprising, given the low correlation between credit ratings and distance to default shown in Table A.11. Credit ratings likely provide additional information about another dimension of firm risk that is not captured by distance to default.

Results for the country heterogeneity specification, given by equation A.9, are reported in Table A.13. Adding heterogeneous interaction terms and country fixed effects improves the fit of the model substantially, from an R^2 of 0.56 to 0.72. Coefficients on distance to default for the Latin American countries are relatively similar to the baseline, with a weaker pass-through for Brazil and a stronger pass-through for Argentina. Results from estimating Equation (3) with the risk premium estimates obtained from each of these models

Table A.12: Alternative first-stage specifications

	(1) Baseline	(2) Non-linear	(3) Rating heterogeneity
DD	-0.056***	-0.150***	-0.057***
	(0.012)	(0.023)	(0.013)
DD squared		0.006***	
		(0.001)	
Inv grade × DD			-0.004
			(0.021)
Any rating × DD			0.010
			(0.019)
Inv grade			-0.441***
			(0.150)
Any rating			-0.021
			(0.124)
N	3,679	3,679	3,679
R^2	0.556	0.593	0.601
Root MSE	0.463	0.443	0.439
Number of firms	65	65	65
Number of bonds	240	240	240

This table reports the results for estimating equations (A.7) and (A.8), which allow nonlinearity and heterogeneity by credit ratings in the first stage of our risk premium estimation. Standard errors in parentheses.

are plotted in Panel (b) of Figure A.12. Across the three specifications, second-stage results look remarkably similar to the baseline.

We examine the sensitivity of our results for investment dynamics to the measure of risk premium using alternative measures in Figure A.13. Panel (a) shows results using the global risk premium estimated on the full set of emerging markets rather than just Latin America. Panels (b)-(d) show results using global risk premium estimates from the above models that allow for heterogeneous effects of distance to default on spreads in the first stage of the risk premium estimation. Panel (b) allows for nonlinearity, Panel (c) heterogeneity by country, and Panel(d) heterogeneity by rating. Our results are similar across measures,

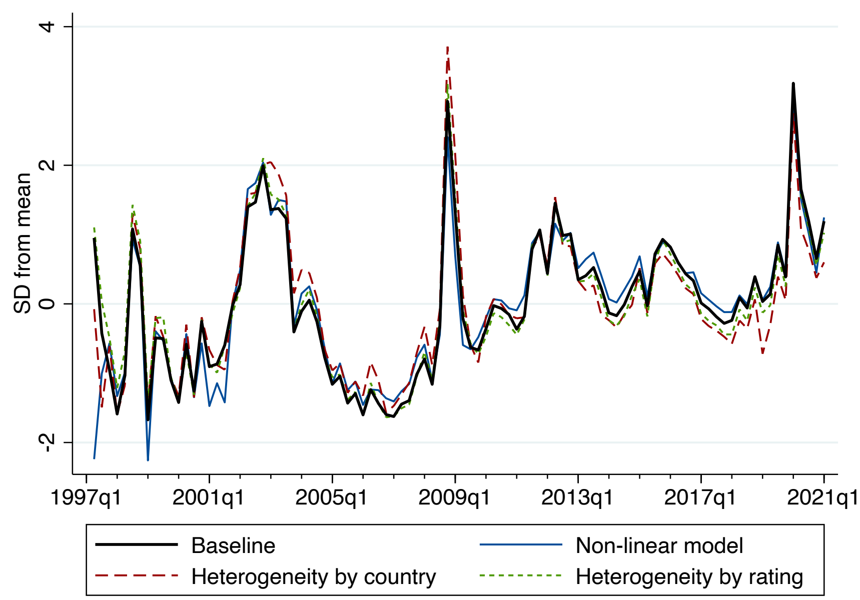
Table A.13: Alternative first-stage specification: Heterogeneity by country

	(1) EMEs	(2) Latin America	(3) Asia	(4) Country Heterogeneity
Distance to default	-0.073***	-0.056***	-0.099***	
	(0.011)	(0.012)	(0.012)	
Argentina × Distance to default				-0.133***
				(0.016)
Brazil × Distance to default				-0.029**
				(0.012)
Chile × Distance to default				-0.056***
				(0.018)
Colombia × Distance to default				-0.055***
				(0.007)
India × Distance to default				-0.116***
				(0.020)
Korea × Distance to default				-0.083***
				(0.018)
Mexico × Distance to default				-0.053**
				(0.021)
Peru × Distance to default				-0.050*
				(0.026)
Philippines × Distance to default				-0.073**
				(0.035)
Thailand × Distance to default				-0.070***
				(0.020)
Turkey × Distance to default				-0.090***
				(0.020)
Ukraine × Distance to default				-0.115***
				(0.017)
Observations	8,085	3,679	3,728	8,085
R^2	0.488	0.556	0.510	0.717
Root MSE	0.527	0.463	0.511	0.404
Number of firms	172	65	94	172
Number of bonds	561	240	275	561

This table reports results for estimating Equation (A.9), which allows for heterogeneity by country in the first stage of our risk premium estimation, relative to our baseline estimates of Equation (1) by region. Standard errors in parentheses.

which is unsurprising given the high correlation of the different estimates, which are plotted in Figure A.12.

