Domestic vs. Foreign Law: Portfolio Dynamics of Sovereign Debt*

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Abstract

Emerging-market governments borrow both under their own law and under foreign law. If the government defaults, the governing law determines whether domestic or foreign courts settle disputes, and so how much investors recover. For twelve governments, we document that all borrow under both laws, that each issues its foreign-law debt at longer duration, and that issuing under foreign law costs a fee proportional to the money raised and independent of maturity. We show that the yield gap between a government's bonds under the two laws widens with the probability of default. We build a quantitative model of sovereign default in which the government cannot commit to repay or to limit its future borrowing. Through the lens of the model, the widening gap implies that investors expect to recover more on foreign-law debt. The government still borrows under domestic law because shorter debt is less exposed to dilution. The fee keeps it from issuing shorter foreign-law debt, which would recover more and be less exposed to dilution. Calibrated to Colombia, the model implies recoveries of 47 percent under foreign law and 40 percent under domestic law. Removing the fee raises welfare by 12 percent of the gain the model generates when aggregate risk and default costs are eliminated, mostly through changes in how the government borrows and defaults.

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1 Introduction

When a government defaults, its creditors cannot seize assets within its borders, and what they can seize abroad falls short of what they are owed. What they recover is instead negotiated with the government, which remains excluded from financial markets until the two sides settle. The bonds' terms set the rules of that negotiation. For example, they may set the majority of bondholders that must accept a deal for it to bind all of them. Whether the government can change those terms depends on the law under which they are written. For bonds under domestic law, the government can change the terms by passing a law, even after the bonds have been sold. Domestic courts then apply the new terms. For bonds under foreign law, the government cannot change the terms. Foreign courts apply them as written at issuance. During the European debt crisis, Greece used this difference to gain an advantage in the negotiation with its creditors. In 2012 it passed a law that changed the terms of its Greek-law bonds. It could not change those of its foreign-law bonds, and their holders recovered more on average (Zettelmeyer et al., 2013).

This paper studies how governments borrow under domestic and foreign law, empirically and quantitatively. We ask why governments borrow under both laws, and why they borrow longer under foreign law. To answer these questions, we need to know how much investors expect to recover under each law after a default. Estimates from past restructurings vary widely across countries and episodes (Cruces and Trebesch, 2013), and say little about what investors expect from a government that has not defaulted recently. We therefore develop a methodology that infers the expected recovery under each law from a country's own bond prices and how much it borrows under each, before any default occurs. For Colombia, we find that investors expect to recover 40 percent of the face value of their bonds under domestic law and 47 percent under foreign law. We then explain why Colombia borrows under both laws and why it borrows longer under foreign law. A fee on foreign-law issuance keeps it from borrowing short under foreign law. Last, we measure what it would gain without the fee.

We first document how emerging-market governments use the two laws. We build a new dataset that combines debt-office records with Dealogic data on every bond that twelve governments issued between 2006 and 2024. We study their marketable debt, which consists of the bonds that any private investor can buy and later resell. We also use daily bond prices from Bloomberg, official sources and Capital IQ Pro. Four facts emerge. First, all twelve governments issue under both laws. Across countries, the median share of marketable debt under foreign law is 24 percent. Second, foreign-law debt is issued

at longer duration in every country. The median difference is 4.8 years. Third, issuing under foreign law costs a fee proportional to the money raised, whatever the maturity of the bond. The median government pays a fee of 14 basis points. Fourth, we provide new evidence from four emerging markets that the yield investors demand on domestic-law bonds rises relative to foreign-law bonds as default becomes more likely. The gap widens by 7 to 69 basis points for every 100-basis-point increase in the government's credit default swap (CDS) spread.

We then develop a quantitative model of sovereign default in which a government that lacks commitment chooses how much to borrow under each law (Arellano, 2008; Chatterjee and Eyigungor, 2012). Debt under each law has its own recovery and its own duration. In the model calibrated to Colombia, with durations of 3.75 years under domestic law and 8.71 years under foreign law, two moments pin down the two recoveries. The slope of the yield gap pins down the difference between them, and the share of debt under foreign law pins down their level.

The model explains why a government that lacks commitment issues under both laws. The government can commit neither to repay nor to a path of future borrowing. On the one hand, foreign-law debt recovers more, which protects investors against default. On the other hand, domestic-law debt is shorter, which protects them against dilution. New borrowing lowers the value of debt that is still outstanding. Long debt stays exposed to it for longer (Hatchondo et al., 2016; Aguiar et al., 2019). Each law addresses one of the two commitment problems, so the government uses both. With equal durations, it issues only the high-recovery bond. With equal recoveries at the observed durations, it issues only the shorter bond.

Next, we ask why governments do not issue short foreign-law bonds, which would combine the higher recovery of foreign law with protection against dilution. Foreign-law bonds are placed through bank syndicates for a fee, while domestic-law bonds are auctioned for free in six of the ten countries where we observe the cost and for at most 1.5 basis points in the other four (Section 2.4). We show that the fee is a tax on rolling over debt, so it weighs most on short bonds (Section 6.1). With only one-period bonds, a fee the size of the one we measure leaves most of the government's debt under foreign law. With a long foreign-law bond available, the same fee keeps the government from issuing short foreign-law debt, because it can offer investors the recovery of foreign law through the long bond, on which it pays the fee less often (Section 6.2). In the model calibrated to Colombia, a fee of 25 basis points cuts short foreign-law debt from 36 to 3 percent of the government's debt.

Last, we use the model to measure what the fee costs the government. Without the fee, the government would issue no domestic-law debt, and its short debt would be issued under foreign law (Section 6.2). In this case, the government borrows more and defaults less often. Spreads fall on both bonds, and more on the short bond, which now recovers more.

Empirical studies measure the benefit of foreign law to governments by the premium investors pay for foreign-law bonds over domestic-law bonds (Nordvig, 2015; Chamon et al., 2018; Saiegh and Biglaiser, 2024). In our model, most of the welfare gain comes from changes in how the government borrows and defaults. Political frictions make governments more impatient than their households (Cuadra and Sapriza, 2008; Aguiar and Amador, 2011). As in Aguiar et al. (2020), we evaluate the gain for households more patient than the government, and they also gain. In the model calibrated to Colombia, welfare rises by 8.2 basis points of permanent consumption at zero debt (and by 9.0 at the mean level of debt), and 7.4 of the 8.2 come from the government's response.

Related literature. We contribute to work that measures the value of foreign law from bond prices. Chamon et al. (2018) show that in the euro area the yield gap between domestic-law and foreign-law bonds rises with default risk. Most of the bonds they compare are in different currencies, so they hedge the currency risk of the domestic-law bond with synthetic forward contracts. As they note, this adjustment does not account for a depreciation of the euro when a member country defaults. Saiegh and Biglaiser (2024) compare identical dollar bonds that Argentina issued under both laws in 2020, and find that the foreign-law bonds trade at higher prices. Such twin bonds are rare. We compare only bonds in the same currency. Several emerging markets issue local-currency bonds under both laws. We study four of them and give the first estimates for Brazil, Colombia and Paraguay. In all four the yield gap between domestic-law and foreign-law bonds also rises with default risk.

In emerging markets, defaults come with large depreciations of the local currency (Section 3.5). We use a simple model in which foreign-law bonds recover more. Without a depreciation, the yield gap between domestic-law and foreign-law bonds widens with default risk (Section 3.1). If the domestic-law bond is hedged with a forward contract, a depreciation upon default can make the gap fall as default becomes more likely (Section 3.6). If both bonds are in the same currency, the gap still widens, but by less, so our estimates are lower bounds (Section 3.2). We measure the depreciation with dollar and local-currency CDS, as in Du and Schreger (2016), and adjust for it. In emerging markets

the gap can also reflect limits on foreign investors, a tax on one of the bonds and the exchange rate at which payments are converted. We check each of them. In a placebo, we compare Peru's domestic-law bonds traded onshore with notes on the same bonds traded offshore. The notes trade and settle abroad like our foreign-law bonds, but their terms are written under Peruvian law. The gap between the two does not move with default risk (Section 3.4).

Estimates of how much creditors recover in default come from past restructurings, mostly of external debt (Cruces and Trebesch, 2013). These episodes are rare for any one government, and recoveries differ widely from one episode to another. Domestic law governs between 65 and 95 percent of the marketable debt in ten of the twelve governments we study, and evidence on defaults on this debt is recent (Erce et al., 2022). Arellano et al. (2023) and Arellano and Barreto (2025) estimate recoveries by matching a quantitative model of default to the data. In their models, the recovery on each type of debt is a fixed parameter. It stands for the outcome of the negotiation between the government and its creditors. We follow this approach for the two laws, taking the durations from the data and matching the share of debt under each law and how the yield gap moves with default risk.[1]

We extend the quantitative models of sovereign default of Aguiar and Gopinath (2006) and Arellano (2008) by letting the government choose the law under which it borrows. As in Chatterjee and Eyigungor (2012), Hatchondo et al. (2016) and Aguiar et al. (2019), the government cannot commit to its future borrowing, so new debt dilutes the value of long-term debt. Several papers let the government choose among types of debt that serve different purposes. In Arellano and Ramanarayanan (2012), short-term debt gives incentives to repay, and long-term debt hedges against changes in spreads. In Ottonello and Perez (2019), foreign-currency debt avoids the costs of inflation, and local-currency debt provides a hedge. Choi et al. (2026) let the government choose currency and maturity together, and Arellano and Barreto (2025) let it default selectively on official and private lenders. In our model, the same investors hold both bonds, and the government defaults on both at once. The two bonds differ in their governing law, which sets how much investors recover, and in their duration. As in Arellano and Barreto (2025), each type of debt has its own fixed duration. In their model official debt is longer than private debt. In ours foreign-law debt is longer than domestic-law debt, and we take both durations from the data. Under each law, a government could in principle issue a short or a long bond.

[1] On haircuts, see Sturzenegger and Zettelmeyer (2008) and Graf von Luckner et al. (2025). On negotiation, see Yue (2010), Benjamin and Wright (2009) and Asonuma and Trebesch (2016). On litigation and holdouts under foreign law, see Schumacher et al. (2018) and Fang et al. (2021).

Our results show why it uses only two of the four. It does not issue a long domestic-law bond, which recovers less than a long foreign-law bond and is as exposed to dilution (Section 5.3). The fee keeps it from issuing a short foreign-law bond (Section 6.2).[2]

We also contribute to work on the maturity of sovereign debt. A government that cannot commit to its future borrowing has a reason to borrow short, because short-term debt is less exposed to dilution (Hatchondo et al., 2016; Aguiar et al., 2019). A government with nominal debt also has a reason to borrow short, because long nominal debt raises its gain from inflation (Missale and Blanchard, 1994; Choi et al., 2026). Broner et al. (2013) find that investors demand a higher return on long bonds than on short bonds, especially in crises, and that governments then shorten their issuance. We abstract from both forces to isolate the role of the law under which the government borrows. Costs of issuing debt favor long-term debt, which is rolled over less often (Jungherr et al., 2024). When the cost rises with the size of each issue, as in auctions where larger issues fetch lower prices, the government spreads its issuance across maturities (Bigio et al., 2022). The cost we study is the fee that banks charge to place foreign-law bonds. This fee keeps the government from issuing short foreign-law bonds. In a simple model without default, we show that with a fee proportional to the money raised the longest bond is the only optimal maturity (Section 6.1). The government then matches its debt payments to its surpluses and never rolls its debt over. Aparisi de Lannoy et al. (2025) find the same maturity matching in the optimal portfolio of US debt. In their model, rolling over exposes the government to interest-rate risk. We measure what the fee costs the government using the welfare decomposition of Aguiar et al. (2020).[3]

2 How Governments Use the Two Laws

In this section we document how twelve emerging-market governments use the two laws. For each government, we measure the share of its marketable debt under each law, the duration at which it issues under each law, and the fee it pays to issue under foreign law.

[2] See also Eaton and Gersovitz (1981), Hatchondo and Martinez (2009), Du et al. (2020) and Passadore et al. (2026). As in Passadore and Xu (2022), a government that returns to the market still carries part of its defaulted debt. Yue (2010) and Mihalache (2020) model how that debt is renegotiated.

[3] On maturity, see Jeanne (2009). On underwriting fees, see Lee et al. (1996), Altınkılıç and Hansen (2000) and Melnik and Nissim (2003).

2.1 Data

Our sample covers the central governments of twelve emerging markets from 2006 to 2024: Brazil, Chile, Colombia, Hungary, Mexico, Paraguay, Peru, Poland, Russia, South Africa, Turkey and Uruguay. We study their marketable debt, the central-government bonds that any private investor can buy and later resell, net of the central bank's holdings. This excludes loans from multilateral and bilateral lenders, bills issued by the central bank, the debt of state companies and retail savings bonds. It also excludes bonds sold without an auction directly to public institutions, such as state pension funds or development banks. These institutions are often required by law to hold government debt, so their purchases may not reflect the price at which private investors would lend.[4] Bonds that public institutions buy at the government's regular auctions remain in the sample.

Each debt office's records give the domestic-law placements, with the date, amount, coupon, maturity and yield at issuance of each. Dealogic gives the same information for foreign-law placements, together with the governing law. A re-tap of an outstanding bond counts as a separate placement. Daily bond prices come from Bloomberg, official sources and Capital IQ Pro. Where these sources overlap, we use the one with the widest coverage and check the results against the others. Daily five-year CDS spreads in dollars and in local currency come from Markit, through Capital IQ Pro.[5] Underwriting fees come from Dealogic, and the issuer's own expenses from the final prospectuses that governments file with the SEC. GDP in current US dollars comes from the World Bank's World Development Indicators.[6]

2.2 Every government borrows under both laws

Table 1 reports each government's marketable debt under each law, as a percentage of GDP and as a share of its total marketable debt, averaged over 2006–2024. Paraguay enters from 2013, the year of its first foreign-law bond. Foreign-law bonds make up between 5 percent of marketable debt in Brazil and 82 percent in Paraguay, and between 20 and 35 percent in seven of the twelve countries. As a percentage of GDP, foreign-law debt ranges

[4] Requiring public institutions to hold government debt is a form of financial repression (Reinhart and Sbrancia, 2015; Chari et al., 2020).

[5] The five-year tenor is the most liquid in CDS markets and the standard in the literature (Chamon et al., 2018; Du and Schreger, 2016).

[6] Dealogic records primary-market placements of bonds, with their terms and the underwriting fees paid to the banks that place them. S&P Capital IQ Pro is S&P Global's data platform, through which we obtain bond prices and CDS spreads. Markit, now part of S&P Global, publishes daily CDS spreads built from dealer quotes.

Table 1. Marketable Debt by Governing Law

	Domestic law		Foreign law		Total
	% GDP	% debt	% GDP	% debt	% GDP
	(1)	(2)	(3)	(4)	(5)
Brazil	41.9	95.0	2.2	5.0	44.1
Chile	14.5	76.2	4.7	23.8	19.2
Colombia	14.9	70.9	6.1	29.1	20.9
Hungary	33.6	69.8	14.7	30.2	48.3
Mexico	23.5	84.0	4.5	16.0	28.0
Paraguay	1.4	17.8	8.9	82.2	10.3
Peru	10.2	65.3	5.2	34.7	15.4
Poland	29.6	79.2	7.8	20.8	37.4
Russia	6.5	79.1	1.5	20.9	8.0
South Africa	41.4	91.5	3.9	8.5	45.3
Turkey	19.2	75.5	5.5	24.5	24.7
Uruguay	11.8	37.5	20.1	62.5	31.9

Notes: Marketable central-government debt outstanding at each 31 December, averaged over 2006–2024, except Paraguay, averaged over 2013–2024, from its first foreign-law bond. Marketable debt consists of the central-government bonds that any private investor can buy on the same terms and later resell, net of the central bank's holdings. Columns (1) and (3) report the domestic-law and foreign-law stocks as a percentage of GDP, columns (2) and (4) as a percentage of total marketable debt, and column (5) the total as a percentage of GDP. Debt and GDP are in current US dollars, GDP from the World Bank (NY.GDP.MKTP.CD). Domestic-law stocks come from each debt office's records and foreign-law stocks from Dealogic. Robustness checks on column (4) are in Table 13.

from 1.5 percent in Russia to 20 percent in Uruguay, and total marketable debt from 8 percent in Russia to 48 percent in Hungary.

We measure the stock of marketable debt under each law at face value at the end of each year from 2006 to 2024. A bond counts as outstanding from its settlement date until it matures. The domestic-law stock comes from the debt offices' records. Inflation-indexed bonds enter at their face value adjusted for inflation. We convert the stock to dollars at the year's average exchange rate. The foreign-law stock is the dollar value of each bond at issuance, from Dealogic. Appendix A.1 reports the shares under other exchange-rate conventions, with foreign-law bonds revalued each year, and without the holdings of all public institutions.

2.3 Foreign-law debt is issued at longer duration

Table 2. Duration at Issuance by Governing Law

	Domestic law				Foreign law				Gap	
	Median (1)	Mean (2)	Face (3)	GDP (4)	Median (5)	Mean (6)	Face (7)	GDP (8)	Median (9)	Face (10)
Brazil	3.47	4.35	2.34	2.28	8.40	9.65	9.87	9.82	4.93	7.53
Chile	8.85	10.31	8.36	8.57	9.90	12.13	12.35	12.26	1.05	3.99
Colombia	3.75	4.74	5.79	5.52	8.71	10.56	10.58	10.62	4.96	4.79
Hungary	2.84	3.74	2.46	2.35	7.54	7.60	8.45	8.39	4.70	5.99
Mexico	0.48	2.67	2.00	1.96	8.87	10.14	11.12	11.13	8.39	9.12
Paraguay	3.46	3.88	4.08	3.87	8.74	10.54	10.51	10.54	5.28	6.43
Peru	8.64	9.28	9.10	9.30	11.77	13.46	13.26	12.97	3.13	4.16
Poland	2.56	3.97	3.72	3.63	8.19	8.75	8.80	8.80	5.63	5.08
Russia	5.80	5.49	4.54	4.64	8.00	8.98	9.51	9.55	2.20	4.97
South Africa	6.88	6.89	3.57	3.59	8.79	10.12	10.23	10.16	1.91	6.66
Turkey	1.43	2.25	2.13	1.86	7.64	7.83	7.43	7.57	6.21	5.30
Uruguay	8.19	8.55	8.91	8.78	9.45	10.55	11.51	11.47	1.26	2.60

Notes: Macaulay duration of each placement at the moment of sale, in years. Median and Mean weight all placements equally, Face weights them by dollars raised, and GDP by dollars raised over that year's GDP. Gap is foreign law minus domestic law. Samples start in 2004 or 2006 and end in 2024. Maturity at issuance, a common-window check and the governing law of foreign-law placements are in Tables 15, 16 and 17.

We measure the duration of every placement of marketable debt at the time of sale. Duration is the average time until the bond's payments, with each payment weighted by its share of the bond's price (Macaulay, 1938). For a bond with face value of 1 that pays

coupon c at $n_1, \ldots, n_J$ years after settlement and is sold at yield y,

$$d = \frac{1}{p}\left[\sum_{j=1}^{J} \frac{n_j\, c}{(1+y)^{n_j}} + \frac{n_J}{(1+y)^{n_J}}\right], \qquad p = \sum_{j=1}^{J} \frac{c}{(1+y)^{n_j}} + \frac{1}{(1+y)^{n_J}}.$$

Duration lets us compare bonds with different coupons, as in Arellano and Ramanarayanan (2012). For each law we report the median and the mean across placements. We also report two weighted means. The first weights each placement by the dollars it raised. The second weights it by those dollars over its year's GDP. Appendix A.3 describes how we treat each type of bond. It also reports maturity at issuance, the medians over a common 2006–2024 window and the laws under which foreign-law placements are written.

Table 2 reports the duration at issuance of each government's placements under each law, and Figure 1 plots their distribution. Two facts emerge. First, foreign-law debt is issued at longer duration than domestic-law debt in every country in our sample. The median foreign-law placement has a duration between 7.5 years in Hungary and 11.8 years in Peru, and the median domestic-law placement between 0.5 years in Mexico and 8.9 years in Chile. The gap between the two medians ranges from 1.1 years in Chile to 8.4 years in Mexico. Second, in most countries, domestic-law placements concentrate at short durations, where foreign-law placements are rare.

2.4 Issuing under foreign law costs a fee proportional to the money raised

Issuing under foreign law costs the government a fee proportional to the money it raises, at a rate that does not depend on the maturity of the bonds or on the amount issued. A government that sells a foreign-law bond hires a syndicate of banks to place it with investors, and the banks keep a share of the proceeds, the underwriting fee. Domestic-law bonds are sold at auctions run by the central bank or the debt office. Because the fee is paid each time a bond is issued, a government that borrows short under foreign law pays it more often for the same debt. Section 6.2 uses this fact to explain why governments issue foreign-law bonds at longer duration, as we document in Section 2.3.

