Crude Credit: The Political Economy of Global Finance and Natural Resource Wealth in Latin America*

Iasmin Goes† Stephen B. Kaplan‡

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Abstract

Over the last several decades, the political economy scholarship has debated the extent of the natural resource curse in developing countries. Conventional wisdom suggests that an abundance of natural resources, such as oil and natural gas, yields developmental stagnation. However, recent empirical studies have found mixed results, showing that natural resources can at times be a blessing, conditional on local economic development. We offer new insights into this debate by incorporating the role of financial investors in intensifying natural resource market volatility. We argue that financial investors rely on global commodity prices as cognitive short-cuts to evaluate the likelihood of sovereign debt repayment, leading to greater risk-acceptance and lower financing rates for national governments during global commodity upturns. Exploiting information asymmetries between financial investors and local commodity suppliers, however, sovereign governments often condition their debt issuance on local production cues rather than global commodity prices.

In an econometric test of 10 Latin American countries between 1996 and 2018, we show this divergent behavior of creditors and debtors. In a region known for its resource dependence, we find that financial investors use of commodity price heuristics can skew market sentiment and spark investor exuberance, while national governments are surprisingly more prudent, tending to limit their debt issuance when they have a higher production capacity. These findings have important implications for the study of globalization and development, demonstrating that financial markets – not sovereign governments – may lay the foundations of the resource curse by breeding over-optimism through easy credit.

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†Junior Research Fellow, Carlos III University of Madrid. Contact: igoesara@clio.uc3m.es

‡Associate Professor, George Washington University. Contact: sbkaplan@gwu.edu

1 Introduction

Do commodity price booms create greater debt capacity and expand the frontiers of state spending? Under what conditions might states instead be more reluctant to increase their debt obligations, despite financial market opportunities? The literature on resource curses and rentier states suggests that oil windfalls often breed state balance sheet expansions (Weyland 2009). In today's financially globalized world, might easy credit from global markets intensify these trends?

In 2017, Venezuelan opposition and National Assembly leader Julio Borges admonished global financial investors, particularly Goldman Sachs, for buying national bonds issued by Venezuela's state oil company, PdVSA. Borges fretted their decision to "aid and abet Venezuela's dictatorial regime"[1] by expanding President Maduro's access to financing, and hence, state capacity. Former Venezuelan Planning Minister Ricardo Hausmann even dubbed them "hunger bonds" for sustaining Maduro's regime, calling for sovereign bonds to be eliminated from JP Morgan's benchmark Emerging Market Bond Index (EMBI).

Next door to Venezuela, a new market entrant, Guyana, had the first of many sizable oil discoveries off its coast in May 2015. A mere five months later, Finance Minister Winston Jordan expressed interest in re-entering global bond markets.[2] Similar to elsewhere in the region during Latin America's *Lost Decade*, Guyana had defaulted on its external debt, which in 1982 had exceeded 214 percent of the country's GNP (Reinhart and Rogoff 2009). Except for a small bond placed in 1994, Guyana took a three-decade hiatus before returning to global capital markets in 2015. How will Guyana manage this new indebtedness? Will it follow a similar path to Venezuela, where financial volatility has arguably intensified the natural resource curse? Or, will it enter markets more circumspectly, opting for more sound debt management?

In this paper, we examine creditor-debtor relationships, exploring the conditions under which global financial markets are willing to provide easy credit to commodity-producing nations, and the extent to which national governments leverage this financial opportunity.

[1] "Goldman Sachs Criticized for Buying Venezuelan Bonds." *The Economist.* 1 June 2017.

[2] Lucien Chauvin. "Guyana Poised to Return to Bond Market After Two Decade Gap." *Global Capital.* 11 October 2015.

We develop a two-tier theoretical framework that analyzes credit supply and demand. From a supply-side perspective, we argue that market exuberance about commodity upturns reflects a combination of investor heuristics (Barberis and Thaler 2002; Ritter 2003) and market liquidity (Ballard-Rosa, Mosley and Wellhausen 2021; Mosley, Paniagua and Wibbels 2020). Basing their investment decisions on fleeting economic narratives (Shiller 2019, 2015; Akerlof and Shiller 2009), global capital investors tend to disproportionately weigh recent commodity price movements, trading on such popular media stories as "commodity super cycles."[3] Engaging in this type of herding behavior, known as projection bias in the behavioral economics literature (Loewenstein, O'Donoghue and Rabin 2003; Wilson 2011), can fuel periods of market optimism that lead to more affordable financing opportunities for governments from natural resource economies.

Despite the availability of such funding opportunities, we predict that resource producers do not borrow more when commodity prices are high because of information asymmetries (Stiglitz 2002). Compared to global investors, local governments base their debt management decisions on higher-quality private information. We thus expect national governments to issue more debt when they have lower economies of scale (i.e. less production capacity). In other words, national governments are more likely to finance enhanced resource production, rather than enhanced government spending. Surprisingly, they tend to be prudent resource managers, with the notable exceptions of Ecuador and Venezuela, where political priorities have at times infused their way into resource management.

To test these priors, we conduct a statistical test of ten Latin American countries between 1996 and 2018, employing data on natural resource wealth and sovereign debt. Latin America is an ideal region for this study, given its combination of historical resource dependence and deep capital market development. For example, Latin American governments have, on average, funded about two-fifths of their external financing (or more than 11 percent of their total GDP) in global capital markets, beginning with the Brady Plan during the early 1990s (Kaplan 2021; Kaplan and Thomsson 2017). Other resource-rich regions, such as Sub-Saharan Africa, have limited experience with sovereign bond issuance. Other than South Africa, which has regularly issued bonds since 1991, most nations (like Angola, Ghana, and

[3] A commodity super cycle is a prolonged period of high commodity prices.

Gabon) have not only entered bond markets recently (after 2006), but also tended to issue official rather than private market debt (Mecagni et al. 2018).

Our study contributes to a growing body of work that seeks to explain capital market behavior. This burgeoning scholarship has established that cross-national investment decisions are a function of electoral and political uncertainty (Kaplan 2013), public deficit size and inflation rate (Mosley 2000), incumbent ideology (Campello 2015; Mosley 2003), balanced budget rules (Kelemen et al. 2014), size and conditions of IMF loans (Chapman et al. 2017), central bank independence (Bodea and Hicks 2018), regime type (Ballard-Rosa 2020), and creditworthiness across similar sovereign asset classes (Brooks, Cunha and Mosley 2015).

We incorporate natural resource wealth into these financial studies to better understand the extent to which global markets might intensify the political resource curse, which predicts that natural resources lead to a deterioration in regime type or institutional quality (Ross 2015). To date, these studies have yielded mixed evidence about the direction of this effect, with some scholars surprisingly finding a positive (Dunning 2008; Haber and Menaldo 2011) rather than a negative (Andersen and Ross 2014) relationship between natural resources and governance, though the reputational and behavioral implications of resource wealth are understudied (with the notable exception of Collier 2017). We find that national governments might not exploit credit access to their political advantage, positing that many policymakers have incorporated governance lessons about the pitfalls of indebtedness from Latin America's *Lost Decade*.

In the following pages, we first develop our argument about how natural resources help developing countries gain cheap short-term financing from sovereign bond markets. In spite of this potential financing boom, we expect most national governments to manage their national debt prudently, issuing debt to enhance production rather than spending. We then craft an empirical strategy to assess how resource wealth affects both market expectations and sovereign debt issuance, finding support for our argument in the oil and gas sector in Latin America. Finally, we use these empirical results to derive more general implications and develop a road map for future research.

2 Theoretical Framework

Are global investors rational actors who efficiently incorporate information to maximize their economic returns, or do information asymmetries make them prone to mispricing risk, and sometimes making bad investments? The "efficient market hypothesis" states that financial markets incorporate all available information about future asset values because of high competition and low information costs among investors (Fama 1970). By contrast, the behavioral finance literature questions this assumption, finding that information asymmetries can sometimes plague financial markets and lead to unsustainable bubbles (Shiller 2019, 2015; Akerlof and Shiller 2009; Stiglitz 2002).

We build on this central tenet of the behavioral finance, which also shares rich connections with the historic observations of political economists, about the tendency of credit expansions to feed market manias (Kindleberger 1978). We expect that global investors do not have perfect information, often trading on economic narratives that risk intensifying financial volatility.

For example, between 2011 and 2013, the three major sovereign credit rating agencies (S&P, Moody's, and Fitch) raised Ecuador's credit rating based on the expectation that the global commodity price recovery would improve the country's oil production prospects. They also all flagged the importance of "access to loans from China to shore up government finances."[4] Such favorable financial narratives contributed to about a 40 percent improvement in Ecuador's sovereign risk premium over the same period, with the country's 10-year bond yield trading a mere 5 percentage points over comparable US Treasury bonds by the end of 2013. However, the national government had borrowed a lofty 7 percent of its GDP from China, leveraging more than 4 years' worth of Ecuador's oil supply to help fund its spending. Despite this concerning trend, global investor confidence in Ecuadorean sovereign assets only soured following the commodity downturn in late 2014, with the country's sovereign risk premium swiftly doubling to 10 percentage points over comparable US Treasury bonds in less than one month.

