Bad News Bankers: Evidence from Pre-1914 Sovereign Debt Markets on Monitor Reputation and Contagion*

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Abstract

Financial institutions facilitate access to financing not only by providing funding, but also by acting as monitors of securities issuers. When an issuer's default damages the reputation of its monitor, contagion may spread to other securities sharing the same monitor. This paper empirically documents that shared monitors can be an important source of contagion. Exploiting features of early sovereign bond markets (where underwriters acted as monitors of sovereigns) and new bond-level data on defaults and prices, I find significant contagion: there is an additional 45% pass-through of a defaulting bond's price decline to non-defaulting bonds when sharing an underwriter.

JEL: G01, G24, N2, F34

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1 Introduction

A regular feature of financial crises that exhibit contagion are shared financial intermediaries (Kaminsky, Reinhart and Vegh, 2003).[1] Understanding and mitigating threats to financial stability requires knowing the channels that facilitate such contagion. Prior work on contagion focuses on the role of financial linkages through a shared *lender* (e.g., Kaminsky and Reinhart, 2000; Allen and Gale, 2000; Goldstein and Pauzner, 2004; Morelli, Ottonello and Perez, 2022). However, another important role that financial institutions play, both historically and in the present, is acting as a *monitor* of issuers (e.g., Petersen and Rajan, 1994, 2002; Sufi, 2009; Frydman and Hilt, 2017). Despite this, there is a lack of evidence on whether an institution's reputation for acting as a monitor can also be an important channel for contagion.

A wide variety of financial institutions can act as monitors. Examples include credit rating agencies, venture capital firms, lead lenders in syndicates, and underwriters. Monitoring can entail ex ante actions (e.g., screening) and/or ex post actions such as supervision and advising. Because monitoring is difficult for investors to directly observe, negative news about issuers, such as default, can lead investors to revise beliefs about their monitor's willingness or ability to monitor. This damage to the monitor's reputation can trigger contagion by increasing the perceived default risk of other securities sharing the defaulter's monitor, causing their prices to decline.

This paper exploits new data and features of early sovereign bond markets to quantify contagion arising through damage to the reputation of underwriters charged with monitoring sovereigns. Pre-1914, the merchant banks underwriting sovereign bonds were important monitors of sovereign borrowers. Ex ante, underwriters played a key role in screening and due diligence. Ex post, they would also exert influence to encourage meeting scheduled payments, negotiate during defaults, and provide debt management and macroeconomic policy advising. An advantage of studying this historical setting is that it allows for better identification of monitor reputation as the channel of contagion compared to modern settings (discussed in detail below).

I find that sharing an underwriter led to significant contagion during sovereign defaults. Using an event study, I estimate the effect of sharing a defaulting bond's underwriter on the price of a non-defaulting bond. In defaults, comovement between defaulting and non-defaulting bonds is 7 times higher when sharing an underwriter. On average, an additional 45% of a defaulting bond's price decline is passed on to bonds sharing its underwriter. These results indicate that monitor reputation can be an important channel of contagion. In terms of policy, most regulation aimed at limiting contagion focuses on contagion spread via *financial* losses (e.g., macroprudential policy). These findings suggest that there may be scope to further improve financial stability if policy can limit contagion via *reputation* losses, highlighting a potentially important avenue for future research.

The empirical analysis uses newly-digitized bond-level data. I manually record over 200

[1] By contagion, I mean financial distress, such as default or price declines, spreading from one issuer, market, or asset class to another (as in, e.g., Forbes and Rigobon, 2002). For example, price decreases for one issuer's securities triggering price decreases for another issuer's securities.

sovereign defaults occurring over 1869–1914, including the specific bonds entering default and often the month of default. My source is the annual reports produced by the *Corporation of Foreign Bondholders* (CFB), a group of British investors that formed in 1868 to collectively bargain with sovereigns during defaults. I also record bond characteristics that I then use to manually link bonds to monthly price data digitized from the *Investors Monthly Manual* (IMM).[2] To my knowledge, this paper is the first, along with contemporaneous work in Meyer, Reinhart and Trebesch (2022), to link monthly price data to precise information on the timing of defaults. The dataset constructed here focuses on a narrower time period than Meyer et al. (2022) but it employs a broader definition of default, thereby capturing more events from this era.[3] It also records additional characteristics of bonds and defaults, such as the underwriter, loan purpose, and collateral. The linked data set (with non-missing analysis variables) contains 21,921 monthly observations from 799 bonds, in 102 defaults, across 72 countries and 6 continents.

In many modern settings, it is difficult to separate contagion through monitor reputation from financial contagion. This is because many monitors have a dual role as a lender. Additionally, reputation-based contagion is challenging to study for credit rating agencies given their small number and the limited variation in the issuers they cover. However, underwriters in early sovereign bonds specialized in underwriting rather than lending. There was also significant variation in sovereigns' exposure to different underwriters. These features make it possible to plausibly identify contagion through monitor reputation.

The empirical strategy exploits *within-country* variation in bond exposure to underwriters. For example, if Argentina defaults on a bond issued by Barings, comparing the price changes of Peruvian bonds issued by Barings to Peruvian bonds issued by a different underwriter is used to help quantify contagion. In the pre-1914 era, it was common for countries to have bonds trading at the same time that were issued through several out of fifty or more potential underwriters. Additionally, countries selectively defaulted on a subset of their bonds in 52% of defaults during my sample period. The ability to selectively default, in addition to different expected recovery rates, is the main reason why default risk could vary across bonds issued by the same country.

Central to this empirical strategy is the use of country-year fixed effects in bond-level regressions. These regressions compare bonds at the same point in time, subject to the same country-level risks, but with different underwriters. This approach to identification disentangles the effect of sharing a defaulter's underwriter from changes in country-level factors (similarly to Khwaja and Mian, 2008). Contagion is identified from the spread that opens up between non-defaulting bonds within the same country in response to another bond's default.

There are two fundamental identification challenges that make it difficult to isolate any specific channel of contagion. The first is correlated exposure among bonds sharing an underwriter

[2] The IMM data were digitized by William Goetzmann and K. Geert Rouwenhoorst. The data are hosted by the Yale School of Management at https://som.yale.edu/imm-issues.

[3] I define default as either missed payments (coupon or principal) or changes to bond contract terms that negatively affect the net present value of the bond's expected cash flows. The latter category includes, for example, modifications to sinking funds and the rehypothecation of collateral. This broader definition helps to capture restructurings and "small" defaults that are typically omitted from other historical records.

(i.e., bonds sharing an underwriter tending to load on the same risk factors). The second is spillovers between bonds sharing an underwriter (e.g., due to economic integration between the bonds' sovereigns). Country-year fixed effects help overcome this challenge by accounting for shared exposure or spillovers at the country-level. Therefore, any tendencies by underwriters to specialize geographically do not pose threats to identification. The analysis will not require assuming underwriters are randomly matched to sovereigns.

Violating the identifying assumption would require within-country differences in bond exposure to shocks or spillovers. This could arise if there is specialization in bond characteristics by underwriter. For example, specializing in bonds with high coupons, no sinking funds, or specific sources of collateral (e.g., revenue from railways versus customs duties). I use bond fixed effects to account for the influence of any time-invariant bond characteristics. However, to address this concern I also conduct two balance tests. I first test whether any characteristic predicts the tendency to share a defaulter's underwriter. The second test examines whether similarity to the defaulting bond predicts sharing their bank. In both tests, I generally find no characteristics are predictive.[4]

If bond characteristics do not differ, violations would instead have to operate through unobserved characteristics of the underwriter. The most natural version of this scenario would be if sovereigns tend to default on an underwriter's bond when the underwriter's reputation is low. This tendency could increase default risk and the cyclical sensitivity of bonds with a low-reputation underwriter. However, two empirical analyses reject this scenario, in favor of monitor reputation being the source of contagion.

First, I show that sharing a defaulter's underwriter is not associated with higher risk of the non-defaulting bond entering default in the short-run (2 years). But in the long-run (3-10 years), there is 4-5% higher risk of entering default. The lack of short-run default risk is at odds with an acute event driving their heightened comovement during default. The elevated long-run default risk is consistent with the original default being an informative signal about future default risk for the underwriters' other bonds. The price response of the underwriter's other bonds in the month of default is consistent with investors rationally updating beliefs based on this informative signal.

Second, I test whether the stronger price comovement when sharing the defaulter's underwriter is driven by bonds of low-reputation underwriters comoving more strongly during defaults.[5] I augment my baseline analysis to allow comovement to also vary with having a low-reputation underwriter. I find the original estimates are nearly identical; simply having a low-reputation underwriter does not account for the stronger comovement with the defaulting bond.

A distinct interpretation concern relates to the mechanism underlying the contagion I document. Specifically, does the estimated contagion operate *primarily* through underwriter reputation, or is there another underwriter-specific mechanism? The main alternative mechanism is financial

[4] 3 out of 60 estimates have statistically significant coefficients, and all estimates are economically small. Robustness exercises dropping bonds with the flagged characteristics yield similar results to my baseline estimates, suggesting that they are unlikely confounders.

[5] I proxy for "low-reputation" with an indicator for whether the underwriter had a bond enter default in the past two years (excluding the current default).

losses, borne by either the underwriter or the investors. For underwriters, this mechanism could arise if default imposes financial losses on their balance sheets. For investors, if bond markets are segmented (specifically, with investors specializing by underwriter), then a default could lead to selling pressure on other bonds from the same underwriter.

To evaluate the mechanism, I draw on two types of evidence. First, I marshal historical evidence in Section 2 indicating that underwriter reputation for monitoring, rather than underwriter or investor financial losses, is plausibly the dominant mechanism. Second, I provide empirical evidence by testing predictions of monitor reputation versus financial contagion.

I first show that the price impact of sharing a defaulter's bank persists for up to two years. A persistent versus short-lived response is more consistent with investors learning new information rather than temporary selling pressure from a wealth shock (Coval and Stafford, 2007).

Next, I consider a scenario specific to underwriting: placement risk. As Section 2 discusses, underwriters generally did not have significant direct financial exposures to the bonds that they underwrote. But one way they could temporarily face this exposure is due to a failed placement. The bonds most at risk of having not yet been fully placed are recently originated bonds. I show that the contagion estimates remain similar when omitting these bonds, suggesting failed placement is unlikely driving contagion.

I then test a competing prediction of reputation versus financial contagion. If underwriter or investor losses are the primary mechanism, then contagion should be stronger when the default involves more wealth. In contrast, if reputation is the primary mechanism, then contagion can be milder. Specifically, if defaults involving more wealth are perceived as harder to prevent, then default is a weaker signal about the underwriter's type and their reputation suffers less damage. Empirically, I find that contagion is two times larger in defaults when the principal of the defaulting bonds is below median. This is consistent with reputation and at odds with financial losses.

The next tests focus on selective default (i.e., a sovereign defaulting on a subset of their bonds). If selective defaults are perceived as easier to prevent because another underwriter was able to avoid default, then there should be more contagion in selective defaults. I find this is the case: contagion is 7 times stronger in selective defaults. To the extent that selective defaults are also smaller defaults, this finding would be at odds with financial loss-based contagion.

Another prediction related to selective default is that avoiding default can send either a positive (or less negative) signal about the underwriter whose bonds escaped default. If only ex post monitoring actions matter, avoiding default would be a positive signal. But if ex ante screening matters, the signal can be negative. If ex post actions do not matter at all, the contagion would be the same as when having the defaulting bond's underwriter. Empirically, I find that avoiding default leads to higher comovement with the defaulting bond, but to a much smaller extent than sharing the defaulter's underwriter. This is consistent with investors learning about both ex ante screening and ex post actions like exerting influence.