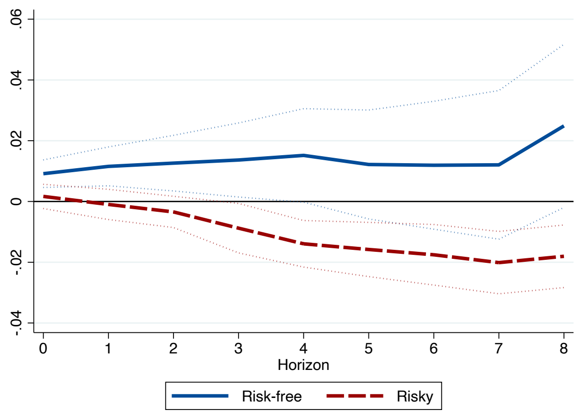
Figure A.12: Alternative global risk premium specifications



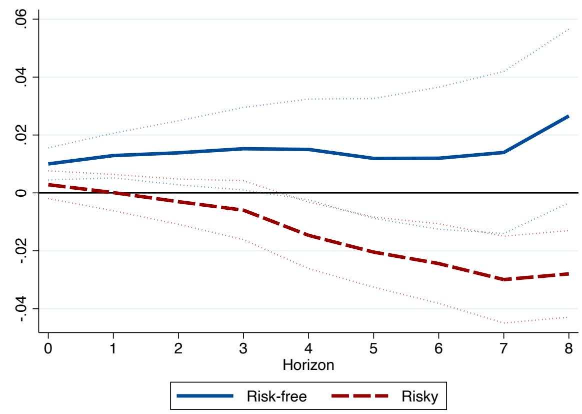
Note: The figure shows the baseline estimate of ρ_t for the Latin America sample and estimates obtained by replacing equation (1) with equations (A.7)-(A.9) to allow for nonlinearity, heterogeneity by country, and heterogeneity by rating in the relationship between distance to default and bond spreads.

Figure A.13: Risky Firms' Responses to the Global Risk Premium, alternative specifications

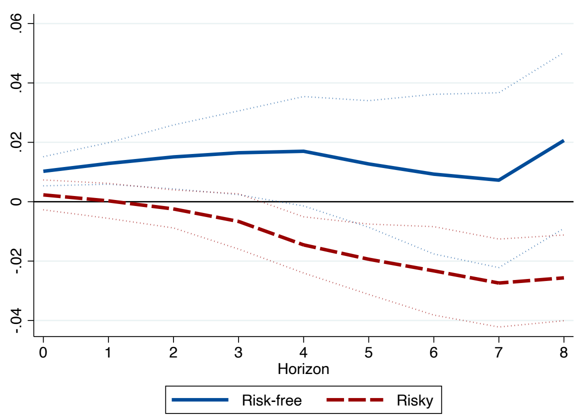
(a) EME Risk Premium



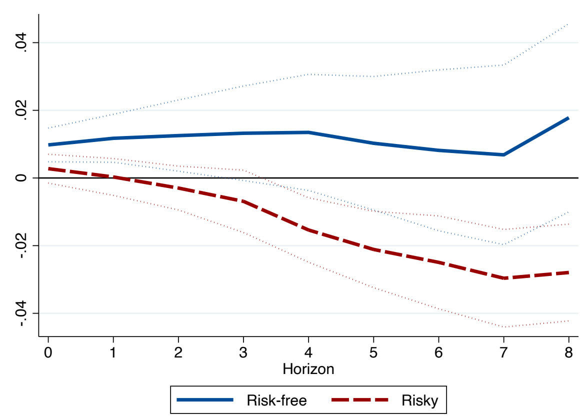
(b) Nonlinear model



(c) Heterogeneity by country



(d) Heterogeneity by rating



Note: The figure shows coefficient estimates from Equation (4) with alternative versions of the global risk premium.

B. Quantitative Appendix

B.1. Model-implied Measure of Risk Premia

We describe here the process to construct the model-implied measure of risk premia. We first define the internal rate of return of a bond b as the rate $r(.)$ that satisfies

$$q\left(k',b',z,\boldsymbol{S}\right)=\frac{m+(1-m)\left(\upsilon+q\left(k',b',z,\boldsymbol{S}\right)\right)}{1+r(k',b',z,\boldsymbol{S})}.$$

The spread of the bond with respect to the risk-free rate, r_f, is defined as $sp(k',b',z,\boldsymbol{S})=\left(\frac{1+r(k',b',z,\boldsymbol{S})}{1+r_f}\right)-1$. To compute the model-implied measure of the risk premium, we need to solve for debt prices under a hypothetical risk-neutral lender. Taking the firms' optimal default and debt policies as given, the risk-neutral pricing kernel would be given by

$$\begin{aligned}\tilde{q}\left(k',b',z,\boldsymbol{S}\right)=\mathbb{E}_{(z',\boldsymbol{S'})\mid(z,\boldsymbol{S})}\Bigg[\beta^{\star}\Bigg(&\left[1-h\left(k',b',z',\boldsymbol{S'}\right)\right]\times\mathbb{R}^{r}_{f}(k',b',z',\boldsymbol{S'})+\\&+h\left(k',b',z',\boldsymbol{S'}\right)\times\mathbb{R}^{d}_{f}\left(k',z',\boldsymbol{S'}\right)\Bigg)\Bigg],\end{aligned}$$

where $\mathbb{R}^{r}_{f}(k',b',z',\boldsymbol{S'})\equiv(1-m)\left(\upsilon+\tilde{q}\left(k'',b'',z',\boldsymbol{S'}\right)\right)+m$, and the next-period policies h', k'', and b'' are obtained under the assumption that foreign lenders are risk averse. Let $\tilde{sp}(.)$ be the spread of the bond under risk-neutral pricing. Our model-implied measure of risk premium is given by

$$RP(k',b',z,\mathbf{S})=sp(k',b',z,\boldsymbol{S})-\tilde{sp}(k',b',z,\boldsymbol{S}). \tag{B.1}$$

B.2. Computational Algorithm

Our model features several state variables, including the firm distribution (an infinite dimensional object) and aggregate uncertainty, which renders it challenging to solve. The aggregate state of the problem can be written as $\boldsymbol{S}\equiv(A,\kappa,\Omega)$, where $\boldsymbol{s}=(A,\kappa)$ denotes the exogenous processes, a is the stock of households' debt, and Ω denotes the firms' distribution across the three idiosyncratic states (k, b, z).