[4]Nathan Gill. "Ecuador Credit Rating Raised by Moody's on China, Finances." *Bloomberg.* 14 September 2012.

What explains the resilience of such financial market narratives that appear inconsistent with local economic and political developments? To what extent do national governments take advantage of such financial market opportunities? To answer these questions, we develop theoretical priors about the relationship between creditors and debtors in natural resource economies.

2.1 Examining Credit Supply

Drawing on the behavior finance literature, we develop the micro-foundations of creditor behavior from a supply-side perspective. In particular, we build on the notions of projection bias and economic narratives. Faced with limited time and certainty, international investors tend to make decisions using representative heuristics to help evaluate sovereign credit risk (Barberis and Thaler 2002; Ritter 2003). Assuming recent economic trends are representative of a longer history, we predict that investors engage in projection bias (Loewenstein, O'Donoghue and Rabin 2003; Wilson 2011) by placing more weight on a recent commodity boom than a past commodity bust. These positive feedback strategies (also known as herd behavior) can intensify short-term market trends despite their long-run tenability, fomenting bubbles in commodity-exporting countries.

What sustains such market movements, particularly when they do not reflect long-run economic fundamentals? A burgeoning scholarship on "economic narratives" suggests that popular ideas about economic life can move markets. Regardless of their validity, such memes as "housing prices never fall" or "tech stocks can only rise" can influence investment trends, intensifying market booms and busts. Likewise, we anticipate that that sovereign risk evaluations often follow the booms and busts of the commodity price cycle: investors tend to evaluate developing countries more favorably during periods of increased liquidity, when cheap credit makes them more tolerant of sovereign risk, and more open to economic narratives about favorable fluctuations in commodity markets. When oil, gas, or mineral prices are high, investors are indiscriminately more willing to finance governments from natural resource economies. However, these favorable yet crude credit assessments tend to be fleeting, and not reflective of long-term fundamentals.

In a world of capital market liquidity (Ballard-Rosa, Mosley and Wellhausen 2021; Mosley, Paniagua and Wibbels 2020), such economic narratives have helped investors rationalize their risk-acceptance. For example, in the early 1990s, US interest rates began a steady three-decade decline that catalyzed an international savings glut, characterized by a mismatch between high savings in developed and emerging Asia countries and insufficient domestic investment opportunities (Bernanke 2005). Flush with liquidity, global investors searching for higher returns became more willing to invest in sovereign assets from emerging market and developing economies.

Against this backdrop, oil windfalls can shift investors' perceptions of short-term credit worthiness. Employing commodity price heuristics, we expect global investors to make swift judgements in a time-sensitive sovereign debt management industry characterized by limited but available real-time data (Mosley 2000, 2003; Datz 2009; Nelson and Katzenstein 2011). We thus predict that a commodity price boom will be associated with an improvement in sovereign risk evaluations across the board, regardless of the size of the extractive sector or the recent discovery of reserves – in other words, regardless of how much the borrower in question stands to benefit from higher prices.[5]

Hypothesis 1 predicts that sovereign risk evaluations will follow the booms and busts of the commodity price cycle: investors tend to evaluate developing countries more favorably during periods of increased liquidity, when cheap credit makes them more tolerant of sovereign risk, and more open to economic narratives about favorable fluctuations in commodity markets (Shiller 2019).

Still, investor risk assessments tend not to account for microeconomic policy reforms (Mosley, Paniagua and Wibbels 2020). When it comes to country-specific microeconomic information about the natural resource sector, we have similar expectations: local – and often private – information about the extractive sector should not have a systematic effect on aggregate risk evaluations, as predicted by Hypothesis 2 below.

> **Hypothesis 1:** *Higher natural resource prices are associated with better sovereign risk evaluations.*

> **Hypothesis 2:** *The size of the natural resource sector is not associated with*

[5] In this sense, the commodity price bubble is comparable to other asset price bubbles, as it fosters similar behavior among investors (Manzano and Rigobon 2001: 26).

better sovereign risk evaluations.

2.2 Examining Credit Demand

Cyclical upturns in global commodity prices have produced an alluring narrative, based on the investment heuristic that higher commodity proceeds increase the likelihood that sovereign governments repay their debt. But such narratives can be inaccurate, as we observed in Venezuela following the 2008-09 global financial crisis. Much like Ecuador, rebounding oil prices were first associated with Venezuela's sovereign risk premium improving by about 40 percent from 2011 to 2013, before surging following the 2014 commodity downturn to reflect Venezuela's falling oil production. How does such commodity price and market volatility translate to debtor issuance? Are borrowers tempted to take advantage of the more affordable financing offered by market exuberance?

We hypothesize that there is a mismatch between the behavior of creditors (who make lending decisions based on short-term commodity price heuristics) and the behavior of borrowers (who have access to private information in the extractive sector). Most Latin American countries are price takers rather than price setters in global commodity markets, meaning they are unlikely to make borrowing decisions based solely on commodity prices that are beyond their control. Rather, we expect them to condition their borrowing decisions on local natural resource production. This is because the quality of information differs between private creditors and debtor governments. Compared to private actors that often base their lending decisions on "contaminated" information that seek to conceal economic rents (Ross 2012), national governments tend to leverage private information into their decision-making process. They have access to the production plans of state-owned enterprises, including the projected pace of resource extraction and the likelihood of new resource discoveries. Given this information asymmetry (Stiglitz 2002), we anticipate that creditors and debtors respond to the same price fluctuation with different intensities.

In other words, compared to our first hypothesis that expected high natural resource prices to translate into better sovereign risk evaluations (indicating an increase in creditors' willingness to lend), Hypothesis 3 anticipates that higher commodity prices alone will not be enough to substantially increase developing countries' willingness to borrow. Given that debt issuance might involve lofty banking fees and steeper-than-official interest rates (Tomz 2007), national governments often approach private lenders with caution. Some of the larger emerging market nations have also internalized the lessons of excessive debt issuance from the 1980's lost decade of development (Mecagni et al. 2018). For example, former Finance Minister Nelson Barbosa recently discussed how Brazil has learned about the costs of borrowing in dollar-denominated global capital markets, and changed its borrowing behavior: "It ended in debt in the 1980s. It ended in debt in the 1990s. But, we are not going to go down this road again" (Kaplan 2021: 274).

Given such historical lessons, we expect to observe variation in the willingness of resource producers to issue debt based on the size of their extractive sectors. In line with recent political economy research, we anticipate that national governments with larger extractive sectors should tend to issue less debt in primary capital markets than those with smaller extractive sectors (Brooks, Cunha and Mosley 2015; Campello 2015; Ballard-Rosa, Mosley and Wellhausen 2021), instead using revenues from commodity windfalls to cover their financing needs (Murillo, Oliveros and Vaishnav 2011; Kaplan 2013).

At the same time, commodity industries tend to have large economies of scale that need considerable upfront capital investments, particularly after new discoveries. For example, in the oil sector, time lags between discovery and production can last as long as 6 to 7 years (Arezki, Ramey and Sheng 2017). For countries with smaller extractive sectors, borrowing from global financial markets could help finance national government expenditures and meet latent spending demands before gaining revenue windfalls from new production. In contrast to our second hypothesis' claim that there is no meaningful relationship between extractive sector size and sovereign risk evaluations, we expect that sovereign borrowers are more likely to issue sovereign debt in greater amounts when they have smaller extractive sectors that need public investment to help reach economies of scale, as predicted by Hypothesis 4.

Hypothesis 3: *Natural resource prices are not associated with more frequent and more sizeable sovereign debt issuance.*

Hypothesis 4: *A smaller natural resource sector is associated with more frequent and more sizeable sovereign debt issuance.*

In sum, we predict that information asymmetries between global creditors and sovereign borrowers often lead to divergent behavior. In periods of high global liquidity, international investors lacking perfect information sometimes misprice risk because of their tendency to use cognitive shortcuts based on economic narratives, such as "commodity supercycles," that can prolong market upturns. Commodity booms can thus catalyze global capital inflows, creating a 'double-bonanza' in natural resource economies (Reinhart, Reinhart and Trebesch 2016). Market institutions appear as myopic as electoral institutions, with both global investors and domestic voters rewarding national governments for commodity upturns.[6] If anything, we anticipate that resource producers are surprisingly prudent. On average, they tend not to borrow more when commodity prices are high, instead adapting their short-run borrowing behavior to the output of the extractive sector. Thus, debt issuance by sovereign governments should be most likely when there is low productive capacity, rather than to facilitate broad-based spending.