Results from several additional subgroup analyses can also be rationalized by reputation. First, I show that contagion is stronger when bonds were issued closer together in time. This is also consistent with investors learning about ex ante actions. It is a pattern also not obviously predicted by financial loss-based contagion. Second, I show that contagion is similar in conversions (restructurings) and missed payment defaults. Reputation does not have obvious predictions for this feature. But under financial loss-based contagion, one might expect contagion to be stronger in missed payments defaults due to these defaults affecting immediate (as opposed to more distant) cash flows. Third, I show that contagion is stronger when the defaulting bond had fewer underwriters. Responsibility may be easier to attribute when fewer underwriters are associated with a default, thereby affecting underwriter reputation more.

The last analysis in the paper speaks to financial stability implications. It is not obvious if having reputable monitors reduces contagion. I show, through a stylized model, that when investors revise beliefs via Bayes' rule, there is a non-monotonic relationship between the size of contagion and the underwriter's initial reputation (i.e., prior to the default). The relationship is U-shaped. At a very low or high level of reputation, investors are very confident about the underwriter's type. New information does not lead to substantial revisions in beliefs. It is in an intermediate region where default leads to the biggest revision in beliefs and the largest contagion. This raises the possibility of a paradox: reputation may improve financial stability if it motivates monitoring, which reduces default. But it may also be bad for stability if it makes default more surprising, leading to more severe contagion when default occurs.

To test if this paradox is empirically plausible, I estimate how contagion varies with a proxy for the pre-default reputation of the defaulting bond's underwriter. The proxy I use is the number of other defaults associated with the defaulter's underwriter in the past two years. I find that contagion becomes milder as underwriter reputation improves. This suggests that underwriter reputation was stability-enhancing in early sovereign bond markets, rather than destabilizing

Related Literature. The central contribution of this paper is both positing and empirically testing whether reputation for monitoring can be an important channel of contagion. This work builds on a banking and corporate finance literature documenting the role of monitoring in shaping financial market outcomes. Monitoring by underwriters, credit rating agencies, and lenders can mitigate information asymmetries between investors and securities issuers, expanding access to financing (Petersen and Rajan, 1994, 2002; Sufi, 2009; Frydman and Hilt, 2017). In both modern and historical settings, investors and borrowers value the association of a security with a reputable monitor. This is evidenced by, for example, higher prices for securities, intermediation fees, and market shares (Beatty and Ritter, 1986; Carter and Manaster, 1990; Megginson and Weiss, 1991; Nanda and Yun, 1997; Carter et al., 1998; Dunbar, 2000; Fang, 2005; Lewellen, 2006; Ivashina, 2009; Drucker and Puri, 2009; Chemmanur et al., 2011; Kang et al., 2018). These studies find an important role for reputation in a variety of markets, ranging from influential VCs funding start-ups, lead lenders in syndicates, to corporate debt and equity underwriters. Even job seekers are more likely to click on job ads for start-ups when funding by a reputable VC is made salient (Bernstein et al., 2022). Additionally, after borrowers default on corporate loans, intermediaries appear to respond to perceived failures in monitoring/screening and write stricter covenants (Murfin, 2012).

Despite these benefits of a reputation for monitoring, prior empirical and theoretical work highlights that moral hazard can deter monitoring (e.g., Chemmanur and Fulghieri, 1994; Baghai and Becker, 2020). Intermediaries trade-off short-run profits from misleading investors or shirking on costly due diligence against the long-run benefits of building reputation. When returns to monitoring are lower—for example, due to low market power or complexity/opaqueness of securities—intermediaries are less likely to monitor (Becker and Milbourn, 2011; Griffin et al., 2014). The risk of moral hazard can make monitor reputation a potent vector of contagion.

This paper also adds to the contagion literature, contributing a new focus on an *intagible* asset (reputation for monitoring). Prior work emphasizes the role of financial capital and intermediary balance sheets in contagion (e.g., Kaminsky and Reinhart, 2000; Kaminsky et al., 2003; Mitchener and Richardson, 2013). Financial losses borne by intermediaries can trigger contagion in a variety of ways. These include reducing lending capacity, weakening intermediaries' bargaining position, or heightening their risk aversion (Gorton and Metrick, 2012; Mitchener and Richardson, 2013; Mitchener and Trebesch, 2023; Arellano et al., 2017; Broner et al., 2006). Contagion via monitor reputation is a form of informational contagion, as opposed to financial contagion (e.g., Allen and Gale, 2000). Prior research on informational contagion focuses on "wake-up calls" that motivate investors to seek more information directly related to an *issuer* (e.g., Bottero, Lenzu and Mezzanotti, 2020; Cole, Neuhann and Ordoñez, 2022). I show that information about third parties, specifically those with monitoring responsibilities, can also contribute to contagion.

Due to its intangible nature, reputation is harder to measure than financial capital. Therefore, macroprudential policies such as financial capital requirements may not be effective at reducing the contagion risk associated with reputation. Knowing whether reputation for monitoring can be a powerful source of contagion is important for understanding risks to financial stability and raises the question (for future research) of how regulation can best counter this form of contagion.

The monitor reputation channel that I study is generally novel relative to the existing contagion literature. To the best of my knowledge, there are two other prior works theorizing that monitor reputation may be a channel of contagion. Morrison and White (2013) formulates a model where a bank regulator's reputation for monitoring is damaged by bank failures, which may prompt runs on other banks. Abreu et al. (2007) hypothesizes that "information spillovers" related to shared underwriters could lead to contagion in the setting that I study, and does a case study of two default episodes. I build on both of these works by highlighting how the economics of monitor reputation could arise in a variety settings where financial institutions can monitor, by estimating the effect of sharing a defaulter's monitor across many default episodes, and by presenting evidence in support of reputation (rather than financial losses) driving contagion.

Lastly, this paper adds to the literature on financial intermediaries in early international capital markets by providing new evidence on the importance of sovereign bond underwriters in this era. This paper builds on de Jong, Kooijmans and Koudijs (2022), which also studies underwriter reputation in early international capital markets, documenting that underwriters' reputation concerns limited the severity of an 18th century mortgage-backed securities boom and bust. Pre-1914, underwriters played an important role negotiating with defaulting sovereigns (Flandreau and Flores, 2012; Esteves, 2013) and (sometimes successfully) lobbying the British government to impose supersanctions on defaulting states (Flandreau, 2005; Mitchener and Weidenmier, 2010). In descriptive work, Flandreau and Flores (2009) and Flandreau et al. (2010) argue that sovereign bond underwriter reputation played a crucial role in overcoming information asymmetries in this era, as evidenced by investors' higher willingness to pay for bonds underwritten by reputable banks. The novel contribution of this paper, relative to this prior literature, is showing that shared monitors (and their reputation) facilitated quantitatively significant *contagion*. Better understanding the origins of financial distress in this era is important, as the impacts of financial distress can be long-lasting and even reshape long-run economics outcomes (e.g., Xu, 2022; Olmstead-Rumsey, 2019). Finally, this paper also assembles a new bond-level dataset on sovereign defaults linked to monthly price data. The data contain many new defaults and additional bond characteristics such as underwriter, loan purpose, and collateral.[6]

Outline. Sections 2 and 3 describe the historical setting and newly-digitized data (respectively). Section 4 presents the empirical strategy and estimates of contagion through shared underwriters. Section 5 provides evidence supporting monitor reputation as the mechanism by testing predictions of this mechanism against an alternative: underwriter or investor financial losses. Section 6 concludes.

2 Setting: Pre-1914 Sovereign Bond Markets

London was the global hub for international finance during 1869–1914, a period referred to as the first era of global financial integration (Fishlow, 1985; Mauro et al., 2002). Not until the 1990s did financial integration again reach the levels achieved during this era (Obstfeld and Taylor, 1998). Relative to the British economy, British foreign investment was large, averaging 5.4% of GDP over 1865-1914 and peaking at 10% by the eve of WWI (Fishlow, 1985; Chabot and Kurz, 2010). Over this period, Britain's foreign government bond investments grew, rising from 6% to 21% of publicly listed securities on the London Stock Exchange (Tomz and Wright, 2013).

2.1 Differences between Early and Modern Sovereign Bond Markets

Asymmetric information was a key friction limiting the extent of lending from external investors to sovereigns. Despite significant improvements in communications technology, investors faced difficulties in gathering timely and accurate information about sovereigns.[7] Compounding the natural information barriers created by geographic distance, governments would occasionally de-

[6] Many of these defaults are new relative to existing datasets (e.g., Reinhart and Rogoff, 2008) and Meyer et al. (2022).

[7] By the 1840s, the London Stock Exchange was linked to regional exchanges by telegraph. The transatlantic cable was operating by 1866, cutting the time it took to send a message between New York and London from three weeks to one day (this fell to one minute by 1914). By 1878, the transoceanic telegraph connected Buenos Aires to Europe. The dates for these technologies are reported in Bordo et al. (1998).

lay or misreport fiscal and trade statistics.[8] Even with the available data, interpreting it was challenging as there could be significant uncertainty about how a sovereign will behave. When it came to interpreting data, investors had a limited set of experts on which to rely. Notably, credit rating agencies only came into existence around the turn of the century and did not begin systematically rating sovereign borrowers until after 1914 (Flandreau et al., 2023). Instead, underwriters played a key role in collecting, communicating, and certifying information.

Sovereign bond contracts in this era differed in several important ways compared to their modern counterparts. First, sovereign bonds were often secured by collateral. Common forms of collateral were customs or tax revenue, and occasionally natural resources. Bonds that were intended to finance a specific project often pledged the revenues associated with the project as collateral (this was regularly the case with railroads). Some forms of collateral were indeed highly pledgeable, as it would be directly controlled by the underwriters through, for example, correspondent banking services. Flandreau et al. (2023) argues that such control also facilitated information production about the government's ability to service its debt and may have prevented debt dilution. By requiring a new revenue source be pledged for a new bond, bondholders could reduce the risk of insufficient funds being available to service the loans.

A second difference is that sovereign bonds often had a sinking fund. Over the life of the bond, sovereigns would make payments into an account from which they could not withdraw. The funds were intended to repurchase bonds and repay the principal of the loan. By effectively amortizing the loan, sinking funds could reduce incentives to default, increasing investor willingness to lend.

Lastly, legal protections for bondholders were limited. Bondholders' lawsuits were rare and generally unsuccessful (Mauro and Yafeh, 2003). Pari passu clauses, stipulating equal treatment of bondholders, only began to appear in the early 20th century, and were rare pre-1914. Perhaps as a result, selective default was not uncommon in this era; 52% of the defaults I study were selective in that only a subset of the sovereign's bonds entered default. Collective action clauses requiring that a supermajority of bondholders agree to a proposed restructuring, were generally not explicitly included in sovereign bond contracts. Instead, bondholder organizations attempted, though not always successfully, to organize bondholders to abide by majority rule (Mauro and Yafeh, 2003).

2.2 Underwriters as Monitors

Merchant banks were the primary institution in Britain underwriting sovereign bonds pre-1914. Most were private partnerships among less than half a dozen people who invested their own capital (Ziegler, 1988). Merchant banks typically got their start by intermediating trade and providing trade credit financing in the 18th century (Chapman, 2013). In the early 1800s, a number of the largest and most prestigious merchant banks began to specialize in underwriting sovereign bonds (Ziegler, 1988). Early success in avoiding default in the "first Latin American debt crisis" in the 1820s would propel Rothschilds and Barings to be market leaders for most of the 19th century.