Dealogic reports the underwriting fee of each bond as a share of its face value. On average the bonds sell at par. Their mean price weighted by face value is 99.9 percent of face value. A share of face value is therefore also a share of the money raised. For each bond, we divide the fee paid in dollars by the money raised. We restrict the sample to bonds issued

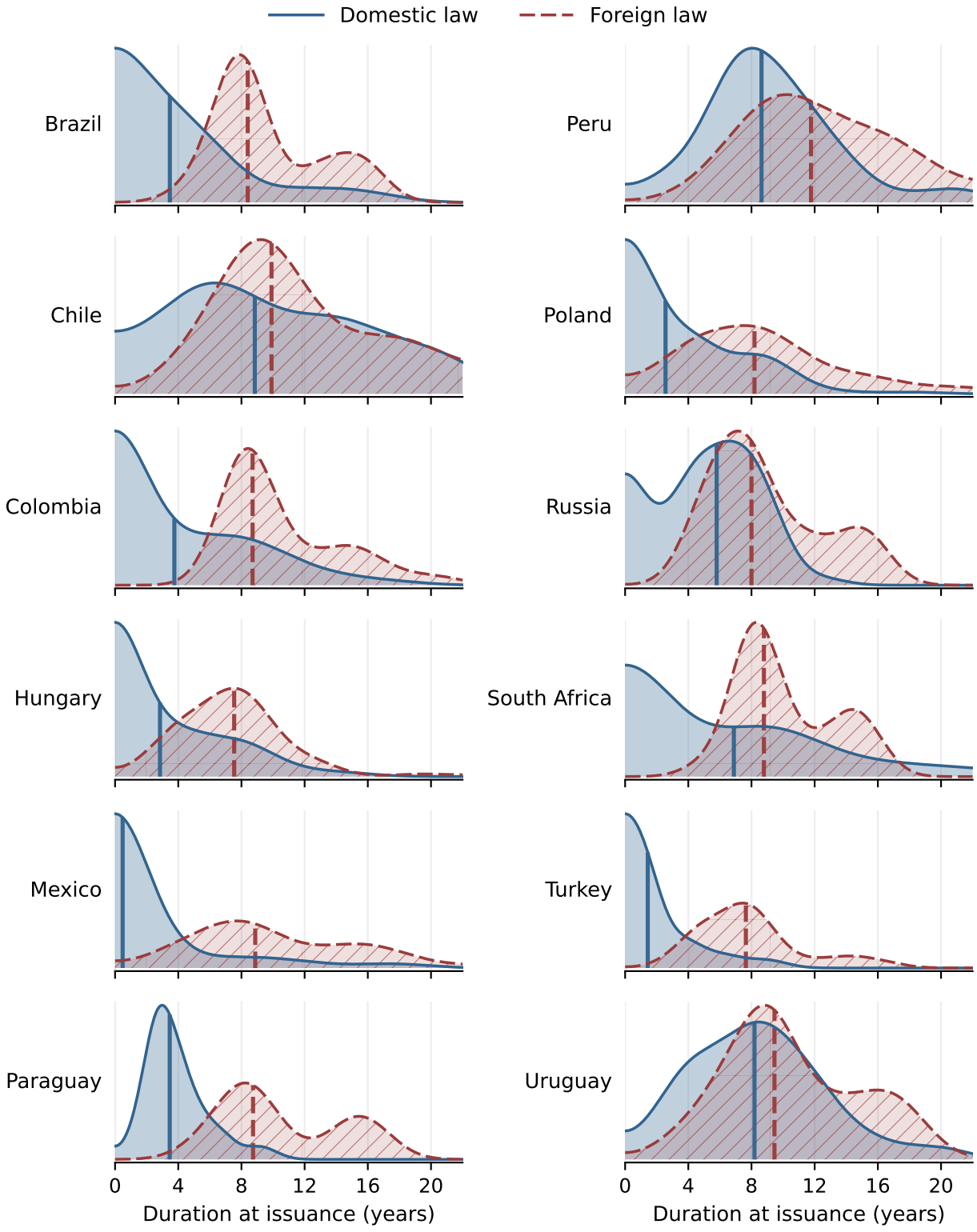


Figure 1. Distribution of Duration at Issuance by Governing Law

Notes: Kernel densities of duration at issuance in years, reflected at zero (Appendix A.3). Each panel uses one government's placements under one law from 2006 to 2024, or from 2004 in Hungary, Poland, Russia, South Africa and Turkey. Each placement, including each re-opening, counts once. Vertical lines are the medians of Table 2. The horizontal axis stops at 22 years; 0.8 percent of placements lie beyond it and enter the estimates.

under New York law, for which Dealogic records a fee for 92 percent of the bonds, against 9 percent of English-law bonds and 43 percent of Japanese-law bonds. The sample has 367 bonds issued by ten governments between 2006 and 2024; Dealogic records no fee for Paraguay and Russia. Appendix A.17 repeats the analysis for bonds issued under other foreign laws. Governments pay a fee of 14 basis points on bonds issued under English law in euros, against 15 on New York-law bonds, and more on bonds issued in yen and Swiss francs.

Table 3. Underwriting Fee on Foreign-Law Bonds

	Median fee	Mean fee
Brazil	23.6	24.0
Chile	4.0	5.6
Colombia	25.1	27.0
Hungary	18.2	19.0
Mexico	18.6	19.7
Peru	4.2	7.8
Poland	14.1	14.9
South Africa	13.2	13.8
Turkey	8.0	8.2
Uruguay	10.0	11.4

Notes: Underwriting fee in basis points of the money raised, New York-law bonds, 2006–2024.

The fee is proportional to the money raised and differs across governments. The median fee ranges from 4 basis points in Chile and Peru to 24 in Brazil and 25 in Colombia (Table 3). After removing country and year averages, the fee does not vary with maturity or with size (Figure 2).

For bond i, issued by government c in year t, we run the following regression:

$$\text{fee}_{ict} = \beta_M \,\text{maturity}_{ict} + \beta_S \,\text{size}_{ict} + \alpha_c + \gamma_t + \varepsilon_{ict}, \tag{1}$$

where the fee is measured as a share of the money raised, in basis points. Maturity is the number of years to maturity at issuance. Size is money raised in billions of US dollars. Country fixed effects α_c absorb the average rate each government pays, and year fixed effects γ_t absorb market conditions in the year of issue. Because there are only ten countries, we report wild-bootstrap p-values, clustered by country. Neither the coefficient on maturity nor the coefficient on size is significant ($p = 0.51$ and 0.27; Table 4, Figure 2, Appendix A.17). On their own, maturity and size give an R^2 of 0.02 (column 1). These

findings are consistent with the evidence of Melnik and Nissim (2003) and Flandreau et al. (2010). Melnik and Nissim find that, for dollar bonds issued by governments and public agencies in 1996–97, the fee is unrelated to maturity and size. Flandreau et al. find that, for bonds that emerging-market governments placed abroad between 1993 and 2007, the fee does not rise with the spread at issue. For the bonds in our sample with data on the spread over US Treasuries, the fee does not rise with the spread either. Maturity and size remain statistically insignificant (Appendix A.17, Table 24).

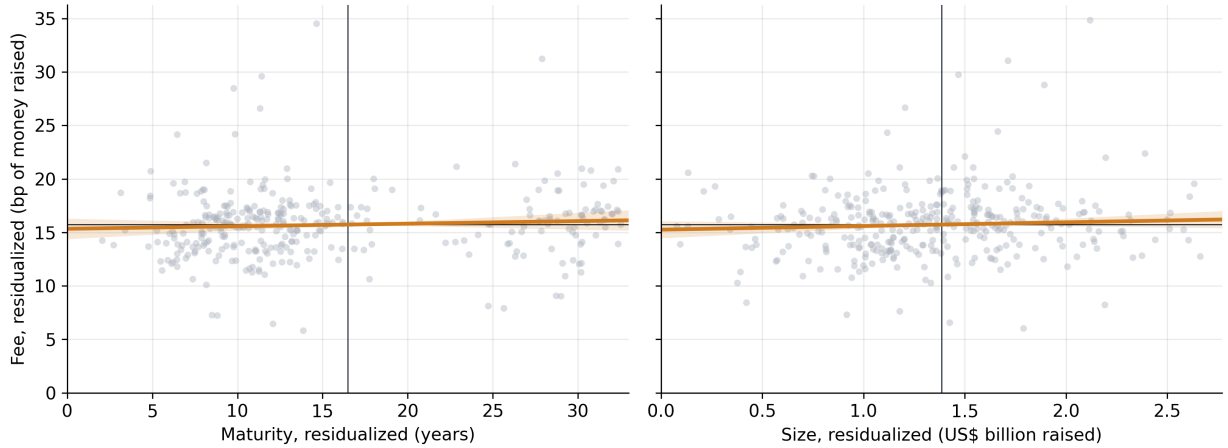


Figure 2. Underwriting Fee, Maturity and Size

Notes: Underwriting fee in basis points of the money raised, against maturity at issuance (left) and money raised in US$ billion (right), 360 New York-law bonds, 2006–2024. Each variable is net of country and year effects and of the other regressor, plus its sample average (fee 15.7 basis points, maturity 16.5 years, size US$1.4 billion). Line: fit of equation (1), with its 95 percent interval. Bonds beyond twice the average on either axis, 17 for maturity and 9 for size, are in the fit but not drawn.

The government also pays a flat amount for each deal, which is similar across countries and deals. These are its own expenses: lawyers, listing and paying agents, which the prospectuses filed with the SEC state as a single estimate. The median ranges from US$120,000 in Uruguay to US$305,000 in South Africa. A deal twice as large costs 14 percent more in expenses, and expenses account for between 4 and 20 percent of the cost of a deal (Table 25). The proportional fee is therefore most of the cost of issuing under foreign law.

When the debt office runs the auctions, as in Hungary and Peru, the government pays no agent. When the central bank runs them, Brazil, Mexico, Russia and South Africa pay nothing. Chile, Colombia, Poland and Uruguay pay at most 1.5 basis points, and Chile less than 0.13 basis points.[7]

[7]Chile pays a fixed amount for each issuance programme, and Uruguay 1 basis point a year on the stock of domestic-law bonds. The figures for Colombia and Poland are upper bounds. Colombia's is all

Table 4. Regression of the Underwriting Fee on Maturity and Size

	(1)	(2)
Maturity (years)	0.050	0.024
	(0.057)	(0.029)
	[0.50]	[0.51]
Size (US$ billion raised)	−1.448	0.342
	(1.740)	(0.294)
	[0.46]	[0.27]
Country effects	No	Yes
Year effects	No	Yes
Countries (clusters)	10	10
Bonds	360	360
R^2	0.019	0.873

Notes: Dependent variable: underwriting fee in basis points of the money raised. Bonds of Table 3 without the 1 percent shortest and longest (Appendix A.17). Standard errors clustered by country in parentheses; wild-bootstrap p-values in brackets.

3 The Yield Gap and Default Risk

In the four countries where we estimate it, the yield gap between domestic- and foreign-law bonds widens with the probability of default. Our sample includes foreign-law bonds that pay in the government's own currency. For each of them we construct a domestic-law bond with the same coupons and maturity.

3.1 Pricing a bond under each law

Consider two one-year bonds of the same government. Both pay one unit of local currency and differ only in their governing law. The government defaults with probability p, and it defaults on both bonds at once.[8] If the government defaults, the law-j bond pays $\nu_j < 1$ units of local currency instead of one. After a default, disputes over domestic-law bonds go to domestic courts, and disputes over foreign-law bonds go to foreign courts. We interpret ν_j as the value of what holders of the law-j bond expect to receive once the default is resolved. The same investors price both bonds. They are risk neutral in dollars and discount at the dollar interest rate r. The exchange rate is $\mathcal{E}$ today, in local currency

the central bank's commissions for managing government funds, over the domestic-law bonds it manages, in 2025. Poland's is everything the government spent in 2017 to issue domestic bonds, apart from retail savings bonds, over what its auctions raised.

[8] In most defaults in which foreign investors could hold domestic-law debt, the government restructured both classes of bonds (Appendix A.11).

per dollar. Next year it is $\mathcal{E}'_R$ if the government repays and $\mathcal{E}'_D$ if it defaults.

The bond pays $1/\mathcal{E}'_R$ dollars if the government repays and $\nu_j/\mathcal{E}'_D$ if it defaults. Investors pay the expected dollar payoff discounted at r. The bonds trade in local currency, so their price in local currency is:

$$q_j = \mathcal{E}\,\frac{1}{1+r}\left[\frac{1-p}{\mathcal{E}'_R} + \frac{p\,\nu_j}{\mathcal{E}'_D}\right].$$

If $p = 0$, the two bonds have the same price, whatever their governing law. If $p > 0$, the gap between their prices is the value of the extra recovery, collected only in default. As default becomes more likely, holding the exchange rates fixed, this gap changes by

$$\frac{\partial\,(q_F - q_D)}{\partial p} = \frac{\nu_F - \nu_D}{1+r}\,\frac{\mathcal{E}}{\mathcal{E}'_D}.$$

If $\nu_F = \nu_D$, the gap does not move with the probability of default. If the recoveries differ, it widens as default becomes more likely, at a rate set by $\nu_F - \nu_D$. How much it widens depends on $\mathcal{E}/\mathcal{E}'_D$, the dollar value in default of one unit of local currency, relative to today. If the currency keeps its value in default, $\mathcal{E}/\mathcal{E}'_D = 1$, and each unit of local currency recovered next year is worth $1/(1+r)$ units today. The more value the currency loses in default, the lower $\mathcal{E}/\mathcal{E}'_D$ and the less the recoveries are worth, whatever ν_j is. In the limit, the gap vanishes.

3.2 The yield gap and depreciation upon default

In the data, we measure the gap in yields. A government has several foreign-law bonds with different coupons and maturities. Yields let us compare the gap across these bonds (Appendix A.7). We define the yield gap as the domestic-law yield minus the foreign-law yield. The logic of Section 3.1 carries over to yields. The yield gap does not move with the probability of default if the recoveries are equal, and widens if they differ. Only the exchange-rate term is different. In the price gap, the exchange rate enters through $\mathcal{E}/\mathcal{E}'_D$. We split it into two terms:

$$\frac{\mathcal{E}}{\mathcal{E}'_D} = \frac{\mathcal{E}}{\mathcal{E}'_R}\,\frac{\mathcal{E}'_R}{\mathcal{E}'_D}.$$

The first reflects the depreciation expected upon repayment. The second reflects the depreciation upon default, $\delta \equiv \mathcal{E}'_D/\mathcal{E}'_R$. As default becomes more likely, holding the exchange rates fixed, the yield gap changes by

$$\frac{\partial\,(y_D - y_F)}{\partial p} \simeq \frac{\nu_F - \nu_D}{\delta}$$

(Appendix A.5). The expected depreciation upon repayment lowers both prices in the same proportion, so it cancels in the yield gap. The depreciation upon default lowers only the dollar value of the recoveries. When $\delta > 1$, the slope is therefore a lower bound on the recovery difference. Section 3.5 measures δ and adjusts the gap for it.

3.3 Measuring the yield gap

We study the foreign-law bonds that Brazil, Colombia, Paraguay and Russia issue in their own currency (Table 5). Section 2.3 shows that foreign-law bonds are issued at longer duration than domestic-law bonds. To compare their yields, we construct a hypothetical domestic-law bond with the same coupons and maturity for each foreign-law bond, as in Chamon et al. (2018).

Table 5. Local-Currency Foreign-Law Bonds

Country	Law	Currency	Bonds	Instruments	Window
Brazil	New York	BRL	3	Global BRL 12.5% '22, 10.25% '28, 8.5% '24	2014–2020
Colombia	New York	COP	3	Global TES 9.85% '27, 7.75% '21, 4.375% '23	2017–2020
Paraguay	New York	PYG	3	Global 7.9% '31, 8.5% '35, 8.5% '38	2025–2026
Russia	English	RUB	1	7.85% '18 eurobond	2014–2017

Notes: All bonds are nominal, fixed-coupon and non-callable. Brazil's and Colombia's windows end at the COVID break. Russia's ends when its bond has less than a year to maturity. Paraguay's runs to the last day of available data.

The construction uses each day's domestic-law zero-coupon yield curve $z_t(\cdot)$. Its value $z_t(m)$ is the yield on day t of a domestic-law bond that makes a single payment m years later, the rate at which investors discount a domestic-law payment due in m years. The curve must be built from domestic-law bonds only. We take the curves for Brazil and Colombia from Bloomberg and the curve for Russia from the Bank of Russia. For Paraguay we fit a Nelson–Siegel curve each day to the domestic-law bonds quoted that day (Appendix A.12). Each foreign-law bond enters the sample once its remaining maturity falls within the curve's range, because we do not extrapolate the curve.

Consider a foreign-law bond with a daily price $q_{F,t}$ and outstanding payments $c_1, \ldots, c_n$ per unit of face on dates $s_1 < \cdots < s_n$, the last one including principal. We build its domestic-law counterpart in three steps. First, we compute its yield to maturity $y_{F,t}$ from its observed price,

$$q_{F,t} = \sum_{\{k:\, s_k \geq t\}} \frac{c_k}{\left(1 + y_{F,t}\right)^{s_k - t}}. \tag{2}$$

Second, we discount its payments on the domestic-law curve,

$$\widetilde{q}_{D,t} = \sum_{\{k:\, s_k \geq t\}} \frac{c_k}{\left(1 + z_t(s_k - t)\right)^{s_k - t}}. \tag{3}$$

Third, we compute the yield $\widetilde{y}_{D,t}$ that this price implies,

$$\widetilde{q}_{D,t} = \sum_{\{k:\, s_k \geq t\}} \frac{c_k}{\left(1 + \widetilde{y}_{D,t}\right)^{s_k - t}}. \tag{4}$$

The yield gap is $\widetilde{y}_{D,t} - y_{F,t}$. The two bonds share issuer, currency, coupons and maturity, so in principle they differ only in their governing law. Section 3.4 checks the conditions under which this holds.

We measure the probability of default with the government's five-year credit default swap (CDS) spread. The buyer of a CDS pays an annual premium, the spread, as long as the government repays, and the seller covers the loss on the government's bonds if it defaults. The standard contract pays in dollars, and its spread rises with the probability of default. For each country, we estimate how the gap moves with it in first differences:

$$\Delta\left(\widetilde{y}_{D,i,t} - y_{F,i,t}\right) = \gamma\, \Delta \mathrm{CDS}_t + \Gamma' X_{i,t} + \mu_i + u_{i,t}, \tag{5}$$

where i indexes bonds and t trading days, and the μ_i are bond fixed effects. $X_{i,t}$ contains three controls: the change in the difference between the bid-ask spread of the foreign-law bond and that of the government's ten-year domestic-law bond, the change in the VIX, and the bond's time to maturity. The first captures changes in the relative liquidity of the two bonds. The second captures movements in the CDS spread that reflect global risk aversion. The third accounts for how the gap changes as the bond approaches maturity (Appendix A.7). Appendix A.14 also lets the effect of liquidity vary with the level of the CDS spread. We use first differences because we cannot reject a unit root in the gap or the CDS spread (Appendix A.13). Differencing also removes any constant wedge between the two bonds.

The coefficient γ measures the slope of Section 3.2 per unit of spread. In the model of Section 3.1, a positive γ implies that investors expect to recover more under foreign law. As default becomes more likely, they demand a larger premium to hold domestic-law bonds. If $\delta > 1$, γ understates the difference in recoveries, and Section 3.5 adjusts it for the depreciation upon default.

3.4 The yield gap widens with the probability of default

Table 6. The Yield Gap and the CDS Spread

$\Delta(\widetilde{y}_{D,i,t} - y_{F,i,t})$	Brazil	Colombia	Paraguay	Russia
Δ CDS spread	0.694^{***}	0.225^{***}	0.169^{**}	0.073^{***}
	(0.102)	(0.059)	(0.078)	(0.026)
Governing law	New York	New York	New York	English
Controls	Yes	Yes	Yes	Yes
Bond fixed effects	Yes	Yes	Yes	—
Bonds	3	3	3	1
Observations	3,332	1,347	713	633
R^2	0.098	0.036	0.043	0.078
Window	2014–2020	2017–2020	2025–2026	2014–2017

Notes: Estimates of γ in equation (5), country by country. $X_{i,t}$: changes in the bid-ask spread difference and in the VIX, and time to maturity (Section 3.3). Standard errors in parentheses are Driscoll–Kraay, robust to heteroskedasticity, autocorrelation and correlation across bonds. Russia has one bond, so its standard errors are Newey–West, robust to heteroskedasticity and autocorrelation. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 6 reports the estimates of γ in equation (5), country by country. The gap widens with default risk in every country we study. For every 100 basis point rise in the CDS spread, it widens by 69 basis points in Brazil, 23 in Colombia, 17 in Paraguay and 7 in Russia. Each estimate is significant at the 5 percent level or better. Appendix A.14 reports the estimates under alternative specifications, windows and samples of bonds.

Reading the coefficients as a difference in what the same foreign investors recover after a default event requires that these investors can hold both bonds and convert their payments into dollars on the same terms. Three conditions make this hold. First, these investors face no restriction on holding the domestic-law bond. Otherwise the gap would also price the cost of access. Each sample starts only after capital can enter and leave the country without controls or entry taxes. Over these windows nonresidents held between 15 and 26 percent of the domestic-law debt in Brazil, Colombia and Russia (Appendix A.8). Second, no tax falls on one bond and not the other. Only Colombia withholds tax from nonresidents on domestic-law bonds. Netting the tax moves its slope from 0.23 to 0.21 (Appendix A.9). Third, holders of both bonds convert coupons and principal at the same exchange rate. Most of the foreign-law bonds automatically credit investors' accounts in dollars, converting each local-currency payment at the onshore rate when it is due. In all the countries we study, a holder of the domestic-law bond buys and sells the currency at that same rate (Appendix A.10).

We run a placebo on Peru's sol notes. Foreign investors can buy Peru's domestic-law bonds abroad through Global Depositary Notes. A depositary bank holds the bonds in custody in Peru and issues notes on them to offshore investors. Like the foreign-law bonds of Section 3.3, the notes are denominated in soles, pay investors in dollars and clear outside Peru. Their claim on the government remains under Peruvian law. We then reprice the notes on the onshore domestic-law yield curve. Both sides of the gap are therefore domestic-law claims, and by Section 3.1 the gap should not move with the probability of default. We apply the construction and the regression of Section 3.3 to three of these notes (Appendix A.16). The coefficient is -0.02, with a p-value of 0.56.

3.5 Adjusting for depreciation upon default

Currencies lose value when governments default. Mano (2013) studies 104 defaults between 1873 and 2008. In 88.5 percent of them, the local currency lost value against the dollar between the end of the year before the default and the end of the default year. On average it lost 17.6 percent of its dollar value.[9] Galli (2025) studies eleven emerging markets between 2004 and 2019. In these markets, the local currency depreciates when default risk rises, and investors expect it to depreciate more over the next five years.

Du and Schreger (2016) measure how much more the local currency depreciates in default than in repayment. They use two CDS on bonds from the same government denominated in different currencies. Each CDS insures a notional amount of these bonds against default. In the dollar CDS, the buyer pays the spread and the seller pays the loss in dollars. In the local-currency CDS, both pay in local currency. For emerging-market governments, CDS in either currency insure only foreign-law bonds (Section 5.1). The two contracts then differ only in the currency of the notional.