3 Research Design

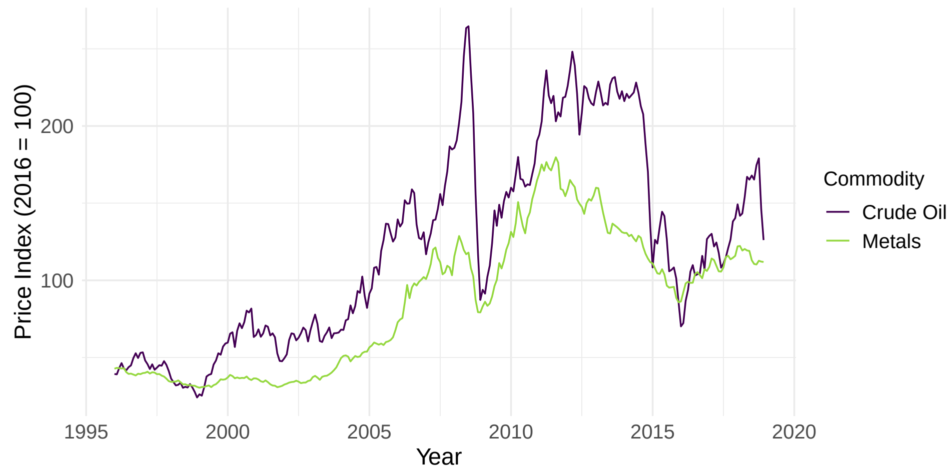
We examine how natural resources affect sovereign risk evaluations and sovereign debt issuance on a monthly basis, between January 1996 and December 2018, for ten net oil exporters in Latin America: Argentina, Bolivia, Brazil, Colombia, Ecuador, Guatemala, Mexico, Peru, Trinidad and Tobago, and Venezuela. Two recent oil producers, Guyana and Suriname, are excluded from the analysis due to limited data availability.

3.1 Independent Variables

To test our two supply-side hypotheses and two demand-side hypotheses, we use the same set of independent variables, which seek to capture different dimensions of natural resource wealth: first, the international price of natural resources; second, the present size of the domestic natural resource sector; and third, expectations about the future size of the domestic natural resource sector.

[6] Campello and Zucco (2021) argue that economic voting does not work in Latin America because voters often cannot separate exogenous shocks, such as commodity upturns, from incumbent competence.

Figure 1: Crude Oil and Metal Prices, 1996–2018



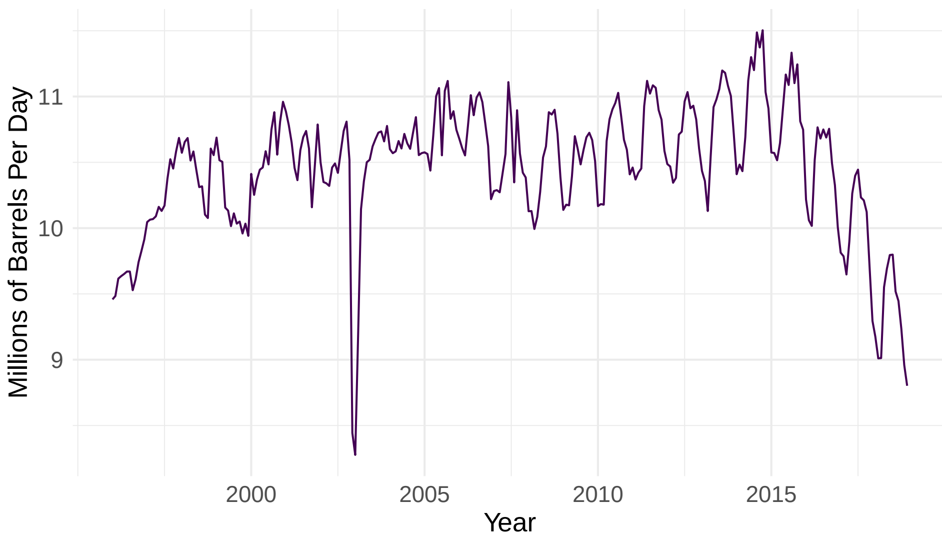
This figure showcases the monthly price index for crude oil and metals, both calculated using 2016 as the base year. Source: IMF Primary Commodity Prices Database.

To measure the effect of international prices, we use the crude oil price index and the metals price index, both calculated using 2016 as the base year and reported on a monthly basis by the IMF Primary Commodity Prices Database. The first index is a simple average of three crude oil spot prices (Dated Brent, West Texas Intermediate, and Dubai Fateh). The second index consists of international prices for base metals (aluminum, cobalt, copper, iron ore, lead, molybdenum, nickel, tin, uranium, and zinc) and precious metals (gold, silver, palladium, and platinum). These prices are correlated at 0.904 ($p < 0.001$), as Figure 1 confirms, which is why models only include one index at a time.

To quantify both the present and the future expected dimension of domestic natural resource wealth, we use two variables related to the oil and gas sector, which is the only sector for which production data are available on a monthly basis. *Oil and gas production* is the average daily output of crude oil, natural gas, and other liquids, in thousands of barrels, compiled by the US Energy Information Administration (EIA) and reported at the end of each month. Figure 2 shows the total production for all ten nations during each year. There is significant variation across countries: on an average day in 2018, Brazil produced 3.353 million barrels, while Guatemala only produced 12.6 thousand barrels. We use logged values to address this skewness, adding one barrel before logging when the value equals zero.

The second variable pertaining to the size of the extractive sector is *Field discovery*,

Figure 2: Total Production of Crude Oil, Natural Gas, and Other Liquids, 1996–2018



This figure showcases the daily production of crude oil, natural gas, and other liquids for all ten countries in the sample. While this figure reports production in millions of barrels, estimations use output data in thousands of barrels, logged. There is a considerable drop in production around December 2002, when employees of Venezuela's state-owned oil company PDVSA went on strike. The seasonal component after 2005 is a function of Brazil's biofuel production. Source: EIA.

which indicates the discovery of a giant, supergiant, or megagiant oil and gas field – that is, a field with over 500 million recoverable barrels of oil or over 3 trillion cubic feet of gas – between 1998 and 2018, as compiled by Horn (2014) and depicted in Figure 3.[7] *Field discovery* indicates the month and year in which discoveries are announced, not necessarily when they are made; governments typically know about a sizable discovery in advance and may even make the announcement themselves. For example, Mexican president Enrique Peña Nieto personally announced the discovery of oil field Ixachi in 2018.[8] Even if discovering an oil or gas field is arguably exogenous, states have access to private information. When incumbents know about a large discovery and know that a public announcement is forthcoming, they might adjust their expectations accordingly. This variable allows us to gauge how governments and financial markets alike respond to "new shocks about future output" (Arezki, Ramey and Sheng 2017: 121).

[7]We thank James Cust and Alexis Rivera Ballesteros from the World Bank for extending Horn's dataset until 2019. Since the resulting dataset only lists field discoveries on a yearly basis, we use LexisNexis to uncover the exact month the discovery is made public.

[8]"México Anuncia 'Importante' Hallazgo de Petróleo y Gas." *Agence France Presse.* 3 November 2017.

Figure 3: Location of Oil and Gas Fields Discovered in Latin America, 1996–2018

This figure indicates the location of 42 oil and gas fields discovered in Latin America between 1996 and 2018: 23 in Brazil, four in Bolivia, three in Mexico, two in Guyana, three in Venezuela, two in Trinidad and Tobago, and one each in Argentina, Colombia, and Peru. The two Guyanese fields are not included in the statistical analysis. Source: Horn (2014).

Oil and gas production captures beliefs about resource output today, whereas *Field discovery* captures beliefs about resource wealth tomorrow. Oil, gas, metals, and other non-renewable resources have a low price elasticity of supply (van der Ploeg and Poelhekke 2009): producers are not able to adjust the supply in response to a change in demand, so they cannot respond to price changes by increasing or decreasing production from one month to another. As a result, *Oil and gas production* is unlikely to change in response to changes in price, and the inverse is equally unlikely to occur (after all, Latin American nations are price takers and not price setters). This gives us confidence that resource prices and resource output will have separate effects on the dependent variables.

3.2 Control Variables

Both our supply-side models and our demand-side models control for several factors that might affect market expectations and borrowing decisions. To capture political uncertainty, we use the Database of Political Institutions (Cruz, Keefer and Scartascini 2021) to construct the count variable *Months since election*, which indicates the time elapsed since the last executive or legislative election, as well as the binary variable *Left executive*, which indicates the ideological orientation of the president. *IMF agreement* is a binary variable that measures whether or not the government in question was under an IMF program in a given month (using data from Kentikelenis, Stubbs and King 2016 complemented by the IMF MONA Database). To capture uncertainty in the domestic economy, *Inflation* is the monthly consumer price index calculated by CEPAL (in percent), whereas *GDP per capita* (in constant 2010 US dollars) and *GDP growth* (in percent) are yearly averages of national wealth and economic growth, both reported by the World Bank.

We further control for each country's degree of *Capital openness* (Chinn and Ito 2006) and the size of its *International reserves*, excluding gold, for every quarter, in billions of US dollars (using data from the Joint External Debt Hub). Finally, we control for monthly variation in the *US treasury rate* (specifically, the per annum yield of ten-year Treasury constant maturities, reported by the US Federal Reserve), since an increase in US rates should reflect tighter borrowing conditions at the global level. The economic variables *Inflation*, *International reserves*, and *US treasury rate* are lagged by one month, whereas *GDP per capita*, *GDP growth*, and *Capital openness* are only available on a yearly basis and correspondingly lagged by one year.