To solve for the equilibrium of the model numerically, we follow a bounded rationality type of approach, as in Krusell and Smith (1998), and use as state variables a set of statistics that summarize the distribution of firms. Such a distribution is a relevant variable to solve firms' problem because of its implications for the economy's aggregates, prices, and real wages. First, let $\tilde{K}_t \equiv \int z_{i,t} \times (k_{it})^{\frac{\alpha\chi}{\varsigma}}$ denote the economy's production capacity. Notice that this is just a function of the economy's stock of capital, weighted by each firm's productivity. It is useful to include this variable as a state, since it allows us to pin down wages. Second, we use the economy's exports, $Z_t = \left(\frac{\xi_t}{P_{H,t}}\right)^{\eta} Y_F^{\star}$, as an auxiliary variable (i.e., a co-state). Although Z_t is not observed at the beginning of each period, we include Z_t as an auxiliary aggregate variable in the firms' problem and, in the simulation stage, we then solve for the value of Z_t such that the H-good market clears. Once we know $(\tilde{K}_t, Z_t)$, we can compute all of the prices of the economy. Combined with a conjectured law of motion for $(\tilde{K}_t, Z_t)$, we then have all the information needed to solve for firms' and households' problems.

Embedded inside $(\tilde{K}_t, Z_t)$, we have all of the relevant information describing the firms' distribution. Other firms' moments, such as average leverage or the cross-sectional standard deviation of capital, are only relevant to improve the forecast of $(\tilde{K}_{t+1}, Z_{t+1})$. However, to keep the solution tractable, we assume a forecasting rule independent of other moments of the firm distribution. Let $\tilde{\boldsymbol{S}} = \left(A, \kappa, \tilde{K}, Z\right)$ denote the (bounded) state space. We consider the following forecasting rule for $\tilde{K}'$:

$$\tilde{H}_K\left(\tilde{\boldsymbol{S}}\right) = e^{\Lambda_0 + \Lambda_1\left(\tilde{\boldsymbol{S}}\right)}. \tag{B.2}$$

As for $\tilde{Z}'$, we consider the following state-contingent forecasting rule:

$$\tilde{H}_Z\left(\tilde{\boldsymbol{S}}, A', \kappa', \tilde{K}'\right) = e^{\Theta_0 + \Theta_1\left(\tilde{\boldsymbol{S}}, A', \kappa', \tilde{K}'\right) + \Theta_2(Z)}. \tag{B.3}$$

The algorithm consists of three main steps. First, we guess the coefficients of the conjectured law of motions. Given these conjectures, we solve for firms' optimal choices following these sub-steps:

1. Guess the value function $V^r\left(k, b, z, \tilde{\boldsymbol{S}}\right)$ and the pricing kernel $q\left(k', b', z, \tilde{\boldsymbol{S}}\right)$ for each point of the state space and for each possible choice of (k', b').

2. Taking the pricing kernel as given, solve the firms' problem and update the value function accordingly.

3. Using the optimal policies computed in the previous step, update the pricing function.

4. Iterate until convergence of both $V^r(.)$ and $q(.)$.

Since the firms' problem presents several non-convexities, we use a global optimization algorithm to solve for k' and b'. This step of the algorithm relies on the use of graphics processing units (GPUs) to speed computation. We approximate all functions using linear interpolation. The firm's idiosyncratic productivity (z) and the aggregate TFP processes (A) are discretized using Tauchen's method. Grids of evenly distributed points are constructed for all states. We use 20 points for k, 20 points for b, 9 points for z, 7 points for A, 2 points for κ, 5 points for $\tilde{K}$, and 5 points for Z.

The last step of the algorithm consists of simulating the economy in order to update the aggregate conjectures. The simulation follows Young's (2010) non-stochastic approach. By not relying on the simulation of individual firms, this approach avoids the sampling error associated with individual firm simulation. This is important in the context of the model, given that due to the firm's default cutoff, small sampling errors may lead to large swings in the aggregate default rate, and thus in Z and $\tilde{K}'$. In each step of the simulation, we use a simple bisection algorithm to solve for the value of Z such that the H-good market clears. We simulate the economy for T periods and use the simulated objects to update the coefficients of the aggregate conjectures $\tilde{H}_{\tilde{K}}$ and $\tilde{H}_Z$. We iterate on this algorithm until convergence of these coefficients.

