The Puzzle of Sovereign Debt Collateral: Big Data and the First Age of Financial Globalization

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Abstract. *During the hypothecation "mania" of 1849-1875, many sovereign borrowers relied on the posting of collateral such as, famously, Peruvian guano. But in fact, such "securities" could not be repossessed. To explain the puzzling phenomenon of sovereign hypothecation, which has a long history before and after the episode we consider, we emphasize an informational channel: Posting collateral produced information on opaque borrowers by displaying borrowers' resources and behavior. Drawing on a novel dataset and a careful exploration of the universe of individual hypothecations in London contracts, as well as of their context and of the institutional framework they created, we establish the pledges' role in documenting sovereigns' wealth, commitment to repay and management of revenue streams. Encasing disclosure in contracts written by lawyers while incentivizing the truthfulness of data process through penalties explains investors' readiness to pay a premium, an early case of "Big Data" supported lending.*

Keywords: Collateral, Information, Sovereign Debt, Property Rights, Financial Innovation, Legal Engineering, State Capacity.

JEL Classification: G24, H63, K12, K33, N20

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I. Introduction

In conventional analysis, contracts exist within formal institutional frameworks built on coercive enforcement (North et al., 1990). The posting of collateral in corporate lending provides an instance. Collateral is a vital instrument for ensuring the performance of debt contracts (see Demarzo, 2019, for a recent survey). Theory interprets it as a tool that can mitigate information asymmetry and moral hazard in credit relationships. In standard corporate debt models of collateral provision, collateral is pledged because of a lack of info on the borrower's type (Besanko and Thakor, 1987a, b), or because of monitoring difficulties (Holmström and Tirole, 1997). The act of posting collateral is a costly signal; as such, it helps borrowers disclose their quality to lenders ex-ante. Moreover, increasing borrowers' stakes ex-post (Bernanke and Gertler, 1989; Kiyotaki and Moore, 1997), it can limit the incentive of insiders to mismanage resources (Smith and Warner, 1979) and protect investors against dilution (Donaldson, Gromb, and Piacentino, 2020). A consequence is that the posting of collateral enhances debt liquidity, making debt less "information-sensitive" by decreasing the need to investigate the project behind the debt (Gorton and Ordoñez, 2014; Dang et al., 2017; Gorton and Ordoñez, 2020). Empirical evidence supporting these varied mechanisms includes Jiménez, Salas, and Saurina (2006); Berger et al. (2011); Berger, Frame, and Ioannidou (2011); Cerqueiro, Ongena, and Roszbach (2016).

Consistently with the above, reliance on collateral has a long history in private and corporate debt. Land registries were developed in Early Modern Britain to identify and mobilize private property as security in credit transactions (Ito, 2013). Asset identification and the ability to repossess were correctly understood to be vital. In today's corporate capital markets, investors achieve collateralization with the help of a supporting institution known as Central Securities Depository (CSD) that stores collateral and updates ownership data in real time. CSDs are legal creatures with deep origins in Anglo-Saxon common law, though they also emerged under a variety of other legal traditions. Today, they operate as trustees and secure loans by ensuring that collateral is automatically executed in case of non-performance. Research has documented a link between the quality of the rule of law and the performance of collateral as an institution. A stronger rule of law improves the quality of CSDs, ensures a higher degree of creditor protection, and ultimately enhances access to credit (Degryse et al., 2020). Likewise, Calomiris et al. (2017) show that poor quality of laws regulating collateralization and repossession impedes the smooth operation of CSDs and encourage

strategic selection of the asset hypothecated.

Against this backdrop, a puzzling phenomenon is the historical use of collateral in sovereign lending. We call it puzzling because of the hurdles that exist on the way of creditors seeking to repossess sovereign properties. Yet collateral clauses in sovereign debt have a long history. They appeared initially when sovereign borrowers delegated to their creditors control of some asset or fund, or earmarked a tax stream as guarantee. Daru (1821, I, 203-4) gives an early instance (perhaps the first), consisting in a 12th century loan by the sovereign Republic of Venice secured by a salt right and Mint revenues. Other Italian Republics made extensive use of similar arrangements borrowing on the security of various rights (Fratianni and Spinelli, 2006). The beginning of sovereign debt in France is famously traced to an arrangement between King Francis I and the City of Paris in the early 16th century, whereby the king ceded royal revenues to his creditors (Vührer, 1886; Cauwès, 1895a, b, 1896; Vammale-Sabouret, 2008). Hirst (1910) states that following the Glorious Revolution, the British Parliament pledged excise duties, levies on East India goods, and wine duties as collateral for loans made during the 1690s. According to Dewey (1934), Revolutionary America mortgaged revenue sources when first borrowing abroad. Jenks (1927) and Fishlow (1985) emphasize that under the boilerplate contract for sovereign debt issued in the London Stock Exchange in the 19th century "customs, land-holdings, and other natural resources" were frequently pledged. The case of guano, a bird manure used as fertilizer and pledged in Peruvian debt contracts, has attracted significant attention (Mathew, 1981; Vizcarra, 2009). Hypothecations were again relied upon in the midst of the 1920s sovereign debt boom in New York (Coleman, 1936). Finally, collateralized sovereign borrowing has surged again more recently, especially in loans to poor and developing countries (IMF and World Bank, 2020). As we write, Chinese agencies' sovereign lending relies on the instrument, attracting the interest of legal scholars and economists alike (Gelpern et al., 2021).

To explain sovereign collateral, the previous literature balances between two approaches. One view (Jenks 1927; Coleman 1936; Buchheit and Pam, 2004) argues that sovereign debt "hypothecations", as they are sometimes known, exploit creditors' irrationality: Investors are fooled into believing that sovereign debt collateral affords protection through the suggestion that an asset has been pledged. This has led authors such as Coleman (1936) to describe the clauses critically as providing a "phantom security", while according to Allen W. Dulles' testimony before the U.S. Securities and

Exchange Commission (quoted by Buchheit and Pam, 2004, p. 21), "pledges of revenues [in sovereign loans contracts] are not worth the paper they are written on." Another view is that sovereign debt hypothecations make sense because some clever legal engineering can render sovereign debt collateral akin to corporate debt collateral. Vizcarra (2009) argues that this might occur if collateral is movable, enabling creditors to actually seize the security. Another situation is the case when sovereigns are not immune from lawsuits. Under modern qualified sovereign immunity since the 1950s, legal recourses exist in some jurisdictions against sovereigns (Weidemaier, 2012; Schumacher, Trebesch, and Enderlein, 2021). If this is so, then sovereign debt hypothecations may make sense as a transplant and replication of the corporate debt logic.

In fact, we argue that neither investor naivety nor threat of sovereign litigation and repossession can explain fully sovereign debt collateralization. The reason is that first, the resurgence of this template across history suggests that there is more to sovereign hypothecations than a simple scam. Second, periods of high popularity for the "boilerplate" encompass the 19th and early 20th century when in fact sovereign immunity was absolute. To be very clear, under "absolute sovereign immunity" courts *simply do not let creditors grab the collateral*. In the language of a 19th century legal textbook by John Westlake, an international lawyer who worked with London sovereign debt law firm Ashurst, Morris & Co: "Foreign states, and those persons in them who are called sovereigns, whether their title be emperor, king, grand-duke, or any other, and whether their power in their states be absolute or limited, cannot be sued in England on their obligations."[1]

As we will show, verdicts returned in the mid-19th century confirmed that creditors could not lay their hands on the security, even when it was located abroad within their physical reach. If this is the case, then belief in repossession cannot be the reason why investors lending to a sovereign require a guarantee. In fact, an influential British Parliamentary Report shows that enforcement was not even contemplated by creditors (Select Committee 1875; p. xlv, p. 151). Coleman (1936) makes a similar observation based upon the experience of the debt crisis of the 1930s. For that reason, the 19th century, often described as the "first era of financial globalization", provides a particularly propitious context to study the conundrum of sovereign debt collateralization: By design, it rules out the main explanation for collateralization – that sovereign collateral is enforceable. As a result, examining the characteristics of collateralization during such a

[1] Westlake (1858, p. 226).

period enables to focus on other possible reasons why, historically, governments have repeatedly pledged collateral. A corollary is that the resulting theory may apply to other historical contexts as well, though we make no attempt at establishing this point, only noting that it is a logical consequence of our argument. In fact, writing about modern sovereign loans by Chinese lenders, Gelpern et al. (2021) suggest so much. After questioning the effectiveness of court-mandated repossession for the Chinese agencies' loans they study, the authors add that in fact, in their view, "one needs to go back to the 19th and early 20th century to find similar security arrangements in sovereign lending."[2]

The interpretation of the sovereign collateral puzzle we provide here is that independently of enforcement, sovereign collateral is valuable as a pure information producing and, as a result, monitoring technology. Drawing on information economics and finance theory, we argue that in a context of severe information asymmetries, fragmentary data and limited visibility over the country's fiscal process, collateralization served as an institutionalized display. It provided creditors with the capacity of producing tangible evidence on a sovereign's characteristics and behavior. Collateral clauses pinpointed subsets of sovereign borrower's income generating (fiscal) activities and set precise progress-to-repayment checklists, allowing bondholders' operatives and their delegates to focus monitoring efforts. Adherence or instead departure from the schedule produced information, both immediately and subsequently, through investigation. This squares with modern interpretations of the functions of contracts when coercive enforcement is not the principal goal, such as Hart and Moore (2008), who describe contracts as "reference points" and analyze the role of contractual stipulations in the management of behavioral expectations.

In fact, in the context we examine, sovereign collateral functioned like a data-generating engine. The point we make is that collateral clauses create a kind of Big Data alternative to more conventional fiscal reporting. This was especially valuable in polities not endowed with robust parliamentary or administrative capabilities. A useful way to think of our findings is in terms of the recent work by Gambacorta et al. (2020) on how new information technologies ("Fintech" and Big Data) facilitate lending. As they find, in fact, reliance on Big Data enables to reduce the incidence of collateral, a valuable outcome in contexts of limited enforcement. The authors document a "data for collateral" substitution effect. As standard theory suggests, pledging collateral enables to address

[2] Gelpern et al. (2021, p. 6 and 8). They underline "it bears emphasis that our study does not systematically address contract implementation and enforcement, for which there is limited anecdotal evidence."

severe information asymmetries but, as Gambacorta et al. discover empirically, Fintech and Big Data allows for detailed profiling of borrowers, revealing their type and at the same time increasing the likelihood of hidden action revelation. This is what enables modern lenders to do away with traditional collateral in opaque markets where enforcement is haphazard. In clear, information is an alternative form of collateral.

Our findings do more than just resolve the sovereign collateralization puzzle. They bring to the fore the importance of the construction of information institutions for economic development. This differs from conventional approaches identifying development with secure property rights (North and Weingast, 1989; La Porta et al., 2000; Djankov et al., 2003). Against traditional emphasis on the role of Parliament and constitutional restraints as fostering property rights, our exploration of 19th century hypothecations brings to the fore information provision along with its legal dimensions. As we show, legal engineering was mobilized to design appropriate incentives in order to mitigate the conflicts of interests that could undermine sincere reporting, aligning the incentives of reporters with those of creditors. This, rather than desire to defraud investors, explains the involvement of lawyers drafting sovereign debt contracts. The outcome was the creation of private monitoring systems – in fact a form of privatization of the fiscal process. The resulting institution had more to do with the presence of creditor representatives on railroad boards in the late 19th and early 20th century described for instance by Frydman and Hilt (2017), than with Douglass North's parliamentary control.

We show this by gathering a library of sovereign loan contracts issued in the London Stock Exchange, by far the principal sovereign debt market of the time. First collecting the information, then examining covenants one by one, and finally researching individual legal, political, financial and historical underpinnings, we demonstrate that the primary object of 19th century sovereign collateral clauses was not repossession. In the prototypical case (called "Type I"), repossession was not provided for and in fact not even mentioned. The fact that it was provided for in a minority of cases (which we call "Type II"), and in such cases in a very precise way, proves that repossession omission in the general template was not the result of sloppy drafting. Indeed, Type I contracts bear witness of the considerable energy expended in designing the monitoring institution. Through debt contracts, lawyers employed by underwriters became the architects of carefully crafted data observatories. These were intended to contribute verified information on the borrower's flow of resources and payments, for instance by placing an agent in strategic locations, such as ports, where government custom-houses were

located. This enabled delegated monitors to cross-check official communications, since (for instance) they had access to captains and crews, or by relying on consuls as independent informants tied up by their official functions to honesty and transparency.

The detail of the monitoring regime adapted to circumstances. Because, in some cases, the security pledged did not yet exist but was going to be developed and valorized with the money lent, monitoring served to observe whether the project was well-run (a positive signal for future repayment). The production of information also helped detect if the credit event had to do with willingness or ability to pay and thus, it informed reputation formation. From the vantage point of creditors, the mechanism provided for synchronized disclosure of information, because the agent of the bondholders would report to his principals in a uniform fashion, via official announcements in the press or through postings in the stock exchange. The system enabled to document departures from agreed upon mechanisms. For instance, news that payments earmarked from custom revenues had not been forthcoming enabled to take early corrective action before formal default. The mechanism also checked over-borrowing because sovereigns running out of collateral either had to stop borrowing or were bound to try and repledge collateral – a tangible signal of debt approaching unsustainable levels.

In addition to direct observation of the manner in which sovereign hypothecations were designed, which as we shall see speaks for itself, we provide econometric evidence in favor of our argument. First, gathering a database of matching bond prices, we show that non-enforceable hypothecations were perceived as valuable, as reflected by higher prices. Using country-year fixed effects to control for selection, we estimate that hypothecated bonds traded at a yield of approximately 100 basis points lower than the country's average non-hypothecated bond. In other words, lenders were prepared to pay a premium for hypothecated securities holding country-risk fixed, even though they knew they would not be able to repossess the asset. Such premium is economically significant, amounting to about 20 percent of the difference between the average yield of countries employing collateral clauses and countries not employing them at all.

Second, our evidence in favor of our information-based theory of sovereign hypothecation hinges on the exploration of the relation between hypothecation and fiscal opacity. We want to show that sovereigns selected into the use of hypothecations when they were fiscally opaque. To that end, we build on an influential contemporary statistical compilation known as the *Statesman's Yearbook*, which collated information on sovereign states. Extracting from the *Statesman* several measures of data opacity, such

as the greater or lesser speed with which fiscal updates were operated for individual states, we establish that the poorer the quality of fiscal information, the more frequent was hypothecation provision. Typically, hypothecation was a tool of choice for countries without a well-oiled budgetary process and reporting system, and these represented in fact a large set of borrowers. What is more, we show that when informational alternatives existed, such as certification by a prestigious underwriter, then the need for creating a reliable fiscal observatory disappeared, since information was disclosed by the underwriter itself, relieving the country from the need for hypothecation.

Finally, we provide another important piece by exploring regulatory attitudes towards hypothecation. In 1872, the *Economist* alerted the public that hypothecation data in the prospectus of a loan to Honduras had been doctored, which caused the loan to flounder immediately. This prompted a Parliamentary investigation and public calls to regulate and perhaps abolish hypothecations through regulation. Unearthing entirely new material from primary archive, we follow the regulatory response. It was provided by the authorities' of the London Stock Exchange because through control of listing requirements, they were equipped to regulate hypothecations. As we show, their response was not to prevent hypothecation but instead, to create personal and criminal liability for disclosure of false collateral data by financial intermediaries. This reinforced the credibility of *information* disclosed in prospectuses. In other words, collateralizations were understood as useful information, whose credibility had to be protected through more severe sanctions. This is inconsistent with the scam theory, but consistent with our interpretation of sovereign collateral as a valuable institutional observatory.

The remainder of the paper proceeds as follows. Section II shows that conventional understandings of sovereign hypothecations are contradicted by the historical record: Collateral clauses did not enable court-assisted repossession of sovereign property and bondholders understood this. Section III uses our database of sovereign loan covenants to spell out the main characteristics of sovereign hypothecations. We show that in the predominant arrangement, no allowance was made for collateral repossession and that collateral was rarely a movable asset: Thus, the objective of the contracts cannot have been repossession. Next, Section IV shows that these non-enforceable hypothecations were valuable nonetheless, as evidenced by the fact that they commanded a premium compared to unsecured issues. After that, Section V tests for our suggested channel that hypothecations were monitoring institutions. Our first exhibit is the positive effect of fiscal opacity on the likelihood of employing hypothecations, even when controlling for

other factors such as risk. Our second exhibit is evidence of substitutability between collateral clauses and other established information provision technologies, such as employing a reputable underwriter's services. Finally, Section VI documents the regulatory response to the Honduras scandal. We end with conclusions.