To see how the two spreads measure δ, consider the simple model of Section 3.1. Both payments are shares of the notional, so we set each notional to one unit of its currency. If the government repays, the buyer of the dollar CDS pays $s^{\$}$ dollars. If it defaults, the seller pays $1 - \nu_F$ dollars. The contract is worth zero when it is signed, so

$$(1-p)\, s^{\$} = p\,(1-\nu_F).$$

If the government repays, the buyer of the local-currency CDS pays s^{LC} units of local currency, worth $s^{LC}/\mathcal{E}'_R$ dollars. If it defaults, the seller pays $1-\nu_F$ units of local currency,

[9] The loss is $1 - \mathcal{E}/\mathcal{E}'$, where $\mathcal{E}$ and $\mathcal{E}'$ are the units of local currency per dollar in December of the year before the default and in December of the default year, averaged over the 104 defaults.

worth $(1-\nu_F)/\mathcal{E}'_D$ dollars. This contract is also worth zero when it is signed, so

$$(1-p)\,\frac{s^{LC}}{\mathcal{E}'_R} = p\,\frac{1-\nu_F}{\mathcal{E}'_D}.$$

In the ratio of the two spreads, the probability of default and the recovery cancel. Therefore

$$\delta = \frac{s^{\$}}{s^{LC}}.$$

We compute this ratio each day for Colombia, Mexico, Russia, South Africa and Turkey. These are the governments in our sample with daily prices on both contracts since 2015 (Appendix A.6). Table 7 reports its average over 2015–2025. In default, the local currency is worth between 35 and 50 percent fewer dollars than in repayment. The average is 39 percent. In Colombia δ is 1.55. A dollar buys 55 percent more pesos in default than in repayment. The peso is then worth $1 - 1/1.55 = 35$ percent fewer dollars. For Mexico and Turkey the losses are 36 and 35 percent. Du and Schreger (2016) find 36 and 37 percent for the years up to 2015.

Table 7. Depreciation upon Default

	δ	s.e.	Loss of dollar value (%)
Colombia	1.55	0.006	35
Mexico	1.55	0.007	36
Russia	1.61	0.004	38
South Africa	2.01	0.009	50
Turkey	1.54	0.005	35
Average	1.65		39

Notes: Mean of the daily ratio of the dollar to the local-currency five-year CDS spread, January 2015 to June 2025 (Mexico to December 2024, Russia to February 2022), with Newey–West standard errors. The loss of dollar value in default relative to repayment is $1 - 1/\delta$.

The slope of the gap is the recovery difference divided by δ (Section 3.2). We remove this factor by multiplying the daily gap in equation (5) by δ. For Colombia and Russia, we average the daily ratio over each country's estimation window. This gives 1.57 for Colombia and 1.56 for Russia. Brazil and Paraguay have no local-currency CDS over their windows. For them we set δ to 1.65. This is the average of δ across the five governments in Table 7. For every 100 basis point rise in the CDS spread, the adjusted gap widens by 115 basis points in Brazil, 35 in Colombia, 28 in Paraguay and 11 in Russia (Table 8). Because the values of δ in Table 7 have standard errors below 0.01, we treat δ as a fixed

parameter. Each adjusted slope then keeps the significance it has in Table 6. Across the values of δ in Table 7, the slope ranges from 107 to 139 basis points in Brazil and from 26 to 34 in Paraguay.

Table 8. The Yield Gap Adjusted for Depreciation upon Default

	Brazil	Colombia	Paraguay	Russia
Measured (Table 6)	0.69^{***}	0.23^{***}	0.17^{**}	0.07^{***}
δ	1.65^{a}	1.57	1.65^{a}	1.56
Adjusted	1.15^{***}	0.35^{***}	0.28^{**}	0.11^{***}
With δ from 1.54 to 2.01	[1.07, 1.39]		[0.26, 0.34]	

Notes: The adjusted slope is the measured slope times δ. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. ^{a}Average of Table 7.

3.6 Comparing bonds in different currencies

Our yield gap compares two bonds that pay in the government's own currency. In principle, the same comparison could use bonds that pay in a foreign currency, such as the dollar. In practice, domestic-law bonds in foreign currency are rare among the governments we study. Brazil, Chile, Colombia, Mexico, Peru, Poland and South Africa have sold none in the market since 2006. Hungary, Paraguay, Russia, Turkey and Uruguay have had only a few, and most were repaid by 2012 or never auctioned. These are not enough to fit the domestic-law curve that the method of Section 3.3 needs. Fitting the curve involves estimating three parameters each day, so we require at least four bonds of different maturities quoted that day (Appendix A.12). An alternative is to compare twin bonds, which share currency, coupon and maturity and differ only in their law. Chamon et al. (2018) search the emerging-market government bonds issued since 1990 and find such pairs only in Argentina and Russia. Neither pair exists in our sample.

Another approach is that of Chamon et al. (2018) for euro-area governments. They compare domestic-law bonds in euros with foreign-law bonds, most of them in dollars. They hedge the currency risk of the domestic-law bond with a synthetic forward contract when the two bonds are in different currencies (Du and Schreger, 2016). In this contract an investor agrees today to exchange the bond's promised euro payments for a fixed amount of dollars. If the government repays, the bond delivers exactly the euros the contract requires. In default it delivers only part of them, and the investor buys the rest at the spot exchange rate. A depreciation upon default makes that purchase cheaper in dollars. The investor then profits on the forward contract, and the profit adds to the recovery on the domestic-law bond. As the probability of default rises, the gap in foreign currency can

then move opposite to what the recovery difference alone would imply (Appendix A.4).

In the emerging economies we study, the depreciation upon default is large (Section 3.5). The bonds we compare both pay local currency, so they require no forward. The yield gap then moves in the direction that the recovery difference alone implies (Section 3.2). This depreciation still lowers the dollar value of the recoveries, so the slope we estimate is a lower bound on the recovery difference. The adjusted slopes in Table 8 remove this effect.

4 Model

We build a quantitative model of sovereign default in which the government can commit neither to repay nor to limit its future borrowing. It borrows from risk-neutral investors under two laws. The two bonds differ in how much investors recover after a default and in their duration. Sections 5.3 and 6 justify this difference in duration.

4.1 Environment

Time is discrete and denoted $t \in \{0, 1, 2, \dots\}$. A small open economy receives a stochastic stream of income y_t, which follows a first-order Markov process. The government is benevolent and maximizes the household's expected utility,

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

where $\beta \in (0, 1)$ and u is strictly increasing and strictly concave.

The government borrows with two bonds, one under domestic law and one under foreign law. The model is real, so both bonds pay in units of the consumption good. Let b_j be the face value of law-j debt outstanding. Debt under each law lies in a bounded set, $b_j \in [0, \bar{b}_j]$, and we write $\mathcal{B} = [0, \bar{b}_D] \times [0, \bar{b}_F]$. As in Arellano (2008), the upper bounds prevent Ponzi schemes. As in Chatterjee and Eyigungor (2012), the government cannot save. Neither constraint binds in the simulations. Each period a fraction λ_j of it matures, as in Hatchondo and Martinez (2009) and Chatterjee and Eyigungor (2012), so b_D and b_F determine every future payment the government owes. With market access, the government repays the maturing principal and chooses the stocks it carries into next period, b'_D

and b'_F. It sells new bonds at prices q_D and q_F, and consumption is

$$c = y - \sum_{j\in\{D,F\}} \lambda_j b_j + \sum_{j\in\{D,F\}} q_j\left[b'_j - (1-\lambda_j)b_j\right]. \tag{6}$$

The second sum is the money raised under the two laws. The prices depend on income and on the stocks the government chooses, (y, b'_D, b'_F), and Section 4.4 derives them.

4.2 Timing

Figure 3 shows the sequence of events within a period. A government with market access enters the period owing b_D under domestic law and b_F under foreign law. It observes income y and decides whether to repay or default on both bonds. A government in default is excluded from credit markets. It loses $\phi(y)$ of output in each period of exclusion and consumes $y - \phi(y)$. Each period it regains access with probability θ.

Default does not erase the debt. In Arellano (2008) and Chatterjee and Eyigungor (2012) the government returns to the market with no debt. In our model, when it regains access, each defaulted unit of law-j bond is exchanged for $\nu_j < 1$ new bonds with the same duration. The government then owes $\nu_D b_D$ and $\nu_F b_F$ upon reentry. Defaulted bonds keep a value during exclusion. As in models where defaulted debt is restructured after a period of exclusion[10], we track their prices, q^D_D and q^D_F.

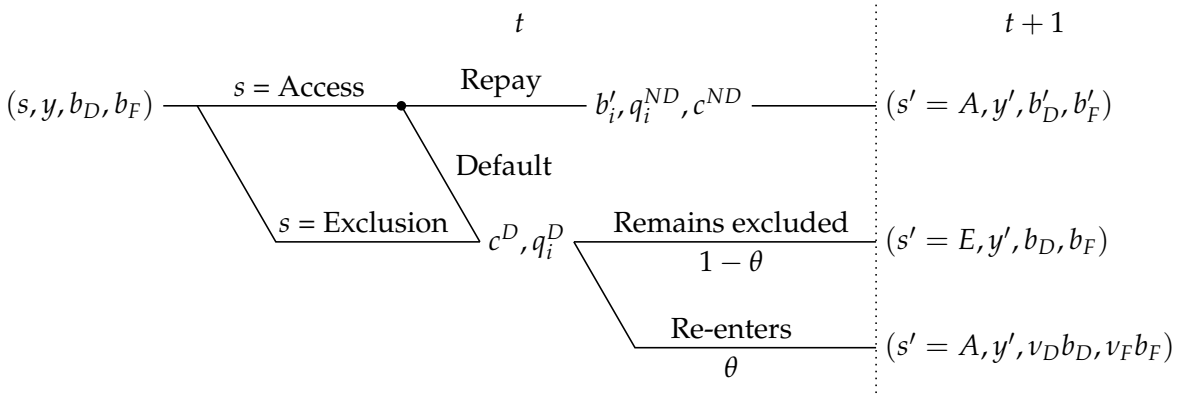


Figure 3. Timing

[10]See, for example, Hatchondo et al. (2016), Dvorkin et al. (2021) and Passadore and Xu (2022).

4.3 Recursive formulation

Upon repayment, the government takes the price schedules as given and chooses a vector of bond holdings for the next period (b'_D, b'_F). We look for a Markov equilibrium in which strategies are conditioned on (y, b_D, b_F). The unconditional value of the government is given by:

$$\widehat{V}(y, b_D, b_F) = \max_{d \in \{0,1\}} (1-d)\, V^R(y, b_D, b_F) + d\, V^D(y, b_D, b_F), \tag{7}$$

where d is the government's default policy:

$$d(y, b_D, b_F) = \mathbb{1}_{\left\{V^D(y, b_D, b_F) > V^R(y, b_D, b_F)\right\}}. \tag{8}$$

In case of default, there is no choice in the government's value:

$$\begin{aligned} V^D(y, b_D, b_F) &= u(c) + \beta \mathbb{E}_{y'|y} \left[(1-\theta) V^D\left(y', b_D, b_F\right) + \theta\, \widehat{V}\left(y', \nu_D b_D, \nu_F b_F\right) \right], \\ \text{s.t.} \quad & c = y - \phi(y). \end{aligned} \tag{9}$$

Under repayment, the government chooses next period's debt b'_D, b'_F:

$$\begin{aligned} V^R(y, b_D, b_F) &= \max_{(b'_D, b'_F) \in \mathcal{B}} u(c) + \beta \mathbb{E}_{y'|y} \left[\widehat{V}\left(y', b'_D, b'_F\right) \right] \\ \text{s.t.} \quad c + \sum_{j \in \{D,F\}} \lambda_j b_j &= y + \sum_{j \in \{D,F\}} q_j^{ND}\left(y, b'_D, b'_F\right) \left[b'_j - (1-\lambda_j) b_j \right] \end{aligned} \tag{10}$$

The choice of debt is also subject to an upper bound on the probability of default it implies, $\mathbb{E}_{y'|y}\left[d(y', b'_D, b'_F)\right] \leq \bar{p}$. Chatterjee and Eyigungor (2015) impose this bound and interpret it as an underwriting standard on new issues. Without it, an impatient government with positive recovery would borrow as much as it can at very low prices just before it defaults. The solution gives the policy functions for both bonds and, with them, the composition of the debt.

4.4 Bond prices

Competitive, risk-neutral investors buy both bonds and require the risk-free return r, as in Arellano (2008) and Chatterjee and Eyigungor (2012). A law-j bond issued by a government with market access is worth

$$q_j^{ND}\left(y, b'_D, b'_F\right) = \frac{1}{1+r} \mathbb{E}_{y'|y} \Big\{ \left[1 - d'\right] \left[\lambda_j + (1-\lambda_j)\, q_j^{ND}\left(y', b''_D, b''_F\right)\right] + d'\, q_j^D\left(y', b'_D, b'_F\right) \Big\}, \tag{11}$$

for $j \in \{D, F\}$, where $d' = d(y', b'_D, b'_F)$ and b''_j is the debt the government chooses next period. If the government repays, the holder receives the maturing fraction λ_j and values the remaining fraction $1 - \lambda_j$ according to next period's price. That price depends on the government's next borrowing choice. If it defaults, the holder is left with a defaulted bond.

A defaulted law-j bond is worth

$$q_j^D(y, b_D, b_F) = \frac{1-\theta}{1+r}\,\mathbb{E}_{y'|y}\left[q_j^D(y', b_D, b_F)\right] + \theta\,\nu_j\,q_j^{ND}(y, \nu_D b_D, \nu_F b_F). \tag{12}$$

With probability $1 - \theta$ the government stays excluded next period and the bond is then worth $q_j^D(y', b_D, b_F)$. With probability θ the government regains access next period. Before it does, each defaulted law-j bond is exchanged for ν_j new bonds with the same duration. The government enters next period owing $\nu_D b_D$ and $\nu_F b_F$ and can default on this debt again. Because of this, during the exchange the new bonds are valued at $q_j^{ND}(y, \nu_D b_D, \nu_F b_F)$.

The government defaults on both bonds at once and reenters on all its debt at once. If the two bonds had the same duration, they would differ only in what investors receive after a reentry.

Proposition 1. *Suppose $\lambda_D = \lambda_F$ and $\nu_F \geq \nu_D$. Then for any default and borrowing policies the prices in (11) and (12) satisfy in every state*

$$q_F^{ND}(y, b_D, b_F) \geq q_D^{ND}(y, b_D, b_F) \quad \text{and} \quad q_F^D(y, b_D, b_F) \geq q_D^D(y, b_D, b_F).$$

If $\nu_F > \nu_D$ the inequalities are strict in every state from which the government later reenters and then repays with positive probability. The first inequality holds with equality in every state from which the government never defaults.

Proof. Appendix A.22. □

4.5 Equilibrium

Definition 1. *A Markov Equilibrium with state variables (y, b_D, b_F), $(b_D, b_F) \in \mathcal{B}$, is given by:*

(i) A set of policy functions for consumption $c(y, b_D, b_F)$, default $d(y, b_D, b_F)$, debt $b'_D(y, b_D, b_F)$ and $b'_F(y, b_D, b_F)$;

(ii) A set of value functions $\widehat{V}(y, b_D, b_F)$, $V^D(y, b_D, b_F)$, $V^R(y, b_D, b_F)$;

(iii) Price schedules $q_D^D(y, b_D, b_F), q_F^D(y, b_D, b_F), q_D^{ND}(y, b'_D, b'_F), q_F^{ND}(y, b'_D, b'_F)$

such that:

1. *Given prices, the value functions solve:* (7), (9), *and* (10), *with associated policy functions;*
2. *Bond prices satisfy* (11) *and* (12).

4.6 Discussion of assumptions

We assume that the same risk-neutral foreign investors price both bonds. Nonresidents hold on average between 10 and 41 percent of the domestic-law debt of ten of our twelve governments (Table 18). This assumption allows us to abstract from the motive for selective default studied in the literature. We do not assume perfectly segmented markets as in Erce and Mallucci (2018), Di Casola and Sichlimiris (2025) and Shakhnov and Paczos (2026). In these models residents and nonresidents are assumed to hold different types of debt. This gives the government an incentive to default selectively.

We also assume that the government defaults on both classes of bonds at once. In the database of Erce et al. (2024), the government restructured both classes of bonds in 12 of the 14 episodes in which private foreign investors could hold bonds under both laws (Appendix A.11). In the model, a default excludes the government from both markets at a cost that does not depend on how much debt it defaults on. A government allowed to default selectively would therefore not choose to. It would bear the full cost of default and still have to service the other bond.

We also assume that the recoveries ν_D and ν_F are parameters that differ only by law. As in Arellano et al. (2023) and Arellano and Barreto (2025), the recovery is a parameter of each debt contract. Governments renegotiate their defaulted debt with their creditors, and Yue (2010) and Benjamin and Wright (2009) model this negotiation. We do not model it. We estimate its outcome, the two recoveries, from the prices of the two bonds and the share of debt issued under each law (Section 5.1). Arellano and Barreto (2025) let the recovery differ between official and private debt. We let it differ between domestic-law and foreign-law debt.

We assume that the model is real, as in Arellano (2008) and Chatterjee and Eyigungor (2012). The model therefore studies outright default. It leaves out default through inflation, which lowers the real value of nominal domestic-law debt (Ottonello and Perez, 2019; Du et al., 2020; Choi et al., 2026). Indexed debt is protected from this channel, since its payments are fixed in real terms. In 2024, inflation-indexed bonds made up between 22

and 47 percent of the domestic-law debt of Brazil, Chile, Colombia, Mexico, South Africa and Uruguay (Appendix A.2). We return to this point in Section 5.1. There we discuss how the currency affects the yield-gap slope that the calibration targets.

Finally, we assume that the government issues one bond under each law, with a fixed duration. Each duration matches the median duration at issuance under that law (Section 5.1). The foreign-law bond is therefore the longer one, as it is for every government in our sample (Section 2.3). Sections 5.3 and 6 explain why a government that could issue a short and a long bond under each law would choose to issue only a long foreign-law bond and a short domestic-law bond.

5 Quantitative Analysis

Through the lens of the model, a yield gap that widens with default risk implies that investors recover more on foreign-law debt after a default. The government uses both laws because each protects investors against a different risk. With equal durations it issues only the bond with the higher recovery. With equal recoveries at the observed durations it issues only the shorter bond. We calibrate the model to Colombia and show that investors expect to recover 47 percent of what they are owed under foreign law and 40 percent under domestic law.

5.1 Calibration

We calibrate the model to Colombia at an annual frequency. Colombia's debt office records every domestic-law placement, and Colombia files its foreign-law bonds with the SEC. The shares, durations, yield gap and fee we target therefore all come from its own bonds. It is also not an outlier in our sample. Its foreign-law share, 29 percent, lies within the range of seven of the twelve countries, and the slope of its yield gap lies between those of Russia and Brazil. Finally, Colombia has not defaulted since the 1930s. With no recent default to observe, we infer the recoveries its investors expect from the prices of its bonds.

We solve a discretized version of the model with the algorithm of Gordon and Guerron-Quintana (2018). It extends the method of Chatterjee and Eyigungor (2012) to general choice sets, such as the choice between two bonds.[11]

[11] Our code builds on the replication files of Passadore and Xu (2022).

We set seven parameters outside the model. Household utility is CRRA, $u(c) = c^{1-\sigma}/(1-\sigma)$, with relative risk aversion $\sigma = 2$, the standard value in the literature. Log output follows an AR(1),

$$\log y_t = \rho \log y_{t-1} + \varepsilon_t, \qquad \varepsilon_t \sim N(0, \sigma_\varepsilon^2), \tag{13}$$

which we estimate on Colombia's annual real GDP from the World Development Indicators over 1976–2024, after removing a linear trend, as in Arellano (2008) and Chatterjee and Eyigungor (2012). This gives $\rho = 0.77$ and $\sigma_\varepsilon = 0.026$. The risk-free rate is $r = 1.8$ percent a year in real terms, following Bocola et al. (2019). The reentry probability is $\theta = 0.25$, a mean exclusion of four years. Estimates of the length of exclusion after a default range from three to six years (Gelos et al., 2011; Cruces and Trebesch, 2013). Coupons are normalized to zero, so each bond is a geometric-decay perpetuity whose Macaulay duration is $D = (1+r)/(\lambda+r)$. We set each λ so that this duration equals the median duration at issuance of Colombia's debt under that law (Section 2.3): 3.75 years for domestic law and 8.71 years for foreign law, which gives $\lambda_D = 0.254$ and $\lambda_F = 0.099$.

We choose the remaining five parameters jointly to match five moments of Colombia's data over 2006–2024: the discount factor β, the two recoveries ν_D and ν_F, and the two parameters of the output loss in default, which follows Chatterjee and Eyigungor (2012),

$$\phi(y) = \max\left\{0,\, d_0\, y + d_1\, y^2\right\}.$$

Three of the five moments are standard targets in quantitative models of sovereign default (Arellano, 2008; Hatchondo and Martinez, 2009; Chatterjee and Eyigungor, 2012; Arellano and Ramanarayanan, 2012). They are the mean and the volatility of the spread on foreign-law bonds, 2.40 and 0.75 percent, and the ratio of marketable debt to GDP, 20.9 percent. The spread comes from the J.P. Morgan EMBI Global Colombia and the debt ratio from Section 2.2. In both the data and the model, this ratio is the face value of debt over output. The other two are new and pin down the recoveries. They are the foreign-law share of marketable debt, 29 percent (Section 2.2), and the slope of the yield gap on the CDS spread (Section 3.4). Colombia issues 98 percent of the face value of its foreign-law debt under New York law (Table 17). The EMBI spread, the yield gap and the issuance fee of Section 2.4 also come from New York-law bonds. We therefore read the foreign-law bond in the model as a New York-law bond and its spread as the model counterpart of the EMBI spread.

We target how the yield gap moves with default risk and do not use its average level. The level of the gap also reflects differences between the two bonds that do not depend on

default risk, such as their liquidity and tax treatment (Section 3.4). The value of a higher recovery does depend on default risk, because investors collect it only if the government defaults. The slope of the gap on the CDS spread isolates this value, and differencing removes wedges that stay constant.