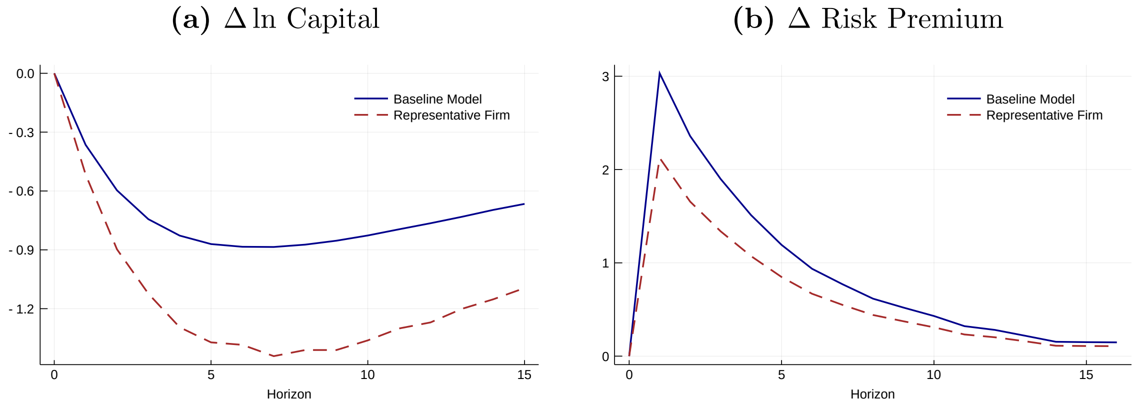
B.3. The Role of Firm Heterogeneity

In this appendix, we analyze the aggregate implications of firm heterogeneity for a global risk-premium shock. We provide a partial-equilibrium counterfactual in which we compare our model-implied aggregate dynamics relative to an economy in which all firms are identical. That is, we consider an economy in which all prices are fixed, we shock such economy with a risk-premium shock, and we compare the outcomes of our baseline model with a representative-firm economy (i.e., an economy in which all firms are identical in terms of $\{k, b, z\}$). In this counterfactual, the only source of (ex-post) heterogeneity is the realization of the exit shock ϵ^d, which is iid. In both cases, the model calibration is the same as that of Table 2 and Table 3 in the main text.

The advantage of focusing on a partial-equilibrium setting is that we can better isolate the direct effect of a risk-premium shock absent any price adjustment. This is important because those general-equilibrium adjustments could be quite different in a representative firm economy, which makes it hard to assess the importance of firm heterogeneity in the transmission of a global risk-premium shock.

Figure B.1 presents the results. It shows that the aggregate contraction in capital is almost 40% *smaller* in our baseline model with heterogeneous firms. This is surprising, since the increase in risk premium is 50% *higher* in our baseline model. That is, the smaller aggregate contraction in capital in a model with firm heterogeneity is not driven by a milder aggregate response of risk premium. More generally, this simple exercise highlights (i) the importance of accounting for firm heterogeneity when analyzing the effects of changes in risk premia, and (ii) the difficulty in extrapolating firm-level responses to the aggregate economy.

Figure B.1: Implications of Firm Heterogeneity



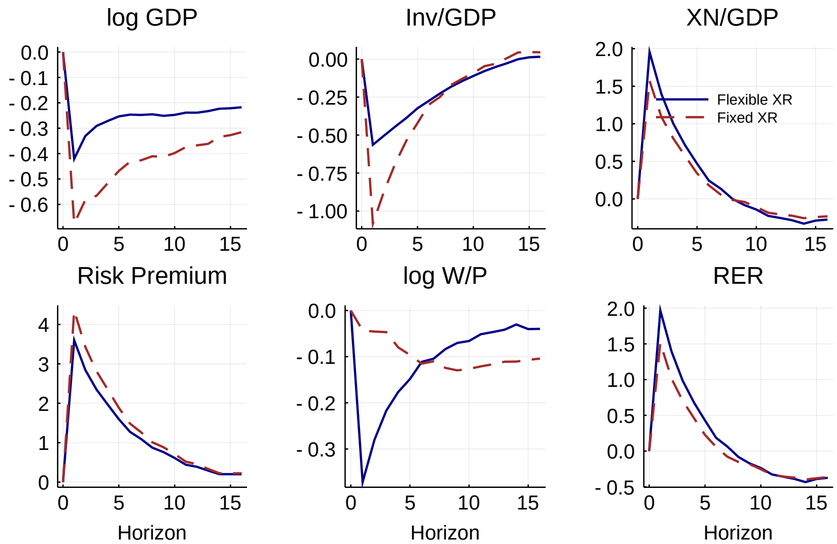
Note: Impulse responses to a risk-premium shock ($\Delta\kappa > 0$). The blue lines show the dynamics for aggregate capital and risk premia for our baseline model with firm heterogeneity. The red lines show the dynamics for an economy with a representative firm. The x-axes show the horizon h.

B.4. Countercyclical Fiscal Policy

In the main text, we compare a flexible exchange-rate regime with a currency peg under the assumption that the government does not use fiscal policy to dampen recessions. This assumption may be too strong since governments under a currency peg may rely more on their fiscal policy to offset negative shocks. In this appendix, we relax this assumption and consider a countercyclical fiscal rule in which the government adjusts G based on the unemployment rate. For this exercise, we consider the following spending rule: $G_t = \bar{G} + \phi_G \times u_t^r$, where $u_t^r \equiv 100 \times (l_t^s - l_t^d)/l_t^s$ denotes the unemployment rate. We set the cyclical component of public expenditures, ϕ_G, so that the volatility of private and public consumption under a fixed exchange-rate regime equals the observed volatility under the flexible case.