[8] Mexico postponed releasing public accounts for several years (Weller, 2015a). A popular source of fiscal and trade statistics (the *Stateman's Yearbook*) was often substantially (and negatively) revised (Flandreau et al., 2023).

Their trade-related origins gave merchant banks connections and familiarity with foreign countries that provided them an information advantage relative to many investors. Underwriters were especially well-suited to conduct ex ante monitoring (screening) and ex post monitoring. Screening could entail avoiding high-risk borrowers, setting appropriate interest rates that compensate investors for risk, or selecting collateral and sinking fund terms that optimally incentivize repayment. In terms of ex post monitoring, underwriters could benefit bondholders by influencing sovereigns to avoid default, issuing new "funding loans" to make repaying easier, negotiating favorable terms in a default/restructuring, and lobbying the British government to intervene in the event of a severe default. Superior information and influence over both foreign and domestic government officials could enable an underwriter to successfully monitor sovereigns.

In order to assess sovereign risk, many underwriters maintained networks of permanent agents abroad. For example, Nicholas Bower, an agent of Barings based in Argentina, would regularly telegraph reports to Barings. Bower's reports described significant events, conversations with Argentine politicians, and statistics on "trade, prices, immigration, financial position, banks, natural resources, [and] tradable assets" (Flores, 2011). Bower provided statistics to Barings that were identical to those published by the Argentine government *three months later*. Another way underwriters gathered advance or hidden information was from providing correspondent banking services or even controlling the financial accounts associated with a bond's collateral.[9]

Underwriters had several tools at their disposal to influence sovereign borrowers. The same agents they relied on for information would also lobby politicians to prioritize repaying debts.[10] Underwriters would also publicly protest political developments that could pose a threat to repayment. For example, Nathan Rothschild criticized the Paraguayan War in a letter to the Brazilian Congress, lamenting the war's financial cost (Weller, 2015b).

Underwriters were often closely involved in debt restructuring and post-default negotiations (Flandreau and Flores, 2012). When facing severe or persistent risks to repayment, underwriters would sometimes underwrite a "funding loan" that would effectively allow sovereigns to roll over their debt. Similarly to modern multilateral institutions like the IMF, underwriters would sometimes attach conditions to funding loans. Conditions ranged from fiscal and monetary reforms to requirements of seeking underwriter approval before issuing subsequent new loans.[11] In extreme cases, underwriters would lobby the British government to intervene diplomatically or militarily

[9] For example, Gibbs & Sons asserted control over Peru's Guano Islands in response to a default (Flores, 2020; Oosterlinck, 2013).

[10] For example, Barings' US agent Thomas Ward launched a media campaign to encourage Pennsylvania to resume debt payments. Describing the campaign, Ziegler (1988) writes "Politicians were persuaded that self-interest demanded a rapid resumption of payments; the press was fed with letters and articles arguing that the economic development of the State would be crippled unless access to foreign funds was restored; appeals were made to pride and a sense of propriety; the clergy was enlisted to preach that credit-worthiness was next to godliness." Ward's campaign succeeded and Pennsylvania soon resumed payments after its initial default.

[11] In a famous case, Rothschilds' 1898 restructuring of Brazil's debt required that Brazil burn paper notes in order to reduce the supply of local currency. Rothschilds blamed loose monetary policy for Brazil's low exchange rate and inability to service its debt. Due to non-compliance with prior loan conditions, Rothschilds coordinated with a British bank located in Brazil to certify that Brazil did indeed burn paper money (Weller, 2015b).

to protect bondholders' interests.[12] The British government was generally reluctant to take such actions on behalf of bondholders but did so on a number of occasions (Mitchener and Weidenmier, 2010; Tomz and Wright, 2013).[13]

For successful monitoring, underwriters were rewarded with market power and profits. Underwriters associated with fewer past sovereign defaults benefited from higher market share, milder price run-ups after issuance, lower yields, and larger issuance fees (Flandreau and Flores, 2009; Flandreau et al., 2010). Investors and sovereigns appeared to have a high willingness to pay for an association with a reputable underwriter. In fact, contemporaries indicated that the reputation of the underwriter may have been *more* important to investors than the reputation of the sovereign in influencing their willingness to invest.[14]

Because monitoring is difficult for investors to directly observe and costly to underwriters, there is scope for underwriter moral hazard to arise. Reputation for monitoring paid off in the long-term. But in the short-term, underwriters could profit from slacking or misleading investors. Ex ante, underwriters could slack on screening efforts or fail to set contract terms that compensate investors for a bond's risk.[15] Ex post, an underwriter could slack on information gathering and processing (e.g., by limiting investment in its network of agents abroad). After default and during restructuring, underwriters could also exert low effort in obtaining investor-friendly outcomes. Underwriters could also mislead investors by understating risks and overstating their abilities to monitor and influence borrowers. Because investors could not perfectly observe monitoring, the occurrence of sovereign default sent investors a negative signal about the underwriter's ability and willingness to monitor, damaging their reputation.

Investors had good to reason to be skeptical of underwriters. Egregious cases of fraud, such as the issuance of bonds for the fictitious nation of Poyais fueled investor fears of opportunistic underwriters (Dawson, 1990; Flandreau and Flores, 2009). In 1875, the British government convened an investigation into the practices of underwriters. However, no regulations or supervisory agency were created in response (Fishlow, 1985).

[12] The *Banker's Magazine* (volume 15, Part 2, 1861) describes such a case where "At the close of November, 1859, Messrs. Baring, Rothschild, Huth, A. Gibbs & Sons, had signed an address to Lord John Russell, begging that the British government would throw its protection over British interests in Mexico, and put a stop to those outrages which continue, unfortunately, to the present day."

[13] In a a famous case, Britain blockaded Venezuela's ports (Mitchener and Weidenmier, 2010).

[14] Two examples of such accounts are below: "And thus it is that the credit of a foreigner, namely that of the House of Rothschild, not that of the Kingdom of Naples, was responsible for the rise of Neapolitan securities. Hence, the value of public securities does not reflect the prosperity of a country...Naples itself had very little to do in all that beyond punctually paying coupons." Source: Austrian Ambassador Ficquelmont in February 1822 (quoted in Gille, 1965); "It was especially regrettable that Barings had lent its name to the proceedings. Although all the firm's partners had repeatedly stated that they had no formal connection with the Mexican government and had agreed to pay out dividends as they would [for?] any other commercial agency, the general public had received a different impression. Many bondholders would never had retained their position in the loan but for the character which Messrs. Barings gave it by undertaking the agency." Source: *The Times*, Sep. 18, 1827 (quoted in Dawson, 1990).

[15] For example, underwriters could set coupons too low, originate too large a loan that is unlikely to be repaid, or not select sinking fund and collateral terms that optimally incentivize repayments.

2.3 Underwriter Specialization, Financial Risk, and Sovereign Bond Investors

Below I summarize additional background information that is relevant to understanding the empirical strategy.

Underwriter Specialization. Underwriters often specialized geographically. Especially for long-lived merchant banks, such specialization naturally arose from the expertise they had cultivated while intermediating trade and trade credit between Britain and particular countries. This feature is part of the motivation for the research design, which compares bonds within the same country-year that *differ* in their underwriter. This comparison differences out country-specific time trends that could influence bond prices. I also use balance and robustness tests that suggest that specialization in other bond characteristics, such as loan purpose or collateral type, are not the sources of the contagion I document. Section 4 discusses this more thoroughly in the context of identification.

Pairing Between Underwriters and Sovereigns. Underwriter-sovereign pairings were highly persistent.[16] Sovereigns had an incentive to retain reputable underwriters. Because underwriters had an information advantage relative to investors, changing underwriters could send a negative signal to investors if they infer that the underwriter has learned negative information about the sovereign. Consistent with this inference, borrowers that switched more often paid higher yields on average (Flandreau and Flores, 2012). Prestigious houses typically ended up initiating an underwriting relationship for riskier countries after the country's earlier loans had defaulted. Having a reputable underwriter involved in the restructuring and issuance of new loans could help entice reluctant investors back to the sovereign.[17]

To maintain their reputation, underwriters have an incentive to issue for sovereigns that rarely default. But post-crisis, sovereigns were in a weakened bargaining position which could enable underwriters to command substantial fees. Ultimately, underwriters competed with each other to issue bonds. Prior to issuance, underwriters would submit bids outlining proposed bond terms and fees to a sovereign (Flandreau and Flores, 2009). This competition contributed to the within-sovereign variation in underwriters. At one extreme was Mexico, who never selected a "patron bank" and constantly pit underwriters against each other (Weller, 2015a). The pairing of underwriters and sovereigns was unlikely random. However, the empirical strategy will not require such an assumption.

[16] For a newly issued bond, 25% of the time the underwriter was the sovereign's most recent previous underwriter. In 72% of new issues, the underwriter had worked with the sovereign at some point in the past.

[17] This quote from the *Daily News* in 1889 (in Flores, 2014) highlights how Baring's involvement in the wake of an Argentine default (in the lead up to the Baring Crisis) initially increased investor optimism about Argentina: "As the matter is understood to be in the hands of Messrs Baring Bros and Co. a successful result may be hoped for. The mere fact that an important syndicate is willing to negotiate is good for Argentine credit. Had matters been as bad as pessimists have been inclined to make out late, eminent firms would not have been disposed to trust the Argentine Republic more money."

Underwriters' Financial Risks. Default damages an underwriter's reputation for monitoring, but to what extent could it also damage an underwriter's finances? This is relevant for understanding whether the mechanism underlying the contagion documented in this paper is plausibly operating through reputation for monitoring versus the financial health of the underwriter. Because underwriters were generally private institutions, there is limited balance sheet data available to directly verify the extent to which underwriters held sovereign bonds.

Prior historical work, informed by contemporary accounts and the available balance sheet data indicates that underwriters' direct financial exposure was rare and small (Chapman, 2013; Flores, 2014). Merchant banks were primarily intermediaries, rather than investors in sovereigns bonds. Summarizing the role of merchant banks, Chapman (2013) writes "merchant banks did not possess sufficient capital or deposits to finance development loans but, more importantly, the most eminent of them enjoyed a reputation which enabled them to act as catalysts for the generation of capital...the actual capital of most of the merchant banks was...quite modest, but it has been shown that their real power lay in their reputation and connections."

Underwriters could act as simply an "agent" for the government and avoid taking placement risk. However, underwriters also could engage in "full underwriting" and take placement risk. That is, underwriters would purchase the bonds at origination with the goal of selling them to investors (Flandreau et al., 2010). If the newly issued bonds were not fully taken up, some could remain on the underwriter's balance sheet past the initial issuance. British underwriters were known to be less willing to engage in full underwriting compared to their smaller counterparts in France and Germany (Flores, 2010).