II. The Sovereign Debt Hypothecation Puzzle

1) *Sovereign Hypothecation Not a Security*

As indicated, one view about the significance of sovereign collateral is that it operates in the same way as corporate collateral. As noted by Calomiris et al. (2017) in the context of corporate debt, when property rights are weak, creditors make sure that they can easily seize the collateral in case of problem and select an asset that can be easily moved. Building on this insight in a paper published in this *Journal*, Vizcarra argues that guano from the country's rich state-owned repositories in the Chincha Islands pledged as security in Peruvian loans issued in London after 1849 provided such a convenience. They secured creditors, because, being an export commodity, guano could be seized when abroad. According to Vizcarra (2009, p. 359; 376) guano hypothecations were credible because guano handling "did not involve meddling by the Peruvian government" and because "guano revenues were collected at the point of sale abroad" that is, "outside the jurisdiction of the Peruvian government." In this reading, movable asset hypothecation would replicate some of the desirable features of a genuine CSD-like arrangement.

In fact, this is an incorrect reading. Under 19th century international law, sovereign possessions were immune so that in particular, guano remained immune *even when located abroad*. What is more, it did not change the nature of the problem that the property was handled by an agent of the government, because agents enjoyed the immunity of their principal.[3] In clear, guano abroad in the hands of a Peruvian agent was privileged. Conveniently for us, this widely admitted interpretation was confirmed by several rulings. A case made prominent for its clarity was Smith v. Weguelin.[4] Smith, a bondholder, claimed that the agents of Peru (Thomson, Bonar and Co. and the Peruvian company doing the shipping, the *Compañía de Consignation de Huano en la Gran Bretaña*) had failed to amortize (reimburse) the stipulated amount of bonds in the

[3] One aspect of the argument which is not sufficiently appreciated is the fact that the agents in charge of handling the collateral abroad inherited their principal's privileges. On agents of sovereigns and immunity, see Story (1839, p.306) and Chitty (1841, p.278-9).
[4] Smith v. Weguelin, 1869, L.R. 8 Eq. 198, p. 212-214.

contract. Charging that this had depressed prices and caused him a prejudice, he asked the court to direct Thomson, Bonar and Co. to reimburse the bonds as provided, using for that purpose money from the sale of guano physically located in London. Yet, aware that his clients were on shaky grounds, plaintiffs' counsel John Westlake invented a novel theory, in fact a trial balloon. Guano secured bonds, he claimed, amounted to an implicit deed of trust established by the government of Peru for the benefit of the bondholders – the "assignees" of this imaginary deed. In clear, Westlake was attempting to make the case that guano hypothecations were in essence a CSD-like arrangement. The fact that Westlake sought to reinterpret the clauses this way – by hinting they were something else – is suggestive of an entrenched view that hypothecations gave no repossession right to creditors.[5]

On May 27, 1869, judge Lord Romilly dismissed the case with costs for the plaintiffs at the same time he quashed the theory that hypothecations such as made in the Peruvian contract were a kind of deed of trust. As he emphasized, guano held by Peru's agents in London was still Peru's guano and it was immune even if located a stone's throw from the Court of Chancery. Visibly angry and possibly concerned with clarifying the matter for all investors, the judge also took care to elaborate: Had he delivered a different ruling, he would have enabled every creditor of any defaulting state to seek the help of British courts and enforce collateral. As he put it, such a decision would "enable a bondholder by the aid of the Court of Chancery practically to declare war against a foreign country" adding that "if the Court of Chancery could seize all the guano belonging to the Peruvian government it might as well seize Peruvian vessels under the article [of the contract] which declares that all the other property and sources of revenue of the Republic should be applicable to payment of the loan." The judge scoffed at the deed of trust theory, deriding it as the "most singular part of the argument." He could recognize a deed of trust when he saw it, but in no place in the covenant was there evidence that the sovereign had granted to creditors "the right of intercepting or dealing with the guano." To be sure, English deeds of trust were unknown in Peru, and one had no ground to argue that such had been the government's intention.[6] The verdict was later considered as having laid to rest once and for all any case for collateral repossession. In fact, this situation gave the impression to critical observers such as Coleman (1936) that securities stipulated in

[5] Smith v. Weguelin, L.R. 8 Eq. 198, p. 204. For that sophisticated lawyer, there was another upside – presenting the matter as a hypothetical case enabled him to test the reaction of courts in the case a formal deed of trust would actually be created.
[6] Smith v. Weguelin, L.R. 8 Eq. 198, p. 204.

sovereign loans were "phantom securities."

Before we move on, a last remark is in order. A number of recent works have suggested that "gunboats" played in the 19th and early 20th century the role of modern courts of justice under limited sovereign immunity. And so one view that has been heard sometimes is that clauses were a way to contract for gunboat intervention.[7] However, the evidence for this in the context of sovereign debt contracts under British law is sketchy at best. The bulk of military interventions took place later or involved other powers and jurisdictions, especially the US and France, while the loans and clauses we deal with were predominantly under British law. What is more, as D. C. M. Platt (1968) famously emphasized, British policy was tied by the Palmerston Circular of 1848, which proscribed creditors using the Navy as a collection agency and Britain closely adhered to the policy.[8] However, more fundamentally, referring to gunboat enforcement does not clarify the reason for giving *collateral*. Even if debts were enforced through reprisal, why collateralize? For believers in the gunboat hypothesis, the shelling of the debtor's port ought to produce the desired reaction and the addition of a provision mentioning, say, land located in the hinterland and peopled by hostile natives could not have helped in any meaningful way.

The same goes for the role ascribed in some recent work on the jurisdiction of the London Stock Exchange committee, which fulfilled the functions of a court of arbitration for sovereign debt (Jenks, 1927; Flandreau, 2013). The committee's authority rested on the right it gave to individual creditors to litigate exploitive debt discharges, thus favoring creditor coordination (Flandreau, 2022). But of course, the committee had even less enforcement or repossession power over a *security* in a sovereign debt contract than British Courts, since it did not have any police authority to begin with. There is not a single instance in the history of the London Stock Exchange when a security was executed through the intermediary of the stock exchange committee. Ergo, conventional interpretations of the economic mechanism whereby collateral addresses information asymmetries through repossession cannot apply to the law of the stock exchange.

[7] The hypothesis of a substitutability between gunboats and limited sovereign immunity in modern courts (though without reference to collateral) is provided in Ahmed, Alfaro, and Maurer (2010). See also Weidemaier (2010) for a similar claim.

[8] In debtor country parliaments, MPs routinely boasted that they could default safely. When Britain was involved, as was the case in the landing in Mexico in 1861, it had to do with violations of the conditions under which the Palmerston doctrine applied: In case of non-performance of debts issued *under a formal treaty* between the two nations, as was the case for the Mexican episode, the British sovereign might intervene to enforce the debt that was owed to itself.

2) *Hypothecations Not a Scam*

In other words, the value of guano hypothecations could not be the ability to repossess. Nevertheless, there remains the possibility that sovereigns and underwriters devised hypothecations to arouse unwarranted beliefs regarding enforcement, a view that is not inconsistent with some contemporary publicities (Vizcarra, 2009). In the context of the 19th century, for instance, hypothecation clauses were sometimes the object of sarcasm, journalists suggesting that they were meant to lure investors.[9] This claim is also at the heart of a classic paper by Coleman (1936), who concluded, in his empirical study of 1920s NYSE-issued sovereign bonds, that the incidence of default was higher among hypothecated bonds (but he did not control for other factors) and that they never enabled repossession. This led him to describe collateral clauses as "phantom security" and to deliver a robust charge against hypothecations (see also Buchheit and Pam, 2004).

This view may be interpreted in the light of the literature stressing the importance of behavioral biases in investment (Hirshleifer, 2015). Neglect of risk due to limited attention can drive investment behavior with sizable effects on securities prices (e.g. Daniel, Hirshleifer, and Teoh, 2002; Baron and Xiong, 2017). Moreover, such biases create incentives for financial innovation (Gennaioli, Shleifer, and Vishny, 2012), pushing financial entrepreneurs to exploit investors' behavioral biases. If investors prefer safe cash flows, but neglect specific risks, financial entrepreneurs devise instruments exposed to precisely the neglected risks (for empirical evidence see Li, Subrahmanyam, and Yang, 2018). As such, we may read sovereign hypothecations as an episode of financial innovation targeted at the neglect of legal risk and at making positive outcomes more salient (Bordalo, Gennaioli, and Shleifer, 2012). In clear, this interpretation suggests that investors were "gaslighted" by financial intermediaries.

This is not a very credible interpretation. Although it may appear that the topic was arcane and for specialists only, the general interest press and especially the reputable journals who guided investors discussed the subject extensively. For instance, following *Smith*, the influential *Economist* declared that the verdict merely confirmed once again that "hypothecation of certain property is really no additional security" and that

[9] The British satirical journal *Punch* quipped about Spain's "Quicksilver Loan" of 1870 that the country may borrow in Quicksilver (i.e. mercury) but would surely repay "in Slow Gold." Later on, Drummond Wolff's apocryphal description of a typical foreign bond during the speculative mania of the 1860s discusses a "duty on cinnamon" given as security, a pun on the stench of guano; *Punch*, June 11 1870, p. 234; Drummond Wolff (1908; Vol. II, pp. 56-66).

"creditors of a foreign government cannot enforce their rights by attaching property hypothecated to them." This was a view they had already conveyed to readers on several previous occasions.[10] The *Times* printed the full verdict including the Judge's critical language, and the provincial press reprinted the material carrying through the pedagogy.[11]

In fact, against this backdrop, *Smith* does provide exceptional testing ground for the hypothesis that hypothecations amounted to a scam meant to create misplaced trust. If this had not been the case before *Smith*, the cat was out of the bag: A British judge had stated loud and clear that assuming court enforcement of sovereign hypothecation was delusional. Against this backdrop, we consider two possibilities: Either (i) there was no misplaced trust, valuations were not influenced by unwarranted beliefs, and the verdict was expected, causing no surprise. In this case, nothing should have happened to Peruvian bond prices. Alternatively, (ii) misplaced trust à la Hirshleifer drove valuations, and the verdict was unexpected; in this case, given the large publicity it received, the event should have triggered significant selling activity by investors, waking up to the grim news they had been gaslighted. Under this alternative scenario, bond spreads should have risen.

We collected monthly data on the yield-spread against risk-free British consols for a representative Peruvian guano-bond[12] and for two portfolios, obtained computing a weighted and an unweighted average of other collateralized bonds.[13] Indeed, as the judge mentioned in his verdict, *Smith* was significant not just for Peruvian bondholders but for all bondholders with hypothecations: Thus, while the Peruvian spread series serves to test for the May 1869 court decision's effect on Peruvian bondholders, the synthetic bonds spread series serve to test its effects on all securities with collateral.[14] Did the

[10] *Economist*, May 29, 1869, p. 626. For one example of an earlier discussion of the same claim, see e.g. *Economist*, Oct 10, 1868, p. 1167-8.

[11] *Times*, May 28, 1869. Extracts of the *Economist*'s article were reprinted in several provincial newspapers such as the *Western Daily Press*, the *Bradford Observer*, etc. (*Western Daily Press*, May 31, 1869; *Bradford Observer*, May 31, 1869).

[12] The Peruvian "benchmark" is the guano "secured" 1865 5%, which had a very active market. We have collected, but do not report, the significantly less actively traded 1862 4.5%, which was seldom quoted and thus provides inferior testing-ground.

[13] In addition to Peru, these portfolios comprise a selection of similarly crafted hypothecations (in the language of the next section, "Type I" hypothecations). The need to ensure diversity and a critical level of liquidity guided our choice. The other bonds are the Chilean 6% 1867 (custom revenues), Romanian ("Danubian") 7% 1864 (custom revenues), the Egyptian 7% 1866 (railways), and the Turkish 6% 1862 (excise on tobacco and salt).

[14] Note that we selected securities with collateralization that are similar in design to those of Peru, or in the terminology proposed further below, "Type I collateral."

verdict affect Peruvian hypothecations and hypothecations at large? To answer these questions we employ the Bai-Perron stability test (Bai and Perron, 1998, 2003), an algorithm that finds the most parsimonious step function to describe a time series. In this framework, if (i) is true, the algorithm should not systematically single-out May 1869 as a significant break date; if by contrast (ii) is true, May 1869 should be systematically *singled out as a break-date*, and spreads *should rise after it*. This is a conventional and widely used framework, and not unimportantly, it is also the one used by Vizcarra to study Peruvian bond prices (Vizcarra, 2009, p. 378, Table 5). In fact, examining the period 1830-1878, she does not identify May 1869 as a break.[15]

Figure 1 shows the time-series behavior of spreads for the Peruvian bond and the two portfolios. Dashed lines capture Bai-Perron break dates, and grey shaded areas represent confidence intervals. The structural breaks thus isolated are coherent with hypothesis (i).[16] We can also see that May 1869 is identified as a break date for the unweighted synthetic bond, but the spread *decreases* after the break, which is the opposite from what would happen if the verdict had been a wake-up call. Even looking with a fine-toothed comb for price movements in the days and weeks around the decision, we simply could not find any change at all.[17] All in all the interpretation we give is that the *Smith* verdict really arose from a spirited lawyer attempting a trial balloon (the deed of trust theory) and it merely confirmed what the marginal investor knew.[18]

[15] Note that Vizcarra (2009) does not mention Smith v Weguelin, which is also ignored by Chabot and Santarosa (2017). See, however, Borchard (1951, p.67) for evidence that this is a well-known decision.

[16] We implement the Bai-Perron procedure employing the R package's routines described in Kleiber et al. (2002) and Zeileis et al. (2003). The algorithm selects intervals in which the time series is approximately stable around a local mean. Each interval we use implies an additional local mean estimate. The algorithm finds a parsimonious description in as much as it trades-off the greater descriptive precision (lower squared errors) achieved by adding an interval, against the cost of adding a parameter. In order to operate the algorithm, we must choose a maximum possible number of steps, i.e. the minimal window of stability. We set this minimal window at one year, but our conclusion does not depend on such choice. Results available upon request.

[17] For the 1865 5% bond, the single largest weekly price variation during the period going from late April 1869 to mid-June was actually an increase of 2.28%, just after the decision. Peruvian bond prices variations around *Smith*, calculated with the help of the Economist, are as follows: For the week ending on April 30, +0.16%; week ending May 7: -2.14%; week ending May 14: 1.46%; week ending May 21: 0.64%; week ending May 28 (the day after decision): 2.28%; week ending June 4: 0.31%; week ending June 11: 0.15%.

[18] We further confirm our finding that bonds did not react to the *Smith* verdict on the yearly yield panel introduced and employed in Section IV. This panel covers more bonds, though at a lower frequency. It allows us for a diff-in-diff inspection of the abnormal bond return after the verdict, using comparable bonds without collateral clauses as counterfactual. We register no spike in yield for hypothecated bonds after the verdict. Results available upon request.

III. Collateral an Information Technology: A Legal Morphology of Sovereign Hypothecations

If sovereign hypothecations were neither protecting creditors nor deliberately gaslighting them, what were they doing? In this section, we articulate our theory that the hypothecations used during the mid-19th century boom of hypothecations had a purpose and a plan: Specifically, they served to put together a technology that ensured disclosure and monitoring, in fact institutional infrastructure to foster the provision of information. This section lays out the ground by drawing on our database and discussing the characteristics of the population of sovereign debt hypothecations. It delves into the legal-financial design of individual sovereign hypothecations whose morphology it also typologizes. In the majority case, collateral clauses supported a reporting system whereby creditors were able to trace the annual flow of money and what is more, recognize in real time delays and diversions.

1) *How Hypothecations Were Manufactured*

For starters, we assembled a novel library of 116 bonds' prospectuses, corresponding to the universe of London Stock Exchange issues between 1849 and 1875.[19] The date 1849 was chosen because it was when the first Peruvian bond was issued and some contemporary sources indicate it had an inspirational effect on subsequent innovation (Clarke, 1859).[20] It is also a conservative starting point, given that the sovereign debt boom only accelerated in the 1860s. We constructed this library by building on the list of bond issues provided in Council of Foreign Bondholders (1878), then cleaning up this list with the help of a variety of sources, especially the Archive of the London Stock Exchange. Twenty-two among the thirty-two sovereign entities identified are accountable for ninety-two of the 116 bonds. The Ottoman and Russian Empires are the most represented issuers, respectively accounting for twelve and thirteen bonds. They are followed by Egypt (nine bonds), and Chile, Brazil and Argentina (seven bonds).[21]

Having pinned down the exact date of issue helped retrieve the relevant

[19] Among the bonds with some trades recorded in the Course of Exchange, we omit only five: Italy 1861 5% rentes; Mexican 1851; Mexican 1864; Turkish 1865 6%; Spain 1871 National Land Mortgage Loan; The Italian rente was issued in Paris, later cross-listed in London, Paris remaining the main market. For the Mexican 1851, 1864 and the Turkish 1865, we could not find complete enough primary information. The Mexican 1864 loan was also primarily a French loan with very limited London trading. Finally, we excluded the Spanish National Land Mortgage Loan, a complex financial product and at bottom not a sovereign loan proper. In fact, it was not reported as a government loan in the *Course of Exchange*.