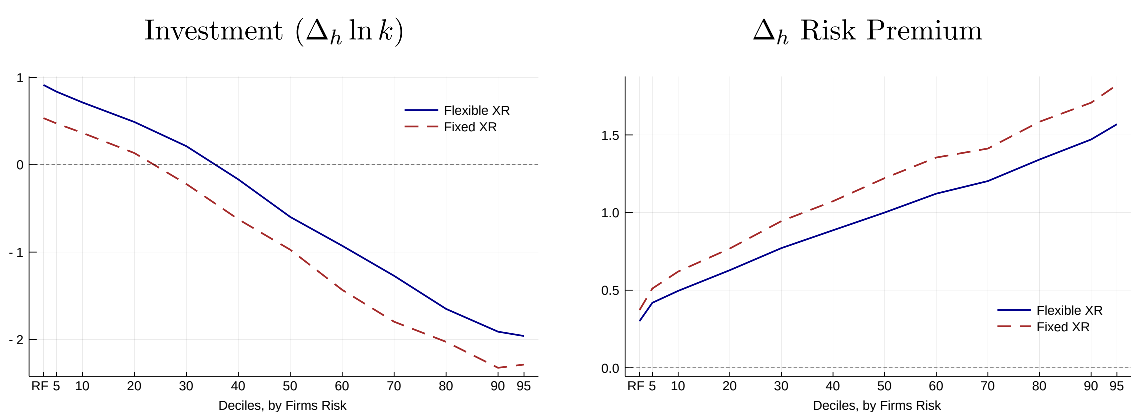
Figure B.2 compares the effects of changes in risk premia under a flexible and fixed exchange-rate regime once the fiscal rule is in place. The dynamics for output and investment under the flexible exchange-rate case are almost identical to those of our main analysis. This is because the targeted 5% devaluation upon a risk-premium shock is enough to relax the wage constraint in Equation (25) and to attain full employment. For the fixed exchange-rate regime, however, the fiscal policy significantly reduces the drop in output. This is because the larger G reduces the contraction in aggregate demand, which leads to a smaller contraction

Figure B.2: Aggregate Effects under a Fiscal Policy



Note: Impulse responses to a risk-premium shock ($\Delta\kappa > 0$). Solid blue lines show the economy's aggregate responses when the government follows a flexible exchange-rate regime. Dashed red lines show the same aggregate responses when the nominal exchange rate is fixed.

Figure B.3: Fiscal Policy: Heterogeneous Effects

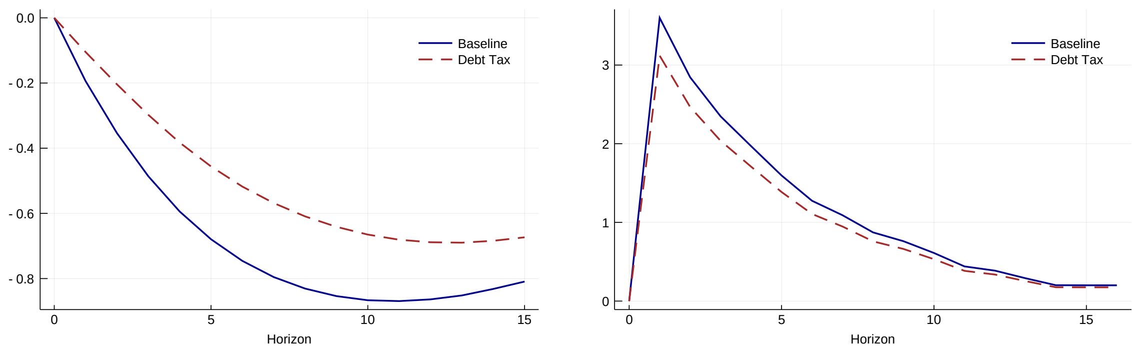


Note: Impulse responses to a risk-premium shock ($\Delta\kappa > 0$) by firm risk. Firms are sorted into deciles based on their pre-shock default probability. The left panel shows the change in firms' capital and the right panel the change in risk premium. Solid blue lines show the firms' responses when the government follows a flexible exchange-rate regime. Dashed red lines show the same responses when the nominal exchange rate is fixed.

in domestic prices, P_H, and to a drop in real wages (absent the fiscal policy, real wages increase —see Figure 9—). Importantly, the contraction in real wages is still larger under a flexible regime, which explains the lower contraction in output and investment. Figure B.3 shows that the heterogeneous effects described in the main text are preserved even after

Figure B.4: Tax on Debt Issuances

(a) $\Delta \ln$ Capital **(b)** Δ Risk Premium



Note: Impulse responses to a risk-premium shock ($\Delta\kappa > 0$). The blue lines show the dynamics for aggregate capital and risk premia for our baseline model. The red lines show the dynamics for an economy in which the government imposes a tax on debt issuances.

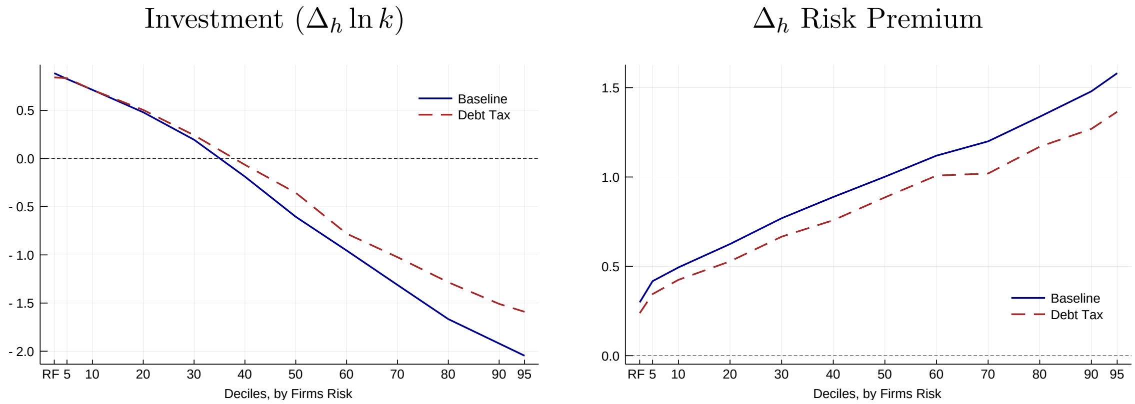
considering a countercyclical fiscal policy.

B.5. Tax on Debt as a Macro-prudential Tool

As we have described in the main text, changes in global risk premia are transmitted to the domestic economy through firms' exposure to foreign lenders. A lower exposure to such lenders should thus dampen the economy's contraction upon a risk premium shock. In this appendix, we analyze a simple tax on foreign debt as a potential macro-prudential policy that is targeted to reduce the economy's exposure to international capital markets. For simplicity, we assume that the government imposes a 2% tax rate on the proceeds from new issuances of foreign debt.