One of the most famous cases of a failed placement was the Baring Crisis, which left Barings holding deeply discounted Argentine bonds and culminated in a bailout of the bank (Mitchener and Weidenmier, 2008). However, this experience was atypical, as Barings rarely took placement risk (Flores, 2010). When bonds initially remained unsold, underwriters attempted to sell them over time.[18]

To the extent that underwriters retained financial exposure, outside of the Baring Crisis, it was not reported to pose a major risk to underwriters' finances. For example, Rothschilds' never had more than 6% of its assets exposed to Brazil, its largest borrower, even during the zenith of Brazil's default crises (Weller, 2015b) spanning 1889–1898. In an analysis of Rothschilds' and Brazil's underwriting relationship, Weller (2015b) argues that during Brazil's crisis, reputational risks far outweighed the direct financial risks facing Rothschilds: "An eventual default on the Brazilian debt would not have caused [Rothschilds'] bankruptcy. However, reputation was the core of the underwriting business, so a default would have had significant effect on the house's book in the long term."

Underwriters were speculated to have occasionally engaged in short-term lending to prevent missed payments (Flandreau and Flores, 2012). In theory, this could be an alternative source of

[18] For example, Paribas refused to issue new loans for Argentine until they had fully placed their last Argentine issue (Flores, 2011).

financial exposure. However, there are few documented cases of such liquidity injections.

To sum up, underwriters' direct financial exposure to sovereigns was not known to be significant. The primary mechanism behind the contagion arising from shared underwriters is more plausibly due to damaged monitor reputation, as opposed to financial losses. To further evaluate the mechanism, Section 5 tests opposing predictions from both financial wealth and reputation-based theories of contagion.

Sovereign Bond Investors. The typical British investor in foreign sovereign bonds was a wealthy individual, rather than a financial institution (Flandreau, 2013). Data on investors' bond holdings is limited. However, contemporary accounts suggest that British investors diversified their holdings of sovereign bonds and, even in large defaults, losses were generally spread across a large set of investors.[19] This suggests that investor financial losses are unlikely the mechanism behind the contagion through shared underwriters that I study. The tests in Section 5 also address alternative explanations centered on investor losses (in addition to underwriter losses).

3 Data

One contribution of this paper is building a new bond-level dataset on sovereign defaults during 1869–1914. Using historical documents, I manually recorded bonds' characteristics (including underwriter identity) and information about their defaults. The data include many defaults that are not part of existing datasets (e.g., Reinhart and Rogoff, 2008; Meyer et al., 2022). In other cases, I record more precise timing of defaults than other data (i.e., the day or month of default as opposed to only the year). I then manually matched these bonds to monthly price data based on bond characteristics. This section describes the data sources and discusses summary statistics.

3.1 Data Sources: CFB and IMM

CFB Data: Defaults and Bond Characteristics. The primary source for the default data are a series of annual reports published by the Council of the Corporation of Foreign Bondholders (CFB). The CFB is a bondholders' organization that formed in London in 1868 to collectively bargain with sovereigns (Mauro and Yafeh, 2003). Every year, from 1873 to 1988, the CFB published an annual report recording an updated history of developments in bond markets for sovereigns. The reports contain detailed descriptions of past and ongoing defaults, renegotiations, and bond issuance. The CFB reports contain detailed descriptions of bond characteristics. From the reports, I extract data on bonds' underwriter(s), borrowing reason, issue price, principal (amount and currency), coupon rate, collateral, sinking fund, and issue year.

[19] Clarke (1879) argues that investors learned to diversify from defaults in Mexico, Central America, Colombia, Argentina, and Greece in the first half of the 19$^{\text{th}}$ century: "Many families attracted by the high interest imperilled [sic] the greater part of their fortunes. Since then, although individuals have committed the same error of putting too many eggs into one basket, the main body of investors in England, Holland, and France, appear to have adopted the practice of distributing their risks." In contemporaneous defaults, Clarke (1879) describes the losses imposed by defaults as being spread across many investors. Regarding large defaults by Turkey, Peru, and Egypt, Clarke (1879) quotes *The Economist* (December 22, 1877): "This loss was undoubtedly distributed over the holdings of a vast number of persons, and probably has affected only a portion of the income of most them."

The reports also provide detailed information on sovereign defaults. One important difference in how I identity defaults, compared to prior work (e.g., Reinhart and Rogoff, 2008; Meyer et al., 2022), is that I use a broader definition. I classify any event that results in an NPV-negative deviation from the original bond contract as a default. These include missed payments (coupon or principal; the usual classification of default) as well as "conversions" (i.e, modifications of contract terms such as a reduced coupon or sinking fund payments). Broadening this definition is valuable, as all are significant events affecting investor returns. The CFB reports also note the specific bonds involved in defaults. This is useful because sovereigns selectively defaulting on a subset of bonds was common—52% of the defaults that I study are selective.

In total, I document 240 defaults. Table C.1 details sample restrictions made to arrive at the final analysis sample. For example, I require that the month of default is reported and that the defaulting bond is identified in the IMM data during the month of default. In the analysis sample (obtained after applying all filters) there are 102 defaults between 1869–1914.

IMM Data: Prices and Bond Characteristics. I obtain monthly bond price data from the *Investor's Monthly Manual* (IMM), published by *The Economist*.[20] The data span 1869 to 1929, though this paper makes use of data only until 1914 due to the outbreak of World War I.[21] Throughout, I use bond prices on the last day of trading for each month.[22] Most IMM bonds have a text description that details characteristics such as coupon, issue year, and purpose. The data also report principal and the names of paying agents (these were either underwriters or institutions that could perform the same ex post monitoring actions as underwriters). To link the CFB bond characteristic and default data to the IMM data, I manually match bonds based on shared bond characteristics (primarily issuer, issue year, and coupon).

3.2 Summary Statistics: Defaults

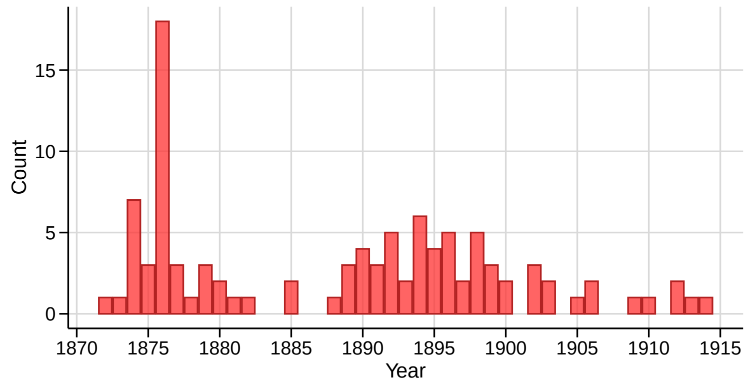
Figure 1 displays the number of defaults by year. Surges in defaults tended to coincide with international financial crises such as the Panics of 1873 and 1890, which catalyzed recessions and financial crises around the world. Figure 2 details defaults by country. The analysis sample contains defaults from 19 different countries, with Turkey/Ottoman Empire contributing the most defaults. In terms of the type of default, 63% are cases of missed payments (i.e., missed coupon or principal payments, including sinking fund payments). The other 37% are conversions, which are restructurings/modifications of contract terms (e.g., reducing coupon rates). Because nearly every bond (99.2%) in this sample was issued in British Pounds, there was virtually no scope for "de facto" default via currency in this era.

[20]The price data were digitized by William Goetzmann and K. Geert Rouwenhoorst and are hosted by the Yale School of Management's International Center for Finance.

[21]Not only did World War I significantly disrupt international capital markets, but the economic devastation of the war led the US to supersede Britain as the global financial hub.

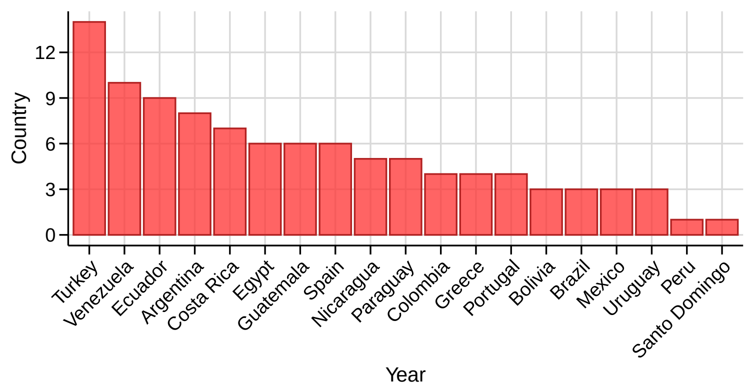
[22]If missing, I use next month's price on the first day of trading.

Figure 1: Defaults by Year



Note: This figure plots the number of defaults by year by for the subset of defaults used in the analysis sample (totaling 102 defaults).

Figure 2: Defaults by Country



Note: This figure plots the number of defaults by country by for the subset of defaults used in the analysis sample (totaling 102 defaults from 19 countries).

3.3 Summary Statistics: Bond Characteristics and Prices

The IMM data contain 1,024 bonds in total. The analysis sample, with all information needed for the regression analysis, contains 799 bonds and 21,921 observations of non-defaulting bonds during defaults. Appendix Table C.3 reports the number of bonds by country (totaling 72 countries), Appendix Table C.4 the number of bonds by underwriter, and Appendix Table C.7 the number of defaulting bonds by underwriter.

Appendix Figure C.1 reports a breakdown of loan purposes. The most common official intended uses of funds borrowed was to manage existing debt (e.g., to support coupon payments or pay down existing debt) or for the development of railways. Other common purposes were general public goods (e.g., development of public infrastructure such as roads), industrial or financial development (e.g., subsidizing a specific industry), and national defense.

Typically when bonds had collateral, it was related to the purpose of the loan. A common combination was loans issued for railway development that were secured on revenues generated by operating the railway. The most common forms of collateral were specific taxes (e.g., a tobacco tax), physical assets (e.g., railways), customs duties, and financial securities. Appendix Figure C.2 describes the prevalence of different forms of collateral. 14% of bonds in the sample reported having some form of collateral.

Table 1 reports additional summary statistics describing the characteristics of bonds at origination. The median bond is issued with a principal of 2.2 million GBP, however the distribution of principal is quite skewed—the mean is 17 million GBP. The median coupon is 5%. Most bonds have one underwriter, but it is not uncommon to have 2-4 underwriters.

Table 1: Bond Characteristic Summary Statistics

Variable	Mean	SD	25th %	50th %	75th %	N
Issue Price	90	23	85	93	98	495
Principal (mil. GBP)	17	105	0.84	2.2	6.2	730
Coupon (%)	4.5	1.7	3.9	5	6	764
Known Collateral (%)	14	35	0	0	0	771
Known Sinking Fund (%)	86	35	100	100	100	771
# Underwriters	1.4	0.66	1	1	2	770
Issue Year	1883	17	1871	1881	1896	737

Note: This table reports bond-level summary statistics. The bonds are the subset used in the main analysis.

Table 2 describes monthly bond prices changes in and out of defaults. The average change (without conditioning on the occurrence of a default) is approximately 0 percentage points. In a default, the price of the defaulting bond(s) on average falls 2.86%. Non-defaulting bonds fall on average 0.78% when they share the underwriter of the defaulter. Non-defaulting bonds with different underwriters on average fall 0.11% during a default. At the beginning of the month of the default, bonds that enter default are already trading at a much lower price (41.9/100) versus 78.5 and 89.8 for non-defaulting bonds (that share and do not share the defaulter's underwriter, respectively).