[20] However, as already emphasized, there were predecessors, and it would be incorrect to believe that hypothecations began the Peruvian contract. See Flandreau (2021) for an early 19th century Portuguese predecessor.

[21] Authors' database.

documentation, including prospectus, general bond and additional covenants. The "general bond" is usually the favored instrument, and under the rules of the stock exchange it was part of the documentation required before a listing. This was a time consuming task, which had to be conducted case by case. The gathering of information took us to the London Stock Exchange, to the archive of private underwriters (Rothschilds, Barings), and to contemporary investor handbooks such as Fenn (1855). We also spent a long time examining domestic sources and legal contexts, which were referred to in some of the documents. When primary documents were not available, the press was used as fallback solution, because loan issues resulted in the publication of prospectuses or at least a summary of them, in advertising sections or "City" articles.[22] Reading through the covenants, we were able to identify 67 individual bonds containing hypothecations in a population of 116 issues, or 58%. In other words, the collateralization template was very widespread but not universal.

The manner sovereign hypothecations were performed consisted in a formula whereby the sovereign did "bind" herself or did solemnly "pledge to hypothecate" a designated asset or set of assets as "security" for the "due payment of the interest and amortization of a loan." The covenant typically recited the characteristics of the hypothecation, stating in detail its nature, location, relevant features, such as its value or the income it generated. The items pledged were varied, including custom revenues, lands, forests, railways, or export commodities such as guano. It is important to emphasize that this pledging was simply an act of display: No effort was made at hiding neither the sovereign character of the entity pledging the asset nor its inherent immunity. In addition, it was standard using a similar language to "pledge" the "general credit" of the country. This was a recognition of the borrower's liability over and beyond the specific hypothecation provided.

Although previous authors such as Buchheit and Pam (2004) have spoken of 19th century sovereign hypothecations as couched in a "vague" language, our evidence suggests a different reading. The task was performed by prominent and highly paid lawyers, which does not fit well with the view that they were motivated by an advertising logic. We found that hypothecations mobilized many clauses and very precise stipulations, sometimes even a nexus of additional contracts. In fact, the drafting of

[22] The digital repositories used were the British Newspaper Archive, at www.britishnewspaperarchive.co.uk and The Times Digital Archive, at www.gale.com. Though found to be reasonably accurate and often quote from them for ease of reference, such advertisements occasionally omitted sections that contain relevant material

contracts involved top law firms in association with the financiers who originated the loans. For instance Philip Rose, partner from Baxter, Rose, Norton & Co, who was also counsel for the Corporation of Foreign Bondholders, was a prominent lawyer responsible for drafting several contracts in our database (he was in fact Benjamin Disraeli's personal lawyer). He worked from the offices of Erlanger & Co, an investment bank prominent in sovereign debt and foreign railway.[23] We argue that the view that hypothecations were vaguely phrased comes from the fact that previous authors have approached such hypothecations from the vantage point of enforceable, corporate collateral. As a result, they have been shocked by the lack of language explaining how collateral would be executed. But our investigation suggests that it is not that the language providing for repossession was vague, it is that in most of the cases, it was absent.

2) *The Logic of Type I Hypothecations*

In fact, we identify two main alternative hypothecation regimes. The main one, to which we refer as "Type I", is exemplified by guano contracts and its distinctive trait is a complete absence of repossession logic. It accounts for the vast majority of the database, 55 individual contracts in our 67 hypothecations, or 82%. As just said, Type I did not provide creditors with any semblance of contingent control of the asset: The asset was never put in the hands of a third party (as should occur under a CSD-like arrangement) and the language of the contract never spoke of what would happen in case of default. In the case of guano, the language even went as far as reminding investors that guano deposits in the Chincha islands remained "inalienable property" of the Peruvian government. A fortiori, there was never any mention of what would happen if Peruvian debt failed to perform. Instead, Type I focused on describing the earning capacity of the source, along with the value of the asset and/or income stream. Simultaneously, it documented the value of the loan and/or the annual burden (interest and amortization). From the language of the document, the message was to secure the investor by providing evidence that the debt was sustainable. Language in prospectuses demonstrates that a high cover did "secure" the investor better than a lower one but, to repeat, at no point was the asset surrendered.

In fact, the material documenting Type I hypothecations described a technology to assess the source pledged and supervise the transfer of semi-annual dividends to creditors out of that source. Typically, they tasked an agency of the bondholders with ensuring

[23] St George (1995, p. 139).

that things would work as planned and to report to creditors in all situations. The identity of the agents, and their responsibility were carefully specified. What is more, efforts were made to secure, through contract, the alignment of the incentives of the agents with that of the principal. For instance, British consuls were often involved because they were already tasked by their functions to document a country's trade and economic prospects. For that reason, they provided a trustworthy third party, at the same time their partially private attributions (their revenues were partly private and partly governmental) ensured that they could be remunerated for their work on behalf of creditors. What is more, their molesting by local authorities amounted under international law to a *casus belli* and so they could be expected to operate relatively secure from foreign interference.

Consider for instance the Imperial Moorish Loan, issued in 1862 in the name of Sultan Muhammad IV. The prospectus provided for the hypothecation of one half of annual custom revenues (valued at £320,000), out of which the annual interest and amortization (or £38,000) would be serviced (art. 5 & 6). The British consul in Morocco was involved to "certify" (as the prospectus put it) the reliability of the estimates of Moroccan custom revenues (art. 5). Next, the contract tasked independent, British government appointed "Special Commissioners" to receive from Moroccan officials the custom duties so hypothecated (art. 2). The involvement of the commissioners did not imply a British guarantee since, as article 4 emphasized, the British government was *not liable* for anything and did not commit to deliver to bondholders more than what reached the hands of the commissioners. A whole machinery was put together involving a timetable for transfers. In this case, typical of many such loans, it was provided that each semester, no later than six weeks before the coupons became due, the Commissioners would transfer the money to the Morocco agents of Robinson, Fleming, the London banking firm in charge of paying the interest. The latter would wire the money to London, enabling creditors to cash the dividend on the due date (art. 3). In this manner, any delay or diversion would be observed far in advance.

Each individual hypothecation differed from the next, revealing significant ingenuity and adaptability in drafting. While this makes it inadequate to speak of sovereign hypothecations as "boilerplate" clauses in a narrow sense, there was a common logic. In the Moroccan case, the role Britain played at the time as mediator between Morocco and Spain had been exploited to create a robust information provision machinery. It consisted in the involvement of the "Special Commissioners" who then became tied to the informational machinery of the loan. However, in other cases a private banker was tasked

with providing the monitoring technology through intervention of their agents abroad, or, again, through consuls. Doing so accurately and reliably did not require as much capital or prestige than was needed for signaling safety as involving super-prestigious banks did (Flandreau and Flores, 2009). A consequence of this is that it enabled more ordinary bankers to participate to the sovereign debt market, because the creation of accurate reporting institutions was within their reach. All they had to do was, with the help of lawyers, create and manage a credible information production infrastructure. Under British common law, merchant bankers had trusteeship responsibilities with respect to funds deposited with them, which created an additional liability containing incentives against mismanagement or abuse.

As a result, contractors could mobilize in the realm of sovereign debt an expertise that they had initially accumulated in the context of infrastructure projects.[24] Sovereign lending took the outlook of a critical path punctuated with successive completion milestones and "forks" that enabled to validate completion. An important aspect is that a system of automatic reporting was created, sometimes including the regular posting of updates inside the walls of the stock exchange. This way, a country could quickly acquire reputational capital. By contrast, because failures to complete assigned tasks could be construed as failure to perform, they enabled to deploy a full set of active measures. This coordinated creditor responses, including mobilization of the law of the stock exchange: For instance, new loans to a country that had failed to follow the critical path adequately, could be denied until they would have cleared the main hurdles (Flandreau, 2022).

The upshot was that this enabled, so to speak, to collateralize development. The project became its own security, by organizing an information disclosure technology that compelled sovereigns to display their efforts and achievements and those of their agents. In this fashion, a country could collateralize the revenues from a yet-to-be-constructed railway, because the process enabled the investor to acquire information pertaining to the quality of the execution. Self-executing penalties could be introduced in cases of delays, and are typically found along or inside collateral clauses, while by contrast staying on track was rewarded. The system also helped coordinate private and public actions through contractual instruments. For instance, in raising money for a second tranche of a railway line, the Honduras 1870 bond prospectus stated that the engineering firms involved had been committed "under heavy penalty, to complete the second section at

[24] For a discussion of contemporary ingenious contractual innovations in railway projects, see Pollins (1957a, b).

the end of 1871."[25]

3) *Type II Hypothecations*

The previous conclusion that Type I hypothecations were not just a failure to collateralize properly, but had a logic of their own also comes out strongly from examining the minority template for hypothecation, which we group under "Type II" hypothecations. In fact, in a few cases (12 bonds), lawyers and financiers who drafted the contracts did indeed harness the "classical" logic of debt hypothecation, resting on repossession, suggesting that they could tell the difference. Of course, this makes sense because contemporaries were fully familiar with the principles underpinning collateralization of corporate debt. In practice, every such hypothecation could be hugely different from the next, much more than occurred under Type I, because each drew opportunistically on idiosyncratic circumstances to achieve a higher degree of enforceability. From that vantage point, it is not strictly correct to think of them as a group and, in statistical work, we will exclude them from the core of our regression analysis.[26] Still, to repeat, all had in common a genuine effort to create a tangible repossession right for creditors, in effect giving them a kind of recourse in case of non-performance and, in particular, control over the pledge, whether direct or indirect.

Because Type II hypothecations harnessed an element that enabled to replicate the logic of CSDs they aimed in effect at finding creative ways to turn sovereigns into private entities, eschewing the all-encompassing nature of sovereign immunity. This was attempted in any number of ways (we summarize the information on Type II collateral in Table A.1 in the Appendix). If, for instance, a robust mortgage statute was available in the country, and if the country admitted limitations to the power of sovereign over private property, bondholders could be secured by relying on domestic law. The Spanish Quicksilver loan of 1870 offers such an example. The loan was secured by a mortgage deed under the Spanish mortgage law of 1860, pledging the mines, machinery, buildings and works of Spain's Almaden mercury mines. In case of non-performance, Rothschilds, who was the creditors' agent, had the right to execute the security.[27] Other similar instances includes a Swedish loan, which formally mortgaged state lands, and two Italian

[25] From *Times*, June 21 1870.

[26] Still, all the findings we present are robust to adding the Type II related observations back and controlling for them, as we show in the Statistical Appendix A.2.

[27] On the Spanish mortgage law of 1860 see Pantoja and Lloret (1861); Martín (1980); López-Morell (2016). Chabot and Santarosa (2017, p.32) suggest incorrectly in our reading that the hypothecation worked as guano, because it was an export commodity, through "legal difficulties of selling quicksilver abroad."

loans, mortgaging State Domains and the Tobacco Monopoly, respectively.

In one case, a formal British deed of trust was created to carry the asset for the benefit of creditors. This appears to have been inspired by the *Smith* verdict, in which the judge had declared that he would be competent in case the security be pledged in this way, which meant that the foreign sovereign would have willfully and unequivocally alienated the property. Under yet another design, used for several loans to Egypt, creditors asked the sovereign to pledge *personal* property, ostensibly relying on the lack of personal immunity. In principle, Khedive's personal debts would become enforceable by so-called Mixed Courts, created in the wake of the new contracts. Their remit included matters that had to do with the Khedive's land and that of his family, so long as no question of acts of sovereignty arose.[28]

Finally, another mechanism we observe consisted in harnessing international law. While under sovereign immunity, courts of justice were not competent to hear a lawsuit nor to return a verdict against a sovereign, sovereigns had the right to do justice themselves. Using as collateral an asset that was secured by international treaties, such as when pledging in Ottoman loans the Egyptian Tribute to the Ottoman empire, whose payment was guaranteed by international powers, or better still, securing the formal backing of the British government as was the case in the Ottoman loan of 1855, enabled to make the security binding. In the last case, Britain would be the enforcer of the collateral.

In this paper, we do not try to assess systematically the success met by the much less frequent Type II hypothecation template, in particular in reducing perceived default risk, for this is beyond our purview, which is to understand why seemingly "absurd" Type I hypothecations were so prevalent. Of course, under the assumption that any individual Type II design was robust, the corresponding hypothecation ought to have reduced sovereign risk-premia and there is evidence that some did. The significantly higher price of the 1855 Ottoman loan for instance has been discussed by Al (2012).[29] At first brush, other attempts appear to have been much less successful. The Egyptian loans secured by the Khedive's own property were trading slightly below other Egyptian loans. This is

[28] See Hoyle (1986, 1987, p. 437). Subsequent failure by the Khedive to respect the rulings of the court would be one of the grounds for the British intervention in Egypt.

[29] See also Esteves and Tunçer (2016). Evidence of lower yield for the Quicksilver loans is also reported Chabot and Santarosa (2017). As stated, they suggest that the credibility of the arrangement had to do with difficulties in exporting mercury. But in view of the Smith verdict, we suggest instead that it had to do with the expectation that default would have led Rothschild to execute the security on behalf of its creditors.

consistent with evidence of subsequent failed attempts at enforcing the Khedive's private property before Mixed Courts, as a result of the ruler's deliberate obstruction.[30] More generally, although the exploration of these remarkable legal creatures should continue, we note that the fact that the template was used much less frequently than the alternative suggests that sovereigns were reluctant to alienate sovereignty. To repeat, our broader point in discussing Type II hypothecations is to prove that more traditional hypothecations were conceptually feasible. In other words, if contemporary borrowers and investors resorted predominantly to Type I hypothecations it is not because they failed to collateralize in a traditional way, but because they recognized the instrument as a valid solution.

4) *Statistical Evidence*

We conclude this section with a discussion of the statistical characteristics of our sovereign bonds database. As said, 67 of the 116 bonds in our sample had collateral clauses in their prospectuses, of which the majority, 55, were Type I hypothecations. This large proportion bears witness of the importance of hypothecations in the 19th century sovereign debt market. What is more, the bar chart in Figure 2 shows the increasing use of the instrument over time, with 84% of the 67 hypothecated bonds (both Type I and Type II) issued during the final thirteen years of the window we consider, and the share of hypothecated bonds over total bonds issued amounting to 60%.

Table 1 provides summary statistics of the loans in our databases, enabling to compare Type I hypothecations with the two other instruments (both non-hypothecated and Type II). As expected, the three groups show different financial characteristics. Type I hypothecations provide more information on the object of the loan than either other group, which is consistent with the fact that they assisted information production. Type I hypothecations also display a higher yield at issuance than the other groups, which is consistent with larger information asymmetries. Next, Type I hypothecations rarely involve a prestigious underwriter (Barings or Rothschilds) especially compared to non-hypothecated bonds. This suggests that hypothecations substituted for alternative forms of monitoring, such as prestigious banks vouching for borrowers whom they rendered information insensitive, eschewing disclosure, a point to which we shall return. Finally, and perhaps more anecdotally, Type I hypothecations involved smaller deals (5 million pounds on average compared to 9 million pounds for non-hypothecated) and with shorter

[30] On this point, see the contributions by Hoyle to the history of mixed courts, in particular (Hoyle, 1987).

maturities (28 years versus 44 years). This is consistent in fact with new and less well-known issuers.

Finally, in Figure 3, we distil statistical information on the distribution of securities across the prospectuses for Type I bonds. In particular, the figure serves to identify the *nature* of the assets that were hypothecated. As can be seen, the most common objects of hypothecation were revenue streams, whether they be tax revenues or the revenues from an immovable assets (e.g. railways). Only six bonds pledged movable assets.[31] Assuming that repossession upon default had been the plan, such selection would have been absurd. The first reason why we see so few movable assets in the lot is that whether the collateral be located in the jungles of Honduras or in the London Docks, it would be immune and so there was no peculiar motive for pledging a movable assets. The other and more fundamental reason is that boilerplate hypothecations had very little to do with repossession.