Figure B.4 shows the effects of a risk premium shock. It compares the aggregates dynamics for capital and risk premium between our baseline model and a counterfactual in which the tax on debt is in place. Overall, the tax reduces the increase in risk premium and dampens the contraction in aggregate capital. Figure B.5 shows that the dampened response is mostly coming from a smaller contraction in the investment of riskier firms. The response of risk-free firms is mostly unaffected.

Figure B.5: Tax on Debt Issuances: Heterogeneous Effects



Note: Impulse responses to a risk-premium shock ($\Delta\kappa > 0$) by firm risk. Firms are sorted into deciles based on their pre-shock default probability. The left panel shows the change in firms' capital and the right panel the change in risk premium. The blue lines show the results for our baseline model and the red lines show the results for an economy in which the government imposes a tax on debt issuances.

B.6. Local-denominated Debt

For our baseline model, we have assumed that firms' liabilities are denominated in foreign currency. In this appendix, we consider a case in which firms' debt is denominated in terms of the H-good. Since $\mathbb{R}_f(.)$ are now payments denominated in terms of the H-good, the bond price function in Equation (12) is replaced with:

$$q\left(k', b', z, \boldsymbol{S}\right) = \mathbb{E}_{(z', \boldsymbol{S'})|(z, \boldsymbol{S})} \left[\Lambda^{\star}_{F}(\boldsymbol{S}, \boldsymbol{S'}) \, \frac{\varepsilon\left(\boldsymbol{S}\right)}{\varepsilon\left(\boldsymbol{S'}\right)} \, \mathbb{R}_f\left(k', b', z', \boldsymbol{S'}\right) \right]. \tag{B.4}$$

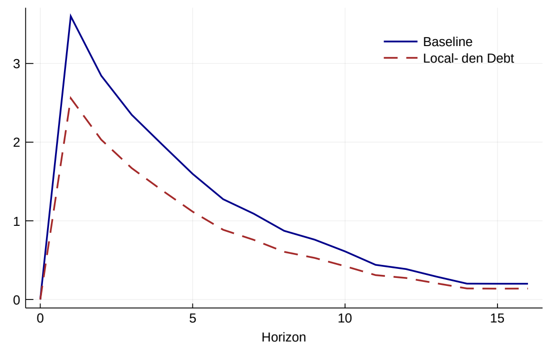
Firms' dividends in Equation (9) are now given by

$$d(1 - \mathcal{C}(d)) = (1 - \tau)\, \pi(k, z, \boldsymbol{S}) - I\left(k', k\right) + \Delta B(b', b, \boldsymbol{S}), \tag{B.5}$$

where $\Delta B\left(b', b, \boldsymbol{S}\right)$ is defined analogously to the expression in Equation (8). That is, $\Delta B\left(b', b, \boldsymbol{S}\right) = q(.)\left[b' - (1-m)b\right] - \left[(1-m)v + m\right] b - \Psi_b\left(b', b\right)$.

Unlike the dollar-denominated debt case, when debt is denominated in terms of the H-good, changes in the real exchange rate do not affect debt service payments, $\left[(1-m)v + m\right] b$. Firms are thus not subject to a negative balance-sheet type of channel. As shown in Figures

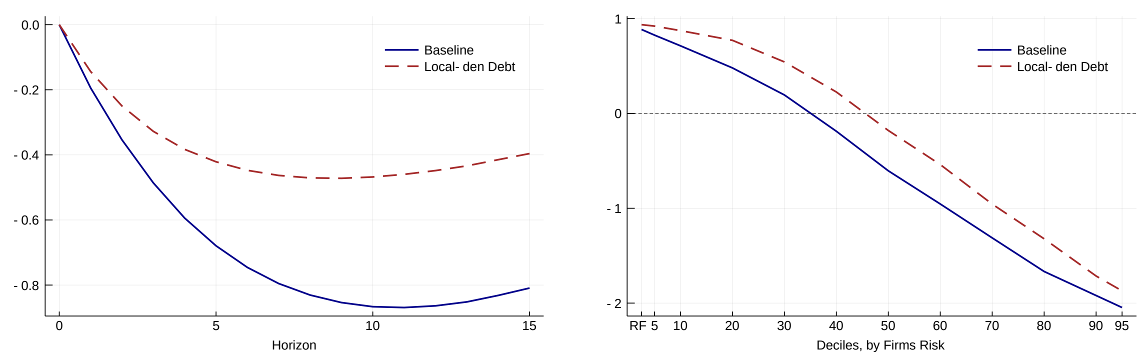
Figure B.6: Risk Premium under Local-denominated Debt



Note: The figure compares the dynamics of risk premium after a $\Delta\kappa > 0$ shock. The blue line depicts our baseline model, in which firms' debt is denominated in foreign currency. The red line shows a counterfactual in which debt is denominated in terms of the H-good.

Figure B.7: Local-denominated Debt: Aggregate and Heterogeneous Responses

(a) $\Delta \ln$ Capital, aggregate effect　　**(b)** $\Delta \ln$ Capital, by firm risk



Note: The figure compares the responses of firms' investment to a risk-premium shock ($\Delta\kappa > 0$). The blue lines show the effects in our baseline model, in which firms' debt is denominated in foreign currency. The red line shows a counterfactual in which debt is denominated in terms of the H-good. The left panel shows the aggregate effect. The right panel shows the heterogeneous effects, by firm risk (at a fixed horizon). RF denotes risk-free firm.