Table 2: Bond Price Summary Statistics

Sample	Variable	Mean	SD	25th %	50th %	75th %	N
All periods	$100 \times \Delta \ln(P_{it})$	-0.001	3.75	-0.651	0	0.913	123760
	Start of Month Price	90.1	33.6	84.5	99	104	124761
Def. Bonds	$100 \times \Delta \ln(P^D_{ie})$	-2.86	9.41	-7.71	-1.83	1.95	212
	Start of Month Price	41.9	27.6	22	34.2	53.8	212
Non-Def. Bonds (Shared = 1)	$100 \times \Delta \ln(P_{ie})$	-0.78	5.62	-1.78	0	0.966	1220
	Start of Month Price	78.5	33.8	55	93	103	1220
Non-Def. Bonds (Shared = 0)	$100 \times \Delta \ln(P_{ie})$	-0.108	3.81	-0.957	0	0.922	20701
	Start of Month Price	89.8	36.4	83	100	106	20701

Note: This table reports summary statistics of bond prices for various subsamples. "All periods" uses the bond-time panel for the subset of bonds used in the main analysis. The remaining samples are the analysis sample (bond-event panel). "Def. Bonds" are the defaulting bonds during defaults. "Non-Def. Bonds (Shared = 1)" are non-defaulting bonds that share the defaulter's underwriter (during a default). "Non-Def. Bonds (Shared = 0)" are non-defaulting bonds that do not share the defaulter's underwriter (during a default).

4 Empirical Results: Estimating Contagion from Shared Underwriters

This section uses the linked CFB and IMM data to estimate the effect of sharing a defaulter's underwriter during a default on non-defaulting bonds' prices. To guide the interpretation of the empirical analysis, I first describe predictions from a model that features reputation-based contagion. I then introduce the econometric specification and discuss the identifying assumptions. I then present and discuss the estimation results. After this, I evaluate two balance tests that attempt to falsify the identifying assumptions and discuss additional evidence on robustness.

4.1 Hypothesis

To illustrate the reputation-based channel of contagion, I develop a stylized model. In this section, I describe the model and its predictions. The full model is detailed in Appendix A. The model is a dynamic game, featuring a sovereign borrower, a sequence of investors, and underwriter.

Timing and Actions. Each period unfolds as follows. First, an investor chooses whether to lend to a sovereign. Next, the sovereign and underwriter learn whether the sovereign faces a "crisis," which may result in default. The underwriter chooses to either "fight" the crisis or to "allow" it to proceed. Fighting *may* prevent the crisis from turning into a default. But if fighting fails, the sovereign defaults. If allowing the crisis to proceed, the sovereign defaults with probability one. If no crisis occurs, the sovereign repays with probability one.

Payoffs. The underwriter receives a finder's fee (a fraction of the investor's payment) for underwriting the bond only if the investors chooses to purchase the bond at the beginning of the stage. There is a direct cost to the underwriter of fighting. "Fighting" is an ex post monitoring action; in reality this would best correspond to exerting influence over the sovereign. The cost could correspond to "relationship" capital with the sovereign.

If an investor buys the bond, they pay the cost of the bond. If default occurs, the investor receives nothing (ending with a negative net payoff). If default is avoided, the investor receives the principal plus interest (ending with a positive net payoff). The sovereign is a "passive" player in that they do not solve an explicit optimization problem. Hence, I do not focus on their payoffs.

Information Asymmetries. The underwriter observes when a crisis occurs, their cost of fighting, and whether default occurs. It also knows the history of these events from previous stages. Investors, on the other hand, only observe the history of defaults. They do not directly observe the occurrence of a crisis, the underwriter's actions, nor the underwriter's cost of fighting.

Investors start with a prior over whether the underwriter has a high or low cost of fighting. Investors use Bayesian updating to revise their beliefs about the sovereign's cost type (high or low) based on the public history of defaults. When a default occurs, investors revise their beliefs downwards about the likelihood that that underwriter is the low-cost type (who is more likely to fight). The belief that the underwriter is the low-cost type corresponds to the underwriter's reputation. Therefore, a higher belief corresponds to a "high" reputation.

Importantly, neither a default nor a lack of default perfectly reveals the underwriter's type. A default could happen if a low-cost underwriter's fighting is unsuccessful or if a high-cost underwriter opted to not fight. Similarly, a lack of default could happen if a high-cost underwriter successfully fought or if a low-cost underwriter did not need to fight because no crisis occurred.

Equilibrium Behavior. At each stage, the investor only lends if their belief that the underwriter is the low cost type is sufficiently high. For simplicity, I assume that the possible costs of fighting are such that the high-cost underwriter never fights and the low-cost underwriter always fights.

If the game were a one shot interaction, the underwriter would never fight. But in this dynamic game, there is a reputation cost to not fighting because default damages the underwriter's reputation. If reputation becomes sufficiently low, investors will stop purchasing bonds through the underwriter and the underwriter will no longer receive the finder's fee in future interactions.

Prices and Contagion. The game described above corresponds to a primary market for bonds. Now consider a secondary market, populated by investors with the same information as those participating in the primary market. In the secondary market, the price of a bond is determined by the expected value of the bond's future payoffs. All else equal, the secondary market price of a bond is higher if investors believe that the underwriter is the low-cost type, as future default risk is lower. Suppose that the dynamic game described above plays out independently across different sovereigns and underwriters. News about default on one sovereign's bond (the "defaulter") is a negative signal about its underwriter's type. The underwriter's reputation falls, which then lowers the secondary market prices of other bonds it has underwritten. It is in this sense that contagion can spread through a shared monitor (the underwriter).

Ex Ante and Ex Post Actions. As described in Section 2, early sovereign bond underwriters could take both ex ante and ex post actions to prevent default. The model features an ex post action. It is straightforward to modify the model to feature a costly ex ante action. For example, one could model due diligence as the underwriter paying a cost to learn about the sovereign's risk of a crisis (which can change across stages). The underwriter could use this information to decide whether to underwrite the bond. If investors are uncertain about the underwriter's cost of due diligence (higher versus low), they would learn about it from the public history of defaults.

Modifying the model to feature ex ante actions would lead to similar predictions in terms of default spreading contagion in secondary markets. However, other predictions of ex ante versus ex post actions about the size of contagion may differ. I explore this in Section 5, where I find evidence suggesting that both ex ante and ex post underwriter actions mattered in early sovereign bond markets.

4.2 Identification and Econometric Specification

Identification Challenges. Estimating the causal effect of sharing a defaulter's underwriter on non-defaulting bonds' prices is challenging. The primary reason is that there are likely unobserved factors that drive comovement in bond prices across countries. Examples include fluctuations in commodities prices, military conflicts, or financial crises. Such events could independently affect bond prices across countries or trigger spillovers between economically integrated countries. This is a fundamental challenge to isolating any specific channel of contagion.

If countries' exposure to such events is correlated with the identity of their underwriter, this could make it difficult to empirically separate contagion through the shared underwriter from contagion through shared economic exposure. This could happen if, for example, low-reputation underwriters tend to underwrite for high-risk countries (and vice versa for high-reputation underwriters).[23] One could find higher comovement between bonds sharing an underwriter simply because the borrowers tend to load similarly on unobserved risk factors.

Another scenario that could pose similar threats to identification would be if underwriters specialized regionally. If proximate regions are more economically integrated, then we could find more comovement between bonds sharing an underwriter not because of reputation-based contagion, but because of their economic integration. Indeed, early underwriters tended to specialize regionally. And underwriting relationships were highly persistent: 25% of new issues had the same underwriter as the sovereign's most recent prior issue. 72% had worked with the same underwriter in the past.

Empirical Strategy and Econometric Specification. To overcome these identification challenges, I exploit *within-country* variation in exposure to a defaulter's underwriter. Specifically, I compare bonds for the same country, during the same year, but with *different* underwriters. For example, in a case where Argentina defaults on a Barings bond, the regression would compare the change

[23] Flandreau and Flores (2009) documents that low-risk countries tended use more reputable underwriters.

in prices between a Mexican Barings bond and a Mexican Rothschilds bond to help estimate the contagion to non-defaulting bonds. I estimate the equation below.

$$\Delta \ln P_{ie} = \beta_1 \Delta \ln P_e^D + \beta_2 \text{Shared}_{ie} + \beta_3 \left(\text{Shared}_{ie} \times \Delta \ln P_e^D\right) + \gamma_{ie} \left(\text{Country}_i \times \text{Year}_e\right) + \xi_{ie} \left(\text{Country}_i \times \text{Def. Country}_e\right) + \iota_i \text{Bond}_i + \varepsilon_{iet} \tag{1}$$

The outcome variable is the log change in a non-defaulting bond i's price over the month of a default event e. The data are structured as a bond-event panel. The explanatory variables are: the monthly change in the defaulting bond's price ($\Delta \ln P_e^D$) during default e, an indicator for sharing the defaulting bond's underwriter ($1[\text{Shared}]_{ie}$), and the interaction of these two variables. Throughout, I two-way cluster standard errors by time (year-month) and bond. Sharing a defaulter's underwriter varies within bonds over events.

The first coefficient, β_1 describes the average amount of comovement between non-defaulting bonds and the defaulting bond during a default when *not* sharing an underwriter. Its expected sign is positive, as sovereign bonds as an asset class will tend to comove.

The second coefficient, β_2, measures how much more a non-defaulting bond falls in price when it shares the defaulter's underwriter (relative to a non-defaulting bond that does not share the defaulter's underwriter). The third coefficient, β_3, measures the additional comovement with the defaulting bond's price when sharing an underwriter. Throughout, I demean the defaulting bond's price (subtracting -2.86%). Therefore, the coefficient on the shared underwriter indicator (β_2) describes the average additional price decline of a non-defaulting bond when it shares the defaulter's underwriter.

The expected sign of β_2 is negative if there is contagion through the shared underwriter. We would also expect a positive β_3 if there is contagion through the shared underwriter; this would indicate stronger comovement with the defaulter when sharing an underwriter. The model in Appendix A predicts that, all else equal, when the underwriter's reputation falls by more (i.e., a bigger revision in beliefs), the price of the non-defaulting bond falls more.

Equation (1) includes three sets of fixed effects. Most importantly, country-year fixed effects account for time-varying country-level shocks or spillovers. If such shocks or spillovers are correlated with the underwriter's identity, they could bias the estimates of β_2 and β_3 in the absence of these fixed effects (i.e., the primary threat to identification described above). The equation also includes country-defaulting country fixed effects. These help account for how much bonds from the defaulter and non-defaulter tend to comove during a default. For example, how much Greek bonds tend to fall in price when Turkey defaults. Lastly, bond fixed effects control for time-invariant bond-specific characteristics that could affect bond prices.

Including a bond fixed effect also controls for the bond's underwriter(s). As a result, this also accounts for any time-invariant unobserved factors affecting bond prices that are correlated with the underwriter's identity. For example, lower average returns in defaults due to specializing in underwriting for riskier borrowers.

Identification Assumption. The key identifying assumption is that sharing a defaulter's underwriter ($1[\text{Shared}]_{ie}$) is uncorrelated with unobserved factors that vary within a country-year and affect non-defaulters' bond prices. Violating this assumption would require that there are omitted factors varying within-country, across time, and correlated with the underwriter's identity. To test for failure of this assumption, I conduct balance tests (reported in Section 4.4). Section 5 also tests competing predictions of reputation-based contagion versus alternative mechanisms: financial losses borne by investors or underwriters and underwriter identity being correlated with unobserved bond risk factors.

The identifying assumption does not require random matching between sovereigns and underwriters. It also does not require that the default was unanticipated. Typically, a bond's price deteriorates over several months leading up to default, suggesting that its occurrence is not a complete surprise to investors. When the default is announced, uncertainty about the timing and severity of the default is resolved. If defaults are almost perfectly anticipated, there would be little information content in the default announcement. This could reduce contagion during the default (i.e., the causal effect), which could limit the power of the empirical analysis to detect contagion, but it would not bias the estimates.