IV. Sovereign Collateral Value

We have established that repossession following default cannot offer a persuasive rationale for sovereign hypothecations' popularity. Here, we bring evidence that investors appreciated hypothecation clauses even when they did not increase recourse chances upon sovereign default. Despite lack of enforcement, Type I hypothecations constituted a valuable tool for investors and risky sovereigns alike. For the former, it reduced information asymmetries and this translated for the latter in market access at better terms.

The empirical question we consider here is whether Type I collateral clauses indeed helped sovereigns lowering funding cost. The challenge is to control for selection of riskier issuers into hypothecation: We expect riskier sovereigns to be more opaque and thus resort more frequently to hypothecations. To uncover a possible benefit from Type I collateral posting, we should measure how the *same sovereign* at the *same time* would have done without collateral clauses. To this purpose, we employ sovereigns floating both hypothecated and non-hypothecated bonds and estimate the traditional panel regression model with country time fixed effects, which is used conventionally in the literature in historical bond spreads (Chavaz and Flandreau, 2017). The key advantage of this specification is that it controls both observable and unobservable time-varying

[31] In order, these were the Chilean bond of 1858 and the Honduras bond of 1867, pledging shares; the Peruvian bonds of 1865 and 1872, both pledging guano; the Ottoman bond of 1865 pledging a reserve fund; the Japanese bond of 1873, pledging rice.

country-risk factors.

Specifically, the equation we consider is:

$$(1) \qquad \text{Yield Spread}_{bcyt} = \eta_{ct} + \beta \text{Collateral.}_{bcy} + \Gamma X_{bcyt} + \epsilon_{bcyt}$$

In Equation 1, Yield Spread$_{bcyt}$ is the spread over British consols, recorded for bond *b* issued by sovereign *c* in year *y* and measured in year *t*.[32] The primary independent variable, Collateral.$_{bcy}$, is a dummy variable taking value one if the bond includes collateral clauses (Type I) and zero otherwise. η_{ct} are fixed effects controlling for risk at the country-year level in the most stringent specification. X_{bcyt} is a matrix of covariates including the log of the total issue size (to control for liquidity) and the log of maturity (to control for bond and time specific ex-ante risk born by the bondholders). Moreover, X_{bcyt} includes dummies for (a) whether the bond is a perpetuity,[33] (b) the presence of an explicit project purpose on the bond's prospectus and (c) for the prestige of the underwriter. The last dummy singles out bonds underwritten by Baring and Rothschilds, the two most prominent operators according to contemporary sovereign debt league tables.[34] Finally, ε_{bcyt} is the standard error, clustered at the country and year-of-bond-issuance (*cy*) level.[35]

In order to estimate Equation 1, we build a panel of yields. We generated it by collecting end-of-year bond prices from 1864 to 1875 from *The Course of Exchange*, the official price list of the London Stock Exchange and computing each bond's yield-to-maturity based on maturity information in prospectuses. The choice of this period is motivated by the fact that the use of hypothecations in the market became more frequent and price data is available on a much more consistent manner than before. In addition, upward of 70% of bonds were issued in such timeframe, so the overall coverage is high.[36]

[32] British consols' yields are from Klovland (1994).
[33] To avoid losing information, perpetuities' infinite maturity was replaced by an arbitrary number higher than the highest maturity recorded. Simultaneously, for this not to "pollute" other estimates, we always include a perpetuity dummy to account for perpetuity-specific characteristics.
[34] Data from Flandreau et al. (2009).
[35] In this way, we account for the correlation in the returns of bonds issued by the same sovereign in a limited span of time, which may otherwise unduly inflate the results' significance. The resulting number of clusters is 80 for the specifications illustrated in columns (1) through (4) of Table 2, and 72 for the specifications illustrated in columns (5) and (6). The decrease in the number of cluster is due to dropping singleton observation when including country-year fixed effects. The significance of our results is robust under multiple clustering schemes, as we show in the Statistical Appendix, Figure A.2.1.
[36] Bonds that do not trade often are likely to be illiquid and display noisy price behavior (see Chavaz and Flandreau, 2017).

Thanks to the greater data availability, the resulting yield dataset achieves comprehensive coverage of the original bonds list, with 766 spread entries from 106 of the 116 bonds; among these, we drop 10 bonds (40 spread entries) with variable Maturity shorter than 10 years, which are tainted by lower pricing frequency and idiosyncratic effects. Moreover, we drop 126 entries due to bonds we file as Type II; as we stated, each Type II is sui generis so that controlling parametrically for such cases is dubious.[37] Nevertheless, as the Statistical Appendix shows, all results are robust to alternative specifications, including if we add back in the panel Type II observations and control for them with a Type II dummy (Table A.2.2). Moreover, marginal changes in the definition of Type I or Type II (which factor in the risk that incomplete documentation lead us to misallocate some contracts) do not affect our findings (Figure A.2.1). Crucially, 544 among the remaining 640 yield observations belong to eight of the most important bond issuers in our dataset that floated both collateralized and non-collateralized bonds. This means that, even after sample selection, we still have enough cross-sectional variation to identify Type I bonds' premia for the same sovereign and at the same time.[38]

We present estimation results in Table 2. In the first two columns, we show that sovereigns issuing Type I securities were riskier: Without accounting for country-specific factors, yields spreads were 476 to 350 basis points higher for Type I bonds. In the next four columns, we instead control for fixed effects, comparing yields of bonds belonging to the same sovereign. This enables us to uncover a Type I *premium*, that is, other things being equal, Type I hypothecations traded at a higher price (lower yield).

First, in columns (3) and (4), we introduce country fixed effects. Comparing bonds with and without Type I clauses issued by the same sovereign, we find that Type I bonds traded at an average spread of 76 to 108 basis points lower than their counterparts. Next, in columns (5) and (6) we add country-year fixed effects. This specification does away with both fixed and varying country risk factors, absorbing all variation that is not purely at the bond-level (i.e. it controls for all sources of unobservable risk). The results show investors' taste for Type I bonds, with a hypothecation premium between 57 and 85 basis points lower (and highly statistically significant). To give a sense of the magnitudes, we

[37] We also drop from our sample the Portuguese perpetuity issued in 1863 and the second installment of the Costa Rican bond of 1871, as these two bonds trade at exactly the same price as, respectively, the Portuguese perpetuity of 1862 and the first installment of the Costa Rican 1871 bond. Their inclusion would unduly increase the significance of our results in the multivariate regression analysis, and we do not count their yield observations among the initial 766.

[38] Italy, Turkey, Chile, Argentina, Sweden, Hungary, Denmark and Spain, accounting for 53 bonds in the prospectuses library.

compute the average, unconditional yield spread over the entire sample for countries employing at least one Type I bond, and for countries not employing any hypothecation whatsoever. As the first amounts to 679 and the second to 253 basis points, the premium we quantified ranges between 14 and 23 percent of the difference between the two averages, a sizable saving on the borrowing cost.

To sum up, our evidence points to the fact that, even if they offered no recourse upon default, Type I clauses were an effective tool to gain market access at a lower cost for sovereigns that were riskier than average. There are also grounds to believe that, since the sample censors countries that failed to secure market access, the effects of hypothecations was even larger than the results suggests, though documenting this would require further investigations. In the next Sections, we deepen the role played by opacity, information collection and monitoring in explaining why Type I clauses added value.

V. Collateral a Solution to Fiscal Opacity: Evidence

We now move to the next stage of our argument and show that collateral clauses were especially employed in information poor environments. Collateralization disclosed certified information on identified sovereign revenues and set up a structure to better monitor the sovereign. Certified information disclosure should have lessened information asymmetries, and relaxed lending constraints. As a result, we should observe more collateralization in places where standard fiscal information is fragmentary or of poor quality. To show this, we need to document borrower's information availability and in particular, fiscal transparency. Our contention is that opaque countries resorted to hypothecations as a way to resolve severe information asymmetries that would have otherwise forced them to borrow at a higher cost (or even prevented them from borrowing). In other words, we want to measure the impact of fiscal opacity on the propensity to hypothecate. However, to do this in a rigorous fashion, we need gather information on the specific information context of contemporary investors.

1) *Fiscal Opacity and its Discontents*

Though some countries started having accounts fairly on, while for others, historians have been able to offer painstaking reconstruction from archival evidence, the rise of systematic, regularly updated, and comparable fiscal data is a late phenomenon, which did not consolidate until the 1890s at best, and which even then remained far from perfect.[39] Before this, sources remained fragmentary, scattered and investors had to

[39] See Jerven (2013) provides evidence in the context of modern developing countries.

navigate the *lacunae* in the primary documentation. Prestigious underwriter controlling market access were often able to bring pressure to bear on borrowers and compel them to disclose privately relevant numbers, but this was not something within the reach of ordinary bankers.[40]

Against this backdrop, a revolution was the *Statesman Yearbook*. First published 1864, the *Yearbook* covered country-level material, aiming at a comprehensive picture of each country's political and economic position. In particular, it documented the political regime, demographic data, exchange rates, and, most importantly, fiscal data, covering budgetary forecasts, accounts (realized budgets) and debts. The editor of the *Yearbook*'s, Frederick Martin, worked with official national sources. When they were missing or not up to date, which was very frequent, he approached foreign governments directly through their embassies or used other routes. Martin's ultimate goal was to report such information as it stood for the current year. He never tried to make guesses, but did strive instead to report official material as it stood best updated.[41]

That no such source as the *Yearbook* existed before 1864 speaks volume of the hurdles in the way of information gathering. As discussed in Flandreau (2003), this was a significant stumbling block for underwriters and investors alike. They devoted significant efforts to remedy the problem of data acquisition. Often, countries did not have (and continued not to have) relevant fiscal data or they did not release it. Many countries that borrowed in the London Stock Exchange had in fact incomplete public finance figures only and some none at all. Against this backdrop, the *Yearbook* soon acquired a solid reputation as the standard source for accurate macro-financial information. For instance, according to Lionel Louis Cohen, a member of the stock exchange and foreign debt investors, the public debts of states and the data for revenues were, thanks to the *Yearbook*, "accessible to anyone" (Cohen, 1876, p. 691).

As a result, because of the manner in which its editor worked, the *Statesman's Yearbook* can be relied upon for providing a good proxy on when was the latest information on any single country updated. Since each year provided an opportunity for the editor to update figures from previous year, we can infer, assuming good faith efforts, that failure to update captured hurdles in the way of data gathering. For that reason, we can exploit the *Yearbook* to produce indicators of the quality of information publicly

[40] See Flandreau (2003) for a discussion.
[41] Steinberg (1966), for a discussion of the making of the Statesman. For early work using its material, see Flandreau, Cacheux, and Zumer (1998); Flandreau and Zumer (2004).

available for any given country in any given year and, in this way, generate a data panel on country-wise fiscal opacity, identified as more or less extensive failure to update. In clear, we identify fiscal transparency with the frequency of updates in the *Statesman's Yearbook*.

To be precise, consider the fiscal information chapter in any *Yearbook* volume. Going volume by volume, we can collect the date of the latest information available year by year. Calling *t* the year of the *Yearbook* edition and $l(i_t)$ the information lag for country *i* on date *t*, we have $t\text{-}l(i_t)$ the date of the latest information available on a given country at date *t*. In the ideal situation of perfect fiscal transparency, the lag is always zero: The more recent numbers in volume 1864 are for year 1864, the more recent numbers for volume 1865 are 1865, and so on. In this case, if we were to plot on the *x*-axis the year of the *Yearbook* edition, and on the *y*-axis the year of the most recent budget available, we would obtain the 45-degree line of full transparency Any delay in updating/releasing figures would show the curve "falling behind" the 45-degree line and the further below, the less transparent the country. Of course, nothing prevents a country from improving its data reporting over time: Transparency is time dependent.

In Figure 4, we plot the transparency lines for each country as constructed from the *Statesman's Yearbook*. The Figure shows red countries as those that do issue Type I hypothecations and blue countries as those that do not hypothecate at all (we exclude Type II from the analysis, though the evidence suggests that Type II hypothecations also occurred in numerically challenged environments). The figure underscores, first, the general extent of the information problem (information tended to arrive with a lag): In the case of many countries, lending was a blind date. Second, we note the significantly superior transparency performance of non-hypothecating countries compared to hypothecating ones. Even while an eyeball test suggests that a modest catch-up occurred towards the end of the period sample, opacity was a characteristic feature of Type I hypothecations.[42]

2) *Opacity and Collateralization*

We now study the statistical link between transparency and collateralization. To begin, we start with comparing the effect of the speed at which the *Statesman Yearbook* reported updated revenue figures for each sovereign. To that end, we use a linear model

[42] Hypothecations were also performed by new states such as Italy, Denmark and Hungary. Reliance by new states on hypothecation is in line with Diamond (1989) and Tomz (2007) on the role of reputation in mitigating information asymmetries.

to estimate the effect of three alternative *Statesman's Yearbook* based measures of transparency on the preference for hypothecated bonds. The first ("Recent Data") is a dummy taking value one if the revenue information for sovereign *s* reported in *Yearbook* volume *t* is less than two years old. The second ("Updated Data"), is a dummy taking value one if revenue information for a given sovereign in *Yearbook* volume *t* is different from the same sovereign's entry in volume *t−1*. Last ("Age of the Data"), is a discrete variable recording how old is the latest revenue information published in volume *t* of the *Yearbook* regarding each sovereign. The prediction we make is that the more recent the data, or the better it is updated, or the less old is the update, the smaller the incentive to hypothecate.

Regarding controls, an important phenomenon to bear in mind is that less transparent sovereigns were likely to be overall riskier because, for instance, they were more poorly managed. So we need to control for country risk. Therefore, we need to introduce an independent measure of sovereign riskiness to be able to capture the marginal contribution of opacity. Another phenomenon which may contaminate the results is that anecdotal evidence suggests that the editor of the *Yearbook* intensified his data collection efforts when a loan took place (this is consistent with the fact that he may have received more inquiries). This makes sense because the *Yearbook* was treated as a reference. In this case, the estimation might understate the true correlation, because extra efforts of the editor would lead to underestimate objective opacity. To address these concerns, we estimate the following linear relationship:

$$\begin{aligned}\text{Currently Hypothecating}_{cy} = \alpha + \beta\text{Information}_{cy} + \delta\text{Risk}_{cy} \ldots \\ + \gamma\text{Recent issuance}_{cy} + \epsilon_{cy}\end{aligned} \tag{2}$$

The dependent variable, Currently Hypothecating$_{cy}$, is a dummy equal to one if sovereign *c*'s last bond issued up to current year *y* is a Type I hypothecation. Information$_{cy}$ is one of the three proxies for transparency, considered alternatively. As control, we include the variable Risk$_{cy}$ that is one of two country-risk proxies. First, we consider the lagged volume-weighted country spread for sovereign *c* computed using our yield panel. Second, we use the country's lagged GDP per capita in 2011$ as documented by the Maddison Project, which we use as a measure of country's resources (Bolt and van Zanden, 2020). Finally, to account for greater reporting effort close to bond issuance episodes, we include a Recent issuance$_{cy}$ dummy, which equals to one if sovereign *c*

issued bonds in the last two years before *y*.[43]

Table 3 depicts a strong negative relationship between transparency and Type I hypothecations: The less opaque the country, the less frequent the hypothecations. In columns (1) and (2), we employ the Recent Data dummy as information measure, the Updated Data dummy in columns (3) and (4), and the Age of Data measure in columns (5) and (6), each time alternatively controlling for risk with one of the two measures described above. Irrespective of the risk and information proxies, we find a 20 to 30 percent negative correlation between recent/updated information and currently accessing the market with a Type I bond. I.e., a drop in the quality of fiscal information below "at most two years old" implies an increase between 20 to 30 percent in the probability that the last bond issued is a Type I. Meanwhile, the effect of a failure to update (whichever the initial and resulting age of the data) on the probability that the last bond issued is a Type I is about 20% too. Finally, in columns (5) and (6), we show that an additional one-year lag in the information disclosed correlates with a 5 to 14 percent greater likelihood of tapping the market with a Type I bond. Which is, a 5-year comparative lag would mean an increased probability to hypothecate between 25% and 70%.

3) *Information Substitutes*

Finally, we harness the fact that alternative information production technologies existed at the time in order to bring additional evidence to bear on our central claim that hypothecations were information provision devices. Fixing the level of fiscal information scarcity, an established relationship with a reputable underwriter signals better quality (Chemmanur and Fulghieri, 1994). This is known to have played a prominent role in historical sovereign debt markets. Flandreau and Flores (2009, 2012a, 2012b), Flandreau et al. (2009), Flandreau, Gaillard, and Panizza. (2010) provide evidence that during both in the 19th and early 20th century prestigious underwriters took care of information asymmetries. Gorton (2017) suggests to interpret this finding as meaning that prestigious underwriters produced information insensitive securities: Rothschilds would pledge their seal of approval, thus removing the need for further information acquisition.[44] If this is so, one effect of association with a prestigious underwriter is that it should relieve pressure on opaque sovereigns to surrender more information through informational workouts such as provided by Type I hypothecations.