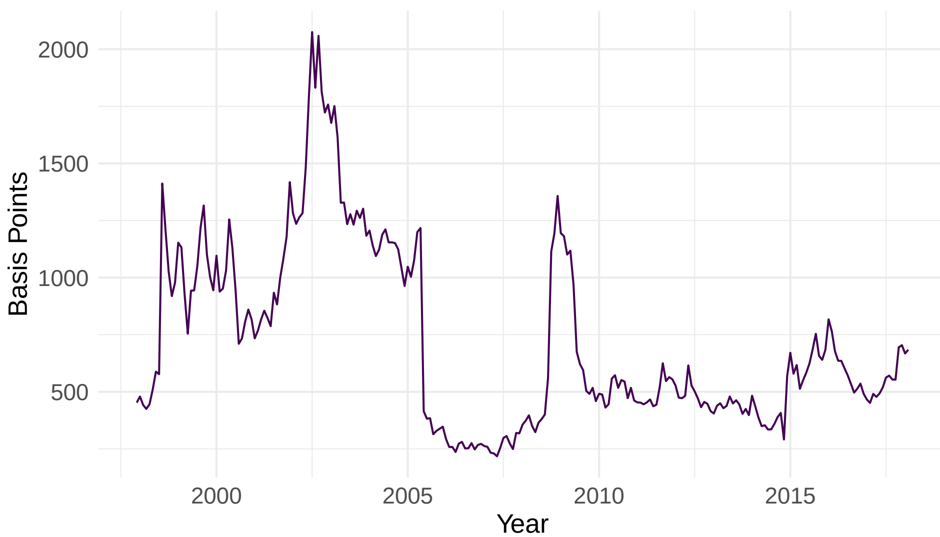
3.3 Dependent Variables and Empirical Strategies

3.3.1 Credit Supply

The dependent variable used to test Hypotheses 1 and 2 is JP Morgan's EMBI Global *Spread*, which represents the weighted average of 10-year yield spreads for US dollar denominated bonds with outstanding face value of at least $500 million over comparable US

Treasury bonds. This variable, which is available between 1998 and 2018, allows us to assess investors' expectations. Figure 4 shows the monthly average EMBI spread for all ten countries included in the analysis. Higher values indicate higher risk; under these circumstances, external borrowing is more expensive. JP Morgan does not calculate EMBI spreads for all countries throughout the entire period; spreads for Bolivia and Guatemala, for example, are only available after 2012. Despite these limitations, we choose this dependent variable because EMBI spreads serve as the benchmark to evaluate the performance of external debt instruments in emerging markets; they are an important reflection of investors' sovereign risk evaluations.

Figure 4: Average EMBI Global Spreads, 1998–2018



This figure shows the value of *Spread*, averaged across all ten countries included in the study. Source: JP Morgan.

We theorize that commodity pricing has reputational benefits for sovereign nations (as measured by decreases in the dependent variable *Spread*), but this effect may not be immediate. Even if commodity prices and sovereign risk are in a dynamic equilibrium and move together in the long run, they might deviate from this equilibrium and move in different ways in the short run (Box-Steffensmeier et al. 2014).[9] To capture both the short-run and the

[9]Indeed, augmented Dickey-Fuller tests show that *Spread* is non-stationary: its mean and variance vary over time, and the best predictor of today's value is yesterday's value. The same applies to the independent variables of interest. Furthermore, all dependent-independent variable pairs are cointegrated, confirming the existence of a joint long-run relationship.

long-run effects of resource wealth on sovereign spreads, we take a cue from Brooks, Cunha and Mosley (2015) and estimate error correction models, conditioning predicted changes in *Spread* not only to its own past levels, but also to past changes and levels of the key independent variables. Error correction models are the standard approach to deal with cointegrated time series, though they can also be used for stationary data (Boef and Keele 2008). Thus, following the specification of Keele, Linn and Webb (2016), we estimate Equation 1,

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \beta_0 \Delta X_t + \beta_1 X_{t-1} + Z_{t-1} + \mu_i + \varepsilon_t, \tag{1}$$

where α_1 is the error correction rate (that is, the rate at which Y changes to restore its long-run equilibrium with X, a value between −1 and 0); β_0 captures the short-term effect of changes in X on Y; $\frac{\beta_1}{\alpha_1}$ represents the long-run relationship between X and Y; Z is a set of control variables; and ε is the error term (Beck and Katz 2011). This estimation includes country and time (month-year) fixed effects.[10]

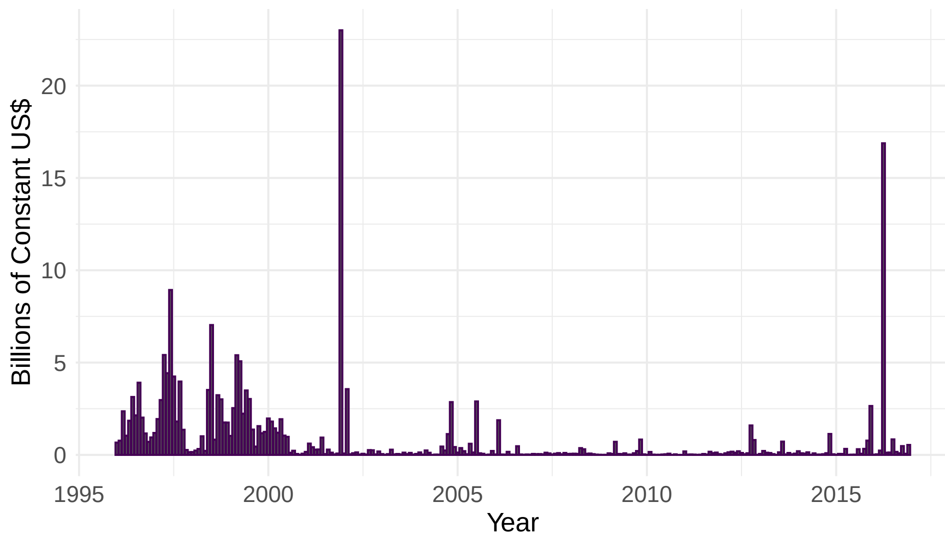
3.3.2 Credit Demand

To test Hypotheses 3 and 4, we use data collected by Ballard-Rosa, Mosley and Wellhausen (2021) on all untapped bonds with maturities greater than six months issued between 1996 and 2016. Like the authors, we use two dependent variables: *Bond issuance* indicates whether the government issued debt in primary capital markets each month, whereas *Amount issued* indicates how much debt was issued, in constant US dollars (logged), gathered from Bloomberg Terminals. We add one US dollar to country-months without issues before logging.

Figure 5 shows the total amount of debt issued by the ten countries of interest between 1996 and 2016. There is considerable variation not only in the *amount* of debt, but also in whether a country issues any debt in the first place. The average Latin American nation included in the analysis issued untapped bonds with maturities greater than six months in 81.6 of all 252 months. However, while Bolivia issued debt for 148 months between January 1998 and December 2018, Guatemala only did so for 11 of these 252 months, and Ecuador

[10]The parameter estimates of autoregressive models with fixed effects are biased by $\frac{1}{t}$ (Nickell 1981). However, the bias in our models is negligible because $t = 252$, as we are working with monthly data for 21 years, from 1998 until 2018.

Figure 5: Total Amount of Debt Issued, 1996–2016



This figure pools *Amount issued* for all countries in the sample, for every month between January 1996 and December 2016. While the figure reports *Amount issued* in billions of constant US dollars, estimations use the logged value of this variable, adding one dollar before logging when the value equals zero. Source: Ballard-Rosa, Mosley and Wellhausen (2021).

only did it once. Thus, *Amount issued* is left-censored: it takes the value of zero for a substantial number of observations. Our empirical strategy must account for this censoring, as parameters obtained with ordinary least squares would be biased. Like Ballard-Rosa, Mosley and Wellhausen (2021), we model bond issuance using a two-step strategy (Tobin 1958). First, a probit selection equation (Equation 2) models whether our outcome of interest is observed, that is, whether or not a country issues a bond in a given month, as captured by the latent variable y_i^*. If the outcome is observed, the second step (Equation 3) is to estimate an equation with the observed dependent variable y_i, which in our case is *Amount issued* (logged):

$$y_{it}^* = x_{it}'\beta + \epsilon_{it} \tag{2}$$

$$y_{it} = \begin{cases} 0 & \text{if } y_{it}^* \leq 0 \\ y_{it}^* & \text{if } y_{it}^* \geq 0 \end{cases} \tag{3}$$

This two-step process captures our expectation that both the decision to issue debt and – if applicable – the amount of debt issued are influenced by natural resources. As recommended by Carter and Signorino (2010), we model time using cubic polynomials to mitigate issues of quasi-complete separation. Models also include country-fixed effects to control for heterogeneity across units. For small values of t, probit or tobit models with fixed effects yield biased estimates, in what is called the incidental parameters problem (Greene 2004). Still, the long duration of of our time series ($t = 252$) minimizes this issue.