Why Can Bond Default Risk Vary Within Country? Equation (1) identifies contagion from the deviation in bond prices that occurs within a given country, reflecting a deviation in their perceived default risk. Default risk can differ for bonds issued by the same country for two main reasons. First, countries often selectively defaulted on bonds in this era (52% of my observations occur in selective defaults). Neither norms nor contracts in this era generally dictated pari passu (equal treatment of bondholders). As a result, bonds for the same country could have a different probability of defaulting. Second, even in a default on all bonds, the lack of pari passu could lead to different recovery rates. If avoiding default was an informative signal about an underwriter's ability to achieve better recovery rates in default, this could also lead to different expected losses in a default.

4.3 Estimation Results

Estimating Equation (1) using OLS, I find economically and statistically significant contagion through shared underwriters during defaults. Table 3 displays the results. Column 7 contains the most saturated regression, corresponding to Equation (1). The estimate of β_2 implies that sharing a defaulter's underwriter (during a default) leads to a 1.28% decrease in a non-defaulting bond's price on average. In the average default, the defaulting bond's price falls 2.86% (Table 2). Therefore, on average there is 45% pass-through of the defaulting bond's price changes to non-defaulting bonds underwritten by the same bank.

When a non-defaulting bond does *not* share the defaulter's underwriter, it tends to fall in price 4bp for every 100bp decrease in the defaulting bond's price (estimated β_1). This small but positive comovement is consistent with default occurring when other factors tend to depress bond prices, such as economic downturns.

Table 3: Estimated Contagion from Sharing a Defaulter's Underwriter

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\Delta \ln(P_{ie}^D)$	0.030**	0.047***	0.040***	0.041***	0.042***	0.042***	0.042***
	(0.014)	(0.012)	(0.013)	(0.014)	(0.014)	(0.014)	(0.014)
$1[\text{Shared}_{ie}]$	-0.962***	-0.813**	-0.947***	-0.976**	-1.149**	-1.267***	-1.284***
	(0.354)	(0.343)	(0.355)	(0.449)	(0.443)	(0.436)	(0.441)
$1[\text{Shared}_{ie}] \times \Delta \ln(P_{ie}^D)$	0.224***	0.223***	0.238***	0.244***	0.251***	0.253***	0.252***
	(0.065)	(0.066)	(0.065)	(0.070)	(0.077)	(0.078)	(0.078)
Obs.	21921	21921	21921	21921	21921	21921	21921
R2	0.030	0.056	0.080	0.207	0.369	0.374	0.386
Country FE	✓	✓	✓				
Year FE		✓	✓	✓			
Def. Country FE			✓				
Country × Def. Country FE				✓	✓	✓	✓
Country × Year FE					✓	✓	✓
Underwriter FE						✓	
Bond FE							✓

Note: The outcome variable is the change in a non-defaulting bond's price ($\Delta \ln P_{ie}$). The explanatory variables are: the change in the defaulting bond's price ($\Delta \ln P_e^D$), an indicator for sharing the defaulting bond's underwriter ($1[\text{Shared}]_{ie}$), and the interaction of these two variables. Price changes are measured as the difference in log prices between the current month and the previous month. The coefficient on the shared underwriter indicator is scaled by 100 so that its units correspond to log points. The defaulting bond's price change is demeaned prior to regression. Standard errors are two-way clustered by time (year-month) and bond. Statistical significance: 0.1*, 0.05**, 0.01***.

Lastly, there is a large and positive coefficient on the interaction term (β_3). This coefficient describes how much the contagion scales with the size of the changes in the defaulting bond's price. An additional 25% of the defaulting bond's price change is transmitted when sharing the defaulter's underwriter. This leads to a total comovement coefficient of 29%. In this sense, sharing a defaulter's underwriter leads to 7 times greater comovement with the defaulting bond's price (29% versus 4%). When the underwriter's reputation suffers greater damage from default (i.e., a larger revision of beliefs), this can lead to a larger price decrease for all of its associated bonds.

The different columns in Table 3 illustrate the impact of including various fixed effects. Overall, the coefficients are fairly stable across the different specifications. Column 5 adds the crucial country-year fixed effects, lowering the coefficient on the shared underwriter indicator from -0.98 to -1.15. Adding underwriter fixed effects leads to a further decrease to -1.27. The relatively small change between columns 6 and 7 suggests that there is limited scope for heterogeneity related to underwriters to act as possible confounders. And recall that, after including this fixed effect, confounders would need to be time-varying as well. Column 7 adds the bond fixed effect, leading to the estimate of -1.28.

Missing Intercept. A standard criticism of using borrower-time fixed effects is that it can lead to a "missing intercept" problem. This can create bias when the effect of interest has a borrower-level effect in addition to a within-borrower effect. Including borrower-time fixed effects nets out the borrower-level effects.

In the context of my setting, using country-year fixed effects would tend to, at worst, cause the estimates to understate contagion. This makes the main result a conservative estimate of the scale of contagion through shared monitors. To see this, suppose that investors revise beliefs about entire countries and not just individual bonds in response to news about the performance of an underwriter's other bonds. Updating beliefs at the country-level could arise if investors are drawing inferences from default about the underwriter's choice of borrowers. While such a scenario is plausible, the stability of the point estimates despite the inclusion of a variety of fixed effects suggests that such bias is unlikely to be quantitatively significant.

4.4 Balance Tests and Robustness

I next test for failures of the identifying assumption and provide additional robustness evidence. There are two scenarios that pose potential threats to identification that are not ruled out by the country-year (or other) fixed effects.

The first scenario arises if there are differences in bond characteristics that vary within a country-year and are correlated with the underwriter's identity. This could happen if underwriters specialize in, for example, the purpose and/or collateral of the loan, such as railways. If railway loans tend to be riskier, these bonds could both default more often and be more likely to experience negative returns. If so, the empirical analysis could conflate this phenomenon with reputation-based contagion.

I test for this first scenario using a balance test. This test regresses the shared underwriter indicator on bond characteristics in the bond-event panel. Figure 3 displays the results of this test. The estimated correlations are small and statistically insignificant, indicating that there are not systematic differences in the characteristics of bonds that tend to share a defaulter's underwriter.

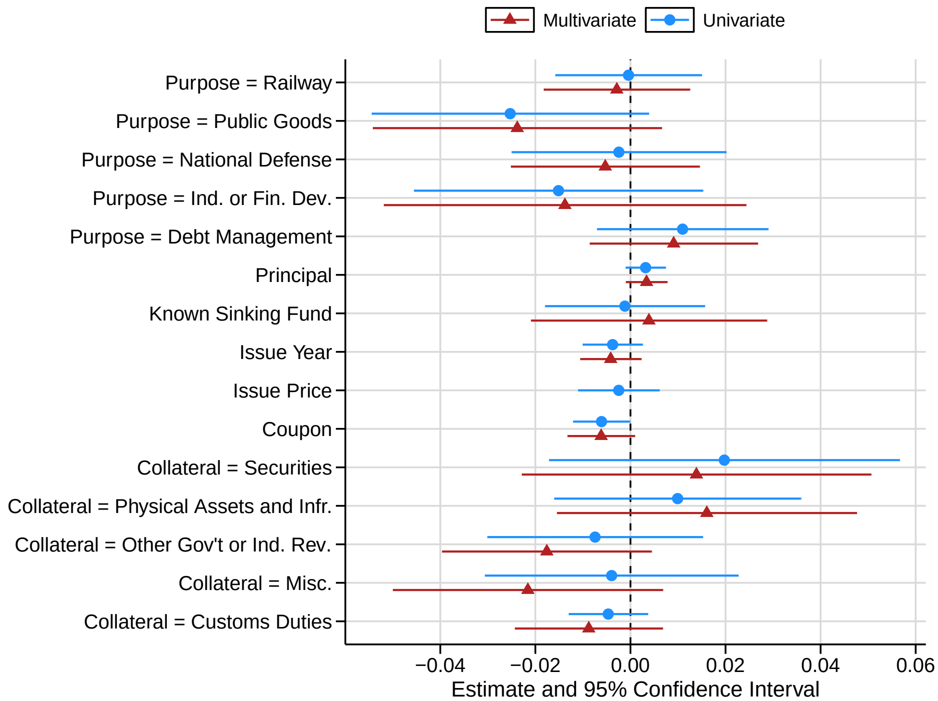
The second scenario arises if there are systematic *similarities* in bonds that share an underwriter. This could also happen if there is specialization in bond characteristics within underwriters. Non-defaulting and defaulting bonds could comove more strongly not because of reputation-based contagion, but because they have similar coupon rates, collateral types, or other characteristics. To the extent that specialization in a time invariant characteristic, this is absorbed by the bond fixed effect. However, if the underwriter's specialization changes over time, this could bias the estimated effect of sharing a defaulter's underwriter.

I use a second balance test to test for evidence of this scenario. This test regresses the shared underwriter indicator on measures of *similarity* in bond characteristics between the non-defaulting and defaulting bond(s).[24] Figure 4 reports the estimation results.

Generally the correlations are small and statistically insignificant. However, two character-

[24] In the case of multiple defaulting bonds, I take the average of their continuous characteristics and the max of indicator variables.

Figure 3: Balance Test 1—Do Bond Characteristics Predict Sharing the Defaulter's Underwriter?



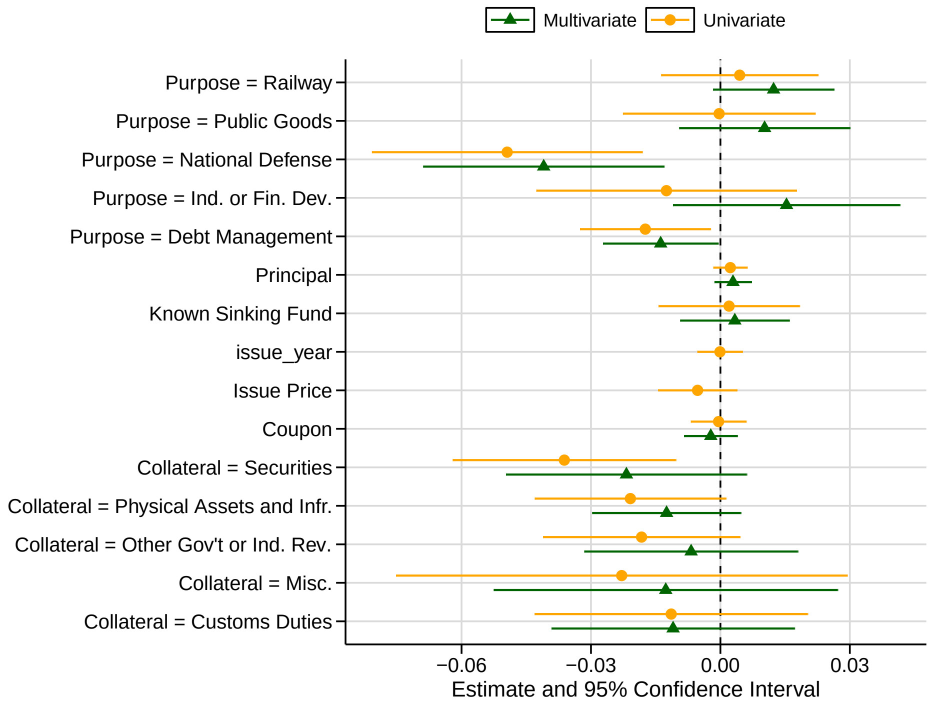
Note: This figure plots regression estimates and 95% confidence intervals. The outcome variable in each regression is the shared underwriter indicator and the explanatory variables are the characteristics of non-defaulting bonds. Each regression includes the same clustering and fixed effects and at the rightmost column in the main analysis (Table 3). Triangles denote estimates from a multivariate regression (i.e., all regressors are included in one regression) and circle denote estimates from a univariate regression (i.e., estimated separately for each regressor). For ease of interpretation, all continuous variables are demeaned and divided by their standard deviation.

istics show up in at least one specification as statistically significant: whether the purpose of the loan was national defense and whether the bond was secured on financial securities. The point estimates are negative and economically small (predicting a 3-5% lower chance of sharing a underwriter). The negative coefficient suggests, if anything, diversification rather than specialization in these characteristics.