[43] Changing the width of this time window does not affect the results, as we show in the Statistical Appendix's Figures A.3.1, A.3.2, A.3.3.

[44] For recent empirical evidence supporting the claim in late 19th century sovereign debt markets, see Indarte (2021).

Armed with our proxies of fiscal transparency, we can test whether this substitutability effect holds. This is done by adding to the previous equation a prestigious underwriter dummy. Suppose our hypothesis is true and Type I bonds can substitute for a prestigious underwriter. In that case, we should observe a negative and significant relationship between a "Currently Prestigious" dummy, taking value one if the most recent underwriter employed by the sovereign is Rothschild or Baring, and the dummy tracking whether the sovereign's most recent bond is a Type I. Moreover, we include $Information_{cy}$ to ensure that we compare countries with similar fiscal opacity levels. Other controls are the same as in Equation 2.

Table 4 shows across all specifications a robust negative correlation between an active relationship with prestigious underwriters and the issuance of Type I hypothecations. This confirms our substitutability hypothesis. Fixed other characteristics, a sovereign that issued its most recent bond with the help of a prestigious underwriter is 40 to 30 percent less likely to have employed Type I clauses in that same bond. The reason is that investors relied on prestigious monitoring instead. They did not need a whole monitoring technology documenting the pathway of their money "from hand to mouth", Rothschilds or Barings provided an alternative instrument and did the work for them.

VI. The Lawyers, Again: Sovereign Collateral and Informational Criminality

Interpreting sovereign hypothecations as an innovative information technology as we do here enables to understand one strong reason why lawyers were involved in drafting the contracts. It was not a way of creating an illusion of enforcement by injection of legalese, but, because information provision was at stake, it was about creating legal hurdles. Information manipulation was possible and to ward off the risk, provisions were made in contracts to try and better align the incentives parties faced in terms of accurate disclosures and truthfulness.

We have already briefly mentioned this question when we unpacked the content of contracts, emphasizing the intervention of British consuls who could be remunerated by bondholders, or of impartial Commissioners who were expected to be trustworthy. As we also indicated, bankers acting as data monitors had legal liability for certain actions (because of trusteeship responsibility vis-à-vis depositors). They also had encompassing but possibly soft moral liability to act in a truthful manner because of reputational concerns. Conflicts of interest could emerge, especially because the instrument enabled the participation of underwriters with less moral capital. Favorable coverage in

prospectuses would act as a piece of "puff" and facilitate distribution, enabling contractors to pocket profits and making them less concerned over truthfulness.

In fact, a collateral confidence crisis erupted in 1872, on the back of the revelation of doctored contents in a Honduras loan prospectus (Flandreau, 2016; Miranda, 2017). In this section, we use this episode to provide a final test of our theory of hypothecations as information technology. We do it by examining policy responses: If the regulators' main concern had been that hypothecations created unwarranted beliefs among investors, then the policy recommendation ought to have been to forbid them, which could be done easily by adapting listing requirements. Yet this is not what happened. Instead, the solution adopted was to make financial intermediaries *liable* for publication of wrongful data in prospectuses. This was achieved by requiring them to make sworn declarations before a notary public that the contents of the prospectus were truthful. This regulatory response is consistent with the view that hypothecations were an information technology that spurred market inclusion of opaque borrowers: Faced with a confidence crisis that undermined the informational value of collateral, the authorities sought to create additional incentives that would restore their credibility as valuable sources of information.

As just stated, public controversy over sovereign collateral followed on the heels of the aborted floatation of a Honduras loan to finance an ambitious "ship railway" project that would transport vessels across the Isthmus. The loan gave the railway and surrounding land (with mahogany forests and the potential to carry a telegraph system) as security. The prospectus, a typical instance of Type I hypothecations, also described the earning potential of the railway. However, on its issue of May 25 1872, a few days before the loan was launched, the *Economist* published an article written under the direct supervision of editor Walter Bagehot, proving with the help of international trade statistics extant that the numbers in the prospectus did not add up. The contractors had produced a calculation of the amount of trade through Cape Horn that the project would hope to capture, but they had massaged the statistics inflating this trade by a huge margin.[45] This spurred a confidence crisis and sovereign hypothecations came under attack. After the Honduras scandal, bondholder representatives and the press voiced widespread concerns regarding sovereign collateral. Simultaneously, the foreign government debt boom of the 1860s and early 1870s was brought to halt, and the data

[45] *The Economist*, May 25, 1872, p. 639. On Bagehot as financial investigative journalist, especially focusing on sovereign bonds, see Grant (2019).

cannot rule out that the Honduras scandal played a role by spurring concerns over the reliability of Type I hypothecations at large. Precisely because they were an information sustaining mechanism, hypothecations were vulnerable to a confidence crisis and contagion.[46]

Examining the regulatory response that ensued reveals the manner in which contemporaries understood hypothecations. In fact, regulatory efforts focused on improving the information content of hypothecations. This comes out clearly when one retraces the step of the regulatory debate that ensued. The debate over regulating hypothecations began with the "Foreign Loans Registration" Bill introduced in Parliament by H.B. Sheridan in March 1875. Sheridan was a member of parliament who was also a corporate lawyer and debt activist (including sovereign debt).[47] The bill would have compelled the agents of sovereign borrowers pledging hypothecations to register the assets with the Registrar of Joint Stock Company. Created as part the Joint Stock Companies Act of 1844, the Registrar fulfilled a disclosure role for British companies, managing and holding available to investors for a small fee relevant information pertaining to companies, including statutes, the list of founding promoters and annual lists of shareholders.[48]

Another aspect of Sheridan's Bill that was relevant for sovereign collateral was that intermediaries who would have falsified information would be guilty of misdemeanor and made personally liable of losses suffered by investors. Items whose manipulation was criminalized included information regarding the "particulars of revenue and taxes" of borrowing governments, in other words, the substance of hypothecations. Thus, the Bill was trying to improve the informational content of sovereign hypothecations by creating penalties for data misrepresentation. In fact, when asked what was the economic logic of the bill, Sheridan answered that if investors were sure that all the hypothecations and mortgages were accurately stated in the prospectus, "states would find it much easier to raise money here." In clear, the object was to limit information asymmetries and lower prices.[49]

[46] For instance, we find evidence of an increase in the spreads of bonds specifically of Type I hypothecations.
[47] "A bill to provide for the compulsory registration of foreign loans." 1875 (60) (94) The Bill came in two readings with mild language differences.
[48] It had been amended by the Joint Stock Companies Act 1856. See Taylor (2013) for a discussion.
[49] Select Committee (1875, p. 274).

In practice, lawmakers and the British government were reluctant to have a British bureaucracy certifying foreign government numbers.[50] The Chancellor of the Exchequer (Sir Stafford Northcote) directed the Bill for examination by a parliamentary committee, the Select Committee on Loans to Foreign States.[51] The suggestion that came back promoted a logic that was similar to that espoused by the Sheridan Bill: The final *Report* of the Select Committee, while fully admitting that hypothecations never led to repossession, did not recommend their erasure. Instead, it recommended to create information liability for underwriters. Again, it was suggested to require contractors to provide in the prospectus a full statement of the "revenues, lands, forests, public works, or other property upon which the proposed loan is secured, and of prior charges, if any, upon such security."[52]

In fact, the recommendation, similar to the idea put forward by Sheridan, drew explicitly on the logic of the Companies Act of 1867, which had made false statements or willful omission a ground for civil action. The technique consisted in aggravating wrongful factual statements by rendering those who committed perjury liable for the losses. When registering a new company with the Registrar of Joint Stock Companies, the promoters had to sign a statutory declaration that the information they disclosed was accurate to the best of their knowledge. As explained in a contemporary legal publication, "were false or untrue in any material particular, the person willfully making such a false declaration would be deemed guilty of misdemeanor."[53]

Because foreign loans were the province of the stock exchange, the matter circled back to its governing body, the Stock Exchange Committee, which was encouraged to consider an adaptation of its listing requirements.[54] On Friday, January 21 1876, its sub-Committee for Rules and Regulations held a special meeting deciding that "a statutory declaration be required from Contractors & Agents."[55] Since depositing the general bond

[50] As Cohen (1876, p. 692) admitted, there were severe hurdles involved in the creation a "Certifying Tribunal for Foreign Loans."
[51] Marichal (1989); Flandreau (2016).
[52] Select Committee (1875, xlix).
[53] *Solicitors' Journal*, Nov 3, 1877
[54] The question had been already discussed during the interview of Herman de Zoete, Chairman of the Stock Exchange, by the Select Committee (Select Committee, 1875, p. 29). The matter had come back once again in the interview of George Webb Medley who recommended that "all statements of agents, contractors, brokers, on [prospectuses ought] to be made by statutory declarations, and the parties making them to be held civilly and criminally responsible for them" (Select Committee, 1875, p. 277-8).
[55] Archive LSE, MS14612/1 Minutes of the Committee for rules and regulations. Showing the import of the Select Committee's suggestion, the regulations considered were said to be "with special reference to the recommendation in the Report of the Select Committee of the House of Commons." For evidence of the adoption of the rule, see

with the stock exchange was already part of the listing requirements, completing the application with a sworn statement declaring that they made "this solemn declaration conscientiously believing the same to be true" ended up replicating the logic of the Company Act of 1867, criminalizing false declarations.

With the new provision, sovereign debt contractors making *deliberately* false disclosures rendered themselves guilty of perjury subsequently. This opened the door to significant penalties, because they could be sued for the full extent of the losses resulting from their wrongful statements. In other words, the mechanism enabled to inflict severe sanctions in case of information manipulation and for that reason, it was expected to render hypothecations safer.[56] While this regulatory intervention is consistent with our interpretation of hypothecations as an instrument to disclose information, it is not consistent with the alternative, that sovereign debt collateral was a scam. Indeed, reliance on sovereign debt hypothecations, far from coming to an end with the mid-19th century hypothecation mania continued to prosper throughout the rest of the 19th century and in fact, well into the 20th century.

VII. Conclusions

This article has studied the perplexing collateralization of sovereign debt, a widespread technique today and one that has also a long history, all the way to the very foundation of sovereign debt. Taking up the cue from Gelpern et al. (2021) that one needs to go back to the 19th and early 20th century to find similar security arrangements in sovereign lending as those used currently in the context of modern Chinese lending for instance, our study has documented the expansion of collateralized sovereign debt during the hypothecation mania that occurred at onset of the first age of globalization and continued afterwards, providing a novel interpretation of the method and logic of this intriguing contractual specialty.

As we showed, contrary to what was suggested by previous research, sovereign debt collateral written into 19th century sovereign debt contracts could not and would not be enforced and what is more, the investing public – or at least most of it, and this included the marginal investor – understood perfectly well that such was the case. And yet they valued sovereign debt collateral. This is evidenced by the fact that they were prepared to

Mihill Slaughter, *Rules and Regulations for the Conduct of Business on the Stock Exchange*, London: Published under the authority of the Committee for General Purposes, 1880.

[56] In practice, the standardized text used in those declarations was derived from the Declarations Act of 1835 (1835 c. 62). The text which contractors had to sign was printed on a card, leaving for the declarer to fill in the blanks.

pay an economically significant premium for collateralized bonds *sans* repossession technology. To explain why, we have provided a detailed archival, legal, economic and statistical study of sovereign debt hypothecations. We argued that sovereign hypothecations served to put together a monitoring institution tasked with the duty of documenting whether milestones set by creditors were met, thus enabling the production of information on borrowers' characteristics, efforts and performance.

Examining the individual structure of each hypothecation contract, we came to the conclusion that hypothecations were an institution tasked with documenting in a truthful way the income accruing from the security and tracing how the money was then paid out to the creditor: In other words, the technology served to document the resource and its administration. It enabled to trace the money all the way to the pocket of the investor. In this way, relevant information was quickly gathered. New borrowers or borrowers who were fiscally opaque could receive funding more easily.

The monitoring institution was itself bolstered by credible disclosure mechanisms. These ranged from the employment of intrinsically trustworthy intermediaries (because of their independence) to the creation of penalties for abuse, either within the instrument itself, or through additional regulatory interventions. A potent such intervention, which drew upon information and disclosure logic of corporate law, was the stock exchange rule of 1876, requiring from underwriters a sworn declaration vouching for the honesty of disclosures. This rendered hypothecation disclosures in bond covenants submitted to the London Stock Exchange liable to perjury and in so doing, bolstered the informational credibility of hypothecations.

To sum up, instead of securing lenders by using courts where collateral could be enforced (so as to increase the borrowers' default cost) non-enforceable collateral secured lenders by using courts where dishonest underwriters could be sued. In other words, the law was mobilized to deliver carefully crafted information institutions, bolstered by accountability. As we indicated in the introduction, this data production logic bears similarities with that identified by Gambacorta et al. (2020) in the context of corporate lending with weak property rights. As they show, "big data" can substitute advantageously for poorly enforceable collateral, because it serves to address information asymmetries. This is very close to what we find here, and the parallel leads us to conclude that widespread sovereign debt collateralization was part of a secular history of Big Data.

A consequence is that the study of the historical process of financial data acquisition

does not have a mere passing interest as an anecdotal study of primitive reporting systems. Nor is it only something we should pay attention to when we need data in the context of empirical research. Rather, digital accumulation and the law it mobilized was part of the fabric of financial globalization: This also means that the exclusive focus on public institutions such as domestic parliaments and the budgets they vote is insufficient. Beyond this, future research should focus on the legal arrangements that did facilitate data acquisition, accumulation, and reliability. Doing so, as we have suggested with our novel use of the *Statesman Yearbook*, ought to go a long way towards making sense of the development record of many countries. In fact, if anything, this paper has demonstrated that the role of data provision in the history of economic development has been underestimated. It is an important field of investigation which future researchers ought to take very seriously.

Tables

Table 1:

Descriptive Statistics for the 116 Bonds List

Non-Hypothecated

	Mean	S.D.	Min	Max	N.
Purpose	0.449	0.503	0.000	1.000	49
Sinking Fund	0.633	0.487	0.000	1.000	49
Yield at Issuance	6.218	1.553	4.396	11.494	41
Prestigious Underwriter	0.531	0.504	0.000	1.000	49
Bond Volume	9.065	19.775	0.358	120.000	49
Maturity	58.133	32.060	4.000	101.000	49

Type I Hypothecations

	Mean	S.D.	Min	Max	N.
Purpose	0.673	0.474	0.000	1.000	55
Sinking Fund	0.873	0.336	0.000	1.000	55
Yield at Issuance	7.870	1.835	4.839	12.500	48
Prestigious Underwriter	0.055	0.229	0.000	1.000	55
Bond Volume	5.198	8.608	0.200	36.800	55
Maturity	27.873	20.476	1.500	100.000	55

Type II Hypothecations

	Mean	S.D.	Min	Max	N.
Purpose	0.500	0.522	0.000	1.000	12
Sinking Fund	1.000	0.000	1.000	1.000	12
Yield at Issuance	6.920	2.125	3.908	10.000	11
Prestigious Underwriter	0.167	0.389	0.000	1.000	12
Bond Volume	11.072	26.235	0.135	94.005	12
Maturity	35.167	31.550	13.000	100.000	12

Note: This Table presents descriptive statistics for the cross-section of bonds, broken down by hypothecation status of the bond. Purpose is a dummy taking value one if the bond's prospect includes a description of the purpose for which the debt is underwritten; Yield at Issuance records the yield at which the bond is presented by the underwriter; Prestigious Underwriter is a dummy taking value one if the bond is underwritten by either Rothschild or Baring; Bond Volume records the issuance in millions of pounds; Maturity records the maturity in years.