4 Results

4.1 Credit Supply: Do Natural Resources Affect Sovereign Risk Evaluations?

Table 1 reports the results of two error correction models assessing how natural resources impact borrowing conditions, as measured by sovereign bond spreads. The coefficient for the lagged dependent variable (-0.05) captures the error correction rate. The differences (Δ) represent short-term effects. In both models, the relationship between the dependent variable *Spread* and the corresponding price index is negative in the short run, as the coefficients for the differences show. All else equal, a one-point increase in the price index of crude oil (Model 1) is associated with a significant, 3.9-point short-term reduction in EMBI spreads across all of Latin America. Likewise, a one-point increase in the price index of metals (Model 2) is associated with a 5.6-point short-term reduction in the dependent variable.

These results, which corroborate Hypothesis 1, are intuitive. As oil prices increase and the world is aflush with petrodollars, EMBI spreads go down: sovereign risk evaluations improve across the board, and financial market actors become more risk acceptant. The same applies to the prices of metals like aluminum, cobalt, copper, gold, or silver. The impact of these short-run changes is substantial, as indicated by the coefficient for the lagged dependent variable: after one month, only 5 percent of the departure from the equilibrium (the "error") is corrected. In contrast, there is no consistent short-term relationship between sovereign risk evaluations and the domestic natural resource sector, as reflected by coefficients and significance levels for *Oil and gas production* Δ as well as *Field discovery* Δ.

In error correction models, long-term effects are computed by dividing the coefficient

Table 1: The Effect of Natural Resources on Sovereign Bond Spreads in Latin America, 1998–2018 (Error Correction Models)

	Dependent variable:	
	Spread $_{\Delta}$	
	(1)	(2)
Spread $_{t-1}$	-0.049^{***}	-0.050^{***}
	(0.012)	(0.012)
Oil price index $_{t-1}$	0.017	
	(0.091)	
Oil price index $_{\Delta}$	-3.944^{***}	
	(1.404)	
Metals price index $_{t-1}$		-0.075
		(0.160)
Metals price index $_{\Delta}$		-5.562^{**}
		(2.204)
Oil and gas production (log) $_{t-1}$	-27.786	-24.282
	(37.483)	(40.099)
Oil and gas production (log) $_{\Delta}$	-41.774	-51.888
	(51.596)	(46.149)
Field discovery $_{t-1}$	-42.974^{***}	-46.294^{***}
	(7.618)	(8.660)
Field discovery $_{\Delta}$	-16.661	-24.043^{*}
	(11.409)	(13.463)
Months since election $_{t}$	0.233	0.222
	(0.261)	(0.267)
Left executive $_{t}$	-40.081	-35.813
	(31.015)	(30.483)
IMF agreement $_{t}$	-9.693	-10.595
	(23.395)	(23.593)
Inflation $_{t-1}$	0.087^{***}	0.100^{***}
	(0.018)	(0.018)
GDP per capita $_{t-1}$	0.385	3.341
	(12.197)	(12.057)
GDP growth $_{t-1}$	-2.207^{**}	-2.577^{**}
	(1.049)	(1.084)
Capital openness $_{t-1}$	-4.137	-5.125
	(7.573)	(11.348)
International reserves $_{t-1}$	-0.438	2.879
	(1.855)	(1.957)
US Treasury rate $_{t-1}$	15.558^{***}	15.987^{***}
	(4.037)	(3.911)
Observations	1,617	1,617
R^2	0.058	0.039

This table presents the results of error correction models with country fixed effects, time fixed effects, and standard errors clustered by country.

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

for the lagged independent variables by the error correction rate. According to Table 1, for every discovery of a giant, supergiant, or megagiant oil and gas field, a government's basis spread declines by around 900 points in the long run (in Model 1, −42.974/0.049; in Model 2, 46.294/0.050). Put simply, discovering a field today provides quick information about a country's ability to repay its debt, reducing tomorrow's perception of sovereign risk. In contrast, oil prices, metals prices, or resource output have no significant long-term equilibrium relationship with EMBI spreads.

4.2 Credit Demand: Do Natural Resources Affect Debt Issuance?

In Table 2, Models 1 and 2 present the results of the first stage: two probit models investigating what makes Latin American governments issue debt in the first place, using the dependent variable *Bond issuance*. If a government decides to issue debt in a given month, Models 3 and 4 present the results of the second stage: two tobit models with *Amount issued* as the dependent variable.

When deciding whether or not to issue sovereign bonds, and how much to issue, Latin American governments do not appear to take international prices into account. Rather, they focus on the domestic economic output, as the coefficient for *Oil and gas production* indicates. All else equal, when a country produces around 10 thousand barrels of oil each month, as Guatemala did in 2010, the probability that it will issue debt is close to 100 percent, according to Models 1 and 2. In contrast, the average predicted probability of debt issuance for a country that produces over 3.5 million barrels of oil each month (like Brazil between 2017 and 2018, or Mexico between 2001 and 2007) is – all else equal – only 2 percent. This effect is robust to the inclusion of control variables, cubic polynomials, and country fixed effects.

Turning Models 3 and 4, we highlight that the dependent variable *Amount issued* is logged, as is the independent variable *Oil and gas production*. This means that the coefficient for *Oil and gas production* is an indicator of elasticity, that is, of the percentage change in the amount of debt issued in response to the percentage change in the oil and gas output. Correspondingly, an increase of one percent in oil and gas production is associated with an 11.5 percent decline in the amount of debt issued. Given that oil and gas production is

Table 2: The Effect of Natural Resources on Sovereign Bond Issuance, 1996–2016 (Probit and Tobit Models)

	Dependent variable:			
	Bond issuance (Yes = 1) $_{t-1}$		Amount issued (log) $_{t-1}$	
	Probit		*Tobit*	
	(1)	(2)	(3)	(4)
Oil price index $_{t-1}$	0.001		0.021	
	(0.001)		(0.018)	
Metals price index $_{t-1}$		0.003		0.064*
		(0.002)		(0.035)
Oil and gas production (log) $_{t-1}$	−0.770***	−0.763***	−11.596***	−11.469***
	(0.168)	(0.166)	(2.244)	(2.227)
Field discovery $_{t-1}$	−0.311	−0.307	−3.966	−3.862
	(0.248)	(0.249)	(3.747)	(3.755)
Months since election $_t$	0.006***	0.007***	0.097***	0.105***
	(0.002)	(0.002)	(0.031)	(0.031)
Left executive $_t$	0.683***	0.677***	9.644***	9.531***
	(0.153)	(0.154)	(1.989)	(1.995)
IMF agreement $_t$	−0.548***	−0.541***	−6.762***	−6.607***
	(0.102)	(0.102)	(1.351)	(1.348)
Inflation $_{t-1}$	−0.0003	−0.0003	−0.004	−0.003
	(0.0003)	(0.0003)	(0.005)	(0.005)
GDP per capita $_{t-1}$	0.081**	0.080**	1.205**	1.173**
	(0.033)	(0.033)	(0.484)	(0.484)
GDP growth $_{t-1}$	−0.029***	−0.029***	−0.355***	−0.348***
	(0.009)	(0.009)	(0.121)	(0.120)
Capital openness $_{t-1}$	0.358**	0.346**	4.784**	4.622**
	(0.171)	(0.169)	(2.321)	(2.312)
International reserves $_{t-1}$	−0.045	−0.043	−0.570	−0.563
	(0.037)	(0.037)	(0.554)	(0.552)
US Treasury rate $_{t-1}$	−0.069	−0.070	−1.034	−0.984
	(0.061)	(0.059)	(0.855)	(0.826)
Constant	5.059***	4.819***	75.483***	71.770***
	(1.497)	(1.497)	(20.204)	(20.237)
Observations	2,244	2,244	2,244	2,244
Log Likelihood	−1,048.018	−1,047.227	−3,520.597	−3,519.554

This table presents the results of two probit models and two tobit models, all with cubic polynomials, country fixed effects, and standard errors clustered by country. *p<0.1; **p<0.05; ***p<0.01

measured in thousands of barrels, this increase is in fact quite substantial.

Lastly, governments appear to respond to oil and gas field discoveries with far less enthusiasm than market actors, given that such discoveries do not have a significant effect on the decision to issue debt or the amount of debt that is issued. The remaining coefficients, effect sizes, and directions are similar to those obtained by Ballard-Rosa, Mosley and Wellhausen (2021), who also investigate the predictors of debt issuance and amount issued. This gives us further confidence in the results presented in Table 2. Overall, we find support for Hypotheses 3 and 4, identifying a significant association between the current size of the natural resource sector and the dependent variables *Bond issuance* and *Amount issued*.