The second balance test raises possible concerns related to selection on two bond characteristics. To gauge whether these characteristics could be related to confounders, I re-estimate the main regression on a subsample that excludes bonds with these characteristics. Table 4 displays the results. Column 2 omits national defense loans and column 3 omits loans secured on financial securities. The estimates remain similar, indicating that the estimated contagion is not driven by these two bond characteristics.

The next columns investigate robustness to two additional features. Column 4 omits all bonds during the year of the Baring Crisis (1890). This crisis began in July 1890 with an Argentine default and Barings' failed placement of Argentinean bonds. Stuck with nearly worthless bonds on

Figure 4: Balance Test 2—Does *Similarity* to the Defaulting Bond Predict a Shared Underwriter?



Note: This figure plots regression estimates and 95% confidence intervals. The outcome variable in each regression is the shared underwriter indicator and the explanatory variables are the *differences* in the characteristics of non-defaulting bonds relative to the defaulting bond. Each regression includes the same clustering and fixed effects and at the right-most column in the main analysis (Table 3). Triangles denote estimates from a multivariate regression (i.e., all regressors are included in one regression) and circle denote estimates from a univariate regression (i.e., estimated separately for each regressor). For ease of interpretation, all continuous variables are demeaned and divided by their standard deviation.

its balance sheet, Barings ultimately received a bailout in November 1890. During this episode, financial losses at Barings did contribute to contagion back in Europe and possibly Latin America as well (Mitchener and Weidenmier, 2008). The Baring Crisis is a rare known case of a sovereign default having a meaningful financial impact on an underwriter. Therefore, since reputation was plausibly not the dominant channel of contagion in this episode, it is important to verify that the results are similar when excluding the Baring Crisis. This is indeed the case, as the point estimate remains similar (-1.284 versus -1.282).

Lastly, I exclude bonds issued by British colonies. These bonds were typically underwritten by a distinct set of underwriters (or the British government itself). They were generally regarded as implicitly guaranteed by the British government. Omitting these bonds is essentially excluding a subset of extremely low-risk securities. Restricting attention to the class of non-colonial bonds suggests even greater contagion within this sub-population.

Table 4: Robustness to Dropping Special Cases

	(1)	(2)	(3)	(4)	(5)
$\Delta \ln(P_{ie}^D)$	0.042***	0.041***	0.040***	0.034**	0.054**
	(0.014)	(0.014)	(0.013)	(0.015)	(0.022)
$1[\text{Shared}_{ie}]$	-1.284***	-1.119***	-1.235***	-1.282***	-1.842***
	(0.441)	(0.398)	(0.424)	(0.448)	(0.518)
$1[\text{Shared}_{ie}] \times \Delta \ln(P_{ie}^D)$	0.252***	0.238***	0.262***	0.243***	0.314***
	(0.078)	(0.070)	(0.081)	(0.081)	(0.087)
Obs.	21921	21394	21209	21456	12820
R2	0.386	0.392	0.397	0.388	0.397
Country × Def. Country FE	✓	✓	✓	✓	✓
Country × Year FE	✓	✓	✓	✓	✓
Bond FE	✓	✓	✓	✓	✓
Excluded Cases	None	Purp. = Nat'l Def.	Col. = Fin. Sec.	Baring Crisis	Colonial

Note: The first column reproduces the baseline specification (the rightmost column of Table 3). The other columns estimate the same regression using a subset of the sample that exclude one of three special cases. Column 2 omits loans originated for the purpose of expenditures related to national defense. Column 3 omits bonds secured on financial securities. Column 4 drops all bonds during the year of the Baring Crisis (1890). The outcome variable is the change in a non-defaulting bond's price ($\Delta \ln P_{ie}$). The explanatory variables are: the change in the defaulting bond's price ($\Delta \ln P_e^D$), an indicator for sharing the defaulting bond's underwriter ($1[\text{Shared}]_{ie}$), and the interaction of these two variables. Price changes are measured as the difference in log prices between the current month and the previous month. The coefficient on the shared underwriter indicator is scaled by 100 so that its units correspond to log points. The defaulting bond's price change is demeaned prior to regression. Standard errors are two-way clustered by time (year-month) and bond. Statistical significance: 0.1*, 0.05**, 0.01***.

5 Evidence on Mechanisms: The Role of Monitor Reputation

This section provides evidence on the role of underwriter reputation for monitoring in driving the estimated contagion. In Section 5.1, I empirically test predictions implied by reputation-based contagion versus an alternative mechanism: financial loss-based contagion (e.g., Allen and Gale, 2000; Goldstein and Pauzner, 2004). The alternative mechanism posits that contagion occurs due to default imposing financial losses on either the underwriter or investors. My findings overall support the reputation mechanism and either fail to support or contradict the financial loss mechanism. Results from these tests also suggest that investors were learning about both ex ante and ex post monitoring actions.

Section 5.2 considers another alternative mechanism: bonds sharing an underwriter tend to load on the same unobservable risk factors. Because of the inclusion of country-year fixed effects, this mechanism could only account for the contagion I document if there is within-country variation in bond characteristics related to the underwriter's identity. The balance and robustness tests of Section 4.4 suggest this scenario is unlikely.

One variant of this risk factor scenario, which is not fully addressed by the previous evidence, arises when the bonds of high- and low-reputation underwriters load differently on global risk factors. This could happen if countries prefer to default on bonds issued through low-reputation underwriters. Testing additional predictions, I find evidence consistent with investors learning about long-run default risk associated with specific underwriters and at odds with bonds sharing an underwriter simply loading more similarly on the same global risk factors.

Lastly, Section 5.3 examines financial stability implications of reputation-based contagion. In theory, it is ambiguous whether contagion will be stronger or milder when it involves a *higher* reputation monitor. That is, does having reputable monitors dampen or amplify contagion? In the context of early sovereign bond markets, I find that contagion was milder when reputation was stronger, consistent with reputation improving financial stability by dampening contagion.

5.1 Mechanism: Monitor Reputation versus Financial Losses

An alternative explanation for contagion through shared underwriters centers on financial losses, rather than reputation for monitoring. If underwriters tended to hold some of the bonds that they issued or engage in short-term liquidity support to sovereigns, default could damage their wealth. If these losses prompted underwriters to sell other assets, including other bonds, this could depress the price of these bonds. A similar mechanism could operate via investor wealth if investors specialize by underwriter. Such segmentation could create contagion if investors tend to sell other bonds issued by the same underwriter in response to a default.

Section 2 discusses institutional details indicating that such scenarios are less plausible than reputation-based contagion. In particular, that underwriters had limited direct financial exposure and that investors were generally diversified. However, to the best of my knowledge, there is not sufficient data to systematically measure underwriter financial exposure nor investor concentration by underwriter in this era. Because underwriters were generally structured as private partnerships and many investors were private individuals, there is little available data on their financial holdings. Given the lack of data to directly test these scenarios, I instead evaluate these competing explanations by empirically testing predictions that differ.

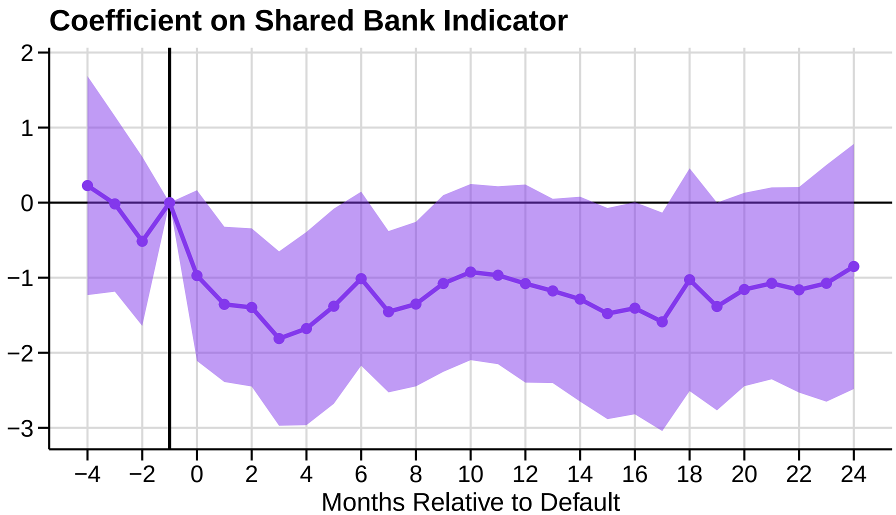
Persistence. I first examine the persistence of the price impact of sharing a defaulter's underwriter. If contagion arose from a wealth effect due to temporary selling pressure, we would expect the price impact to be short-lived. In contrast, learning new information with persistent relevance (e.g., about underwriter monitoring ability/willingness) would have a persistent price impact.[25]

To gauge persistence, I estimate a local projections (Jordà, 2005) variant of Equation (1) over the 4 months before and 24 months following a default. I define the outcome variable to be the cumulative log price change relative to the month before the default.[26] Figure 5 displays estimation results for the shared underwriter indicator, which summarizes the average cumulative price change for bonds sharing a defaulter's underwriter.

Prior to default, there are not significant differences in prices. However, after default, bonds

[25]This observation is motivated by Coval and Stafford (2007), which compares the price impact of "forced" versus "voluntary" mutual fund sales of assets. They find that forced sales have a temporary effect (dissipating within 1-2

Figure 5: Persistence of Average Price Effects of Sharing a Defaulter's Underwriter



Note: This figure plots regression coefficients (and their 95% confidence intervals) for local projections estimates of the impact of sharing a defaulter's underwriter over -4 to +24 months relative to default. The specification has the same clustering and fixed effects and at the rightmost column in the main analysis (Table 3). The outcome variable is the log price change relative to period -1, therefore the graph describes the cumulative price change.

sharing the defaulter's underwriter fall 1-1.5% in the three months following default and remain about 1% lower through a total of 24 months. This persistence suggests investors are learning new information rather than facing temporary selling pressure due to financial losses.

Excluding Young Bonds. One scenario in which an underwriter may have had at-risk bonds on their balance sheet is a failed placement. If default occurred when the underwriter had not yet fully placed the bonds, contagion could spread via a wealth effect. Table 4 excludes the most well-known case of a failed placement during a default: the Baring Crisis. But limited information is available about other failed placements, making it difficult to explicitly exclude other cases. Given this limitation, I instead re-run the regression but omit all defaults with bonds at risk of not yet being fully placed: recently originated bonds.

Table 5 reports the results. Column 1 reproduces the baseline estimates. Column 2 restricts to the subset of bonds for which the defaulting bond's age is known (but does not yet impose restrictions on the *value* of the defaulting bond's age). The subgroup for which the necessary data is available exhibits higher average contagion: a 1.66% price decrease versus 1.28%.