Table 2:

Type I Hypothecations Helped Lower Cost of Debt for Risky Sovereign

	Dependent variabile: Yield Spread					
	(1)	(2)	(3)	(4)	(5)	(6)
Type I Bond	4.761***	3.504***	-.7631***	-1.083***	-.5698***	-.8513***
	(3.62)	(2.69)	(-3.33)	(-3.16)	(-2.85)	(-3.36)
Perpetuities	2.534**	4.58***	.2875	.9064**	.5474	1.073**
	(2.62)	(3.43)	(0.65)	(2.07)	(0.98)	(2.36)
Prestige	.1171	.0625	-.523	-.5885	-.5448	-.6352
	(0.09)	(0.05)	(-1.03)	(-1.24)	(-0.82)	(-1.10)
Log of Volume		.1003		.1823**		.186**
		(0.29)		(2.46)		(2.39)
Log of Maturity		-2.328**		-.9852***		-.8381***
		(-2.07)		(-3.66)		(-3.57)
Purpose		.7482		.4051**		.3341**
		(0.79)		(2.60)		(2.24)
Year FE	✓	✓	✓	✓		
Country FE			✓	✓		
Country*Year FE					✓	✓
Adj. R^2	.2132	.2438	.7608	.7633	.9729	.9767
Observations	640	640	640	640	544	544

Note: The Table presents results from the estimation of Equation 1. The first two columns report estimates that only absorb common year of trade fixed effects; the second two columns add country fixed effects; the last two columns absorb all country-year specific variation via country-year fixed effects. Errors are clustered at the country-year of bond issuance level, with 80 country-year clusters over the first four columns and 72 country-year clusters over the last two columns; t-statistics are in parenthesis.

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

Table 3:

Countries issuing Type I bonds were Less Transparent

Dependent variable: Currently Hypothecating						
Information Measure:	Recent Data		Updated Data		Age of the Data	
	(1)	(2)	(3)	(4)	(5)	(6)
Information Measure	-.2399***	-.2968***	-.2024***	-.2028**	.0498***	.1384***
	(-4.59)	(-3.91)	(-4.29)	(-2.56)	(2.71)	(8.54)
Recent Issuance	.1591***	.0118	.1607***	.0173	.11**	.0012
	(3.32)	(0.16)	(3.36)	(0.23)	(2.08)	(0.02)
Lag Weighted Spreads	.0377***		.0406***		.0342***	
	(10.96)		(11.10)		(9.35)	
Lag GDPPC (2011 $)		-.1029***		-.1182***		-.0618
		(-2.83)		(-3.21)		(-1.60)
R^2	.274	.1755	.2678	.1288	.2601	.2755
Observations	341	154	341	154	280	153

Note: The Table presents results from the estimation of Equation 2 using different information availability proxies as controls. The dependent variable "Currently Hypothecating" is a dummy taking value one if the last bond issued by sovereign *c* is a Type I hypothecation. Information proxies are: A dummy taking value one if the revenue information for sovereign *c* reported in Yearbook volume *y* is less than two years old (first two columns); a dummy taking value one if revenue information for sovereign *c* in Yearbook volume *y* is different from information for the same sovereign in volume $y-1$ (second two columns); a discrete variable recording how old is revenue information published in volume *y* of the Yearbook regarding each sovereign *c* (last two columns). Each pair of columns alternatively controls for country risk with the lag of volume-weighted spreads, or with lag GDP per capita.

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

Table 4:

Hypothecation and Prestigious Underwriters were Substitutes

Dependent variable: Currently Hypothecating						
Information Measure:	Recent Data		Updated Data		Age of the Data	
	(1)	(2)	(3)	(4)	(5)	(6)
Currently Prestigious	-.3852***	-.3505***	-.392***	-.3798***	-.3554***	-.3171***
	(-6.66)	(-5.28)	(-6.93)	(-5.59)	(-6.31)	(-5.60)
Information Measure	-.1647***	-.2495***	-.1357***	-.1639**	.0395**	.1253***
	(-3.06)	(-3.36)	(-2.82)	(-2.12)	(2.49)	(7.62)
Recent Issuance	.2023***	.0287	.204***	.0344	.1521***	.0176
	(4.30)	(0.40)	(4.32)	(0.47)	(2.90)	(0.26)
Lag Weighted Spreads	.0358***		.0378***		.0317***	
	(10.53)		(10.68)		(8.73)	
Lag GDPPC (2011 $)		-.1057***		-.119***		-.0666*
		(-3.21)		(-3.53)		(-1.90)
R^2	.3416	.2436	.3382	.2099	.3299	.332
Observations	341	154	341	154	280	153

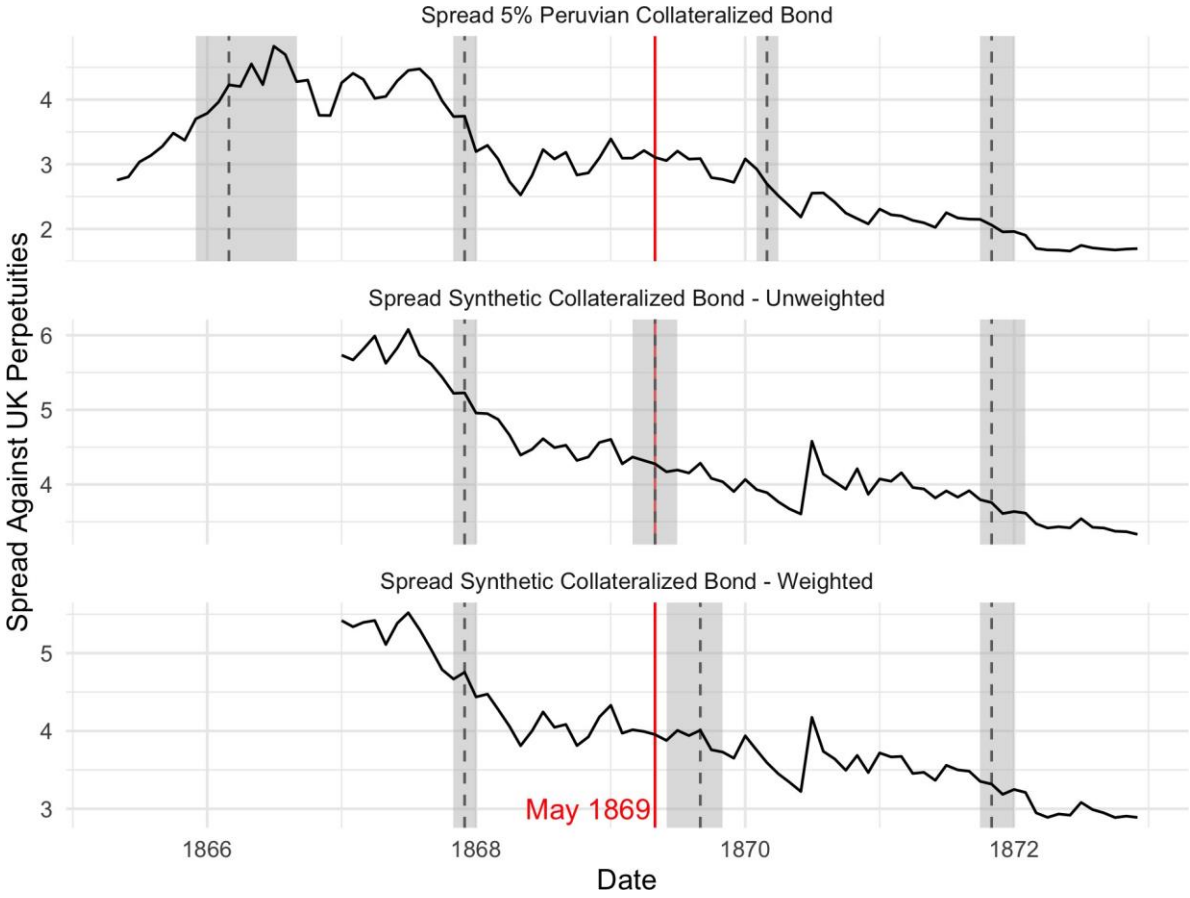
Note: The Table presents correlations between the use of hypothecation and prestigious underwriters in the last bond issued by country *c*, using different information availability proxies as controls. The dependent variable "Currently Hypothecating" is a dummy taking value one if the last bond issued by sovereign *c* is a Type I hypothecation. The independent variable "Currently Prestigious" is a dummy taking value one if the last bond issued by sovereign *c* was underwritten by either Barings or Rothschild. Information proxies are: A dummy taking value one if the revenue information for sovereign *c* reported in Yearbook volume *y* is less than two years old (first two columns); a dummy taking value one if revenue information for sovereign *c* in Yearbook volume *y* is different from information for the same sovereign in volume $y-1$ (second two columns); a discrete variable recording how old is revenue information published in volume *y* of the Yearbook regarding each sovereign *c* (last two columns). Each pair of columns alternatively controls for country risk with the lag of volume-weighted spreads, or with lag GDP per capita.

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

Figures

Figure 1:

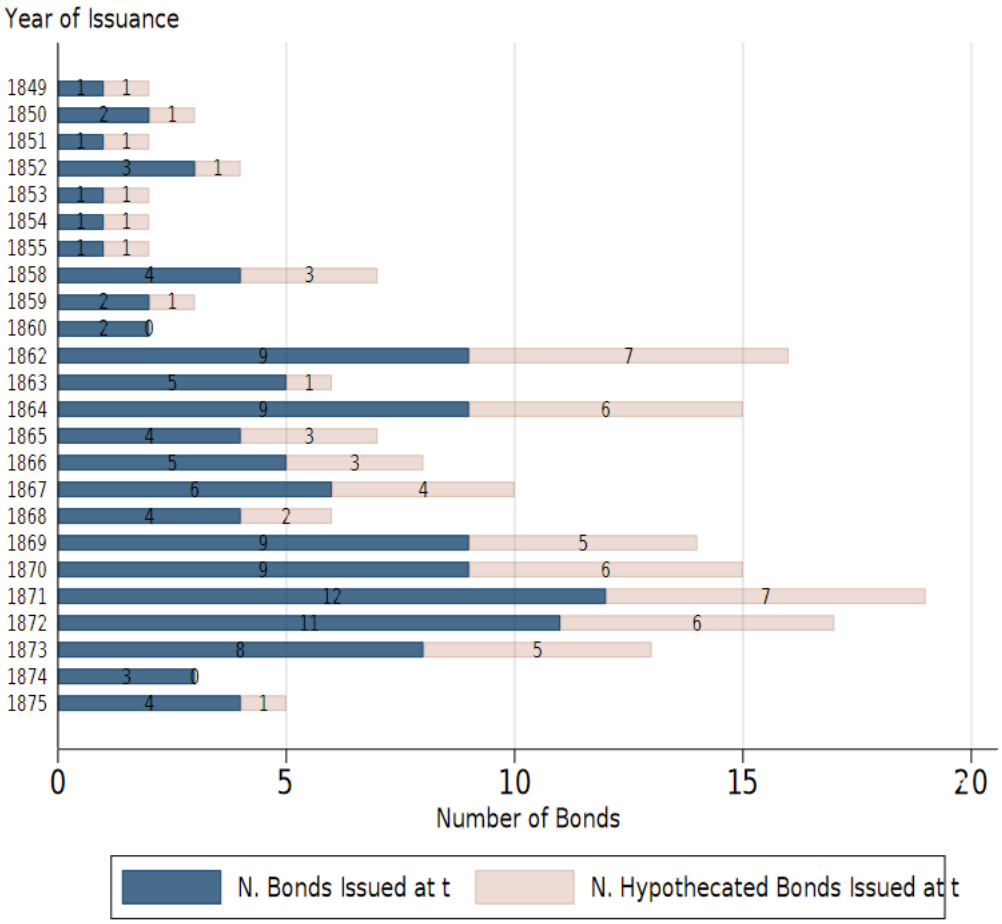
Smith v Weguelin Verdict Did Not Impact Spreads



Note: From the top, the Figure reports the graphical results of performing the structural break test on, first, the Peruvian 1865 5% bond's spread series; second, the spread series for the unweighted portfolio composed of the Chilean 6%1867 (custom revenues), the Romanian ("Danubian") 7% 1864 (custom revenues), the Egyptian 7% 1866 (railways) and the Turkish 6% 1862 (excise on tobacco and salt); third, the spread series for the same portfolio of bonds, weighted for issuance size. Dashed lines represent break dates; gray areas cover 95% confidence intervals; the red line tracks the monthof *Smith v Weguelin*'s verdict. May 1869 falls within an imputed break date range only for the unweighted synthetic bond, but the implied break is in this case a *reduction* of the spread, which is the exact opposite from what would happen if the verdict had been a wake-up call that collateral could in fact not be enforced (the spread should have then *increased*).

Figure 2:

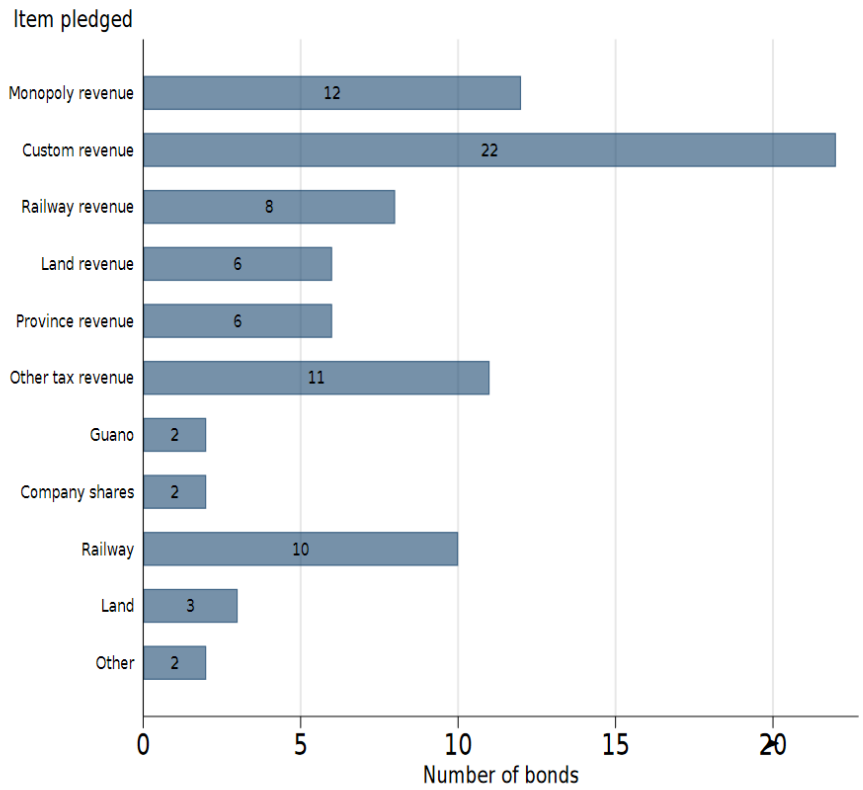
Bond Issuance over Time



Note: This Figure documents the distribution of bonds over year of issuance, specifying in red the number of bonds including collateral clauses issued each year.

Figure 3:

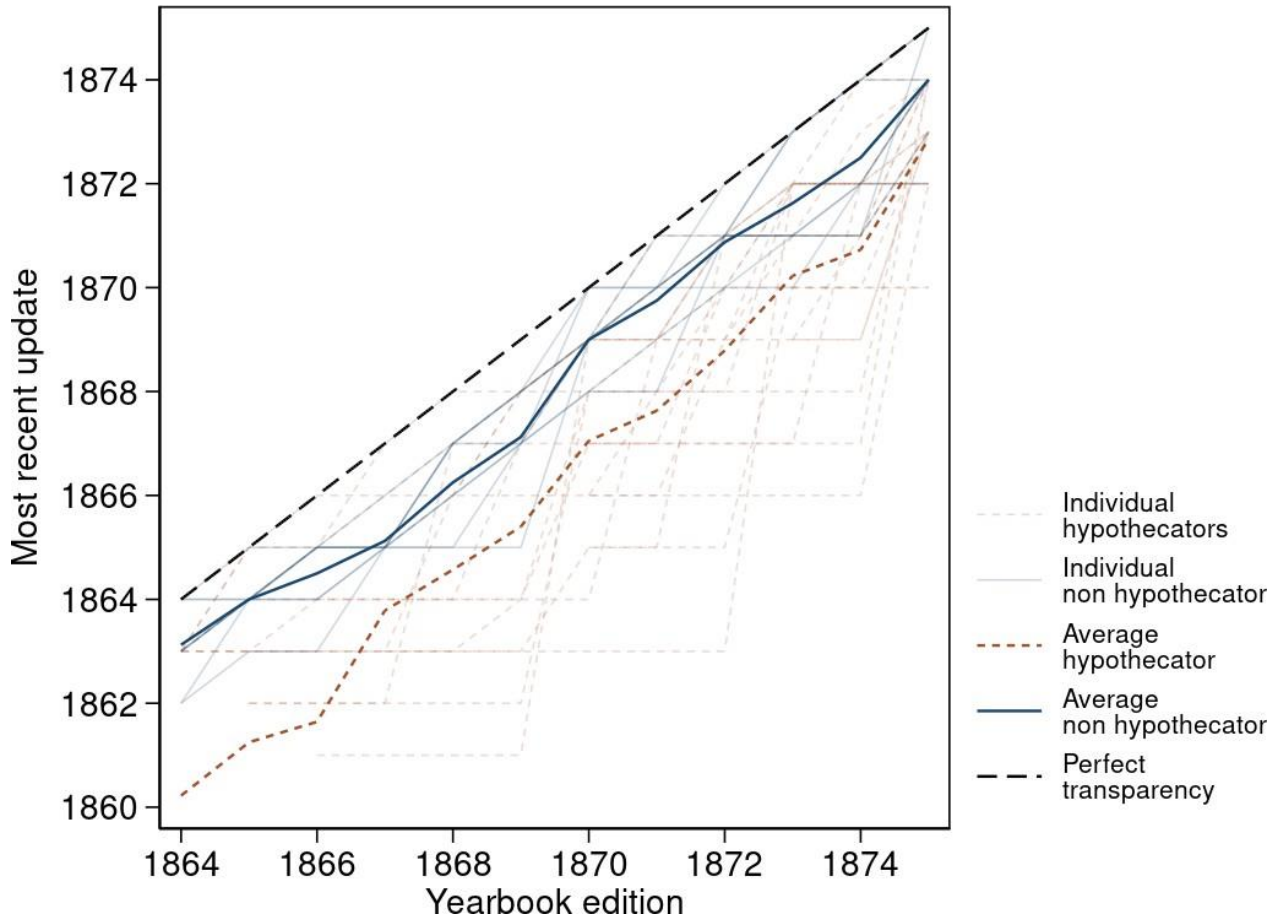
Collateral Clauses Description



Note: This Figure presents summaries of prospectus characteristics for the fifty-five Type I bonds, focusing on the assets pledged. "Other tax revenue" category includes "octrois" revenues, octrois being taxes on the movement of goods for sale within a state; taxes on the sale of small animals and the manufacture of oil; taxes on liquor and coffee; personal (income) tax; taxes on slaughterhouses; the sale of stamps and licenses; navigation tolls. The "Monopoly revenue" category includes guano revenues; tobacco revenues; revenues from salt; revenues from coal and mahogany; from mercury; from fish and locks; from a navigation company. The "Other" category includes a reserve fund and rice reserves. The number on each bar counts how many bonds pledge that specific revenue or physical asset. Categories are *not mutually exclusive*, as each bond may pledge multiple items.