4.3 Discussion

Our models provide compelling evidence that creditors charge a lower risk premium when they expect global liquidity to increase (that is, during commodity price booms or in the wake of a field discovery). Creditors are not always able to make nuanced, country-specific assessments about the extractive sector because they do not have perfect information about each country's short-term and medium-term production trends. Given the need to make quick real-time judgments, these individuals are likely to engage in projection bias, extrapolating from past returns to project future returns, expecting price trends to continue in the short run and responding to field discoveries almost instantly. This behavior, operationalized as a decline in EMBI spreads, reflects a bias towards exaggerating potential future revenues, particularly when it comes to oil (Collier 2017).

Admittedly, our analysis is restricted to the period between 1998 and 2018, which limits our ability to draw inferences about the past or future relationship between sovereign debt and commodity price booms in Latin America. But this finding aligns with anecdotal evidence from the oil price boom of the 1970s, when commercial banks awash with petrodollars lent to Latin American governments at generous rates. At the time, Argentina, Brazil, Mexico, and others borrowed large sums and later defaulted on their commitments, precipitating the Latin American debt crisis of the 1980s. Our supply-side findings suggest that the behavior of creditors has not changed from the 1970s until today: they still respond positively to "new shocks about future output" (Arezki, Ramey and Sheng 2017: 121), whether these shocks are commodity price increases or oil field discoveries.

Our demand-side results suggest that the behavior of debtors has changed, though. In the 1996–2018 period, price booms might have increased creditors' willingness to lend (as indicated by lower EMBI spreads), but did not significantly affect states' willingness to borrow (as indicated by the variables *Bond issuance* and *Amount issued*). The discovery of 42 giant, megagiant, and supergiant oil and gas fields did not significantly influence debtors' behavior, either. This is consistent with Mecagni et al.'s (2018) assertion that emerging markets internalized the lessons learned from past periods of excessive debt issuance. But it also reflects the uncertain and unpredictable nature of resource exploration; after all, geological features, technological innovations, or political events might delay a country's ability to explore fields and collect rents (Arezki, Ramey and Sheng 2017). As a result, oil-producing Latin American countries condition sovereign borrowing decisions each month mainly to oil and gas output in the previous month. These findings align with Campello (2015) and others, who show that resource-rich countries tend to issue debt less frequently and in smaller amounts, since their resource windfalls can be used to cover domestic expenditures. Table 2 suggests that there is variation even within resource-rich countries, which borrow more when output goes down and less when output goes up.

With the exception of Ecuador and Venezuela (which were already OPEC members by 1973), most Latin American governments did not produce large quantities of oil or natural gas until very recently. Today, incumbents can take into account information that was unavailable in the past, conditioning their borrowing behavior to domestic resource output, instead of merely responding to increases in global liquidity. Information asymmetries can explain why governments (which have private information about the state of their own economy) are more cautious in entering debt markets than investors.

5 Conclusion

This paper argues that natural resource wealth can improve sovereign risk perceptions. Given that investors can only collect and evaluate a limited amount of information, we predict that they will use natural resource prices as a heuristic to appraise the short-term credit worthiness of any potential borrower: in general, higher prices will be associated with an improvement in sovereign risk evaluations. Still, we expect natural resource wealth to affect credit supply and credit demand differently, as borrowers have access to private information about the size of the domestic resource sector and can better assess their own latent spending needs. We derive four testable hypotheses from our theory and test them using monthly data from 1996 to 2018 for ten Latin American countries. Our findings suggest that commodity price booms are associated with a substantial decrease in sovereign risk premiums, but no substantial change in the frequency or amount of debt issued by sovereign governments in capital markets. Instead, sovereigns condition borrowing decisions to characteristics of the domestic economy based on their access to private information.

Despite the focus on Latin America, our theoretical framework offers several future research opportunities because it has the potential to explain borrowing behavior across the developing world. As Gabon, Ghana, Nigeria, Senegal, Tanzania, Zambia, and other resource-rich countries in sub-Saharan Africa enter bond markets, it becomes increasingly important to understand how these two sources of public revenue – resource rents and sovereign debt – affect each other. To the extent that capital-scarce countries can choose between different sources of revenue, it is important to understand under what circumstances politicians choose one source over another, and what implications these choices can have for economic development in the long run.

In showing that financial market volatility may intensify the resource curse, our work also speaks to a large literature on the *conditionality* of such curse. Jones Luong and Weinthal (2006), Liou and Musgrave (2014), and several others suggest that the negative effects of oil, gas, and mining endowments are not absolute, but rather contingent on the quality of institutions. "Good" institutions are subject to government oversight, fostering transparent regulatory environments that are less susceptible to corruption and rent-seeking (Mahdavi 2020). Future research can examine the extent to which technocrats in financial institutions are able to protect the natural resource sector from market volatility (or vice-versa), reducing the risk that emerging markets borrow too much from overly exuberant creditors.

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Appendix

A Countries Included in the Analysis

Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Panama, Paraguay, Peru, Trinidad and Tobago, Uruguay, and Venezuela.

B Descriptive Statistics

Table B.1: Descriptive Statistics

Statistic	N	Mean	St. Dev.	Min	Max
Spread	1667	758.01	988.97	0.00	7078.00
CDS	364	337.98	561.45	28.44	4201.61
Central government debt	2460	38.17	20.72	8.00	152.00
Bond issuance	2376	0.32	0.47	0	1
Amount issued (log)	2376	5.15	7.87	0.00	23.86
Oil price index	2700	118.20	63.58	24.09	264.61
Metals price index	2700	85.42	44.20	30.42	179.73
Oil and gas production (log)	2670	6.06	1.75	2.16	8.36
Copper production (log)	1536	2.96	2.74	−3.96	6.64
Field discovery	2700	0.01	0.12	0	1
Months since election	2700	21.01	14.71	0	64
Left executive	2688	0.38	0.48	0	1
IMF agreement	2700	0.20	0.40	0	1
Inflation	2643	1312080.00	34376546.00	3.60	1268517191.00
GDP per capita	2640	7.72	4.21	1.49	17.06
GDP growth	2640	3.02	3.79	−10.89	18.29
Capital openness	2592	0.57	0.32	0.00	1.00
International reserves	2554	23.09	1.08	19.64	26.66
US Treasury rate	2691	3.96	1.55	1.50	7.78

C Robustness Checks

Tables C.1 and C.2 indicate that our results (both on the supply side and on the demand side) are robust to replacing the two monthly measures of oil and gas output – *Field discovery* and *Oil and gas production (log)* – with a yearly measure of *Copper production* (in thousands of tons, logged), using data from the British Geological Survey.

As Table C.3 shows, investors' increased risk acceptance in times of commodity price boom is not moderated by a country's natural resource output. This is indicated by the coefficients for the two interactions (*Oil price index* × *Oil and gas production* and *Metals price index* × *Copper production*), which are not significant in the short or in the long run. On the demand side, this interactive effect is statistically significant, but substantively small, as identified by Table C.4.

Table C.5 replicates the results presented in Table 1, but replacing the dependent variable *Spread* with *CDS*. Though CDS data are only available for five countries (Argentina, Brazil, Chile, Colombia, and Mexico) from 2004 to 2012, our results are robust to this alternative specification.

Table C.6 examines the effect of natural resources not on bond issuance, but on central government debt (all maturities, all instruments, nominal value, as a percentage of GDP), using data from the World Bank Quarterly Public Sector Database. Though this variable is only available for 12 countries on a quarterly basis from 2008 to 2018, we recover results that are consistent with those presented in Table 2: increases in domestic oil production are associated with increases in the size of the central debt, an association that is both substantively and statistically significant. Meanwhile, price increases are associated with a significant *decline* in the size of the public debt, though the effect size is very small. The implication, again, is that governments' borrowing decisions are influenced by the output of the domestic extractive sector more than by international prices of oil, metals, or natural gas.

According to Tables C.7, C.8, and C.9, our results remain statistically and substantively unchanged when we exclude Venezuela from the analysis. The same holds if we exclude Brazil or Mexico, the other two large producers in the sample.