To compute the slope in the model, we follow the construction of Section 3.3. We price five pairs of hypothetical bonds in zero net supply along the simulated equilibrium path, given the government's equilibrium default and borrowing policies. The two bonds in a pair differ only in their recovery. Each repays a fraction $\lambda_M = 1/M$ of its face value every year, so it matures in $M \in \{1, 3, 5, 7, 10\}$ years on average. Their durations span those of the bonds in Section 3. The yield gap for pair M is the difference between the spreads of its two bonds,

$$s^D_{M,t} - s^F_{M,t} = \lambda_M \left(\frac{1}{q^D_{M,t}} - \frac{1}{q^F_{M,t}} \right). \tag{14}$$

The model counterpart of the five-year dollar CDS spread in our data (Section 2.1) is the spread on the foreign-law bond with $M = 5$, $s^F_{5,t}$. After a default, a CDS pays its buyer the difference between the face value and the market price of the government's bonds. For Latin American and for Emerging European and Middle Eastern governments, the payment is computed using only foreign-law bonds (ISDA, 2017).[12] Duffie (1999) shows that, under no arbitrage, the CDS spread then equals the spread of the foreign-law bond over the risk-free rate.

The model slope γ is the estimate of

$$\Delta\left(s^D_{M,t} - s^F_{M,t}\right) = \gamma\, \Delta s^F_{5,t} + \alpha_M + \varepsilon_{M,t} \tag{15}$$

over the years with market access in a long simulation.[13] The maturity fixed effect α_M plays the role of the bond fixed effect, and holding each maturity constant plays the role of the maturity control. The model is real, so its slope has no currency effect. We target the measured slope. Section 5.2 adjusts it for depreciation upon default.

Table 9. Parameters and Targets

A. Externally set			
Parameter	Value	Description	Source
σ	2	Relative risk aversion	Standard
ρ	0.77	Autocorrelation of log output	WDI, 1976–2024
σ_ε	0.026	Std. deviation of output shocks	WDI, 1976–2024
r	0.018	Risk-free rate	Bocola et al. (2019)
θ	0.25	Reentry probability	Four-year exclusion
λ_D	0.254	Share maturing each year, domestic-law debt	Duration, 3.75 years
λ_F	0.099	Share maturing each year, foreign-law debt	Duration, 8.71 years

B. Internally calibrated				
Parameter	Value	Main target	Data	Model
ν_D	0.40	Foreign-law share (%)	29	29.0
ν_F	0.469	Slope of the yield gap, γ	0.23	0.23
β	0.920	Marketable debt / GDP (%)	20.9	21.0
d_0	-0.188	Mean spread (%)	2.40	2.34
d_1	0.236	Spread volatility (%)	0.75	1.02

Notes: Annual frequency. Colombia, 2006–2024. The parameters in panel B are chosen jointly to match the five moments; each is listed next to the moment it affects most. The spread is the J.P. Morgan EMBI Global Colombia spread, and its model counterpart is the spread on the foreign-law bond.

5.2 The calibrated model

Table 9 pairs each parameter with the moment it affects most, although all five are chosen jointly. The mean spread mainly disciplines d_0, its volatility d_1, and the debt ratio β. The calibrated discount factor is 0.92, below $1/(1+r) = 0.982$. As is standard in quantitative models of sovereign default, the government is more impatient than investors (Aguiar and Gopinath, 2006; Chatterjee and Eyigungor, 2012). Our d_0 is negative and d_1 is positive, as in Chatterjee and Eyigungor (2012). The cost of default as a share of output rises with output and is zero when output is low enough. Arellano (2008) shows that this asymmetry is needed to match how often governments default. The two recoveries are pinned down jointly by the two new moments, as Figure 4 shows.

The slope of the yield gap on the CDS spread identifies the recovery gap $\nu_F - \nu_D$. The

[12] ISDA's Credit Derivatives Physical Settlement Matrix sets this rule. It is the same in the versions of September 2014, December 2017, May 2022 and October 2025.

[13] We simulate 101,000 years and drop the first 1,000. The regressor is common to all maturities, so γ equals the average of the five slopes estimated maturity by maturity. If we instead weight the five pairs by how often each duration appears among Colombia's foreign-law bonds over 2017–2020, the slope is 0.228, against 0.233 with equal weights.

yield gaps in the model regression come from pairs of bonds with the same duration that differ only in their recovery (Section 5.1). Until the government defaults the two bonds of a pair have the same cash flows. After a default the foreign-law bond pays more when $\nu_F > \nu_D$. The larger the recovery gap, the more the yield gap responds to a change in the probability of default and so to the CDS spread. Panel (a) of Figure 4 shows the slope rising with $\nu_F - \nu_D$. Through the lens of the model the positive slopes of Section 3.4 imply that foreign-law debt recovers more in Brazil, Colombia, Paraguay and Russia. For Colombia the slope of 0.23 implies a recovery gap of 7 percentage points.

Given the recovery gap, the foreign-law share of debt identifies the level of the two recoveries. Panel (b) holds the recovery gap at 7 percentage points and raises both recoveries together. Higher recoveries lower what investors lose in a default. The government then borrows more and in turn defaults more often. In the model the default probability rises from 3.0 to 4.9 percent as ν_F rises from 0.37 to 0.62. With more frequent defaults the larger cash flows of the foreign-law bond after a default matter in more states. This makes the foreign-law bond relatively more attractive to issue, and the foreign-law share rises with the level of recovery. Given a gap of 7 percentage points, the foreign-law share of 29 percent pins down recoveries of 40 percent on domestic-law debt and 47 percent on foreign-law debt.

We calibrate the model to Colombia's measured slope in Section 3.4, 0.23. This slope understates the recovery gap, because depreciation upon default lowers the dollar value of what investors recover on both bonds (Section 3.5). Adjusted for this depreciation, Colombia's slope is 0.35. Our calibrated recoveries therefore understate the gap between them. To understand by how much, we keep the government's policies at the baseline and lower the domestic-law recovery and raise the foreign-law recovery of the bond pairs by the same amount until the model slope reaches 0.35. This happens at recoveries of 39 and 48 percent, a gap of 9 percentage points instead of 7. We keep the baseline calibration throughout the paper because it does not depend on the estimates of the depreciation upon default, and its recovery gap of 7 percentage points can be interpreted as a lower bound on the difference between the two recoveries.

Table 10 reports untargeted moments. The model reproduces the volatility of consumption relative to output, 1.17 against 1.15 in the data. Debt service is 4.3 percent of GDP in the model and 3.9 percent in the data. Spreads and the foreign-law share of new issuance are more countercyclical in the model than in the data. Their correlations with output are -0.69 in the model, against -0.12 and -0.29 in the data. As in other models in which output is the only shock (Arellano, 2008), default risk in the model rises only when output

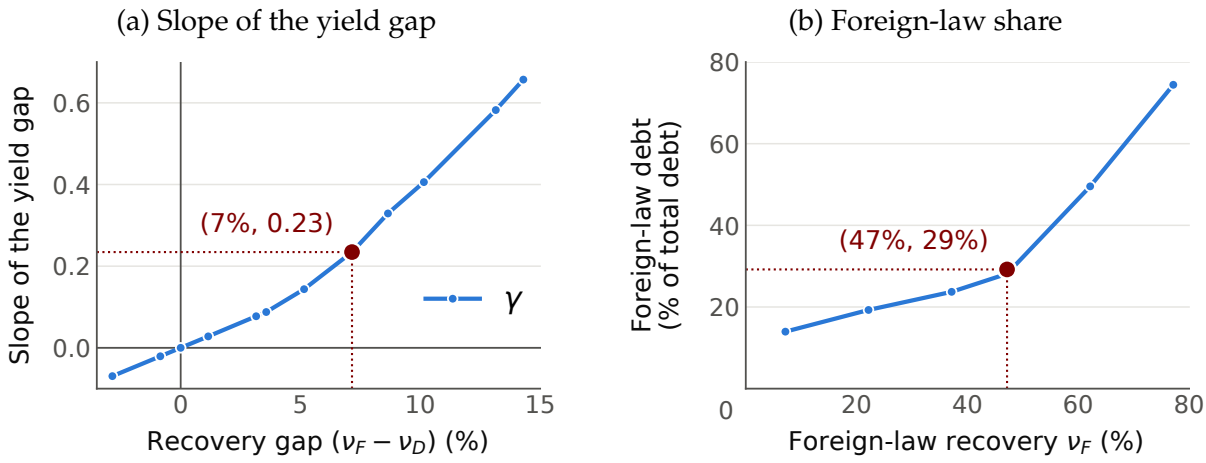


Figure 4. Identification of the Recoveries

Notes: Panel (a) plots the model slope of the yield gap on the CDS spread, γ, against the recovery gap $\nu_F - \nu_D$. Panel (b) plots the foreign-law share of debt against the foreign-law recovery ν_F, holding the recovery gap at its calibrated value. Other parameters at their calibrated values.

Table 10. Untargeted Moments

	Model	Data
corr(spread, y)	-0.69	-0.12
corr(foreign-law share of issuance, y)	-0.69	-0.29
$\sigma(c)/\sigma(y)$	1.17	1.15
corr(c, y)	0.83	0.92
Debt service / GDP (%)	4.3	3.9
$\sigma(\log y)$	0.039	0.041
Default frequency (%)	3.7	—

Notes: Colombia, 2006–2024. Data moments for output and consumption use the cyclical component of logged series, HP filter with $\lambda = 100$, except $\sigma(\log y)$, which is implied by the linearly detrended AR(1); model moments use the simulated series. Model debt service includes amortization only, because coupons are zero; the data include coupons.

falls, so spreads move more closely with output than they do in the data. The model implies that Colombia defaults in 3.7 percent of years. The calibration infers this frequency from Colombia's spreads and debt, as it does the recoveries.

The model also generates the split between the two laws that we observe. The government holds 29 percent of its debt under foreign law and the rest under domestic law. Section 5.3 shows that this split requires the two bonds to differ in both recovery and duration.

5.3 The trade-off between recovery and duration

In the calibrated model the two bonds differ in their recovery and in their duration. Using counterfactual experiments that remove one difference at a time, we show that the government values foreign-law debt for its higher recovery and domestic-law debt for its shorter duration. In every experiment, all other parameters stay at their calibrated values in Table 9.

In the first experiment, we solve the model with bonds of the same duration and keep the higher recovery on the foreign-law bond. We then repeat this exercise at durations from 1 to 8.71 years. In every simulation we run, the government issues only the foreign-law bond (Table 29). Proposition 1 shows that with equal durations the foreign-law bond trades at a higher price whenever the probability of default is positive. In exchange, if the government defaults in the future, it reenters the market with more debt (equation (12)). Quantitatively, the government values the extra money raised at issuance more than the extra debt owed at reentry. This is because the government is more impatient than investors and reenters with relatively small amounts of debt. In the calibrated model, the discount factor β is 0.92, below $1/(1+r) = 0.982$, and debt at reentry averages 10 percent of output, against an average of 21 percent.

In the second experiment, we solve the model with bonds of the same recovery and keep the longer duration on the foreign-law bond. As in the calibrated model, the duration is 3.75 years for the domestic-law bond and 8.71 years for the foreign-law bond. We repeat this exercise at recoveries from 0 to 0.75. In every simulation we run, the government holds at most 0.3 percent of its debt under foreign law (Table 31). Quantitatively, the cost of dilution (Hatchondo et al., 2016; Chatterjee and Eyigungor, 2015) outweighs the insurance that the foreign-law bond provides to the government (Arellano and Ramanarayanan, 2012).[14] At issuance, investors price bonds according to the probability of

[14] A one-year bond has no exposure to dilution but provides no insurance (Appendix A.21). When we

default until they are repaid. Their expectations about the government's future borrowing lower the price of the longer bond (Aguiar et al., 2019). After the bond is issued, its price moves with realized output. When realized output is low, the probability of default rises and the price of the bond falls. The government's debt is then worth less when marginal utility is high (Appendix A.21).

The government values foreign-law debt for its higher recovery and domestic-law debt for its lower exposure to dilution. In the calibrated model the bond with the higher recovery is also the longer one, so neither bond has both advantages. The government therefore borrows under both laws and holds 29 percent of its debt under foreign law. A long domestic-law bond would have neither advantage, and the government would never issue it. This matches the data, where foreign-law debt is issued at longer duration than domestic-law debt in every country in our sample (Section 2.3). A short foreign-law bond would have both advantages. Why do governments not issue it?

6 The Fee on Foreign-Law Debt

Governments pay a fee each time they issue a foreign-law bond (Section 2.4). To maintain its stock of outstanding debt, a government that borrows short must issue new bonds each time its bonds mature, so it pays the fee more often. This keeps governments from issuing short foreign-law bonds.

6.1 Fees and maturity

The fee on foreign-law bonds is proportional to the money raised and independent of maturity. This type of fee makes short foreign-law debt more costly than long foreign-law debt (Appendix A.23).[15] We first study the effect of such a fee in a simple model without the usual forces that the sovereign debt literature uses to explain maturity choices: default, dilution and insurance. As we will see, in this case the fee is the only force that shapes maturity, and the government finds it optimal to issue only the longest bond.

Consider a government that receives a constant endowment y and values consumption at $\sum_{t\geq 0} \beta^t u(c_t)$, with u strictly increasing and strictly concave. It borrows from lenders who

repeat the second experiment with a one-year domestic-law bond, the government holds between 48 and 68 percent of its debt under foreign law (Table 31). Dilution outweighs the insurance of the foreign-law bond because the domestic-law bond also provides insurance.

[15] On issuance costs and debt maturity, see van der Wansem et al. (2019), Jungherr et al. (2024) and Bigio et al. (2022).

discount at the interest rate r, and it is as patient as they are, $\beta = 1/(1+r)$. It always repays. It starts owing $B_0 > 0$, due at date 0. At date 0 it chooses one λ for all the bonds it will ever issue. A unit pays 1, $1-\lambda$, $(1-\lambda)^2, \ldots$ in the periods after it is issued, so λ plays the same role as in Section 4. Its price is the value of these payments discounted at r:

$$q(\lambda) = \sum_{k \geq 1} \beta^k (1-\lambda)^{k-1} = \frac{\beta}{1-\beta(1-\lambda)}.$$

The one-period bond is $\lambda = 1$ and the consol is $\lambda = 0$. Each issue or buyback pays a fee f on its market value. Appendix A.24 gives the budget constraints and the debt limit.

Proposition 2 (Maturity under a fee)**.** *If $f = 0$, every maturity gives the same allocation. If $f \in (0,1)$ and $(1-f)\,u'(y - B_0) > u'(y)$, so that the government borrows at date 0, the consol is the unique optimal maturity: the government issues only at date 0 and never rolls its debt over.*

Proof. Appendix A.24. □

Without a fee, every maturity gives the same allocation. Any positive fee makes the consol the unique optimal maturity. The fee is paid every time the government issues and depends only on the money it raises. A government that refinances its initial debt does so once, with a consol issued at date 0. The consol pays the same amount every period, which matches the government's primary surplus after date 0, as in the optimal portfolio of US debt in Aparisi de Lannoy et al. (2025). With shorter debt it would have to borrow periodically to keep its consumption constant and pay the fee each time on the value it rolls over.[16]

6.2 Fees and the choice of law

Ten of the twelve governments sell domestic-law debt with durations under one year, and none sells foreign-law debt that short. In Colombia, the country to which we calibrate the model, the shortest foreign-law bond had a duration of 7.2 years at issuance, and the shortest domestic-law placement 0.2 years.

Section 6.1 shows that the fee on foreign-law debt weighs more on short bonds, because a short bond must be issued again each time it matures. We now use the quantitative model to ask whether at the fees we see in the data this effect is enough to keep governments

[16] Without a fee on buybacks, Proposition 2 holds except that the consol is no longer the only optimal maturity. Bonds whose payments grow, $\lambda < 0$, are also optimal.

from issuing short foreign-law bonds. Such bonds would protect investors against both default and dilution.

We add the fee to the model of Section 4. We first consider a government that chooses between two one-period bonds, one under each law. It pays a fee f on the market value of the foreign-law bonds it issues or buys back, as in Section 6.1. We then add a long foreign-law bond, so we write the budget constraint for any number of bonds and collect the foreign-law bonds in the set $\mathcal{F}$:

$$c + \sum_j \lambda_j b_j \;=\; y + \sum_j q_j \left[b'_j - (1-\lambda_j) b_j \right] \;-\; f \sum_{j \in \mathcal{F}} q_j \left| b'_j - (1-\lambda_j) b_j \right|. \tag{16}$$

The pricing equations are those of Section 4, so the fee affects prices only through the government's default and borrowing policies. We set f at Colombia's median fee of 25 basis points (Table 3) and keep all other parameters at their values in Section 5.1. Without a fee the government borrows only under foreign law (Section 5.3). At 25 basis points it still holds 63 percent of its debt under foreign law (Table 11). Foreign-law debt falls to 1.5 percent of its debt at 75 basis points and to 0.04 percent at 100 basis points. That is three to four times Colombia's fee. With only one-period bonds, the government avoids the fee only by giving up the higher recovery.

With three bonds, the government chooses among a short domestic-law bond, a short foreign-law bond and a long foreign-law bond. The two short bonds last one period, as before. The long bond has a duration of 2.32 years, so the ratio of the long to the short duration matches the one we see in Colombia's debt. The two foreign-law bonds share the recovery ν_F. They pay the same fee f, since in the data the fee does not depend on maturity (Section 2.4), in Colombia as in the other countries (Figure 7). All other parameters keep their values from Section 5.1.[17]

With a long foreign-law bond, the fee needed to keep the government out of short foreign-law debt falls from 100 to 35 basis points (Table 11).[18] Without a fee, the government holds 36 percent of its debt in the short foreign-law bond, 64 percent in the long one and none under domestic law. At Colombia's fee of 25 basis points, the short foreign-law share falls to 2.9 percent, and total debt stays at 19 percent of GDP. The difference comes from the long bond, which has the same recovery as the short foreign-law bond but pays the fee only on the share that matures each year. With a long foreign-law bond, the government

[17] We solve the model on a grid of 25 points for output and 50 for each debt stock.

[18] Without a fee on buybacks, the results do not change. The share of short foreign-law bonds moves by at most 0.3 percentage points at any fee.

can pay the fee less often without giving up the higher recovery.

Table 11. Short Foreign-Law Bonds and the Issuance Fee (%)

	Two bonds	Three bonds		
Fee (bp)	Foreign law	Short domestic	Short foreign	Long foreign
0	100.0	0.0	35.9	64.1
20	75.7	11.2	5.7	83.1
25 (Data)	63.0	13.3	2.9	83.8
35	43.9	17.1	0.8	82.0

Notes: Shares of total face value, in percent, means over simulated periods. Two bonds: one-period bonds under each law. Three bonds: adds a foreign-law bond with a duration of 2.32 years.

Quantitatively, the fee we measure in the data is enough to keep the government from issuing short foreign-law bonds whenever it can also issue a long foreign-law bond and a domestic-law bond. Section 7 measures what the fee costs in terms of welfare.

7 Gains from Removing the Fee

Through the lens of our model, we now analyze what the fee costs a government by keeping it from issuing short foreign-law bonds. Without the fee, the government would issue no domestic-law debt, and its short debt would be issued under foreign law (Section 6.2). We solve the model calibrated to Colombia for a specification in which the short bond takes the recovery of foreign-law debt, 47 percent instead of 40, and keeps its duration of 3.75 years. Unlike the experiments of Section 6.2, this exercise keeps the durations of the calibrated model, which match Colombia's debt. The rest of the parameters are set to the values of the baseline calibration. Welfare rises by 8.2 basis points of permanent consumption, 12 percent of the 71 basis points gained by eliminating aggregate risk and the costs of default in the baseline economy.

We measure welfare as the permanent percentage change in consumption Δ that makes the household indifferent between the baseline economy $\mathcal{E}_0$ and the economy without the fee $\mathcal{E}_1$,

$$(1+\Delta)^{1-\sigma} \sum_y \pi(y)\, V^{\mathcal{E}_0}(y,b) = \sum_y \pi(y)\, V^{\mathcal{E}_1}(y,b), \tag{17}$$

where $V^{\mathcal{E}}$ is the value function in economy $\mathcal{E}$, π is the invariant distribution of output and $b = (b_D, b_F)$ is the debt at which we evaluate the gain. In $\mathcal{E}_1$ the government's borrowing

and default policies adjust. At zero debt, the gain is 8.2 basis points. At the mean level of debt in the baseline economy, it is 9.0.

Table 12. Removing the Fee on Foreign-Law Debt

A. Change in the economy	
Mean spread, short debt (bp)	−46
Mean spread, long debt (bp)	−22
Debt / GDP (percentage points)	+0.4
Default frequency (percentage points a year)	−0.3
B. Welfare gain (bp of permanent consumption)	
Total	+8.2
New prices, policies fixed	+2.1
New debt at reentry, policies fixed	−1.3
Both, policies fixed	+0.8
Change in borrowing and default policies	+7.4

Notes: Changes from the baseline economy to the economy without the fee, model simulations. The welfare gain is Δ in equation (17), evaluated at zero debt. The change in policies is the total minus the gain with both changes and fixed policies. Appendix A.27 describes the decomposition.

Table 12 shows how the economy changes when the fee is removed. The government borrows more and defaults less often. Debt rises by 0.4 percentage points of GDP, and the default frequency falls by 0.3 percentage points a year. In equilibrium, both spreads fall because the probability of default falls. The spread on the long bond falls by 22 basis points. The spread on the short bond falls by 46 basis points, because, relative to the baseline, it also recovers more after a default.

Removing the fee affects welfare through three forces. The first two act even when the government's borrowing and default policies stay fixed. First, investors expect to recover more on short debt after a default, so they pay more for it. Second, the government reenters financial markets owing more. Third, the government changes how much it borrows and when it defaults. We measure the first two forces with the policies at their baseline values (Table 12, panel B). Giving the government the prices of the new economy, with the baseline debt at reentry, raises welfare by 2.1 basis points. Giving it the larger debt at reentry of the new economy, with baseline prices, lowers welfare by 1.3 basis points. With both changes and fixed policies, welfare rises by 0.8 basis points, so the remaining 7.4 basis points come from the government's response. Appendix A.27 describes these calculations.

Empirical studies measure the benefit of foreign law to governments by the premium investors pay for foreign-law bonds over domestic-law bonds (Nordvig, 2015; Chamon et al., 2018; Saiegh and Biglaiser, 2024). In our model, most of the benefit of foreign law to the government comes from the changes in its incentives to borrow and to default.