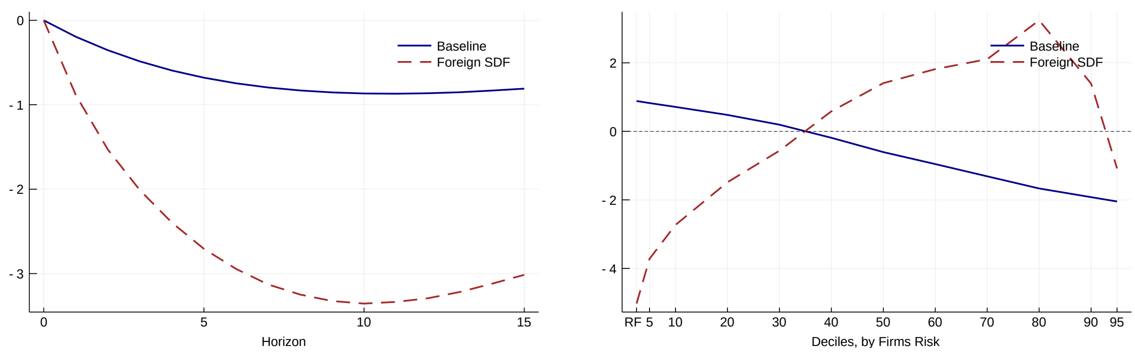
B.6 and B.7, this, in turn, implies a smaller increase in risk premium, for any given $\Delta\kappa > 0$ shock and a smaller contraction in aggregate capital. Importantly, the heterogeneous effects across firms with different levels of risk are still preserved.

B.7. Firms' Stochastic Discount Payoff

In the main text, we have assumed that firms' are owned by domestic households and they discount payoffs based on households' SDF. One could argue, however, that these firms are

Figure B.8: Foreign Lenders' SDF: Aggregate and Heterogeneous Responses

(a) $\Delta \ln$ Capital, aggregate effect **(b)** $\Delta \ln$ Capital, by firm risk



Note: The figure compares the responses of firms' investment to a risk-premium shock ($\Delta\kappa > 0$). The blue lines show the effects in our baseline model, in which firms' discount payoffs based on the households SDF. The red lines show a counterfactual in which firms discount payoffs based on the foreign lenders' SDF. The left panel shows the aggregate effect. The right panel shows the heterogeneous effects, by firm risk (at a fixed horizon). RF denotes risk-free firm.

traded in global equity markets and that the marginal investor is a foreign agent. In this appendix, we relax this assumption and we consider an economy in which firms discount their payoffs using the foreign lenders' SDF. Based on Equation (20) (which describes the lenders' SDF), the firms' SDF is now given by:

$$\Lambda_{(t,t+1)} = \beta^\star \times \exp\left(-\kappa_t\, \epsilon^A_{t+1} - \frac{1}{2}\kappa_t^2\, \sigma_A^2\right) \times \frac{\varepsilon_t}{\varepsilon_{t+1}}, \tag{B.6}$$

where $\frac{\varepsilon_t}{\varepsilon_{t+1}}$ captures the next-period change in the real exchange rate. In the baseline model, we assumed that household have a discount rate of β and we calibrated $\beta < \beta^\star$ in order to match the average leverage that we observe in the data. For this appendix, instead, we assume that household's discount rate is $\beta^\star$ (i.e., that of the lenders) but firms have an exogenous death rate of ϖ such that $\beta = \beta^\star \times \varpi$ (similarly to Cooley and Quadrini (2001)). This exogenous exit rate effectively reduces the firms' discount factor and allows us to match a similar average leverage without the need of recalibrating the model.[14]

Figure B.8 presents the results. When firms are priced by foreign lenders, their SDF decreases upon a risk-premium shock (i.e., they are more impatient) and they optimally

[14]The rest of the calibration for this economy is identical to that Table 2 and Table 3 in the main text.

choose to reduce their investment. The drop in aggregate capital, thus, is significantly larger compared to our baseline economy (Panel a). More importantly, the heterogeneous effects across firms with different levels of risk are flipped. If firms' are priced by risk-averse foreign lenders, we find that the subset of *safer* firms are the ones that reduce their investment the most (Panel b). This is the opposite to what we find in our empirical analysis and it can be interpreted as evidence suggesting that the marginal investors of these firms are domestic households.

B.8. Model with Private Firms

For our baseline quantitative analysis, we calibrated the parameters that govern firms' cross-sectional moments based on our sample of Compustat firms. Since these are large publicly traded firms, their responses to a risk-premium shock could be different to that of private firms. This is because private firms are typically smaller, have lower leverage, and face higher spreads. In addition, private firms exhibit a much lower cross-sectional dispersion in terms of their leverage, which may lead to different heterogeneous responses to a risk-premium shock to the one documented for public firms.[15] In this appendix, we show that private firms exhibit a similar (albeit smaller) reaction to changes in risk premia and, thus, our main results are robust to the inclusion of these firms.