Figure 4:

Collateral Clauses and Transparency



Note: The Figure summarizes the availability of revenue figures in the Statesman Yearbook, distinguishing between sovereigns that issued Type I collateralized bonds (in red) and sovereigns that did not issue any hypothecation (in blue). On the *x*-axis, we list the year of publishing of each issue of the Yearbook. On the *y*-axis, we list the year of the most recent update for each sovereign's revenue figures. We represent perfect transparency as continuously updated and current figures available each year, i.e. the dark, dashed line.

Appendices

Table A.1: Details and References for Type II Securities

Nb	Loan	Security	Instrument	Court/Enforcer	Source
1	Republic of Bolivia 6% 1872	Profits from transp. companies held in trust	Deed of Trust	British Court of Chancery	Stock Exch. Arch. Anonymous (1873), Flandreau (2016)
1	Commission of the Danube, 4% 1869	Tolls on Danube	Receivership of company	Any court of justice of signatories	Stock Exch. Arch. *London Standard*, 3/8/1869.
3	Khedive's Private Loans of 1866, 1867, 1870	Personal property of Khedive	Recovery against Khedive	Mixed Courts? (not created until 1875)	Stock Exch. Arch. Landes (1958), Hoyle (1986, 1987).
1	Italian State Domain Loan of 1865	Real estate	Mortgage	Italian courts	Stock Exchange Arch. Anonymous (1865)
1	Italian Tobacco Loan of 1868	Tobacco Monopoly	Mortgage	Italian courts	Stock Exchange Arch. Regno d'Italia (1868), Ceci (2015)
2	Ottoman Egyptian Tribute Loan, 6% 1854 Ottoman Egyptian Tribute Loan, 6% 1871	Portions of the Egyptian Tribute	International Treaty	British gov.? (no formal guarantee)	Stock Exch. Arch. (for 1871); Fenn (1855); Hertslet (1874); Rose and Staniforth (1876); Egyptian Tribute Bondholders (1876); Shee (1876); Du Velay (1903)
1	Ottoman Egyptian Tribute Loan, 4% 1855	Portion of the Egyptian Tribute	British gov. guarantee	British gov.	Ayres (1857); Al (2012)
1	Spanish Quicksilver Mortgage Loan 5% 1870	Quicksilver mines incl. equipment &c.	Mortgage	Spanish courts	Stock Exch. Arch. Pantoja and Lloret (1861); Ministerio de Justicia (1861); Martín (1980); López-Morell, (2016); Peña-Mir (2019)
1	Swedish Provincial Mortgage Loan	Landed estates	Mortgage	Swedish courts	*London Daily News*, 10/6/1852

Source: Authors.

Statistical Appendices

A.2) Hypothecations and Yield Behavior

We propose three kinds of robustness test: First, we want to be sure that the Type I bond premium we estimate in fitting the country fixed effect versions of Equation 1 is indeed the effect of controlling for country risk, not of the lower risk of countries issuing both hypothecated and non-hypothecated bonds. Relying on country or country-year fixed effect implies using only the variation from sovereigns that floated both hypothecated and non-hypothecated bonds. If such set of countries is inherently safer, we could not conclude that demand for hypothecated bonds was higher when absorbing country risk. Second, we want to understand whether our results are broadly robust to the inclusion of Type II bonds. Indeed, even if such bonds employ heterogeneous mechanisms to try and grant recourse upon default to their investors, they all have in common the standard Type I features, i.e. the systematic display of information regarding sovereign resources and the provision of mechanism to closely monitor repayment. Thus, we expect them at least to command a similar premium as Type I bonds. Finally, we want to gauge the robustness of the result to a broad spectrum of modifications to the clustering scheme, and to marginal changes in the Type II bond classification.

We perform the first robustness by replicating Table 2, now only employing the 544 observations that identify the most stringent specification, the one including country-year fixed effects. From the results of such estimation, displayed in Table A.2.1, we observe that the greater spread of Type I bonds reported in the first two columns of Table 2 is still there in the restricted sample. I.e., even restricting our attention to sovereigns floating at the same time both Type I and non-hypothecated bonds, significant selection of riskier issuers into Type I bonds can be observed in the data, as the Type I effect estimate turns negative only upon the inclusion of country or country-year fixed effects. Thus, Type I premium is not just driven by sample selection.

We implement the second robustness keeping Type II spread observations, and controlling for the possibility of recourse they bring in by adding to Equation 1 a Type II dummy variable.[57] The results we display in Table A.2.2 imply three relevant facts: First, the estimates of Type I hypothecations' effect on the cost of borrowing remain broadly consistent across all specifications, with small (10 basis points) increases in the premium's quantification upon inclusion of country and country-year fixed effects (column (3) through (6), first line). Second, the Type II premium is large, ranging from 180 to 210 basis points lower spreads than what their issuers would have paid without any form of collateralization (column (3) through (6), second line). Such large within-country premium suggests that at least some of the 12 Type II bonds earned high degrees of trust from the investors. Finally, in columns (1) and (2), second line, we can observe that Type II bonds do not trade

[57] We noted that controlling parametrically for Type IIs is not ideal, as their effect on yields may be more complex than the common average impact captured by a Type II dummy. For example, if Type IIs affect yields in a highly idiosyncratic and bond dependent fashion, controlling for a common Type II dummy may leave further components of the Type II effect in the residuals and distort other estimates, as the Type I's premium. However, the fact that our Type I premium estimates' significance and magnitude remain extremely close to what originally shown in Table 2 mitigates this concern and increases the relevance of the robustness we present.

at a statistically significant disadvantage against non-hypothecated bonds, even if we omit country or country-time fixed effects. Again, a finding in line with the credibility of the further services promised by such instruments.

For the final robustness, we follow Simonsohn, Simmons, and Nelson (2020) and present a Specification Curve.[58] Our objective is to show a thorough sensitivity analysis of our estimates and standard errors to alternative clustering schemes, alternative definitions of what counts as Type I or Type II bond, and combinations thereof. A Specification Curve allows us to present many such tests in a parsimonious and transparent way.

Robustness to clustering is almost "mechanical".[59] We will instead briefly comment on the robustness to changes in the Type I/Type II definitions. The coding of collateral clauses as Type I or II carries a (limited) degree of subjectivity. For example, the scope of hypothecations achieved through mortgage deeds depends strongly on each foreigner investor's access to one country's courts. On balance, we decide to code all hypothecations achieved through a mortgage as Type II and exclude them from the estimation of Equation 1. Still, if such choice was crucial for our Table 2 results, this would be concerning. To mitigate similar concerns, we want to explore our results' dependence on perturbations of how we classify prospectuses containing different collateral clauses.

In Figure A.2.1, we plot point estimates and confidence intervals for estimates of β from Equation 1, always including all controls. On the left of the graph, we can see the country and country-year fixed effect estimates, while we can see the estimates obtained without controlling for sovereign-specific risk on the right of the graph. Below the graph, we record with black dots under which clustering scheme, Type II definition, and specification we obtained the estimate.

The plot shows that results are robust to alternative clustering schemes and marginal perturbations of which collateral clauses we code as Type II. We always record a strong selection effect associated with the use of sovereign hypothecation. Hypothecated bond spreads range at about 350 basis points above the average non-hypothecated bond yield. At the same time, we always detect a statistically and economically significant within-country premium of about 100 basis points, against non-hypothecated bonds issued by the same sovereign.

A.3) Hypothecations and Transparency

We probe with Specification Curves also our results on the correlation between proxies of transparency based on the Statesman Yearbook (presence of recent or updated revenue data and age of the data) and accessing the market via hypothecated bonds. In this case, we have three residual concerns.

First, we want to ensure no single year (i.e. *Yearbook* volume) is driving all of our correlation. Second, our results should not depend on the decision to control for each sovereign's past issuing behavior up to $y-2$. Controlling for issuing behavior up to $y-1$, $y-3$, etcetera should not affect what we find. Third, Type I bonds are collateralized bonds in which we are positively sure the information aspect is the only one that matters. For this reason, we present results in Table 3 focusing on sovereigns

[58] The code employed to obtain the graphs builds on the code made available by Hans H. Sieversten at https://github.com/hhsievertsen/speccurve.

[59] Note that the bond level clusters employed for part of the estimates displayed in Figure A.2.1 count different installments of the same bond as the same bond, even if issued over multiple years. We count in total 77 bond clusters with non-missing spreads.

accessing the market through Type I bonds. Still, collateral clauses embedded in Type II bonds do also convey information. Thus, we expect our results to be broadly robust to doing away with the distinction in the estimation of Equation 2.

In Figure A.3.1, A.3.2 and A.3.3 we plot point estimates and confidence intervals for estimates of β from Equation 2. Below the graphs, we record under which specification and which time-horizon of the control variable for past issuing behavior (the Recent Issuance dummy) we obtain each estimate. We show results for both the specification controlling for country-risk with a lag of volume-weighted yield or lag of GDP per capita. Moreover, we add specifications in which we include both risk measures as controls. Indeed, while the lag volume-weighted yield captures investors' perception of country-risk, the reconstructed GDPPC may track elements that were unobservable to the 19th century investor, but still relevant in driving sovereigns' hypothecation decision on top and above sheer fiscal opacity. Accounting for both may thus provide a more thorough control for country-risk factors. Results hold across a broad spectrum of specifications and alternative criteria for controlling for past issuance behavior.

Table A.2.1:

Country-Year Fixed Effect Sample Selection Robustness

	Dependent variabile: Yield Spread					
	(1)	(2)	(3)	(4)	(5)	(6)
Type I Bond	4.939***	2.8**	-.6669***	-.9668***	-.5698***	-.8513***
	(3.41)	(2.01)	(-3.06)	(-3.29)	(-2.85)	(-3.36)
Perpetuities	2.786***	5.724***	.435	1.059**	.5474	1.073**
	(2.81)	(3.76)	(0.91)	(2.36)	(0.98)	(2.36)
Prestige	.3897	-.0092	-.6039	-.6841	-.5448	-.6352
	(0.29)	(-0.01)	(-1.06)	(-1.34)	(-0.82)	(-1.10)
Log of Volume		.0539		.1398*		.186**
		(0.15)		(1.78)		(2.39)
Log of Maturity		-3.384**		-.9433***		-.8381***
		(-2.63)		(-3.51)		(-3.57)
Purpose		1.755*		.3386**		.3341**
		(1.84)		(2.05)		(2.24)
Year FE	✓	✓	✓	✓		
Country FE			✓	✓		
Country*Year FE					✓	✓
Adj. R^2	.2043	.2742	.7943	.7966	.9729	.9767
Observations	544	544	544	544	544	544

Note: The Table presents results from the estimation of Equation 1 on the observation subset for which the country-year fixed effect specification is identified. The first two columns report estimates that only absorb common year fixed effects; the second two columns add country fixed effects; the last two columns absorb all country-year specific variation via country-year fixed effects. Errors are clustered at the country-year of bond issuance level, with 72 country-year clusters over all columns; t-statistics are in parenthesis.

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

Table A.2.2:

Country-Year Fixed Effect Sample Selection Robustness

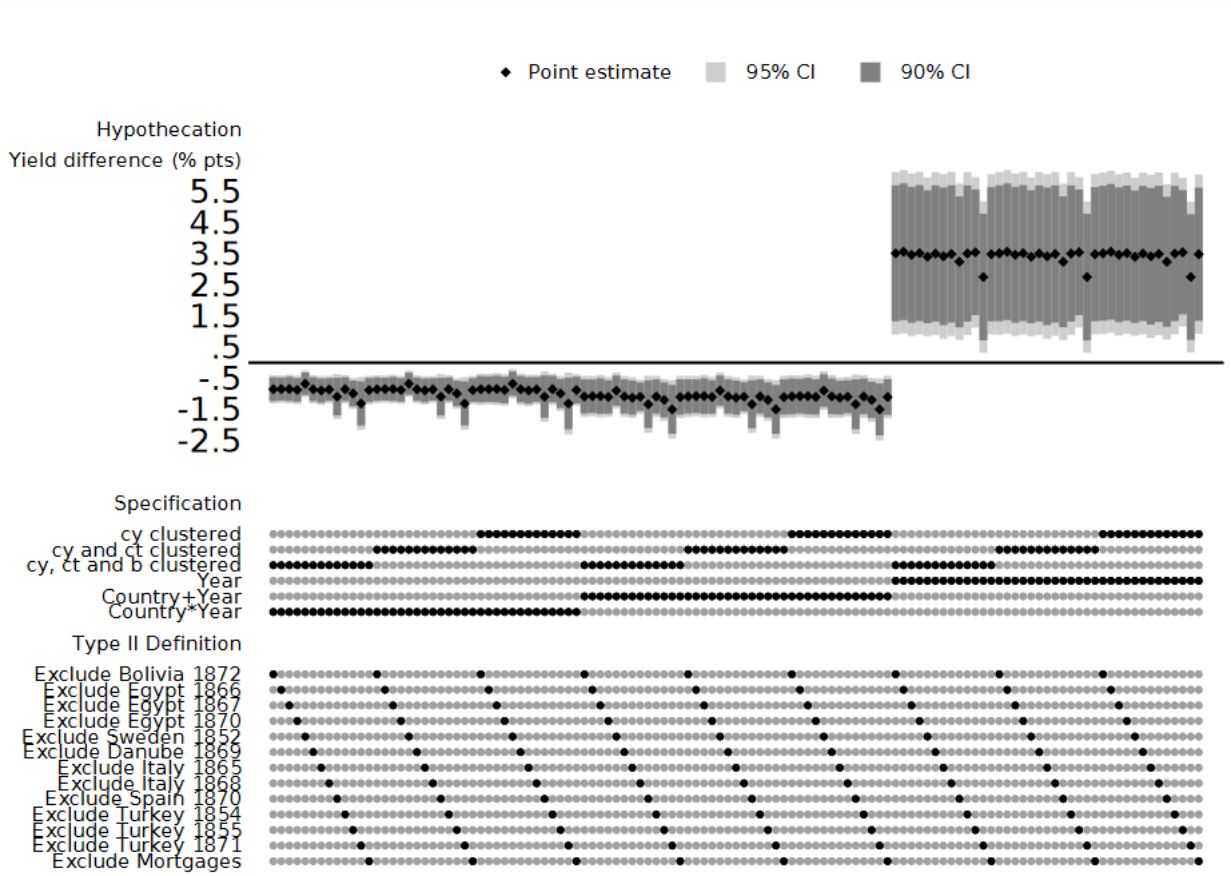
	Dependent variabile: Yield Spread					
	(1)	(2)	(3)	(4)	(5)	(6)
Type I	4.431***	3.395***	-.8574**	-1.112**	-.6675**	-.9338**
	(3.54)	(2.99)	(-2.50)	(-2.42)	(-2.11)	(-2.27)
Type II	1.413	.8075	-2.016***	-2.303***	-1.833***	-2.123***
	(1.55)	(0.87)	(-3.81)	(-3.81)	(-3.31)	(-3.55)
Perpetuities	2.326**	4.084***	1.407**	2.258***	1.551**	2.353***
	(2.47)	(3.40)	(2.11)	(3.26)	(2.01)	(3.12)
Prestige	-.3783	-.3175	-1.744***	-1.728***	-1.776**	-1.776**
	(-0.33)	(-0.29)	(-2.67)	(-2.86)	(-2.30)	(-2.57)
Log of Volume		.0027		.166*		.1831**
		(0.01)		(1.68)		(2.04)
Log of Maturity		-1.929**		-.9508***		-.915***
		(-2.40)		(-3.71)		(-3.57)
Purpose		.7079		.4431**		.427*
		(0.92)		(2.01)		(1.73)
Year FE	✓	✓	✓	✓		
Country FE			✓	✓		
Country*Year FE					✓	✓
Adj. R^2	.2129	.2456	.7479	.7533	.9423	.9507
Observations	726	726	726	726	627	627

Note: The Table presents results from the estimation of Equation 1 adding back the observations due to Type II bonds, while singling them out with a Type II dummy. The first two columns present the results that only absorb common year fixed effects; the second two columns, add country fixed effects; the last two columns, absorb all country-year specific variation via country-year fixed effects. Errors are clustered at the country-year of bond issuance level, with 91 country-year clusters over the first four columns and 82 country-year clusters over the last two columns; t-statistics are in parenthesis.