So far we evaluate welfare with the government's discount factor, $\beta = 0.92$, below the investors', $1/(1+r) = 0.982$. This impatience relative to investors makes the higher recovery attractive, because it lets the government move consumption from the years after reentry to today (Section 5.3). Although the government maximizes the utility of a representative household, the two need not discount the future at the same rate. Political frictions make governments more impatient than their households (Cuadra and Sapriza, 2008; Aguiar and Amador, 2011). As in Aguiar et al. (2020), we therefore value the consumption that the government's policies generate with a household discount factor β_H. It ranges from 0.92, a household as impatient as the government, to 0.982, a household as patient as investors. The government keeps its discount factor, so its policies and the prices they imply do not change. We also follow them in decomposing the gain into three terms: default costs, front-loading and variability. The first measures the output lost while the government is excluded, the second the value of bringing consumption forward by borrowing, and the third how borrowing changes the volatility of consumption. The gain is the product of the three terms (Appendix A.27). Figure 5 shows the results.

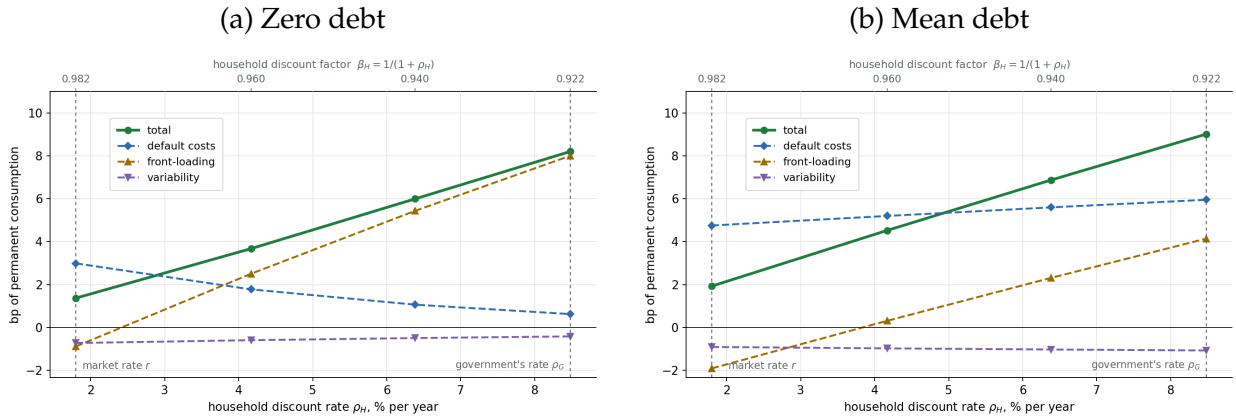


Figure 5. Welfare Gain and the Household's Discount Rate

Notes: Welfare gain from removing the fee, in basis points of permanent consumption, against the household's discount factor, from that of investors, $1/(1+r)$, to that of the government, β. The total is the product of the default-cost, variability and front-loading terms defined in Appendix A.27. Panel (a) evaluates the gain at zero debt and panel (b) at the mean level of debt in the baseline economy.

Households gain from removing the fee at every discount factor between that of the government and that of investors. Panel (a) of Figure 5 evaluates this gain at zero debt. Panel (b) evaluates it at the mean level of debt. At zero debt, the gain falls from 8.2 basis points

for a household as impatient as the government to 1.4 for one as patient as investors. The two ends differ in where the gain comes from. For the impatient household, front-loading accounts for 8.0 of the 8.2 basis points, and the lower costs of default for 0.6. The patient household gains 3.0 basis points from the lower costs of default and loses 0.9 from the additional borrowing. The variability term is negative at every discount factor, between -0.7 and -0.4 basis points, because the government borrows more and consumption becomes more volatile. At the mean level of debt, the gain ranges from 1.9 to 9.0 basis points, and the lower costs of default are worth between 4.7 and 6.0.

8 Conclusion

Emerging-market governments borrow both under their own law and under foreign law, usually that of New York or England. If the government defaults, the governing law determines whether domestic or foreign courts settle disputes, and so how much investors recover. This paper studies how these governments borrow under the two laws. We document four facts for twelve governments. First, all twelve borrow under both laws. Second, each issues its foreign-law debt at longer duration than its domestic-law debt. Third, issuing under foreign law costs a fee proportional to the money raised and independent of maturity. Fourth, in Brazil, Colombia, Paraguay and Russia the yield gap between domestic- and foreign-law bonds widens with the probability of default.

We develop a quantitative model of sovereign default in which the government borrows under both laws. Through the lens of the model, a yield gap that widens with default risk implies that investors expect to recover more on foreign-law debt in the event of a default. The model also measures the two recoveries. The slope of the yield gap pins down their difference, and how much the government borrows under each law pins down their level. In the model, the government faces a trade-off between the two laws. Foreign-law debt recovers more, and domestic-law debt is shorter and less exposed to dilution. The government therefore borrows under both laws. The fee explains why foreign-law debt is the longer one. A short bond must be issued again each time it matures, and each issue under foreign law pays the fee. We measure the welfare cost of the fee by letting the government issue foreign-law debt at the shorter duration of its domestic-law debt. We find that welfare rises, mostly through changes in how the government borrows and defaults.

Applied to Colombia, the model implies recoveries of 40 percent under domestic law and 47 percent under foreign law. With a long foreign-law bond available, the fee needed to keep the government out of short foreign-law debt falls from 100 to 35 basis points. A fee

of 25 basis points, Colombia's median, cuts short foreign-law debt from 36 to 3 percent of the government's debt. Issuing foreign-law debt at the duration of its domestic-law debt would raise Colombia's welfare by 8.2 basis points of permanent consumption, 7.4 of which come from changes in the government's borrowing and default policies.

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A Appendix

A.1 Shares of outstanding debt

Inflation-indexed bonds enter the domestic-law stock at their accreted capital. This is the indexed amount times the current value of the index. It is what the government owes. We convert the domestic-law stock to dollars at the annual average of the year's daily

exchange rates. GDP is converted at the same rate, so the exchange rate does not affect debt as a percentage of GDP. Both stocks are measured on 31 December. Table 13 also converts the domestic-law stock at the 31 December rate. We count a Dealogic tranche as domestic law only when its governing-law field names the home country. Tranches with a blank field count as foreign law.

Table 13. Foreign-Law Share of Marketable Debt: Robustness

	Headline (1)	Dec. FX (2)	Med. FX (3)	Revalued (4)	Net pub. (5)
Brazil	5.0	5.2	5.0	5.1	—
Chile	23.8	24.2	23.7	23.7	23.8
Colombia	29.1	30.2	29.4	29.8	31.6
Hungary	30.2	30.5	30.0	30.2	30.6
Mexico	16.0	16.3	15.9	15.8	—
Paraguay	82.2	82.7	82.2	82.2	—
Peru	34.7	34.8	34.8	34.9	35.5
Poland	20.8	20.8	20.7	20.6	22.2
Russia	20.9	21.6	20.8	20.8	23.5
South Africa	8.5	8.6	8.5	8.7	8.5
Turkey	24.5	26.3	24.5	24.4	28.0
Uruguay	62.5	62.9	62.6	62.4	—

Notes: Column (1) repeats column (4) of Table 1. Paraguay is averaged over 2013–2024, as in Table 1. Columns (2) and (3) convert domestic-law stocks at the 31 December exchange rate and at the annual median of daily rates, instead of the annual average. Column (4) revalues foreign-law bonds at each year's exchange rate instead of keeping their dollar value at issue. Column (5) also removes holdings of public institutions. — : not available.

In the baseline, the domestic-law stock is converted at the annual average of daily exchange rates, and each foreign-law bond keeps its dollar value on the issue date. Columns (2) and (3) of Table 13 instead use the 31 December rate and the annual median of daily rates. Column (4) revalues each foreign-law bond at each year's exchange rate, using the dual-currency face values that Dealogic records. Column (5) also removes the domestic-law holdings of public institutions that bought at competitive auctions. The 31 December rate moves the foreign-law share by 1.8 percentage points in Turkey and by at most 1.1 elsewhere. The median and the revaluation move it by at most 0.7. Removing the holdings of public institutions raises it by up to 3.5 points in Turkey and by 2.5 in Colombia.

A.2 Inflation-indexed domestic-law debt

Table 14 reports the share of inflation-indexed bonds in the domestic-law marketable debt of each government.

Table 14. Inflation-Indexed Share of Domestic-Law Debt

	Mean, 2006–2024	2024
Brazil	20.4	22.4
Chile	67.2	46.5
Colombia	31.8	33.8
Hungary	0.0	0.0
Mexico	23.5	29.8
Paraguay	0.0	0.0
Peru	7.3	3.1
Poland	1.9	2.1
Russia	2.2	5.6
South Africa	20.3	22.2
Turkey	16.5	10.9
Uruguay	57.3	33.1

Notes: Share of domestic-law marketable debt that is inflation-indexed, at each 31 December, averaged over 2006–2024 (Uruguay, 2010–2024). We do not count Uruguay's wage-indexed notes as indexed. Their payments follow a wage index. If we counted them, Uruguay's share would be 82.0 percent on average and 94.4 percent in 2024.

A.3 Duration differences

For each country and law, Figure 1 centers a normal density on the duration of each placement and averages these densities. Each placement counts once. The standard deviation of each normal is 0.45 times the standard deviation of the durations in that series. Durations cannot be negative, so we reflect at zero the part of each normal that falls below it. The medians and the tables use the durations themselves.

For bills and zero-coupon bonds, duration equals maturity. For fixed-coupon bonds we apply the formula of Section 2.3 to their coupons and principal, and for inflation-linked bonds we apply it in real terms, with the real coupon and the real yield. For floating-rate bonds, duration equals the time to the next coupon reset. The yield at issuance comes from official sources for domestic-law placements and from Dealogic for foreign-law placements. The duration of a floating-rate bond depends on how we treat its coupon resets. Maturity does not, so Table 15 reports maturity at issuance, with the same columns

as Table 2. Table 16 recomputes the medians with every country on 2006–2024. Table 17 splits the face value of foreign-law placements by governing law.

Table 15. Maturity at Issuance by Governing Law

	Domestic law				Foreign law				Gap	
	Median (1)	Mean (2)	Face (3)	GDP (4)	Median (5)	Mean (6)	Face (7)	GDP (8)	Median (9)	Face (10)
Brazil	4.59	7.29	4.45	4.36	10.40	16.41	16.24	16.46	5.81	11.79
Chile	9.84	13.81	10.67	10.81	11.42	16.48	16.83	16.60	1.58	6.16
Colombia	4.08	6.64	8.41	—	11.00	17.79	17.76	—	6.92	9.35
Hungary	3.85	4.94	3.08	2.91	8.50	9.39	10.82	10.64	4.65	7.74
Mexico	1.00	4.98	3.31	3.23	10.00	17.25	19.74	19.30	9.00	16.43
Paraguay	3.83	4.92	5.28	4.96	11.41	16.79	16.89	16.94	7.58	11.61
Peru	11.54	15.28	14.05	14.65	16.00	24.20	22.74	22.60	4.46	8.69
Poland	5.26	6.32	5.36	5.15	10.00	11.00	11.34	11.22	4.74	5.98
Russia	7.44	8.33	8.91	8.72	10.00	12.90	14.35	14.31	2.56	5.44
South Africa	9.62	11.34	6.72	6.84	12.00	16.91	17.18	16.90	2.38	10.46
Turkey	2.99	3.89	3.54	3.16	10.00	10.95	10.94	11.37	7.01	7.40
Uruguay	9.53	9.90	10.14	10.00	12.00	16.20	18.92	19.01	2.47	8.78

Notes: Years from settlement to final payment of each placement. Columns as in Table 2. — : not available.

Table 16. Maturity and Duration at Issuance: Common Window

	Maturity		Duration	
	Domestic (1)	Foreign (2)	Domestic (3)	Foreign (4)
Brazil	4.59	10.40	3.47	8.40
Chile	9.84	11.42	8.85	9.90
Colombia	4.08	11.00	3.75	8.71
Hungary	4.29	9.00	2.94	7.43
Mexico	1.00	10.00	0.48	8.87
Paraguay	3.83	11.41	3.46	8.74
Peru	11.54	16.00	8.64	11.77
Poland	5.32	10.00	2.60	8.15
Russia	7.57	10.00	5.62	8.00
South Africa	9.58	12.00	6.89	9.06
Turkey	4.25	10.00	1.64	7.68
Uruguay	9.53	12.00	8.19	9.45

Notes: Median maturity and median duration at issuance, in years, with every country on 2006–2024.

Table 17. Governing Law of Foreign-Law Placements

Country	Governing law (% of foreign-law face)
Brazil	NY 84, London 9, Tokyo 4, Frankfurt 2, Lux 2
Chile	NY 100
Colombia	NY 98, Tokyo 2
Hungary	London 72, NY 21, Tokyo 4, China 2, Frankfurt 1
Mexico	NY 90, Tokyo 8, Frankfurt 2, London 1
Paraguay	NY 100
Peru	NY 100
Poland	London 66, NY 27, Tokyo 5, Frankfurt 1, China 1
Russia	London 96, Frankfurt 4
South Africa	NY 90, London 5, Tokyo 3, Frankfurt 2
Turkey	NY 64, London 23, Frankfurt 7, Tokyo 6
Uruguay	NY 93, Tokyo 7

Notes: Share of foreign-law face issued under each law, from most to least.

A.4 Bonds in different currencies

We use the setting of Section 3.1. Bonds last one year and the government defaults with probability p. Investors are risk neutral in dollars and discount the future at r. In local currency per dollar the exchange rate is $\mathcal{E}'_R$ next year if the government repays and $\mathcal{E}'_D$ if it defaults, and $\delta \equiv \mathcal{E}'_D/\mathcal{E}'_R$. The foreign-law bond pays one dollar if the government repays and ν_F dollars if it defaults. The domestic-law bond pays one unit of local currency if the government repays and ν_D units if it defaults. To turn the domestic-law bond into a dollar bond the investor buys $\mathcal{F}$ domestic-law bonds. Together they promise $\mathcal{F}$ units of local currency. The investor also signs a forward contract to exchange $\mathcal{F}$ units of local currency for one dollar. The contract is worth zero today:

$$\frac{1}{\mathcal{F}} = \frac{1-p}{\mathcal{E}'_R} + \frac{p}{\mathcal{E}'_D}. \tag{18}$$

If the government repays, the bonds pay the $\mathcal{F}$ units of local currency the contract requires and the investor receives one dollar. If it defaults, the bonds pay $\nu_D\mathcal{F}$ units of local currency. The investor delivers them and receives ν_D dollars. The rest of the contract exchanges $(1-\nu_D)\mathcal{F}$ units of local currency for $1-\nu_D$ dollars. After the default, buying $(1-\nu_D)\mathcal{F}$ units of local currency in the market costs $(1-\nu_D)\mathcal{F}/\mathcal{E}'_D$ dollars. The rest of

the contract is therefore worth

$$(1-\nu_D) - (1-\nu_D)\,\frac{\mathcal{F}}{\mathcal{E}'_D} = (1-\nu_D)\,g, \qquad g \equiv 1 - \frac{\mathcal{F}}{\mathcal{E}'_D}.$$

Multiplying (18) by $\mathcal{E}'_D$ gives $\mathcal{E}'_D/\mathcal{F} = (1-p)\,\delta + p$, so

$$g = \frac{(1-p)(\delta-1)}{(1-p)\,\delta + p}. \tag{19}$$

The gain is positive when the currency depreciates upon default, $\delta > 1$, and zero when $\delta = 1$. A higher probability of default lowers the gain, because the forward prices in more of the depreciation, but the investor collects it more often. This second effect dominates whenever $p < \sqrt{\delta}/(1+\sqrt{\delta})$, a bound above one half for any depreciation.

The converted bond is therefore worth

$$\tilde{q}_D = \frac{(1-p) + p\left[\nu_D + (1-\nu_D)\,g\right]}{1+r},$$

and the foreign-law bond is worth $q_F = \left[(1-p) + p\,\nu_F\right]/(1+r)$. The gap between the two prices is

$$q_F - \tilde{q}_D = \frac{p\left[(\nu_F - \nu_D) - (1-\nu_D)\,g\right]}{1+r}. \tag{20}$$

The first term is the recovery difference. The second is the gain from the forward contract and enters with the opposite sign. The regressions of Section 3.4 measure how the gap changes with the probability of default. The derivative of (20) at $p = 0$ is

$$\left.\frac{\partial\,(q_F - \tilde{q}_D)}{\partial p}\right|_{p=0} = \frac{(\nu_F - \nu_D) - (1-\nu_D)\,(1-1/\delta)}{1+r}, \tag{21}$$

which is negative whenever the gain from the forward contract exceeds the recovery difference.

We take the calibrated recoveries of 40 and 47 percent (Section 5.1) and Colombia's depreciation upon default of $\delta = 1.55$ (Table 7). The recovery difference is then 0.07 and the gain term is $0.60 \times 0.35 = 0.21$. The slope of the converted gap is -0.14. As default becomes more likely the converted domestic-law bond rises in price relative to the foreign-law bond. This happens even though domestic-law investors recover 40 percent in default and foreign-law investors recover 47 percent. When the comparison uses a forward contract the sign of the slope is uninformative about the recovery difference.

A.5 Depreciation upon default and the yield gap

We use the setting of Section 3.1. Investors are risk neutral in dollars and discount the future at r. The government defaults within the year with probability p. In local currency per dollar the exchange rate is $\mathcal{E}$ today, $\mathcal{E}'_R$ next year if the government repays and $\mathcal{E}'_D$ if it defaults. The depreciation upon default is $\delta \equiv \mathcal{E}'_D/\mathcal{E}'_R$, and $\mathcal{E}/\mathcal{E}'_R$ reflects the depreciation expected if the government repays.

A law-j bond pays one unit of local currency if the government repays and ν_j units if it defaults. Its price in local currency is

$$q_j = \frac{\mathcal{E}}{1+r}\left[\frac{1-p}{\mathcal{E}'_R} + \frac{p\,\nu_j}{\mathcal{E}'_D}\right] = \frac{\mathcal{E}}{\mathcal{E}'_R}\,\frac{(1-p)+p\,\nu_j/\delta}{1+r}.$$

With continuously compounded yields, $y_j = -\ln q_j$,

$$y_j = \ln\frac{\mathcal{E}'_R}{\mathcal{E}} + \ln(1+r) - \ln\big[(1-p)+p\,\nu_j/\delta\big].$$

The first two terms are the same for both bonds and cancel in the gap. The yield gap is then

$$y_D - y_F = \ln\frac{(1-p)+p\,\nu_F/\delta}{(1-p)+p\,\nu_D/\delta} \simeq \frac{p\,(\nu_F-\nu_D)}{\delta}. \tag{22}$$

A.6 Measuring depreciation upon default

We use the setting of Appendix A.5. We measure δ with two CDS on the same government. A CDS insures a notional amount against a default by the government. The spread is the share of the notional that the buyer pays if the government repays. If the government defaults, the seller pays the share of the notional that bondholders lose. Only foreign-law bonds can be delivered into the contract (Section 5.1), so the loss is $1-\nu_F$.

The two contracts differ only in the currency of the notional. Both payments are shares of the notional, so the spread does not depend on its size. We set each notional to one unit of its currency. For the dollar CDS, if the government repays, the buyer pays $s^{\$}$ dollars. If it defaults, the seller pays $1-\nu_F$ dollars. The contract is worth zero when it is signed, so

$$(1-p)\,s^{\$} = p\,(1-\nu_F).$$

For the local-currency CDS, if the government repays, the buyer pays s^{LC} units of local currency. If it defaults, the seller pays $1-\nu_F$ units of local currency. In dollars, this

contract is also worth zero when it is signed, so

$$(1-p)\,\frac{s^{LC}}{\mathcal{E}'_R} = p\,\frac{1-\nu_F}{\mathcal{E}'_D}.$$

Dividing the first condition by the second gives

$$\delta = \frac{s^{\$}}{s^{LC}}. \tag{23}$$

The probability of default, the recovery and the exchange rate upon repayment cancel. The ratio is the depreciation upon default. This depreciation does not depend on the maturity of the bond, so the same δ applies to bonds of every maturity.

We compute δ_t each day as the ratio of Markit's five-year dollar and local-currency par spreads. Table 7 reports the mean of δ_t from January 2015 to June 2025 for Colombia, Mexico, Russia, South Africa and Turkey. Across them the local currency loses between 35 and 50 percent of its dollar value in default. We drop the days with $\delta_t < 1$. On these days the local-currency spread is above the dollar spread, so the local currency would gain value in default. In Colombia this drops three days. In the other four countries it drops none. Brazil's local-currency CDS is quoted only until May 2015. From 2010 to May 2015 dropping these days raises Brazil's δ from 1.31 to 1.37. Markit has no local-currency CDS for Chile, Hungary, Paraguay, Peru, Poland and Uruguay.

A.7 Maturity and the yield gap

We extend the setting of Appendix A.5 to bonds that mature in n years. For simplicity we assume that both bonds pay in dollars. The government defaults in each year with probability p if it has not defaulted before. A law-j bond pays ν_j dollars in year k if the government survives $k-1$ years and then defaults. This happens with probability $(1-p)^{k-1}p$. The bond pays one dollar in year n if the government survives all n years. This happens with probability $(1-p)^n$. Discounting each payment at r gives the price

$$q_j^{(n)} = \sum_{k=1}^{n} \frac{(1-p)^{k-1}\,p\,\nu_j}{(1+r)^k} + \frac{(1-p)^n}{(1+r)^n}.$$

Multiplying the price by $(1+r)^n$ gives

$$X_j \equiv (1+r)^n q_j^{(n)} = (1-p)^n + p\,\nu_j \sum_{k=1}^{n} (1-p)^{k-1}(1+r)^{n-k}.$$

The yield gap is then

$$y_D^{(n)} - y_F^{(n)} = \frac{\ln X_F - \ln X_D}{n} \simeq \frac{p\,(\nu_F - \nu_D)}{n} \sum_{k=1}^{n} (1+r)^{n-k} = p\,(\nu_F - \nu_D)\,\frac{(1+r)^n - 1}{n\,r}.$$

We use the recoveries of the calibrated model, $\nu_D = 0.40$ and $\nu_F = 0.47$, and $r = 1.8$ percent. We set p to the model's default frequency of 3.7 percent a year (Table 10). The gap is 26.5 basis points at $n = 1$ and 28.7 at $n = 10$. At both maturities the approximation is 0.6 basis points below the exact gap. The slope of the gap is 0.073 at $n = 1$ and 0.078 at $n = 10$, against a recovery difference of 0.07.