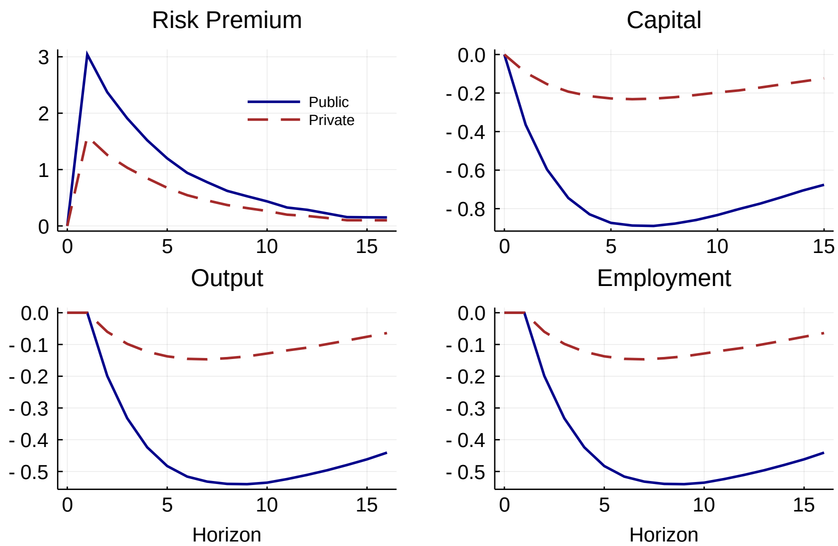
We first extend our model to capture two types of firms, $j = \{\text{Public}, \text{Private}\}$. To this end, we assume that the idiosyncratic productivity process of firm i is given by

$$\ln(z_{i,j,t+1}) = (1 - \rho_z)\ln(z_j^\star) + \rho_z \ln(z_{i,j,t}) + \sigma_z \epsilon^z_{i,j,t+1}, \tag{B.7}$$

where $z_j^\star$ captures permanent differences in productivity between private and public firms. We normalize $z^\star_{\text{Public}}$ to one and we calibrate $z^\star_{\text{Private}}$ so that the average size of a private firm is 10 times smaller to that of a public firm. We then calibrate private firms' exit option

[15] See for instance, Dinlersoz, Kalemli-Özcan, Hyatt and Penciakova (2018) and Kalemli-Özcan, Srensen, Villegas-Sanchez, Volosovych and Yesiltas (2023) for a comparison of Compustat and Orbis firms. Chodorow-Reich, Darmouni, Luck and Plosser (2022) analyze loan rates to US firms (based on the Y-14 dataset) and show that smaller firms face higher spreads, even after controlling for firms' fundamentals.

Figure B.9: Private vs Public Firms - Effects of a Risk-premium Shock



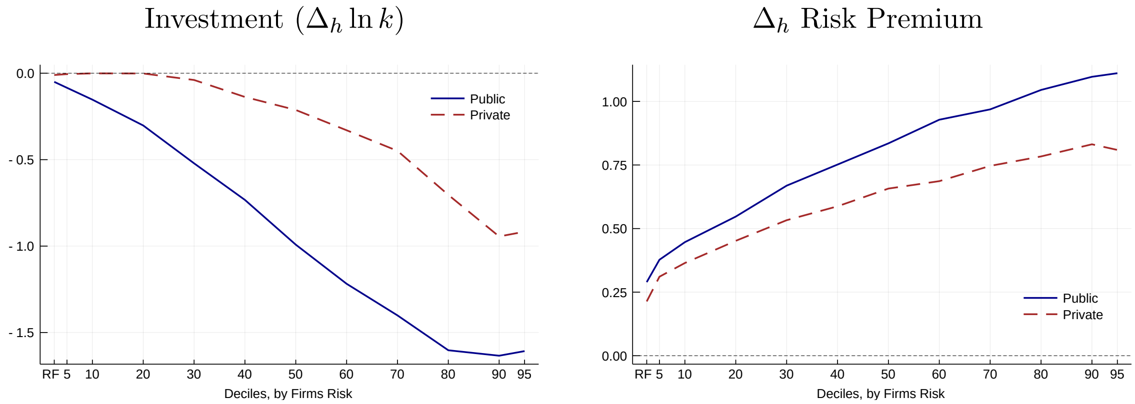
Note: Impulse responses to a risk-premium shock ($\Delta\kappa > 0$). Solid blue lines show the average response for public firms. Dashed red lines show the average responses for private firms.

to target a lower leverage and a higher spread. For this, we assume a more general exit option given by $\epsilon^d_{\text{Private}} \sim N(\mu^d_{\text{Private}}, \sigma^d_{\text{Private}})$ and we calibrate μ^d_{Private} and $\sigma^d_{\text{Private}}$ to match a leverage that is 20% smaller than that of the average public firm and an unconditional spread that is about 100bps higher.[16] Lastly, we increase the debt adjustment costs, ψ_b, to capture a less dispersed cross-sectional distribution for private firms' leverage.

After introducing these private firms into the model, we analyze the effects of a risk-premium shock for each type of firm. We do this in partial equilibrium (i.e., keeping all prices fixed) to better isolate the direct effect of risk premia on firms' investment. We find that, on average, private firms also contract their investment in response to a risk-premium shock. We find that their contraction is smaller than that of public firms (about a third). This, in turn, leads to a smaller contraction in their output and employment levels (as shown in Figure B.9). The heterogeneous effects across firms are nevertheless preserved: Riskier private firms decrease more their investment than safer firms (Figure B.10). In fact, a subset

[16] An alternative is to fix $\mu^d_{\text{Private}} = 0$ (as we do for public firms) and re-calibrate the discount rate of private firms to match the desired leverage target. We prefer to add an extra degree of flexibility and not alter the discount rate of private firms as this may have implications on their optimal investment and profit over capital ratio.

Figure B.10: Private vs Public Firms: Heterogeneous Effects



Note: Impulse responses to a risk-premium shock ($\Delta\kappa > 0$) by firm risk. Firms are sorted into deciles based on their pre-shock default probability. The left panel shows the change in firms' capital and the right panel the change in risk premium. The blue lines show the results for public firms (our baseline) and the red lines show the results for a private firms.

of private firms are not responsive to changes in the global risk premium because they hold little or no debt. This result is line with those in Aruoba *et al.* (2022) who document that private firms with no debt are not responsive to changes in domestic monetary policy.