Table C.1: The Effect of Natural Resources on Sovereign Bond Spreads, 1998–2018: Examining the Effect of Yearly Copper Production

	Dependent variable:		
	Spread $_{\Delta}$		
	(1)	(2)	(3)
Spread $_{t-1}$	-0.05^{***}	-0.05^{***}	-0.05^{***}
	(0.01)	(0.01)	(0.01)
Oil price index $_{t-1}$	0.15		
	(0.11)		
Oil price index $_{\Delta}$	-2.04^{***}		
	(0.43)		
Metals price index $_{t-1}$		0.27	
		(0.21)	
Metals price index $_{\Delta}$		-3.26^{***}	
		(1.06)	
Natural gas price index $_{t-1}$			0.09
			(0.10)
Natural gas price index $_{\Delta}$			−0.09
			(0.39)
Copper production (log) $_{t-1}$	10.51	10.46	10.93
	(8.08)	(8.13)	(8.15)
Copper production (log) $_{\Delta}$	−33.70	−29.90	−32.31
	(37.33)	(37.49)	(37.60)
Election year $_{t}$	−3.38	−2.71	−4.34
	(9.84)	(9.90)	(9.93)
Inflation $_{t-1}$	−0.80	−0.81	−0.85
	(0.66)	(0.66)	(0.66)
GDP per capita $_{t-1}$	−4.39	−4.96	−2.45
	(3.43)	(3.57)	(3.26)
GDP growth $_{t-1}$	-7.16^{***}	-7.03^{***}	-6.87^{***}
	(1.85)	(1.87)	(1.89)
International reserves $_{t-1}$	0.04	0.05	0.04
	(0.10)	(0.10)	(0.10)
IMF agreement $_{t-1}$	11.86	12.89	9.49
	(14.63)	(14.83)	(14.72)
US treasury rate $_{t-1}$	1.81	7.07	4.58
	(8.80)	(8.86)	(8.86)
Global GDP growth $_{t-1}$	7.80^{*}	6.43	7.68^{*}
	(4.26)	(4.26)	(4.31)
Time	0.14	0.22	0.20
	(0.27)	(0.28)	(0.27)
Observations	1,738	1,738	1,738
R^2	0.05	0.04	0.04

This table presents the results of error correction models with country-fixed effects. *p<0.1; **p<0.05; ***p<0.01

Table C.2: The Effect of Natural Resources on Sovereign Bond Issuance, 1998–2018: Examining the Effect of Yearly Copper Production

	Dependent variable:		
	Bond Issuance (Yes = 1) $_t$		
	(1)	(2)	(3)
Oil price index $_{t-1}$	0.004***		
	(0.001)		
Metals price index $_{t-1}$		0.005***	
		(0.002)	
Natural gas price index $_{t-1}$			0.004***
			(0.001)
Copper production (log) $_{t-1}$	0.001***	0.001***	0.001***
	(0.0002)	(0.0002)	(0.0002)
Election year $_t$	0.13	0.15*	0.13
	(0.09)	(0.09)	(0.09)
Inflation $_{t-1}$	−0.005	−0.01	−0.004
	(0.005)	(0.005)	(0.005)
GDP per capita $_{t-1}$	−0.18***	−0.18***	−0.17***
	(0.03)	(0.03)	(0.03)
GDP growth $_{t-1}$	0.09***	0.10***	0.08***
	(0.02)	(0.02)	(0.02)
International reserves $_{t-1}$	−0.003***	−0.003***	−0.003***
	(0.001)	(0.001)	(0.001)
IMF agreement $_{t-1}$	−0.36***	−0.31***	−0.40***
	(0.11)	(0.11)	(0.11)
US treasury rate $_{t-1}$	−0.08	−0.07	−0.06
	(0.07)	(0.07)	(0.07)
Global GDP growth $_{t-1}$	−0.04	−0.06*	−0.04
	(0.03)	(0.03)	(0.03)
Time	−0.001	0.0001	−0.0004
	(0.002)	(0.002)	(0.002)
Constant	3.88***	3.81***	3.52***
	(0.55)	(0.55)	(0.56)
Observations	2,154	2,154	2,154
Log Likelihood	−729.71	−733.26	−727.92

This table presents the results of probit models with cubic polynomials and country-fixed effects. *p<0.1; **p<0.05; ***p<0.01

Table C.3: The Effect of Natural Resources on Sovereign Bond Spreads, 1998–2018: Examining Conditional Effects

	Dependent variable:	
	Spread $_{\Delta}$	
	(1)	(2)
Spread $_{t-1}$	-0.05^{***}	-0.05^{***}
	(0.01)	(0.01)
Oil price index $_{t-1}$	0.14	
	(0.10)	
Oil price index $_{\Delta}$	-2.48^{***}	
	(0.31)	
Oil and gas production (log) $_{t-1}$	1.48	
	(7.82)	
Oil and gas production (log) $_{\Delta}$	8.71	
	(35.07)	
Oil price index × Oil and gas production (log) $_{t-1}$	−0.02	
	(0.02)	
Oil price index × Oil and gas production (log) $_{\Delta}$	−1.09	
	(3.48)	
Metals price index $_{t-1}$		0.36
		(0.28)
Metals price index $_{\Delta}$		-3.25^{***}
		(1.06)
Copper production (log) $_{t-1}$		12.73
		(9.67)
Copper production (log) $_{\Delta}$		−30.95
		(50.32)
Metals price index × Copper production (log) $_{t-1}$		−0.02
		(0.04)
Metals price index × Copper production (log) $_{\Delta}$		0.04
		(13.10)
Field discovery $_{t-1}$	−50.83	−35.93
	(49.50)	(55.37)
Field discovery $_{\Delta}$	−25.50	−13.37
	(34.98)	(39.07)
Election year $_{t}$	0.03	−2.83
	(7.19)	(9.91)
Inflation $_{t-1}$	0.30^{***}	−0.90
	(0.09)	(0.68)
GDP per capita $_{t-1}$	−1.60	−4.46
	(2.14)	(3.74)
GDP growth $_{t-1}$	-3.11^{***}	-7.01^{***}
	(1.14)	(1.88)
International reserves $_{t-1}$	0.05	0.05
	(0.09)	(0.10)
IMF agreement $_{t-1}$	−2.94	14.03
	(10.17)	(15.14)
US treasury rate $_{t-1}$	6.01	7.40
	(6.34)	(8.89)
Global GDP growth $_{t-1}$	1.05	6.24
	(2.94)	(4.28)
Time	−0.17	0.24
	(0.14)	(0.28)
Observations	3,150	1,738
R^2	0.05	0.04

This table presents the results of error correction models with country-fixed effects. *p<0.1; **p<0.05; ***p<0.01

Table C.4: The Effect of Natural Resources on Sovereign Bond Issuance, 1998–2018: Examining Conditional Effects

	Dependent variable:	
	Bond Issuance (1 = Yes) $_t$	
	(1)	(2)
Oil price index $_{t-1}$	0.005***	
	(0.001)	
Oil and gas production (log) $_{t-1}$	0.23***	
	(0.03)	
Oil price index × Oil and gas production (log) $_{t-1}$	−0.001***	
	(0.0001)	
Metals price index $_{t-1}$		0.01***
		(0.002)
Copper production (log) $_{t-1}$		0.001***
		(0.0004)
Metals price index × $_{t-1}$ Copper production (log)		−0.0000*
		(0.0000)
Field discovery $_{t-1}$	−0.001	
	(0.24)	
Election year $_t$	0.05	0.14*
	(0.05)	(0.09)
Inflation $_{t-1}$	−0.002***	−0.01
	(0.001)	(0.005)
GDP per capita $_{t-1}$	0.07***	−0.17***
	(0.01)	(0.03)
GDP growth $_{t-1}$	0.01	0.10***
	(0.01)	(0.02)
International reserves $_{t-1}$	−0.004***	−0.003***
	(0.001)	(0.001)
IMF agreement $_{t-1}$	−0.18***	−0.30***
	(0.06)	(0.11)
US treasury rate $_{t-1}$	−0.04	−0.07
	(0.04)	(0.07)
Global GDP growth $_{t-1}$	0.02	−0.06*
	(0.02)	(0.03)
Time	0.001	−0.0001
	(0.001)	(0.002)
Constant	0.33	3.70***
	(0.35)	(0.56)
Observations	5,850	2,154
Log Likelihood	−2,271.56	−731.78

This table presents the results of probit models with cubic polynomials and country-fixed effects. *p<0.1; **p<0.05; ***p<0.01

Table C.5: The Effect of Natural Resources on Credit Default Swap Prices, 2004–2012

	Dependent variable:		
	CDS $_{\Delta}$		
	(1)	(2)	(3)
CDS $_{t-1}$	-0.13^{***}	-0.13^{***}	-0.12^{***}
	(0.02)	(0.03)	(0.02)
Oil price index $_{t-1}$	0.17		
	(0.30)		
Oil price index $_{\Delta}$	-3.32^{***}		
	(0.64)		
Metals price index $_{t-1}$		−1.23	
		(0.86)	
Metals price index $_{\Delta}$		-5.28^{***}	
		(1.50)	
Natural gas price index $_{t-1}$			0.66^{***}
			(0.24)
Natural gas price index $_{\Delta}$			−0.03
			(0.58)
Oil and gas production $_{t-1}$	−20.59	−10.76	25.92
	(55.74)	(56.90)	(57.27)
Oil and gas production (log) $_{\Delta}$	−3.97	17.90	16.86
	(124.01)	(126.24)	(126.95)
Field discovery $_{t-1}$	25.41	22.20	−3.70
	(78.70)	(78.84)	(81.46)
Field discovery $_{\Delta}$	19.19	7.56	−5.67
	(53.14)	(53.54)	(54.59)
Election year $_{t}$	−17.96	−25.14	−19.16
	(18.97)	(18.97)	(19.48)
Inflation $_{t-1}$	−3.68	−3.30	−2.59
	(5.57)	(5.73)	(5.72)
GDP per capita $_{t-1}$	6.46	5.66	−0.02
	(8.60)	(8.74)	(8.86)
GDP growth $_{t-1}$	−5.39	−5.70	−6.86
	(5.51)	(5.59)	(5.65)
International reserves $_{t-1}$	0.04	0.13	0.11
	(0.17)	(0.18)	(0.18)
IMF agreement $_{t-1}$	−34.19	−25.30	−13.07
	(34.75)	(35.41)	(36.02)
US treasury rate $_{t-1}$	−16.49	10.95	2.11
	(18.78)	(21.17)	(19.05)
Global GDP growth $_{t-1}$	1.47	7.24	4.39
	(9.02)	(9.72)	(9.18)
Time	−0.17	2.34	0.78
	(1.78)	(2.39)	(1.86)
Observations	452	452	452
R^2	0.13	0.09	0.08