Per 100 of face value, the price gap $q_F^{(n)} - q_D^{(n)}$ is 0.25 at $n = 1$ and 2.01 at $n = 10$. Its slope is 0.069 at $n = 1$ and 0.458 at $n = 10$. Because the government can default in any of the ten years before the long bond matures, its price gap is eight times that of the one-year bond. The yield gap divides the log of the price ratio by n, which brings the two slopes within 7 percent of each other. Equation (5) controls for time to maturity.

A.8 Nonresident access to domestic-law debt

We start each sample only after nonresidents can hold the domestic-law bond on the same terms as the foreign-law bond. A nonresident buys the foreign-law bond through Euroclear or DTC and pays in dollars. The domestic-law bond may instead require bringing dollars into the country, converting them into local currency, holding the bond through a local custodian and converting the payments back into dollars. A tax or a restriction on any of these steps raises the yield the investor requires on the domestic-law bond, and the yield gap would then also price the cost of access. For each country we check that capital can enter and leave without controls or entry taxes, and that the currency trades at a single onshore rate open to nonresidents.

Brazil. Brazil meets the conditions from June 2013.[19] Until then, a nonresident who bought domestic-law bonds had to convert dollars into reais onshore and paid the IOF tax on the conversion: 2 percent on portfolio inflows from October 2009, and 4 and then 6

[19] Decreto 6.306/2007, as amended by Decretos 6.983/2009, 7.323/2010, 7.330/2010 and 8.023/2013.

percent on fixed-income inflows in October 2010. The tax applied to the onshore purchase and not to the Global BRL bonds, which are bought and settled in dollars. It was cut to zero on 4 June 2013. Brazil's sample starts in January 2014, the first full year after the tax was removed.

Colombia. Colombia meets the conditions throughout its sample.[20] The unremunerated reserve requirement on portfolio inflows, imposed in May 2007 at 40 percent and raised to 50 percent in May 2008, was abolished in October 2008. Foreign portfolio investors have a legal right to remit profits and the proceeds of sales abroad in convertible currency. The one difference between the two bonds is a withholding tax on the domestic-law bond (Appendix A.9). Colombia's sample starts in June 2017. That month the longest of its foreign-law bonds enters the ten-year range of the domestic-law curve (Appendix A.12).

Paraguay. Paraguay meets the conditions from January 2025.[21] On 26 December 2024, the central bank revised its rules on issuance, custody and trading and opened the domestic market to nonresidents. Before then, a nonresident had no practical way to hold the domestic-law bonds. Funds can be converted and repatriated without restriction, and the guaraní floats. Paraguay's sample starts on 6 February 2025, when Bloomberg's prices for the domestic-law bonds begin (Appendix A.12).

Russia. Russia meets the conditions from February 2013.[22] That month Euroclear began settling its domestic-law government bonds (Lu and Yakovlev, 2017). Before then a nonresident needed a local custodian. The rouble floats freely from November 2014. In July 2014 the United States and the European Union sanctioned named Russian banks and energy firms. The sanctions barred new debt of these firms. They did not apply to the government's bonds or to their trading. Russia's sample runs from March 2014 to March 2017. Over this window its foreign-law bond has between four years and one year left to maturity. The panel has no observations from 22 December 2014 to 27 April 2015. Over these months the ten-year domestic benchmark that we use for the liquidity control has no quotes.

[20] Decretos 1801/2007, 1888/2008 and 3913/2008; Decreto 1068/2015, arts. 2.17.2.2.3.1 and 2.17.2.2.3.2, as amended by Decreto 119/2017.

[21] Banco Central del Paraguay, Resolución N.º 25, Acta N.º 62, 26 December 2024; IMF, *Paraguay: 2024 Article IV Consultation*; U.S. Department of State, *Investment Climate Statement: Paraguay*.

[22] IMF, *Russian Federation: 2015 Article IV Consultation*, Country Report No. 15/211; OFAC Directive 1 under E.O. 13662, 16 July 2014, as amended 12 September 2014; Council Regulation (EU) No 833/2014, 31 July 2014.

Peru. Peru meets the conditions over the whole sample.[23] Its constitution guarantees the right to hold and dispose of foreign currency, the sol floats, and portfolio flows face no controls. Since 2017, Bonos Soberanos have also settled through Euroclear.

Holdings. Table 18 reports the share of each government's domestic-law marketable debt that nonresidents hold, using data from each country's central bank, treasury or debt office. We measure this share in two ways. The first divides nonresident holdings by the debt held by all holders. The second divides them by the debt held by private investors, leaving out the central bank and public institutions and funds. We average each share over the full period of each source and over the estimation window of the yield gap (Table 5). Over the estimation windows nonresidents hold between 15 and 26 percent of the domestic-law debt in Brazil, Colombia and Russia, and 44 percent in Peru. Net of public holdings, the shares are between 16 and 33 percent in Brazil, Colombia and Russia, and 45 percent in Peru.

Table 18. Nonresident Holdings of Domestic-Law Debt

		Full period		Estimation window	
	Source, period	All holders	Net of public	All holders	Net of public
Brazil	Tesouro Nacional, 2007–2026	11.4	12.0	15.2	16.1
Chile	Banco Central, 2012–2026	9.5	—		
Colombia	MinHacienda, 2010–2026	17.3	20.0	25.6	29.2
Hungary	ÁKK, 2004–2026	29.1	30.7		
Mexico	Banxico, 2004–2026	20.9	21.8		
Paraguay	MEF, 2025–2026	3.5	—	—	—
Peru	MEF, 2007–2026	41.4	42.6	43.6	45.2
Poland	Ministry of Finance, 2004–2026	25.4	27.5		
Russia	Bank of Russia, 2011–2026	19.1	24.3	22.9	32.7
South Africa	National Treasury, 2006–2026	31.6	43.7		
Turkey	Treasury, 2004–2026	12.2	16.6		
Uruguay	Debt office, 2024–2026	2.2	—		

Notes: Percent of domestic-law marketable government debt held by nonresidents, means of monthly or quarterly data. Estimation windows as in Table 5, and for Peru as in Appendix A.16.

A.9 Taxes on the two bonds

A withholding tax on the domestic-law bond raises its yield and enters the yield gap. The foreign-law bonds pay gross in all five countries. Among the domestic-law bonds, non-

[23] Constitución Política del Perú (1993), art. 64; D.S. N.º 309-2016-EF; R.M. N.º 059-2017-EF/52; U.S. Department of State, *Investment Climate Statement: Peru*.

residents pay a withholding tax only in Colombia. Brazil has exempted nonresidents' income from federal government bonds since 2006.[24] Russia paid coupons on its domestic-law bonds to nonresidents without withholding until 2021. Its sample ends in 2017.[25] Paraguay exempts nonresidents' income from public debt.[26] Peru exempts interest on government bonds for all holders.[27]

In Colombia, nonresident portfolio investors paid a 14 percent withholding tax on income from domestic-law bonds from 2013, reduced to 5 percent from 2019.[28] The Global TES pay gross. Colombia undertakes to pay additional amounts so that holders receive their payments free of any Colombian withholding (Republic of Colombia, 2007, clause 5(a)).

Because the tax is levied on income, a nonresident who holds the domestic-law bond earns approximately $(1 - m_t)\,\widetilde{y}_{D,t}$, where m_t is the tax rate. The tax adds $m_t\,\widetilde{y}_{D,t}$ to the yield gap. This term rises with the domestic-law yield, and so with default risk, and first differences do not remove it. We measure the gap net of the tax as $(1 - m_t)\,\widetilde{y}_{D,t} - y_{F,t}$, with m_t at 14 percent before 2019 and 5 percent from 2019, and Colombia's slope falls from 0.225 to 0.212 (Table 23). Since we apply the full statutory rate, and holders covered by a tax treaty or who credit the tax at home bear less, Colombia's slope net of the tax lies between 0.212 and 0.225.

A.10 Settlement of the foreign-law bonds

Each foreign-law bond promises fixed amounts of local currency. Because the real, the Colombian peso and the guaraní cannot be delivered through DTC, Euroclear or Clearstream, Brazil's, Colombia's and Paraguay's bonds pay the dollar value of each local-currency payment. The rouble could be delivered through Euroclear, so Russia's bond pays roubles unless the holder chooses dollars. We use its Euroclear-settled tranche.

The conversion uses the onshore reference rate, the PTAX in Brazil and the Representative Market Rate in Colombia and Paraguay.[29] Each is a spot rate that the central bank or

[24] Lei 11.312/2006, art. 1. The exemption excludes investors in jurisdictions that tax income at less than 20 percent.

[25] Tax Code of the Russian Federation, art. 310.

[26] Ley 6380/2019, art. 79, numeral 4.

[27] D.S. N.º 179-2004-EF, art. 19, inciso h). The exemption runs to 31 December 2026.

[28] Ley 1607/2012, art. 125; Ley 1943/2018, art. 72; Ley 2010/2019. Investors in listed jurisdictions pay 25 percent.

[29] Colombia's rate is a five-business-day average of the weighted average of buy and sell rates on transactions by banks in Bogotá, Cali, Barranquilla and Medellín, published by the Superintendencia Financiera (Republic of Colombia, 2007). Brazil's is the commercial rate the central bank reports on the SISBACEN system. Paraguay's is fixed by the Banco Central del Paraguay ten business days before each payment.

the financial regulator computes from transactions inside the country shortly before the payment. A holder of the domestic-law bond converts the same payments into dollars at this rate, so the two bonds convert their payments at the same rate.

A.11 Defaults on both classes of bonds

The model assumes that the government defaults on both classes of bonds at once. We assess this assumption with the January 2026 release of the database of Erce et al. (2024), which records government defaults and restructurings on domestic and external debt. Not every episode in it fits the model, where investors hold marketable bonds and can buy them under both laws. We select the episodes that fit in three steps.

First, we keep bonds that private investors bought in the market. The database records 297 events in 84 countries. Of these, 184 are bank loans and commercial credit and 113 are bonds. The authors' companion volume of sovereign histories names the instrument in each episode. With it we keep the 90 bond events in which an instrument traded in the secondary market (Table 19). We group these events into episodes as the authors do, which gives 43 episodes in 31 countries.

Second, we keep episodes in which the government had issued bonds under both laws before the default. We take foreign-law issuance from Dealogic and the existence of a domestic bond market from the authors' episode narratives. The government had issued under both laws in 27 of the 43 episodes. Both classes were restructured in 12 of them. Only domestic-law bonds were restructured in 8 and only foreign-law bonds in 7 (Table 20).

Third, we keep the episodes in which foreign investors could hold the domestic-law debt. Eleven of the 15 episodes in which only one class was restructured do not meet this condition. In them exchange controls or terms that applied only to residents limited the domestic-law debt to resident holders. This leaves 16 episodes. Both classes were restructured in 12 of them (Table 21).

Table 19. Default Events in the Database

	Events	Percent	US$ billion
All events	297	100.0	1,671.6
Bank loans and commercial credit	184	62.0	736.9
Bonds	113	38.0	934.8
	Domestic	Foreign	Total
Bond events: bought by private investors	59	31	90
Bond events: other instruments	23	0	23

Notes: Events in Erce et al. (2024), January 2026 release. A bond event counts as bought by private investors if any instrument in it traded in the secondary market. Domestic and foreign refer to the market of issuance.

Table 20. Default Episodes on Bonds Bought by Private Investors

	All episodes		Issued under both laws	
	Episodes	Percent	Episodes	Percent
Both classes restructured	12	27.9	12	44.4
Domestic-law bonds only	18	41.9	8	29.6
Foreign-law bonds only	13	30.2	7	25.9
Total	43	100.0	27	100.0

Notes: Episodes in which both classes were restructured: Argentina 2001, Barbados 2018, Côte d'Ivoire 2011, Dominica 2003, Ecuador 1997, Greece 2011, Grenada 2004 and 2013, Russia 1998, St Kitts and Nevis 2011, Ukraine 1998 and Uruguay 2002.

Table 21. Episodes in Which Foreign Investors Could Hold Domestic-Law Debt

	Strict		Lenient	
	Episodes	Percent	Episodes	Percent
Both classes restructured	12	85.7	12	75.0
One class restructured	2	14.3	4	25.0
Total	14	100.0	16	100.0

Notes: Episodes dropped because only residents could hold the domestic-law debt: Belize 2006, 2012 and 2016, Brazil 1986, Cyprus 2013, Jamaica 2010 and 2013, Mozambique 2015 and 2016, Seychelles 2008 and Venezuela 1998. Strict keeps Turkey 1999 and Panama 1998. Lenient also keeps Venezuela 2002 and Pakistan 1998.

A.12 Instruments and curves

Table 22 lists the bonds in the yield-gap sample. Two short bonds never enter the sample. They are Brazil's 12.5% '16 and Colombia's 12% '15.

Table 22. Bonds in the Yield-Gap Sample

Country	Bond	ISIN	Governing law
Brazil	Global BRL 12.5% '22	US105756BL31	New York
	Global BRL 10.25% '28	US105756BN96	New York
	Global BRL 8.5% '24	US105756BT66	New York
Colombia	Global TES 9.85% '27	XS0306322065	New York
	Global TES 7.75% '21	XS0502258444	New York
	Global TES 4.375% '23	XS0833886095	New York
Paraguay	Global 7.9% '31	US699149AP51	New York
	Global 8.5% '35	US699149BX76	New York
	Global 8.5% '38	US699149CC21	New York
Russia	7.85% '18	XS0564087541	English
Peru (placebo)	GDN 6.90% '37	US715638AV48	Peruvian[a]
	GDN 6.95% '31	US715638BE14	Peruvian[a]
	GDN 6.35% '28	USP78024AC31	Peruvian[a]

[a] New York law governs the deposit agreement; the claim on the government is the underlying Bono Soberano and remains under Peruvian law.
Notes: Regulation S tranches unless stated. Paraguay's 7.9% '31 has a Regulation S twin, USP75744AP07; Russia's Rule 144A tranche is US783064AN80.

We use Bloomberg's domestic-law zero curves for Brazil and Colombia and the Bank of Russia's curve for Russia. Brazilian rates are effective annual rates on a calendar of 252 business days a year, and we price Brazil's bonds on the same convention. Colombia's curve covers maturities of one to ten years, so a Colombian bond enters the sample once it has ten years or less left to maturity. The 2027 bond enters in June 2017, when Colombia's sample starts. Brazil's and Colombia's samples end in February 2020, before the COVID crisis. Russia's ends when its bond has one year left to maturity, and Paraguay's runs to the last day of available data.

Paraguay has no published zero curve for its domestic-law guaraní bonds, so we fit one each day to the 11 domestic-law Bonos del Tesoro with Bloomberg evaluated prices (BVAL). Between 9 and 11 of them are quoted on a given day. The bonds pay semiannual coupons, and we compute accrued interest on a 30/360 basis. Bloomberg's evaluated prices for these bonds begin on 6 February 2025, the first day of Paraguay's sample.

Each day we fit the Nelson–Siegel curve

$$y(t) = \beta_0 + \beta_1 \frac{1 - e^{-t/\lambda}}{t/\lambda} + \beta_2 \left(\frac{1 - e^{-t/\lambda}}{t/\lambda} - e^{-t/\lambda} \right),$$

where $y(t)$ is the annually compounded zero yield at a horizon of t years. The price of a bond on the curve discounts each remaining cash flow at the zero yield of its date,

$$P^{\text{model}} = \sum_k CF_k \left(1 + y(t_k)\right)^{-t_k}.$$

We choose $(\beta_0, \beta_1, \beta_2)$ to minimize

$$\sum_{\text{bonds}} \left(\frac{P^{\text{model}} - P^{\text{market}}}{\text{DV01}} \right)^2,$$

where P^{market} is the bond's dirty mid price and DV01 its price change for a one-basis-point move in yield, so the criterion is approximately a sum of squared yield errors. We drop bonds within 30 days of maturity and days with fewer than four quotes.

The decay parameter λ sets where the curvature term peaks. Each day we choose λ from a grid between 0.15 and 3 years and then use the 21-day rolling median of these daily choices. Of the rules we compared, this one keeps the fit within 25 percent of the best daily fit and moves the curve least from one day to the next. It gives $\lambda = 3$ on 278 of the 331 days.

We use the curve only between the shortest and the longest domestic-law bond quoted that day, and a foreign-law bond enters the sample on a given day only if its final payment falls within that range. Over the 331 days, the median root-mean-squared yield error of the fit is 7 basis points. When we drop one bond at a time, refit the curve and price the omitted bond on it, the median absolute error is 7 basis points if the omitted bond lies inside the range of the others and 16 if it lies at either end. This is why we do not extrapolate the curve. When we fit the curve separately to bid and to ask prices, half the distance between the two curves is about 8 basis points at ten years and 12 at five years.

Figure 6 shows the fit on four dates. Each red point is the yield to maturity of a domestic-law bond, plotted at its duration. Each cross is a foreign-law Global, placed on the fitted curve at its duration. The range of quoted maturities and the number of bonds change across dates as domestic-law bonds mature and new ones are issued. The 2038 Global enters in February 2026.

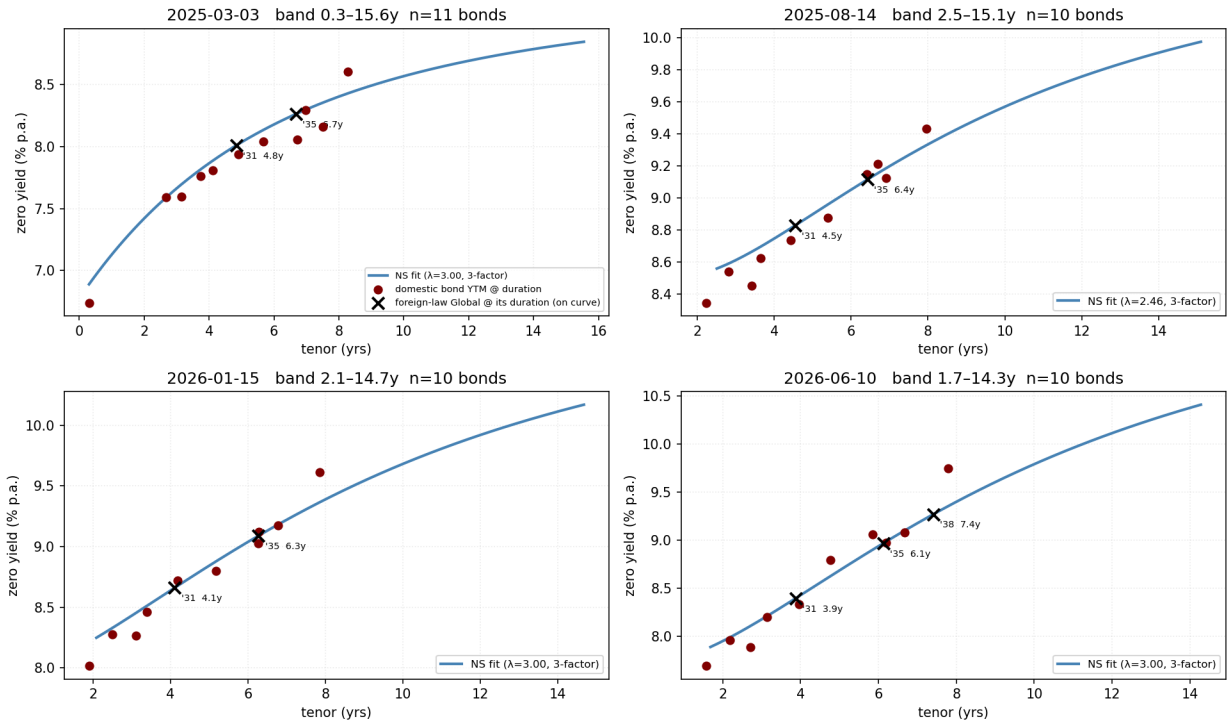


Figure 6. Paraguay's Fitted Domestic-Law Curve

Notes: Nelson–Siegel zero curve fitted to Paraguay's domestic-law Bonos del Tesoro on four dates. Points are domestic-law bonds and crosses are foreign-law Globals, both at their duration. Panel titles give the range of quoted maturities and the number of domestic-law bonds.

A.13 Stationarity, cointegration and inference

Augmented Dickey–Fuller tests cannot reject a unit root in the level of the yield gap or of the CDS spread in Brazil, Colombia, Paraguay and Peru. KPSS tests reject stationarity in the same series, and the first differences are stationary on both tests. In Russia the yield gap is stationary while the CDS spread is not.

A regression in levels requires the yield gap and the CDS spread to be cointegrated. Over the full sample, the Engle–Granger test does not reject the null of no cointegration for any bond in Brazil, Colombia, Paraguay or Peru. Over the period before COVID, it rejects for one bond in Brazil ($p = 0.019$ for the 10.25% '28) and one in Colombia ($p = 0.012$ for the 9.85% '27).

The Driscoll–Kraay standard errors use the automatic Newey–West bandwidth $L = \lfloor 4\,(T/100)^{2/9} \rfloor$, where T is the number of trading days. In Brazil and Colombia daily changes are positively autocorrelated, and correcting for this raises the standard errors. In Paraguay and Russia daily changes are negatively autocorrelated, and the correction lowers them.

A.14 Robustness of the yield-gap estimates

Table 23 re-estimates equation (5) under alternative specifications, country by country, without and with the change in the VIX. For each country, the first row repeats the baseline and the second reports its Driscoll–Kraay t-statistic. The next rows drop the liquidity control, drop the maturity control, and keep only differences between consecutive trading days. We then interact the change in the relative bid-ask spread with the level of the CDS spread, so that the effect of liquidity can vary with default risk. For Colombia, we also measure the gap net of the withholding tax that nonresidents paid on domestic-law bonds. We extend Brazil's sample past the COVID break, from July 2020 or from July 2021 to December 2025, and Colombia's to 2017–2025 and to 2015–2025, excluding the COVID period. For Russia we exclude the crisis months from November 2014 to March 2015, and for Peru we extend the sample to 2017–2025, including the COVID period. The last rows drop one bond at a time.