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

Figure A.2.1:

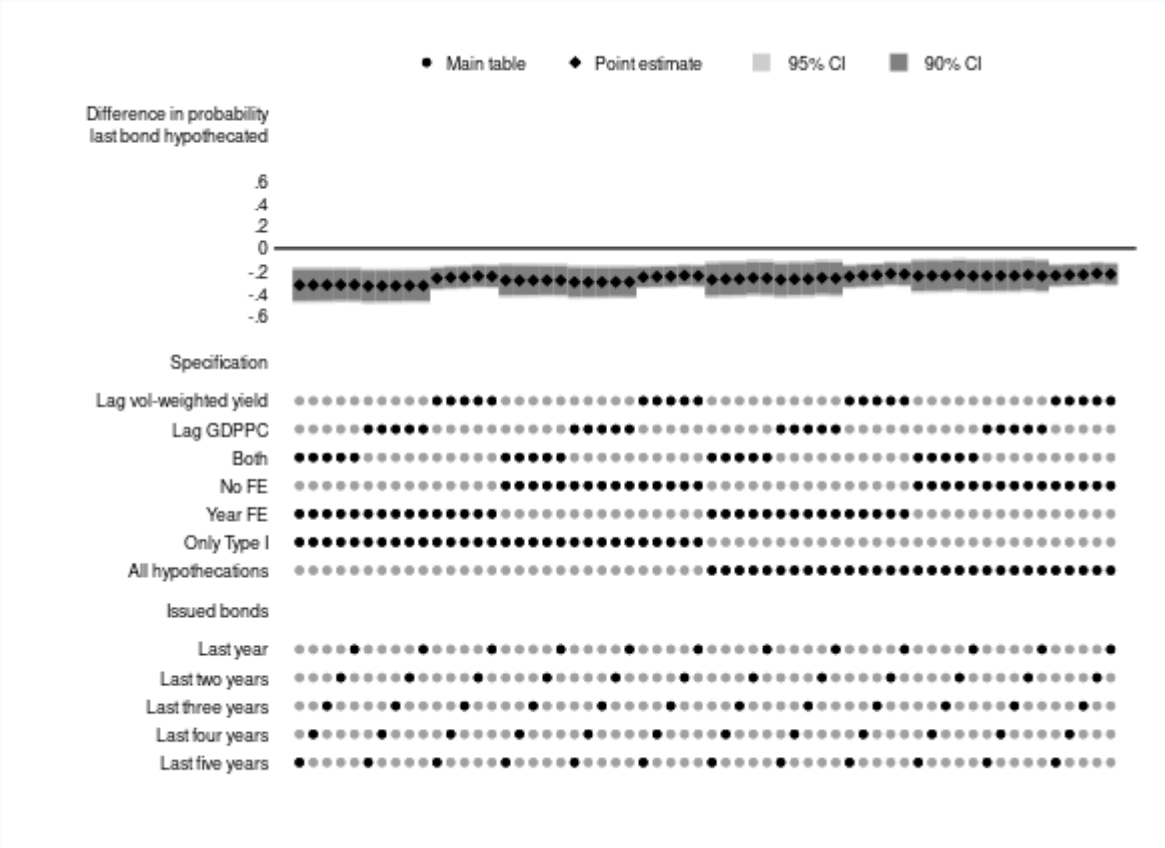
Specification Curve for Table 2 - Alternative Type II Definitions



Note: The Figure presents a specification curve for the estimation of Type I hypothecation's effect on yield spreads in Equation 1. We record estimates as black diamonds and 95% confidence intervals as grey shaded areas. Black dots below the plot mark the combination of clustering scheme, fixed effect and definition of Type II hypothecations under which we obtain each estimate. Under "Specification", the first three lines record the clustering scheme. "cy clustered" stands for the country-year of issuance of the bond scheme we adopt in Table 2. "cy and ct clustered" stands for doubly clustered errors at the country-year of bond's issuance level, and at the country-year of yield observation's level. "cy, ct and b clustered" adds a further clustering layer at the bond level. The second three lines record the fixed effect scheme. A black dot to the right of "Year" signifies that we obtained the estimate only absorbing fixed effects for the year in which the yield spread observation was recorded; "Country + Year" that we absorbed country and year fixed effects separately; "Country*Year" that we absorbed joint country-year fixed effects. Under "Type II Definition", we record which bonds or group of bonds we stopped counting as a Type II. For example, a black dot to the right of "Exclude Italy 1868" implies that we did not count the Italian Tobacco loan as a Type II hypothecation, but only as a Type I. We thus only dropped observations relative to the other 11 Type II hypothecations and proceeded estimating Equation 1 including the Italian Tobacco bond's observations.

Figure A.3.1:

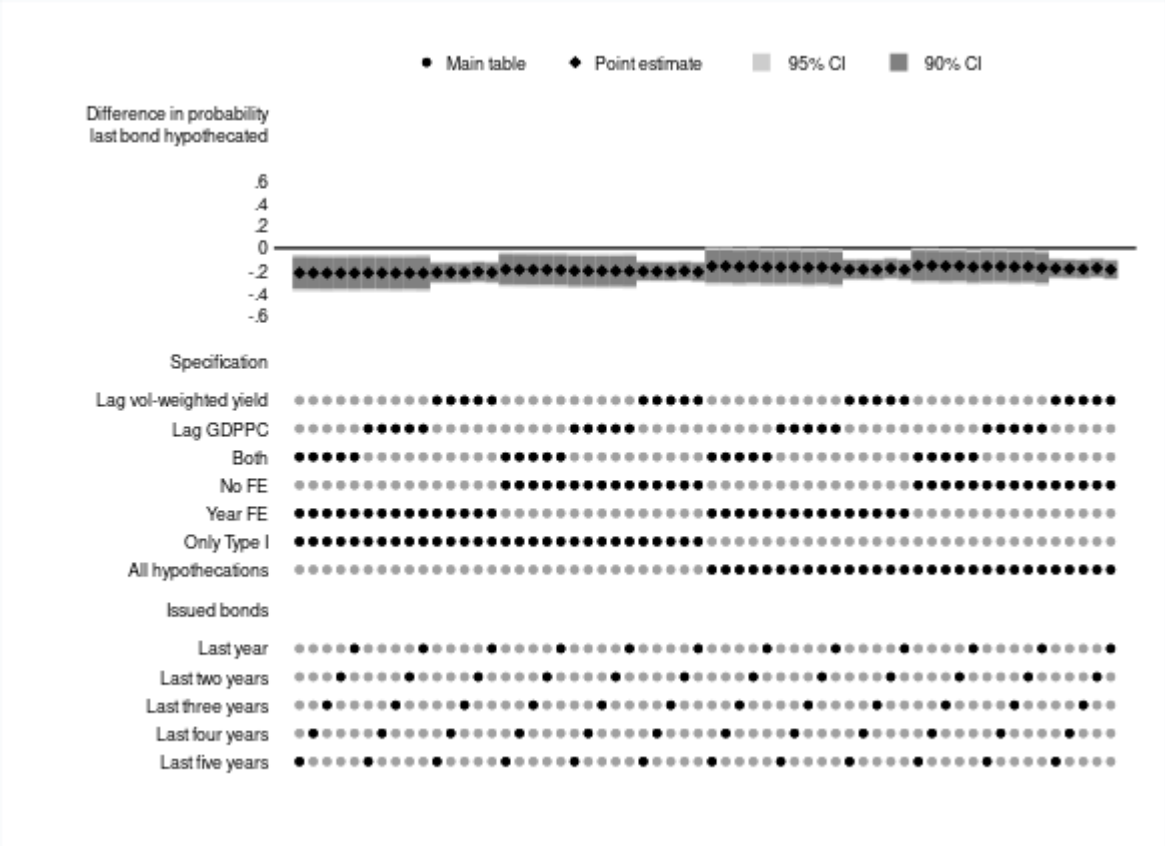
Specification Curve for Table 3 - Recent Information



Note: The Figure presents a specification curve for the estimation of Equation 2, using the "Recent Data" dummy as the information transparency proxy. This is a dummy taking value one if sovereign *c*'s information on *Yearbook*'s volume *y* is less than two years old. We record estimates as black diamonds and 95% confidence intervals as grey shaded areas. Below the plot, under "Specification", the first three lines mark the control for country-risk. A black dot to the right of the first line marks the use of the lag volume-weighted yield; a black dot to the right of the second line, the use of Maddison Project's lag GDPPC; a black dot to the right of the third line that we included both as controls. The next two lines mark whether we included or not *Yearbook* volumes' fixed effects, to account for whether our results are driven by a specific year. The last two lines mark whether we only counted Type I bonds to define the dependent variable, a dummy equal to one if the sovereign's last bond as of year *y* included collateral clauses (as in Table 3), or we also counted Type II bonds. Under "Issued bonds", we account for different definitions of the "Recent Issuance" dummy, controlling for recent issuance activity by the sovereign. A black dot to the right of "Last year" implies that the "Recent Issuance" dummy takes value one if sovereign *c* issued its last bond last year; a black dot to the right of "Last two years" implies that the dummy takes value one if the last bond was issued in the last two years, and so on.

Figure A.3.2:

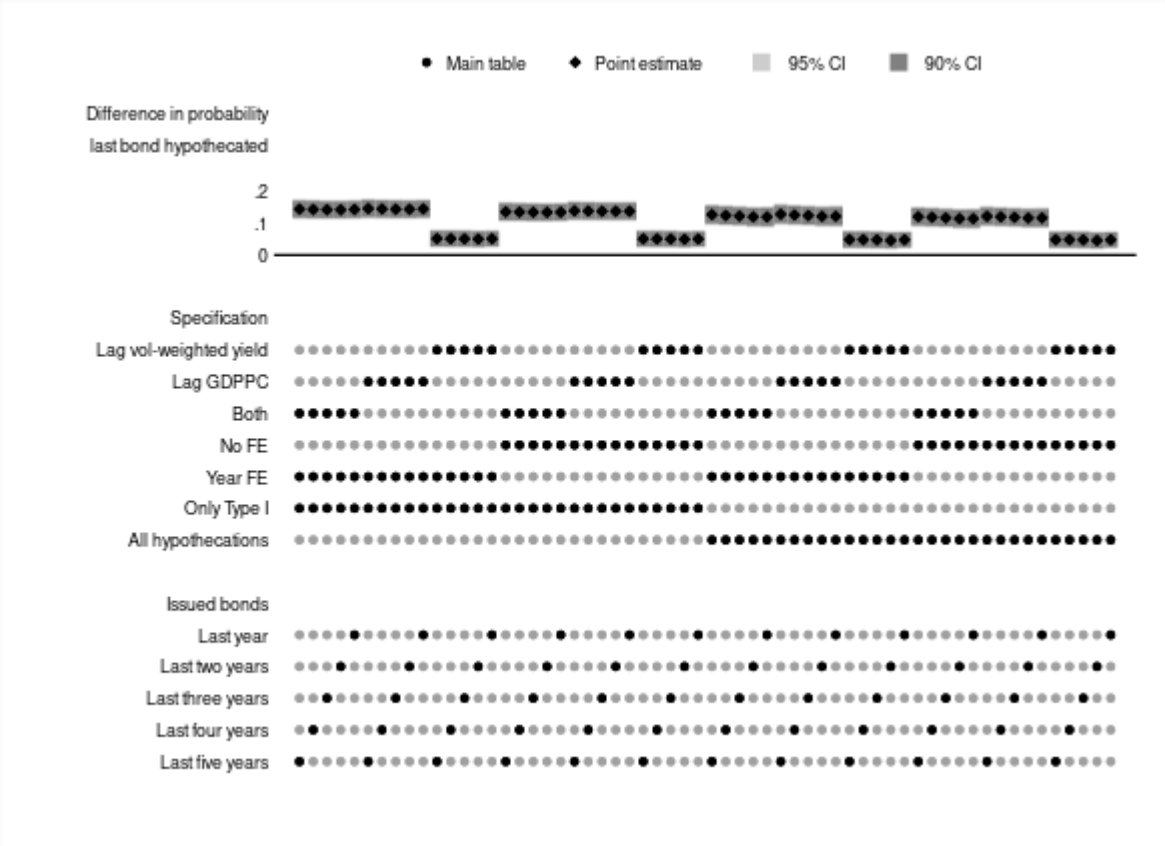
Specification Curve for Table 3 - Updated Information



Note: The Figure presents a specification curve for the estimation of Equation 2, using the "Updated Data" dummy as the information transparency proxy. This is a dummy taking value one if sovereign *c*'s information on *Yearbook*'s volume *y* has been updated with respect to volume *y-1*. We record estimates as black diamonds and 95% confidence intervals as grey shaded areas. Below the plot, under "Specification", the first three lines mark the control for country-risk. A black dot to the right of the first line marks the use of the lag volume-weighted yield; a black dot to the right of the second line, the use of Maddison Project's lag GDPPC; a black dot to the right of the third line that we included both as controls. The next two lines mark whether we included or not *Yearbook* volumes' fixed effects, to account for whether our results are driven by a specific year. The last two lines mark whether we only counted Type I bonds to define the dependent variable, a dummy equal to one if the sovereign's last bond as of year *y* included collateral clauses (as in Table 3), or we also counted Type II bonds. Under "Issued bonds", we account for different definitions of the "Recent Issuance" dummy, controlling for recent issuance activity of the sovereign. A black dot to the right of "Last year" implies that the "Recent Issuance" dummy takes value one if sovereign *c* issued its last bond last year; a black dot to the right of "Last two years" implies that the dummy takes value one if the last bond was issued in the last two years, and so on.

Figure A.3.3:

Specification Curve for Table 3 - Age of Information



Note: The Figure presents a specification curve for the estimation of Equation 2, using the "Age of the Data" variable as the information transparency proxy. This is a discrete variable counting the years since the last update of sovereign's *c* fiscal data in a *Yearbook* volume. We record estimates as black diamonds and 95% confidence intervals as grey shaded areas. Below the plot, under "Specification", the first three lines mark the control for country-risk. A black dot to the right of the first line marks the use of the lag volume-weighted yield; a black dot to the right of the second line, the use of Maddison Project's lag GDPPC; a black dot to the right of the third line that we included both as controls. The next two lines mark whether we included or not *Yearbook* volumes' fixed effects, to account for whether our results are driven by a specific year. The last two lines mark whether we only counted Type I bonds to define the dependent variable, a dummy equal to one if the sovereign's last bond as of year *y* included collateral clauses (as in Table 3), or we also counted Type II bonds. Under "Issued bonds", we account for different definitions of the "Recent Issuance" dummy, controlling for recent issuance activity of the sovereign. A black dot to the right of "Last year" implies that the "Recent Issuance" dummy takes value one if sovereign *c* issued its last bond last year; a black dot to the right of "Last two years" implies that the dummy takes value one if the last bond was issued in the last two years, and so on.

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