This table presents the results of error correction models with country-fixed effects. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table C.6: The Effect of Natural Resources on the Size of the Central Government Debt, 2008–2018

	Dependent variable:		
	Central Government Debt $_t$		
	(1)	(2)	(3)
Oil price index $_{t-1}$	−0.01***		
	(0.002)		
Metals price index $_{t-1}$		−0.02***	
		(0.01)	
Natural gas price index $_{t-1}$			−0.02***
			(0.003)
Oil and gas production (log) $_{t-1}$	2.00***	1.97***	2.03***
	(0.69)	(0.70)	(0.69)
Field discovery $_{t-1}$	0.54	0.58	0.60
	(1.20)	(1.22)	(1.20)
Election year $_t$	0.46**	0.39*	0.50**
	(0.22)	(0.22)	(0.22)
Inflation $_{t-1}$	0.25***	0.25***	0.25***
	(0.01)	(0.01)	(0.01)
GDP per capita $_{t-1}$	−0.77***	−0.95***	−0.76***
	(0.14)	(0.13)	(0.14)
GDP growth $_{t-1}$	0.23***	0.26***	0.20***
	(0.06)	(0.06)	(0.06)
International reserves $_{t-1}$	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)
IMF agreement $_{t-1}$	−0.44	−0.16	−0.66
	(0.43)	(0.43)	(0.43)
US treasury rate $_{t-1}$	0.73***	0.64***	0.62***
	(0.18)	(0.18)	(0.18)
Global GDP growth $_{t-1}$	−0.10	−0.09	−0.10
	(0.11)	(0.12)	(0.11)
Time	0.02**	0.02***	0.01*
	(0.01)	(0.01)	(0.01)
Observations	1,242	1,242	1,242
R^2	0.62	0.61	0.62

This table presents the results of linear models with country-fixed effects. *p<0.1; **p<0.05; ***p<0.01

Table C.7: The Effect of Natural Resources on Sovereign Bond Spreads, 1998–2018: Excluding Venezuela

	Dependent variable:		
	Spread $_{\Delta}$		
	(1)	(2)	(3)
Spread $_{t-1}$	-0.05^{***}	-0.05^{***}	-0.05^{***}
	(0.01)	(0.01)	(0.01)
Oil price index $_{t-1}$	0.07		
	(0.08)		
Oil price index, $_{\Delta}$	-2.24^{***}		
	(0.31)		
Metals price index $_{t-1}$		0.03	
		(0.14)	
Metals price index $_{\Delta}$		-3.83^{***}	
		(0.77)	
Natural gas price index $_{t-1}$			0.07
			(0.07)
Natural gas price index $_{\Delta}$			0.02
			(0.28)
Oil and gas production (log) $_{t-1}$	−0.54	0.14	−0.47
	(7.19)	(7.23)	(7.25)
Oil and gas production $_{\Delta}$	11.72	11.80	10.75
	(30.34)	(30.50)	(30.63)
Field discovery $_{t-1}$	−42.86	−43.47	−43.22
	(50.81)	(51.08)	(51.32)
Field discovery $_{\Delta}$	−15.44	−19.14	−18.56
	(35.93)	(36.12)	(36.27)
Election year $_{t}$	0.77	1.45	0.41
	(7.28)	(7.32)	(7.36)
Inflation $_{t-1}$	−0.44	−0.47	−0.38
	(0.32)	(0.32)	(0.32)
GDP per capita $_{t-1}$	−1.11	−0.92	−0.11
	(2.16)	(2.20)	(2.12)
GDP growth $_{t-1}$	-4.45^{***}	-4.04^{***}	-4.46^{***}
	(1.32)	(1.32)	(1.37)
International reserves $_{t-1}$	0.03	0.05	0.04
	(0.09)	(0.09)	(0.09)
IMF agreement $_{t-1}$	1.11	−0.07	−0.81
	(10.07)	(10.12)	(10.16)
US treasury rate $_{t-1}$	5.26	10.61	8.21
	(6.40)	(6.45)	(6.45)
Global GDP growth $_{t-1}$	2.92	1.59	2.78
	(3.02)	(3.03)	(3.07)
Time	0.05	0.17	0.08
	(0.17)	(0.18)	(0.17)
Observations	2,945	2,945	2,945
R^2	0.05	0.04	0.03

This table presents the results of error correction models with country-fixed effects. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table C.8: The Effect of Natural Resources on Sovereign Bond Issuance, 1998–2018: Excluding Venezuela

	Dependent variable:		
	Bond Issuance (1 = Yes) $_t$		
	(1)	(2)	(3)
Oil price index $_{t-1}$	0.001***		
	(0.001)		
Metals price index $_{t-1}$		0.001	
		(0.001)	
Natural gas price index $_{t-1}$			0.002***
			(0.0004)
Oil and gas production (log) $_{t-1}$	0.06**	0.05**	0.06**
	(0.03)	(0.03)	(0.03)
Field discovery $_{t-1}$	−0.08	−0.07	−0.09
	(0.25)	(0.25)	(0.25)
Election year $_t$	0.04	0.04	0.04
	(0.05)	(0.05)	(0.05)
Inflation $_{t-1}$	−0.01***	−0.01***	−0.01***
	(0.001)	(0.001)	(0.001)
GDP per capita $_{t-1}$	0.02	0.02	0.02
	(0.01)	(0.01)	(0.01)
GDP growth $_{t-1}$	0.01	0.02**	0.01
	(0.01)	(0.01)	(0.01)
International reserves $_{t-1}$	−0.005***	−0.005***	−0.005***
	(0.001)	(0.001)	(0.001)
IMF agreement $_{t-1}$	−0.04	−0.03	−0.05
	(0.06)	(0.06)	(0.06)
US treasury rate $_{t-1}$	−0.02	−0.02	−0.01
	(0.04)	(0.04)	(0.04)
Global GDP growth $_{t-1}$	0.01	0.01	0.02
	(0.02)	(0.02)	(0.02)
Time	0.004***	0.005***	0.005***
	(0.001)	(0.001)	(0.001)
Constant	0.94***	0.96***	0.75**
	(0.34)	(0.34)	(0.35)
Observations	5,621	5,621	5,621
Log Likelihood	−2,255.61	−2,258.80	−2,250.96

This table presents the results of probit models with cubic polynomials and country-fixed effects. *p<0.1; **p<0.05; ***p<0.01

Table C.9: The Effect of Natural Resources on Amount of Sovereign Bond Issuance, 1998–2018: Excluding Venezuela

	Dependent variable:		
	Amount Issued (log) $_t$		
	(1)	(2)	(3)
Oil price index $_{t-1}$	0.01***		
	(0.004)		
Metals price index $_{t-1}$		0.01*	
		(0.01)	
Natural gas price index $_{t-1}$			0.02***
			(0.003)
Oil and gas production (log) $_{t-1}$	0.74***	0.71***	0.81***
	(0.22)	(0.23)	(0.23)
Field discovery $_{t-1}$	−0.41	−0.34	−0.44
	(1.99)	(1.99)	(1.98)
Election year $_t$	0.18	0.18	0.18
	(0.37)	(0.37)	(0.37)
Inflation $_{t-1}$	−0.05***	−0.06***	−0.05***
	(0.01)	(0.01)	(0.01)
GDP per capita $_{t-1}$	0.005	0.03	0.03
	(0.09)	(0.10)	(0.09)
GDP growth $_{t-1}$	0.07	0.10	0.03
	(0.06)	(0.06)	(0.06)
International reserves $_{t-1}$	−0.05***	−0.05***	−0.05***
	(0.01)	(0.01)	(0.01)
IMF agreement $_{t-1}$	−0.29	−0.22	−0.38
	(0.45)	(0.45)	(0.45)
US treasury rate $_{t-1}$	−0.15	−0.14	−0.06
	(0.29)	(0.29)	(0.29)
Global GDP growth $_{t-1}$	0.12	0.09	0.13
	(0.15)	(0.15)	(0.15)
Time	0.04***	0.04***	0.04***
	(0.01)	(0.01)	(0.01)
log σ	2.38***	2.38***	2.38***
	(0.01)	(0.01)	(0.01)
Constant	11.44***	11.64***	9.47***
	(2.51)	(2.51)	(2.55)
Observations	5,621	5,621	5,621
Log Likelihood	−13,698.91	−13,703.35	−13,692.31

This table presents the results of tobit models with cubic polynomials and country-fixed effects. *p<0.1; **p<0.05; ***p<0.01