Table 23. The Yield Gap and the CDS Spread: Robustness

	Without ΔVIX		With ΔVIX	
	Slope	t	Slope	t
Brazil				
Baseline	0.669^{***}	(10.65)	0.694^{***}	(9.72)
Driscoll–Kraay t-statistic	0.669^{***}	(7.37)	0.694^{***}	(6.80)
Without the liquidity control	0.668^{***}	(10.62)	0.694^{***}	(9.68)
Without the maturity control	0.669^{***}	(10.66)	0.694^{***}	(9.74)
One-trading-day differences	0.703^{***}	(8.96)	0.738^{***}	(8.21)
Liquidity control × CDS level	0.666^{***}	(10.57)	0.692^{***}	(9.69)
Adding July 2020 to December 2025	0.590^{***}	(10.83)	0.631^{***}	(10.21)
Adding July 2021 to December 2025	0.628^{***}	(11.28)	0.676^{***}	(10.64)
Without the 2022 bond	0.657^{***}	(7.97)	0.686^{***}	(7.27)
Without the 2028 bond	0.681^{***}	(10.29)	0.706^{***}	(9.42)
Without the 2024 bond	0.659^{***}	(7.56)	0.682^{***}	(6.87)
Colombia				
Baseline	0.221^{***}	(5.74)	0.225^{***}	(4.83)
Driscoll–Kraay t-statistic	0.221^{***}	(4.35)	0.225^{***}	(3.81)
Without the liquidity control	0.221^{***}	(5.74)	0.225^{***}	(4.83)
Without the maturity control	0.221^{***}	(5.74)	0.225^{***}	(4.83)
One-trading-day differences	0.104^{***}	(3.16)	0.117^{***}	(2.93)
Liquidity control × CDS level	0.218^{***}	(5.73)	0.220^{***}	(4.82)
Net of the withholding tax	0.186^{***}	(5.16)	0.212^{***}	(4.56)
2017–2025, excluding the COVID period	0.231^{***}	(3.25)	0.250^{***}	(2.90)
2015–2025, excluding the COVID period	0.187^{***}	(3.47)	0.203^{***}	(3.10)
Without the 2027 bond	0.265^{***}	(5.25)	0.260^{***}	(4.32)
Without the 2021 bond	0.205^{***}	(4.55)	0.229^{***}	(4.00)
Without the 2023 bond	0.193^{***}	(4.31)	0.188^{***}	(3.55)
Paraguay				
Baseline	0.157^{**}	(2.03)	0.169^{**}	(2.10)
Driscoll–Kraay t-statistic	0.157^{**}	(2.20)	0.169^{**}	(2.16)
Without the liquidity control	0.222^{***}	(2.83)	0.231^{***}	(2.81)
Without the maturity control	0.158^{**}	(2.03)	0.170^{**}	(2.10)
One-trading-day differences	0.109	(0.96)	0.108	(0.90)
Liquidity control × CDS level	0.153^{**}	(1.98)	0.164^{**}	(2.07)
Without the 2031 bond	0.298^{***}	(2.94)	0.364^{***}	(3.43)
Without the 2035 bond	0.088	(0.87)	0.059	(0.58)
Without the 2038 bond	0.117	(1.49)	0.123	(1.54)
Russia				
Baseline	0.079^{***}	(2.64)	0.073^{**}	(2.30)
Driscoll–Kraay t-statistic	0.079^{***}	(3.38)	0.073^{***}	(2.83)
Without the liquidity control	0.098^{***}	(2.80)	0.097^{**}	(2.54)
Without the maturity control	0.079^{***}	(2.64)	0.072^{**}	(2.30)
One-trading-day differences	0.028	(0.76)	0.018	(0.46)
Liquidity control × CDS level	0.062^{**}	(2.13)	0.054^{*}	(1.79)
Excluding November 2014 to March 2015	0.059^{*}	(1.75)	0.049	(1.38)
Peru (placebo)				
Baseline	−0.028	(−1.46)	−0.017	(−0.76)
Driscoll–Kraay t-statistic	−0.028	(−1.08)	−0.017	(−0.58)
Without the liquidity control	−0.027	(−1.42)	−0.018	(−0.78)
Without the maturity control	−0.028	(−1.46)	−0.017	(−0.75)
One-trading-day differences	-0.038^{*}	(−1.93)	-0.046^{**}	(−2.05)
Liquidity control × CDS level	−0.028	(−1.46)	−0.017	(−0.76)
2017–2025, including the COVID period	−0.021	(−1.01)	−0.022	(−0.95)
Without the 2037 bond	−0.014	(−0.54)	0.011	(0.33)
Without the 2031 bond	-0.054^{***}	(−2.87)	-0.052^{**}	(−2.41)
Without the 2028 bond	−0.017	(−0.72)	−0.012	(−0.41)

Notes: Estimates of γ in equation (5), without and with the change in the VIX among the controls, on the days for which the VIX is available. t-statistics in parentheses use Huber–White standard errors, except in the Driscoll–Kraay row (Newey–West for Russia, which has one bond). Stars follow the t-statistic shown: $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

A.15 Binned scatters by country and bond-by-bond estimates

A.16 Placebo: Peru's Global Depositary Notes

Peru's sol Global Depositary Notes give a placebo for the yield gap. Each note is a claim, issued by a depositary bank, on domestic-law Bonos Soberanos held in custody in Peru. New York law governs the deposit agreement, and the payment claim remains under Peruvian law, so both sides of the gap are domestic-law claims. Nonresidents can buy, hold and sell the Bonos Soberanos without restrictions, and held 40.9 percent of their outstanding stock at the end of 2024.[30]

We use the notes on the Bonos Soberanos maturing in 2028, 2031 and 2037, from April 2017 to December 2025, excluding March 2020 to July 2021, and apply the construction and the regression of Section 3.3. The slope of the gap on Peru's CDS spread is -0.017, with a Driscoll–Kraay t-statistic of -0.58 and 3,391 observations. Table 23 reports the alternative specifications.

A.17 The cost of issuing

We estimate equation (1), with the fee in basis points of the money raised and size in US$ billion raised. The sample is the New York-law bonds with a fee, without two retail notes that Mexico sold in 2006, and without the bonds below the 1st and above the 99th percentile of maturity: three bonds shorter than 5 years and four longer than 50 years. This leaves 360 bonds from ten countries. Standard errors are clustered by country, and because there are only ten clusters we also report p-values from a wild bootstrap. Neither coefficient is significant: $p = 0.41$ for maturity (0.51 with the bootstrap) and $p = 0.24$ for size (0.27), and the joint test that both are zero gives $p = 0.23$. With ten clusters, the clustered covariance matrix cannot test the eighteen year effects jointly, so the joint tests of the country and of the year effects in Table 4 use heteroskedasticity-robust errors. With the seven bonds outside the percentiles included, the coefficient on maturity is 0.048, with $p = 0.25$. For Colombia, the same regression on its 49 New York-law bonds, with year effects and errors clustered by deal, gives $p = 0.63$ for maturity and $p = 0.63$ for size (Figure 7).

Only five countries have bonds with a recorded fee under laws other than New York law, 50 bonds in all, and three quarters of them are yen bonds issued under Japanese law. Table 27 compares the fee by law and market. The median English-law bond in euros

[30] Ministerio de Economía y Finanzas, *Informe Anual de Deuda Pública 2024* (May 2025).

Table 24. The Underwriting Fee and the Spread at Issue

	(1) All bonds	(2) Dollar bonds with a spread
Maturity (years)	0.024	0.046
	[0.51]	[0.12]
Size (US$ billion raised)	0.342	0.356
	[0.27]	[0.19]
Spread at issue (per 100 basis points)		0.766
		[0.15]
Country and year effects	Yes	Yes
Bonds	360	263
R^2	0.873	0.907

Notes: Dependent variable: underwriting fee in basis points of the money raised. Column (1) is column (2) of Table 4. Wild-bootstrap p-values in brackets.

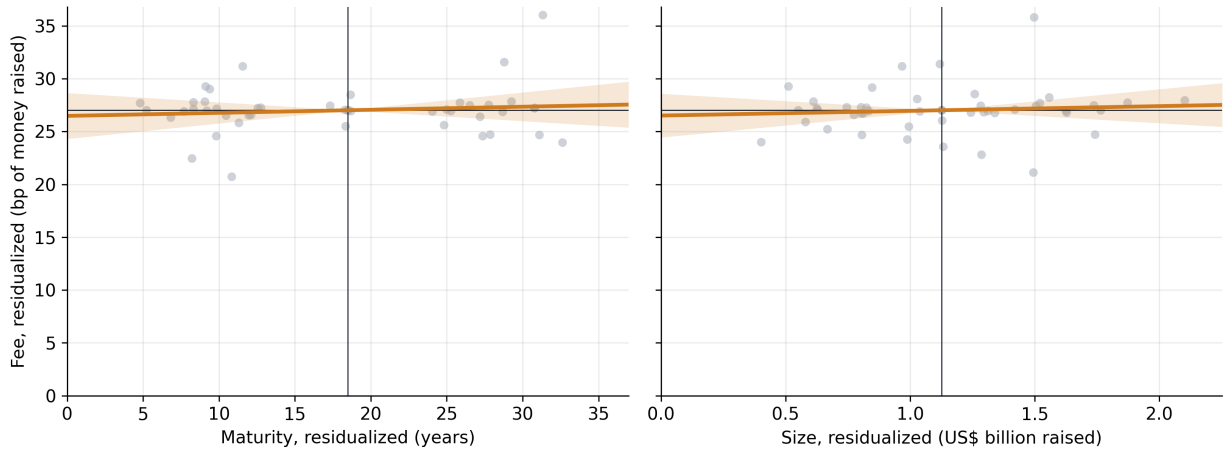


Figure 7. Underwriting Fee, Maturity and Size: Colombia

Notes: As Figure 2, for Colombia's 49 New York-law bonds, 2006–2024, with year effects; averages added back (fee 27.0 basis points, maturity 18.5 years, size US$1.1 billion). Shaded: 95 percent interval of the slope, with errors clustered by deal.

PROSPECTUS SUPPLEMENT
(TO PROSPECTUS DATED APRIL 15, 2021)



U.S. $2,000,000,000

Republic of Colombia

3.250% Global Bonds due 2032

The bonds will mature on April 22, 2032. The Republic of Colombia ("Colombia" or the "Republic") will pay interest on the bonds each April 22 and October 22, commencing on October 22, 2021. The bonds will be issued in denominations of U.S. $200,000 and integral multiples of U.S. $1,000 in excess thereof.

The bonds will be direct, general, unconditional, unsecured and unsubordinated external indebtedness of Colombia and will be backed by the full faith and credit of Colombia. The bonds will rank without any preference among themselves and equally with all other unsecured and unsubordinated external indebtedness of Colombia. It is understood that this provision shall not be construed so as to require Colombia to make payments under the bonds ratably with payments being made under any other external indebtedness.

Colombia may, at its option, redeem the bonds, in whole or in part, before maturity, on not less than 10 nor more than 60 days' notice on the terms described under "Description of the Bonds—Optional Redemption" in this prospectus supplement. The bonds will not be entitled to the benefit of any sinking fund.

The bonds will be issued under an indenture and constitute a separate series of debt securities under the indenture. The indenture contains provisions regarding future modifications to the terms of the bonds that differ from those applicable to Colombia's outstanding public external indebtedness issued prior to January 28, 2015. Under these provisions, which are described beginning on page 7 of the accompanying prospectus, Colombia may amend the payment provisions of any series of debt securities (including the bonds) and other reserve matters listed in the indenture with the consent of the holders of: (1) with respect to a single series of debt securities, more than 75% of the aggregate principal amount of the outstanding debt securities of such series; (2) with respect to two or more series of debt securities, if certain "uniformly applicable" requirements are met, more than 75% of the aggregate principal amount of the outstanding debt securities of all series affected by the proposed modification, taken in the aggregate; or (3) with respect to two or more series of debt securities, more than 66 2/3% of the aggregate principal amount of the outstanding bonds of all series affected by the proposed modification, taken in the aggregate, and more than 50% of the aggregate principal amount of the outstanding debt securities of each series affected by the proposed modification, taken individually.

Application will be made to list the bonds on the official list of the Luxembourg Stock Exchange and to trade them on the Euro MTF Market of the Luxembourg Stock Exchange.

See "Risk Factors" beginning on page S-7 to read about certain risks you should consider before investing in the bonds.

Section 309B(1)(c) of the Securities and Futures Act (Chapter 289 of Singapore) Notification

The bonds are prescribed capital markets products (as defined in the Securities and Futures (Capital Markets Products) Regulations 2018).

Neither the Securities and Exchange Commission, referred to as the SEC, nor any other regulatory body has approved or disapproved of these securities or determined if this prospectus supplement or the accompanying prospectus is truthful or complete. Any representation to the contrary is a criminal offense.

	Per bond	Total
Public offering price(1)	99.032%	U.S. $1,980,640,000
Underwriting discount	0.200%	U.S. $ 4,000,000
Proceeds, before expenses, to Colombia	98.832%	U.S. $1,976,640,000

(1) Purchasers will also be required to pay accrued interest, if any, from April 22, 2021, if settlement occurs after that date.

Source: Republic of Colombia, prospectus supplement (424B5) for the U.S.$2,000,000,000 3.250% Global Bonds due 2032, April 2021. SEC EDGAR accession 0001193125-21-124194, cover page. Highlight added.

Figure 8. The Cover of a Prospectus

Table 25. Issuer Expenses per Deal

Country	Prospectuses with an expense figure (1)	Expenses, median, US$ thousand (2)	Expenses, s.d., US$ thousand (3)	Share of the cost of a deal, % (4)
Brazil	29	185	121	5
Chile	30	150	106	20
Colombia	34	300	44	7
Hungary	7	175	71	5
Mexico	40	250	88	4
Peru	14	265	73	17
Poland	11	200	79	6
South Africa	14	305	187	12
Turkey	1	—	—	—
Uruguay	20	120	40	10

Notes: Expenses the issuer pays outside the underwriting fee (legal, listing, agents), as estimated in each SEC prospectus, New York-law bonds, 2006–2024. Where the stated figure includes the fee, the fee is subtracted. Column (4) is the median, deal by deal, of expenses over the fee plus expenses.

Table 26. Underwriting Fee on Bonds under Other Foreign Laws

	Bonds (1)	Median (2)	Mean (3)	Mean, face-weighted (4)
Hungary	6	30.0	33.3	22.0
Mexico	18	26.0	26.6	25.8
Poland	21	35.0	38.8	35.3
Turkey	1	13.0	13.0	13.0
Uruguay	4	8.0	8.0	8.0

Notes: As in Table 3, for bonds issued under Japanese, English and Swiss law, 2006–2024.

Table 27. Underwriting Fee by Governing Law and Market

	All countries			Same country: median		
Law and market	Bonds	Median	Mean	Mexico	Poland	Hungary
New York law	368	15.0	16.5	19.0	14.0	18.0
English law, euro	8	14.0	14.2	—	14.5	10.0
Japanese law, yen	37	29.0	29.2	26.0	35.0	30.0
Swiss franc	4	75.0	81.2	—	75.0	75.0
English law, hand-collected	37	14.0	13.5	—	14.0	12.5

Notes: Underwriting fee in basis points of face value, Dealogic, 2006–2024. The last three columns give the median fee of each country's bonds in each market. The last row uses English-law fees read from Luxembourg and London exchange filings.

pays 14 basis points, against 15 for New York-law bonds. In Poland, the median English-law bond in euros pays 14.5 and the median New York-law bond 14.0. The median fee is 29 basis points on yen bonds and 75 on Swiss-franc bonds.

A.18 How often and how much governments issue

Governments issue under foreign law less often than under domestic law, and each issue is larger. Table 28 reports, for each country, how often the government issues under each law and how much it raises each time, by quarter, over 2006–2024. The share of quarters with no foreign-law issuance ranges from 0.26 in Turkey to 0.83 in Paraguay. Under domestic law it is at most 0.25, and six countries issue domestic-law bonds every quarter. As a share of that quarter's GDP, the median foreign-law issue is larger than the median domestic-law issue in ten of the twelve countries, by a factor between 1.1 in Poland and 90 in Uruguay. In Brazil and Turkey it is smaller.

We treat all bonds that settle on the same day in a market as one issue, whose size is the total amount that settles that day. We count each re-opening of an outstanding foreign-law bond as an issue, because each is a new sale with its own prospectus and fee. As in the previous sections, foreign-law placements come from Dealogic and domestic-law placements from debt-office records. We convert each issue to US dollars and divide it by that quarter's nominal GDP in US dollars.

Table 28. Issuance by Governing Law, Quarterly

	Inaction rate		Issues per quarter		Spacing,	One issue, % of quarterly GDP		
	Foreign (1)	Domestic (2)	Foreign (3)	Domestic (4)	quarters (5)	Foreign (6)	Domestic (7)	Ratio (8)
Brazil	0.54	0.00	0.61	20.1	2.1	0.22	0.48	0.5
Chile	0.75	0.17	0.36	3.4	3.1	2.51	0.45	5.5
Colombia	0.55	0.09	0.50	8.4	2.3	1.95	0.28	7.0
Hungary	0.62	0.00	0.51	10.0	2.6	3.38	0.58	5.9
Mexico	0.34	0.00	0.84	15.1	1.5	0.61	0.25	2.4
Paraguay	0.83	0.25	0.17	1.7	3.7	5.11	0.15	34.6
Peru	0.80	0.05	0.22	6.7	4.4	2.54	0.09	26.8
Poland	0.41	0.00	0.99	5.4	1.7	0.92	0.81	1.1
Russia	0.80	0.01	0.20	8.6	3.1	0.61	0.09	7.0
South Africa	0.80	0.00	0.21	19.5	5.3	1.87	0.19	9.7
Turkey	0.26	0.00	1.12	5.6	1.4	0.73	0.76	1.0
Uruguay	0.64	0.19	0.39	4.0	2.9	7.95	0.09	90.0

Notes: 2006Q1–2024Q4. An issue is one settlement day in a market, with amounts summed. Foreign-law placements from Dealogic, counting re-openings as issues; domestic-law placements from debt-office records, bonds only. Exchange operations are excluded on both sides. Columns (1)–(2) give the share of quarters with no issuance, (3)–(4) the issues per quarter, (5) the mean number of quarters between foreign-law issuance quarters, (6)–(7) the median issue as a percentage of that quarter's GDP, and (8) the ratio of (6) to (7).

A.19 Recovered debt in the numerical solution

We solve the model on a uniform grid for each bond. Domestic-law debt takes the values $b_D(i) = \bar{b}_D\, i/(N_D - 1)$ for $i \in \{0, 1, \ldots, N_D - 1\}$, and foreign-law debt is defined in the same way on N_F points. A government that regains access after a default carries $\nu_D b_D$ and $\nu_F b_F$. Since the grid is uniform and starts at zero, $\nu_D b_D(i) = b_D(\nu_D i)$. Recovered domestic-law debt therefore sits at position $p_D = \nu_D i$ of its grid, and recovered foreign-law debt at $p_F = \nu_F j$. These positions need not be integers. They stay within the grid because both recoveries are at most one.

Each recovered position lies between two grid points, $i^- = \lfloor p_D \rfloor$ and $i^+ = \min(i^- + 1, N_D - 1)$, with weight $a = p_D - i^-$, and likewise j^-, j^+ and $c = p_F - j^-$ for foreign-law debt. We evaluate the new-issuance prices q_D^{ND} and q_F^{ND} and the continuation value at the recovered point by bilinear interpolation of the four surrounding grid values,

$$\tilde{f}(p_D, p_F) = (1-a)(1-c)\, f[i^-, j^-] + a(1-c)\, f[i^+, j^-] + (1-a)c\, f[i^-, j^+] + ac\, f[i^+, j^+]. \tag{24}$$

The weights are nonnegative and sum to one. When a recovered position falls on a grid point, the formula uses that point alone.

A.20 The two experiments

Table 29. Same Durations, Different Recoveries: Foreign-Law Share (%)

	Duration of both bonds (years)				
ν_D / ν_F	1.00	2.00	3.75	5.50	8.71
0.200 / 0.400	100.0	100.0	100.0	100.0	100.0
0.400 / 0.420	100.0	100.0	100.0	100.0	100.0
0.400 / 0.471	100.0	100.0	100.0	100.0	100.0
0.400 / 0.550	100.0	100.0	100.0	100.0	100.0
0.400 / 0.700	100.0	100.0	100.0	100.0	100.0
0.471 / 0.400	0.0	0.0	0.0	0.0	0.0

Notes: Foreign-law share of debt when both bonds have the same duration. Other parameters at their calibrated values. The last row reverses which law has the higher recovery.

Table 30. Same Durations, Different Recoveries: Recovery Grid (%)

	ν_F				
ν_D	0.300	0.375	0.450	0.525	0.600
0.300	39.7	100.0	100.0	100.0	100.0
0.375	0.0	39.7	100.0	100.0	100.0
0.450	0.0	0.0	45.6	100.0	100.0
0.525	0.0	0.0	0.0	43.7	100.0
0.600	0.0	0.0	0.0	0.0	39.1

Notes: Foreign-law share of debt, both bonds with a duration of 3.75 years. On the diagonal the two bonds are identical and the split is not determined by the model.

Table 31. Same Recoveries, Different Durations: Foreign-Law Share (%)

	Duration, domestic / foreign law (years)		
$\nu_D = \nu_F$	1 / 8.71	2 / 8.71	3.75 / 8.71
0.00	47.8	2.0	0.3
0.40	58.8	2.0	0.3
0.4715	60.4	2.0	0.1
0.60	65.3	2.0	0.1
0.75	67.8	3.7	0.1

Notes: Foreign-law share of debt when both bonds have the same recovery. The last column uses the calibrated durations. Other parameters at their calibrated values.

A.21 Measuring insurance

We measure the insurance a bond provides as Arellano and Ramanarayanan (2012) do, with

$$H_j = \frac{\mathbb{E}\left[u'(c')\, R'_j\right]}{\mathbb{E}\left[u'(c')\right]\, \mathbb{E}\left[R'_j\right]}, \qquad R'_j = \lambda_j + (1-\lambda_j)\, q_j^{ND}. \tag{25}$$

Here R'_j is the value next period of a unit of law-j debt, the share λ_j that matures plus the market value of the rest. The expectations are over next period's states with repayment. The numerator weights the value of the bond in each state by the government's marginal utility. H_j equals one when this value does not move with marginal utility. This is the case for a one-period bond, whose value next period is one in every state. A long bond whose price falls in bad times has H_j below one.[31]

In the calibrated model, $1 - H_j$ is 15.9 basis points for foreign-law debt and 11.3 for domestic-law debt. With the foreign-law recovery, the domestic-law bond's measure falls to 10.1 basis points. A higher recovery lowers the measure because the price of the bond falls less when default becomes more likely. With the same recovery, the longer bond provides 15.9 basis points of insurance and the shorter one 10.1.

A.22 Proof of Proposition 1

Events. Fix the government's policies and start at date 0 from a state $s_0 = (y_0, b_{D,0}, b_{F,0})$ at which one unit of each bond is issued. Along a path of output and reentry draws, the

[31] Suppose there are two equally likely states, with marginal utility 1.5 in the bad state and 0.5 in the good state, so that its mean is one. A bond is worth 0.70 in the bad state and 1 in the good state. Then $\mathbb{E}[u'R] = (1.5 \times 0.70 + 0.5 \times 1)/2 = 0.775$ and $\mathbb{E}[R] = 0.85$, so $H = 0.775/0.85 = 0.91$.

policies determine in each period $t \geq 1$ whether the government repays and whether it reenters:

$$\chi_t = \begin{cases} 1 & \text{repays at } t \\ 0 & \text{otherwise} \end{cases}, \qquad \eta_t = \begin{cases} 1 & \text{reenters at } t \\ 0 & \text{otherwise} \end{cases}, \qquad \chi_t \, \eta_t = 0.$$

The government reenters only from default, so it never repays and reenters in the same period. It repays both bonds or defaults on both, so χ_t and η_t are the same for both bonds.

Holdings and payments. An investor buys one unit of law-j debt at date 0, and $h_{j,t}$ is the number of units the investor holds at the start of period t. A fraction λ matures upon repayment, and each unit becomes ν_j units upon reentry:

$$h_{j,1} = 1, \qquad h_{j,t+1} = h_{j,t} \times \begin{cases} 1-\lambda & \chi_t = 1, \\ \nu_j & \eta_t = 1, \\ 1 & \text{otherwise.} \end{cases}$$

With $a_t \equiv \sum_{s<t} \chi_s$ repayments and $k_t \equiv \sum_{s<t} \eta_s$ reentries before t,

$$h_{j,t} = (1-\lambda)^{a_t} \, \nu_j^{k_t}, \qquad c_{j,t} = \chi_t \, \lambda \, h_{j,t} = \chi_t \, \lambda \, (1-\lambda)^{a_t} \, \nu_j^{k_t},$$

where $c_{j,t}$ is the payment at t: the matured fraction of the holdings if the government repays, and zero otherwise.

Prices as present values. Investors are risk neutral, so the price of a bond is the expected present value of its payments:

$$q_j^{ND}(s_0) = \mathbb{E}_0 \sum_{t=1}^{\infty} \frac{c_{j,t}}{(1+r)^t}. \tag{26}$$

Equations (11) and (12) are the recursive form of (26). The same expression gives $q_j^D(s_0)$, with the path starting in default at date 0 and reentry possible at date 0.

Comparison. By (26),

$$q_F^{ND}(s_0) - q_D^{ND}(s_0) = \mathbb{E}_0 \sum_{t=1}^{\infty} \frac{\chi_t \, \lambda \, (1-\lambda)^{a_t}}{(1+r)^t} \left(\nu_F^{k_t} - \nu_D^{k_t} \right) \; \geq \; 0,$$

since $\nu_F \geq \nu_D \geq 0$ gives $\nu_F^k \geq \nu_D^k$ for every $k \geq 0$. The same holds for $q_F^D - q_D^D$.

Strictness. If $\nu_F > \nu_D$, then $\nu_F^k > \nu_D^k$ for every $k \geq 1$, so each term with $\chi_t = 1$ and $k_t \geq 1$ is positive. The gap is positive whenever, with positive probability, the government reenters and then repays. If the government never defaults from s_0 then $k_t = 0$ in every period and $q_F^{ND}(s_0) = q_D^{ND}(s_0)$.

A.23 The fee and the cost of borrowing

The fee f on foreign-law bonds is proportional to the money raised and independent of maturity, and it is paid each time a bond is issued (Section 2.4). This type of fee makes short foreign-law debt more costly than long foreign-law debt.

The bond. Each period, a share λ of the face value of a bond with decay λ matures. Without a coupon, the bond pays λ per unit of face next period, $\lambda(1-\lambda)$ the period after, and so on. Its yield y is the constant rate that discounts these payments to the bond's price q:

$$q = \sum_{k=1}^{\infty} \frac{\lambda(1-\lambda)^{k-1}}{(1+y)^k} = \frac{\lambda}{1+y} \sum_{k=0}^{\infty} \left(\frac{1-\lambda}{1+y}\right)^k = \frac{\lambda}{1+y} \frac{1+y}{y+\lambda} = \frac{\lambda}{y+\lambda}. \tag{27}$$

Solving for the yield gives $y = \lambda/q - \lambda$. A one-period bond has $\lambda = 1$ and $y = 1/q - 1$.

The fee as a lower price. Investors pay q for one unit of face. The government keeps $(1-f)\,q$ and owes the same payments as without the fee. The yield it pays on the money it receives is

$$\hat{y} = \frac{\lambda}{(1-f)\,q} - \lambda. \tag{28}$$

Subtracting y and using $q = \lambda/(y+\lambda)$ from equation (27),

$$\hat{y} - y = \frac{\lambda}{q} \frac{f}{1-f} = (y+\lambda) \frac{f}{1-f}. \tag{29}$$

Short against long bonds. We compare the wedge on two bonds of the same government that differ only in their decay rate and trade at the same yield. At a given yield, the wedge in equation (29) rises one for one with λ, so it is larger on the shorter bond.

The table evaluates these expressions at the fee of 25 basis points and a common yield of 4.2 percent, the risk-free rate plus Colombia's mean spread. The first two rows are the

short and the long foreign-law bonds of Section 6.2; the third is the foreign-law bond of Section 5.1. To keep one unit of face outstanding, the government issues λ units each period and pays $fq\lambda$ in fees; the last column is the wedge in the yield.

Bond	λ	Price q	$fq\lambda$ (bp of face)	Wedge $(y+\lambda)f/(1-f)$ (bp a year)
One period	1.000	0.960	24.0	26.1
2.32 years	0.420	0.909	9.5	11.6
8.71 years	0.099	0.702	1.7	3.5

From one period to 8.71 years, the wedge falls by a factor of seven. For the wedge on a long bond to reach that on the one-period bond, its yield would have to exceed the one-period yield by the difference in λ: by 90 percentage points for the 8.71-year bond and by 58 for the 2.32-year bond.

A.24 Proof of Proposition 2

This appendix sets out the full environment of the simple model of Section 6.1, states Proposition 2 in full and proves it.

Environment. Time is discrete and infinite, $t = 0, 1, 2, \ldots$, and there is no uncertainty. The government receives a constant endowment y. It values consumption at $\sum_{t\geq 0} \beta^t u(c_t)$, with u strictly increasing, strictly concave and differentiable. Lenders discount at the interest rate r, and $\beta = 1/(1+r)$. The government always repays. It starts period 0 owing $B_0 > 0$, due in full in period 0.

At $t = 0$ the government chooses $\lambda \in (1 - 1/\beta, 1]$, and every bond it issues, at that date and later, has this λ. A unit issued at t pays 1 at $t+1$, $1-\lambda$ at $t+2$, $(1-\lambda)^2$ at $t+3$, and so on. Lenders price it at $q = \beta/(1-\beta(1-\lambda))$.

Let i_t be the units issued at t, with $i_t < 0$ for a buyback, and b_t the payment due at t on the bonds issued from period 0 on, so that b_{t+1} is the debt the government chooses at t. The government pays a fee $f \in [0, 1)$ on the market value of what it issues or buys back. Its budget constraints are

$$c_0 = y - B_0 + q\, i_0 - f\, q\, |i_0|, \qquad c_t = y - b_t + q\, i_t - f\, q\, |i_t| \quad (t \geq 1), \tag{30}$$

with $b_1 = i_0$ and $b_{t+1} = (1-\lambda)\, b_t + i_t$ for $t \geq 1$, and its debt is bounded, $b_{t+1} \leq \bar{b}$ for all $t \geq 0$, with $\bar{b} \geq \max\{B_0,\, (1-\beta)\, B_0/((1-f)\,\beta)\}$. A plan $\{c_t, i_t\}_{t\geq 0}$ is feasible under maturity λ if it satisfies (30) in every period and the debt limit.

Proposition A.1. *(i) If $f = 0$, every λ gives the same allocation, $c_t = y - (1-\beta) B_0$ for all t.*

(ii) If $f \in (0,1)$ and $(1-f)\,u'(y - B_0) > u'(y)$, the government borrows at $t = 0$ and the consol, $\lambda = 0$, is the unique optimal maturity. The government issues only at $t = 0$. Consumption is c_0^* at $t = 0$ and $\bar{c}^*$ at every $t \geq 1$, where

$$(1-f)\,u'(c_0^*) = u'(\bar{c}^*), \qquad c_0^* < \bar{c}^*.$$

(iii) If $f \in (0,1)$ and $(1-f)\,u'(y - B_0) \leq u'(y)$, the government does not borrow, $c_0 = y - B_0$ and $c_t = y$ for $t \geq 1$, and every λ gives this allocation.

Proposition 2 in Section 6.1 summarizes parts (i) and (ii).

Proof. Fix λ and write $q = q(\lambda)$.

Step 1: intertemporal budget constraint. Iterating the law of motion, $b_t = \sum_{s<t}(1-\lambda)^{t-1-s} i_s$. A unit issued at s is worth $\beta^s q$ at date 0. Its payments up to T are worth $\sum_{t=s+1}^{T} \beta^t (1-\lambda)^{t-1-s}$, and those after T are worth $(1-\lambda)^{T-s}\beta^T q$. Summing over all issues up to T,

$$\sum_{s=0}^{T} \beta^s q\, i_s = \sum_{t=1}^{T} \beta^t b_t + \beta^T q\, b_{T+1}. \tag{31}$$

Multiplying each constraint in (30) by β^t, adding up to T and using (31),

$$\sum_{t=0}^{T} \beta^t c_t = y\,\frac{1-\beta^{T+1}}{1-\beta} - B_0 + \beta^T q\, b_{T+1} - f\,q \sum_{t=0}^{T} \beta^t |i_t|.$$

By the debt limit, $\beta^T q\, b_{T+1} \leq \beta^T q\, \bar{b} \to 0$. Letting $T \to \infty$,

$$\sum_{t\geq 0} \beta^t c_t \leq \frac{y}{1-\beta} - B_0 - f\,q \sum_{t\geq 0} \beta^t |i_t|. \tag{32}$$

Step 2: a constraint common to every maturity. Let $x = c_0 - (y - B_0)$ be the net amount raised at $t = 0$. By (30), $x = q\,i_0 - f\,q\,|i_0|$, so x has the sign of i_0, and the fee paid at $t = 0$ is $f\,q\,|i_0| = \varphi(x) - x$, with

$$\varphi(x) = \begin{cases} x/(1-f), & x \geq 0, \\ x/(1+f), & x < 0. \end{cases}$$

Separating $t = 0$ in (32) and dropping the fees paid after $t = 0$, every feasible plan satisfies, whatever λ,

$$\sum_{t \geq 1} \beta^t c_t \leq \frac{\beta y}{1-\beta} - \varphi(x). \tag{33}$$

The fee at $t = 0$ does not depend on λ, because every bond pays it.

Step 3: the relaxed problem. Maximize $\sum_{t \geq 0} \beta^t u(c_t)$ subject to (33) alone. Every plan that is feasible under some maturity satisfies (33). The value of the relaxed problem is therefore an upper bound on the value of any feasible plan, and a feasible plan that reaches it is optimal.

Given c_0, the right side of (33) is fixed. Because $\beta(1+r) = 1$, consumption after $t = 0$ is constant at $\bar{c}$, and the constraint binds:

$$\bar{c}(c_0) = y - \frac{1-\beta}{\beta} \varphi\big(c_0 - (y - B_0)\big).$$

The problem reduces to maximizing $W(c_0) = u(c_0) + \frac{\beta}{1-\beta} u\big(\bar{c}(c_0)\big)$. The function φ is convex, with slope $1/(1+f)$ below zero and $1/(1-f)$ above, so $\bar{c}$ is concave in c_0 and W is strictly concave. Its maximizer is unique. Away from the kink at $c_0 = y - B_0$,

$$W'(c_0) = u'(c_0) - \varphi'(x)\, u'\big(\bar{c}(c_0)\big).$$

At the kink $\bar{c} = y$. The left derivative is $u'(y - B_0) - u'(y)/(1+f) > 0$, since $B_0 > 0$, so saving is never optimal. The right derivative is $u'(y - B_0) - u'(y)/(1-f)$. If $(1-f)\, u'(y - B_0) > u'(y)$, the right derivative is positive and the maximizer c_0^* satisfies $(1-f)\, u'(c_0^*) = u'(\bar{c}^*)$, with $\bar{c}^* = \bar{c}(c_0^*)$. Then $u'(c_0^*) > u'(\bar{c}^*)$, so $c_0^* < \bar{c}^*$, and the government raises $x^* = c_0^* - (y - B_0) > 0$. Otherwise the right derivative is not positive, and the maximizer is the kink: $c_0^* = y - B_0$ and $\bar{c}^* = y$.

Step 4: the consol attains the relaxed optimum. Let $\lambda = 0$, so $q = \beta/(1-\beta)$. Issue $i_0 = (1-\beta)\, x^*/((1-f)\,\beta)$ at $t = 0$ and nothing afterwards. Then $b_t = i_0$ and $c_t = y - i_0$ for every $t \geq 1$, and

$$y - i_0 = y - \frac{1-\beta}{\beta} \frac{x^*}{1-f} = \bar{c}^*.$$

No fee is paid after $t = 0$ and $\beta^T q\, i_0 \to 0$, so (32) and (33) hold with equality. Since $c_0^* < \bar{c}^* < y$, we have $x^* < B_0$, so $i_0 < (1-\beta)\, B_0/((1-f)\,\beta) \leq \bar{b}$ and the debt limit holds.

Step 5: no other maturity attains it. Suppose $f > 0$, the government borrows, and a plan with $\lambda \neq 0$ attains the relaxed optimum. Then (33) holds with equality, so no fee is paid

after $t = 0$: $i_t = 0$ for $t \geq 1$. Hence $b_t = (1-\lambda)^{t-1} i_0$ and $c_t = y - (1-\lambda)^{t-1} i_0$, with $i_0 > 0$ because $x^* > 0$. Then $c_2 - c_1 = \lambda\, i_0 \neq 0$, so consumption after $t = 0$ is not constant, which contradicts Step 3. This proves part (ii).

Step 6: the remaining cases. In part (iii), $x^* = 0$, and issuing nothing at any date gives $c_0 = y - B_0$ and $c_t = y$ for every λ. In part (i), $\varphi(x) = x$ and (33) becomes $\sum_{t\geq 0} \beta^t c_t \leq y/(1-\beta) - B_0$, whose solution is $c_t = y - (1-\beta)\, B_0$ for all t. Any λ attains it by keeping the market value of debt at $q\, b_{t+1} = \beta B_0$ in every period. Then $c_0 = y - B_0 + q\, b_1 = y - (1-\beta)\, B_0$. For $t \geq 1$, $q\, i_t = q\, b_{t+1} - (1-\lambda)\, q\, b_t = \lambda\, \beta B_0$ and

$$c_t = y - \frac{\beta B_0}{q} + \lambda\, \beta B_0 = y - (1-\beta)\, B_0.$$

Face value is $b_{t+1} = (1 - \beta(1-\lambda))\, B_0 \leq B_0 \leq \bar{b}$. □

A.25 The fee ladder

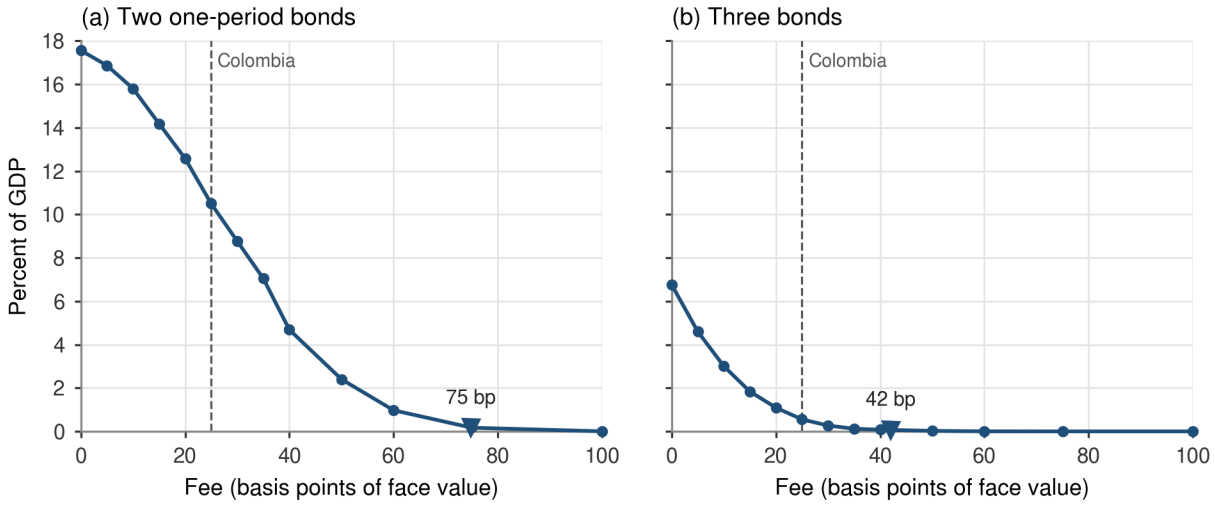


Figure 9. Foreign-Law Debt and the Fee

Notes: Mean debt in percent of GDP against the fee on the money raised under foreign law. Panel (a): foreign-law debt when the government has a one-period domestic-law bond and a one-period foreign-law bond. Panel (b): short foreign-law debt when the government also has a foreign-law bond with a duration of 2.32 years. The dashed line marks Colombia's fee of 25 basis points. The triangle marks the fee at which the plotted debt falls below 1 percent of its value without a fee.

A.26 The fee and the probability of default

With two one-period bonds, the fee needed to keep foreign-law debt below 1 percent of the government's debt is 30 basis points when the probability of default in the next year

is below 0.5 percent and 100 basis points when it is 1 percent or more. At 25 basis points, foreign-law debt is 1.5 percent of the government's debt in the first case and all of it in the second. With a long foreign-law bond, the fee needed to keep short foreign-law bonds below 1 percent is 20 basis points when the probability of default is below 0.5 percent and 40 basis points when it is 1 percent or more. At 25 basis points, short foreign-law bonds are below 0.1 percent of the government's debt in the first case and 4.8 percent in the second.

A.27 Welfare: measurement and decomposition

Decomposition with policies fixed. The economy without the fee is the baseline with the short bond issued under foreign law, so that it recovers 0.47. The price of defaulted debt,

$$q_i^D(y, b_D, b_F) = \frac{1-\theta}{1+r}\,\mathbb{E}_{y'|y}\left[q_i^D(y', b_D, b_F)\right] + \theta\,\nu_i\,q_i^{ND}(y, \nu_D b_D, \nu_F b_F)\,,$$

shows the two roles of the recovery: a higher ν_i raises the price investors pay, and it raises the debt the government carries at reentry. We fix the borrowing and default policies at their baseline values and compute welfare in four economies. The first is the baseline. The second has the prices of the new economy and the baseline debt at reentry. The third has the baseline prices and the debt at reentry of the new economy. The fourth has both changes. Comparing the second and the third economies with the baseline gives the price effect and the reentry effect. Welfare in the economy without the fee minus welfare in the fourth economy is the effect of the government's response.

The value of market access. For an economy $\mathcal{E}$, let $\bar{V}^{\mathcal{E}}$ be the household's expected discounted utility along the equilibrium path, with consumption $y - \phi(y)$ while the government is excluded. Let $\bar{V}^{ND,\mathcal{E}}$ be the same value when exclusion carries no output loss, so that consumption equals y while excluded and the government still reenters owing $\nu_D b_D$ and $\nu_F b_F$. Let $\bar{V}(\bar{c}^{ND,\mathcal{E}}) = \sum_t \beta_H^t u(\bar{c}_t^{ND,\mathcal{E}})$ be the value of receiving for sure the mean path $\bar{c}_t^{ND,\mathcal{E}}$ of that consumption. Let $\bar{V}^A$ be the value of consuming output forever, and $\bar{V}^A(y^\infty)$ the value of consuming mean output $y^\infty = \sum_y \pi(y)\,y$ forever. Following Aguiar et al. (2020), the consumption-equivalent value of market access is

$$1+\chi^{\mathcal{E}} \equiv \left(\frac{\bar{V}^{\mathcal{E}}}{\bar{V}^A}\right)^{\frac{1}{1-\sigma}} = \underbrace{\left(\frac{\bar{V}^{\mathcal{E}}}{\bar{V}^{ND,\mathcal{E}}}\right)^{\frac{1}{1-\sigma}}}_{\text{default costs}} \underbrace{\left(\frac{\bar{V}^{ND,\mathcal{E}}}{\bar{V}(\bar{c}^{ND,\mathcal{E}})}\,\frac{\bar{V}^A(y^\infty)}{\bar{V}^A}\right)^{\frac{1}{1-\sigma}}}_{\text{variability}} \underbrace{\left(\frac{\bar{V}(\bar{c}^{ND,\mathcal{E}})}{\bar{V}^A(y^\infty)}\right)^{\frac{1}{1-\sigma}}}_{\text{front-loading}}. \quad (34)$$

The value of autarky is the same in the two economies, so the welfare gain of equation (17) is $1+\Delta = (1+\chi^{\mathcal{E}_1})/(1+\chi^{\mathcal{E}_0})$, and each term contributes the ratio of its own values across the two economies.