Column 3 retains defaults where the defaulting bond's age is at least one year. The estimate is little changed (-1.68 versus -1.66). Restricting to bonds at least two years old (column 4) also yields a similar estimate (-1.69). These results show that contagion via shared underwriters is not driven by defaults on recently originated bonds, which were at risk of not yet being fully placed.

years). Voluntary sales driven by new information, however, have a persistent effect over this horizon.

[26]That is, $\ln(P_{ie,h}) / \ln(P_{ie,-1})$ where $P_{ie,h}$ is horizon h price and $P_{ie,-1}$ is the price in the month before default.

Table 5: Excluding Recently Originated Defaulting Bonds

	(1)	(2)	(3)	(4)
$\Delta \ln(P_{ie}^D)$	0.042***	0.040**	0.040**	0.036**
	(0.014)	(0.016)	(0.016)	(0.017)
$1[\text{Shared}_{ie}]$	-1.284***	-1.663***	-1.675***	-1.688***
	(0.441)	(0.591)	(0.590)	(0.626)
$1[\text{Shared}_{ie}] \times \Delta \ln(P_{ie}^D)$	0.252***	0.305***	0.305***	0.295***
	(0.078)	(0.093)	(0.093)	(0.098)
Obs.	21921	21097	20865	19818
R2	0.386	0.399	0.399	0.407
Country × Def. Country FE	✓	✓	✓	✓
Country × Year FE	✓	✓	✓	✓
Bond FE	✓	✓	✓	✓
Def. Bond Age	Baseline	Non-Missing	$\geq$ 1 year	$\geq$ 2 years

Note: The first column reproduces the baseline specification (the rightmost column of Table 3). The other columns estimate the same regression using a subset of the sample. Column 2 is the subset for which the defaulting bond's age is known. Columns 3 and 4 exclude bonds less than one and two years old (respectively). In the case of multiple defaulting bonds, I take the minimum of all bonds' ages. The outcome variable is the change in a non-defaulting bond's price ($\Delta \ln P_{ie}$). The explanatory variables are: the change in the defaulting bond's price ($\Delta \ln P_e^D$), an indicator for sharing the defaulting bond's underwriter ($1[\text{Shared}]_{ie}$), and the interaction of these two variables. Price changes are measured as the difference in log prices between the current month and the previous month. The coefficient on the shared underwriter indicator is scaled by 100 so that its units correspond to log points. The defaulting bond's price change is demeaned prior to regression. Standard errors are two-way clustered by time (year-month) and bond. Statistical significance: 0.1*, 0.05**, 0.01***.

Variation with Wealth Involved. I next examine how contagion varies with the amount of wealth involved in the default. If contagion is driven by financial losses, contagion would be larger when more wealth is affected. Instead, if contagion is driven by reputation, it is possible to have milder contagion when the wealth involved is greater. In the model discussed in Section 4.1, contagion is milder when default is more difficult to prevent (specifically, when the probability of "fighting" is less likely to succeed). Proposition 1 in Appendix B formalizes this result. If defaults involving more wealth are harder to prevent, default is a less informative signal and reputation changes less.

Table 6 tests this prediction by splitting the sample based on the total principal of the bonds involved in default: above and below the median. The average effect of sharing a defaulter's underwriter is a statistically significant 1.89% price decrease in defaults involving below-median wealth. The average decrease is 0.82% for in cases with above-median wealth. I caution that this last coefficient, while not statistically different from zero is estimated with less precision.

Because the smaller sample size may limit the power of this test, I also estimate a higher-power (but more restrictive) variant that uses interactions instead of splitting the sample in Appendix

Table 6: Heterogeneity by Defaulting Bond Total Principal

	(1)	(2)	(3)
$\Delta \ln(P_{ie}^{D})$	0.042***	0.021	0.084***
	(0.014)	(0.020)	(0.023)
$1[\text{Shared}_{ie}]$	-1.284***	-1.893**	-0.820
	(0.441)	(0.747)	(0.587)
$1[\text{Shared}_{ie}] \times \Delta \ln(P_{ie}^{D})$	0.252***	0.226***	0.228**
	(0.078)	(0.080)	(0.109)
Obs.	21921	10730	10931
R2	0.386	0.558	0.405
Country x Def. Country FE	✓	✓	✓
Country x Year FE	✓	✓	✓
Bond FE	✓	✓	✓
Def. Bond Principal	All (Baseline)	Below Median	Above Median

Note: The first column reproduces the baseline specification (the rightmost column of Table 3). The other columns estimate the same regression using a subset of the sample. Columns 2 and 3 use subsets where the sum of the defaulting bond's principal above or below median (respectively). The outcome variable is the change in a non-defaulting bond's price ($\Delta \ln P_{ie}$). The explanatory variables are: the change in the defaulting bond's price ($\Delta \ln P_{e}^{D}$), an indicator for sharing the defaulting bond's underwriter ($1[\text{Shared}]_{ie}$), and the interaction of these two variables. Price changes are measured as the difference in log prices between the current month and the previous month. The coefficient on the shared underwriter indicator is scaled by 100 so that its units correspond to log points. The defaulting bond's price change is demeaned prior to regression. Standard errors are two-way clustered by time (year-month) and bond. Statistical significance: 0.1*, 0.05**, 0.01***.

Table C.2.[27] Those results find an economically significant difference in contagion: a one standard deviation increase in defaulting bond's principal is associated with 0.48 percentage points more contagion. However, this coefficient is also not precisely estimated.

Cautiously interpreting these results, the evidence is more consistent with reputation rather than financial loss-based contagion. When more wealth is involved, contagion appears to be either milder or similar.

Variation with Selective Default. Selective default presents another opportunity to test a prediction of reputation-based contagion. 52% of the defaults I study are selective in that the sovereign defaults on a subset of its outstanding bonds. Selective default could signal that the default was *easier* to prevent, as some bonds were able to avoid it. If so, under Proposition 1, contagion would be more severe in selective defaults, all else equal.

Regarding the alternative mechanism (financial losses) the prediction is less clear. To the extent that selective default involves a smaller amount of wealth, selective defaults would tend have weaker contagion under this mechanism.

[27]It is more restrictive in the sense that the pooled regression constraints the fixed effects to take on the same value for both subgroups.

Table 7: Heterogeneity by Selective Default Indicator

	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta \ln(P^D_{ie})$	0.030**	0.048***	0.039***	0.041***	0.042***	0.042***
	(0.014)	(0.011)	(0.013)	(0.014)	(0.015)	(0.015)
1[Shared$_{ie}$]	-0.067	0.094	-0.094	-0.066	-0.228	-0.310
	(0.352)	(0.357)	(0.376)	(0.538)	(0.519)	(0.509)
1[Sel. Def.$_e$]	-0.096	0.410	0.218	0.311	0.326	0.345
	(0.242)	(0.260)	(0.335)	(0.336)	(0.316)	(0.310)
1[Shared$_{ie}$] $\times \Delta \ln(P^D_{ie})$	0.247***	0.241***	0.256***	0.262***	0.267***	0.267***
	(0.064)	(0.066)	(0.064)	(0.070)	(0.078)	(0.079)
1[Shared$_{ie}$] $\times$ 1[Sel. Def.$_e$]	-1.777***	-1.792***	-1.652***	-1.721**	-1.731**	-1.770***
	(0.576)	(0.551)	(0.542)	(0.677)	(0.682)	(0.668)
Obs.	21921	21921	21921	21921	21921	21921
R2	0.033	0.059	0.082	0.209	0.371	0.387
Country FE	✓	✓	✓			
Year FE		✓	✓	✓		
Def. Country FE			✓			
Country $\times$ Def. Country FE				✓	✓	✓
Country $\times$ Year FE					✓	✓
Bond FE						✓

Note: This table adds two regressors: an indicator for whether the default was selective (i.e., not all of the defaulting state's bonds entered default) and its interaction with the shared underwriter indicator. The outcome variable is the change in a non-defaulting bond's price ($\Delta \ln P_{ie}$). The explanatory variables are: the change in the defaulting bond's price ($\Delta \ln P^D_e$), an indicator for sharing the defaulting bond's underwriter (1[Shared]$_{ie}$), and the interaction of these two variables. Price changes are measured as the difference in log prices between the current month and the previous month. The coefficient on the shared underwriter indicator is scaled by 100 so that its units correspond to log points. The defaulting bond's price change is demeaned prior to regression. Standard errors are two-way clustered by time (year-month) and bond. Statistical significance: 0.1*, 0.05**, 0.01***.

To test this, I augment the baseline regression to include an interaction between an indicator for selective default and the shared underwriter indicator. Table 7 presents the results. The coefficient on the uninteracted shared underwriter indicator is -0.31 and is statistically insignificant. The interacted coefficient is both economically and statistically significant. It indicates that, holding constant the defaulting bond's price decrease, contagion is 1.77 percentage points more severe when default is selective. This stronger contagion is consistent with the reputation mechanism.

Avoiding Selective Default. Selective default could also send a signal about the underwriter(s) that *avoided* the default. That is, the underwriters who had outstanding bonds for the same country but whose bonds avoided entering default. First, default on the other bonds could send a positive signal about the "good" underwriter's ability to exert ex post influence over a sovereign to avoid default. In the language of the model, the occurrence of default indicates that a "crisis" arose (the sovereign wanted to default), and a lack of default signals that the underwriter successfully "fought" the crisis. Second, default could send a negative signal about the underwriter's ex ante screening and due diligence, as the sovereign did default on some of its bonds.

I test this by focusing on the subset of selective defaults and adding an indicator for being a "good" underwriter that avoided default (and its interaction with the log change in the defaulting bond's price). Table 8 displays the results. The average contagion when sharing the defaulter's underwriter is a 2.64% price decrease, versus a (statistically insignificant) 0.39% price decrease when sharing a good underwriter. The 95% confidence interval for the good underwriter rules out an increase larger than 0.17% (and a decrease smaller than -0.95%) for bonds underwritten by a good underwriter. Comovement with the defaulting bond is weakest for those underwritten by banks not at all associated with the defaulting sovereign (4% pass through of the defaulting bond's price change), moderate for those associated via a good underwriter (4% + 10% = 14%), and strongest for those associated with the defaulting bond's underwriter (4% + 35% = 39%).

The bonds of underwriters that avoid default are on average penalized, but much less so compared to bonds sharing the defaulter's underwriter. If ex ante screening and due diligence (with respect to country choice) did not matter in the eyes of investors, we would expect no contagion or positive price impacts for the bonds of good underwriters. The presence of these negative effects suggests these ex ante actions are an important part of what investors are learning about. However, because contagion is significantly milder compared to bonds sharing the defaulter's underwriter, it suggests that ex post actions (e.g., exerting influence) are also important. That is, investors are not only learning about ex ante actions.

These results are not necessarily at odds with financial loss-based contagion. For example, the default likely signals a higher risk of the same sovereign defaulting on its other bonds in the near future. The good underwriter's bonds for this sovereign would likely fall in price. This could depress the prices of other sovereigns' bonds sharing that underwriter if there is (1) segmentation in ownership by underwriter and (2) a wealth effect from this (possibly unrealized) wealth shock. However, because the bonds associated with the good underwriter did not experience a cash flow shock like an unpaid coupon, it is less plausible that contagion to these bonds is driven by financial losses (as opposed to learning about the underwriter's monitoring).

Variation with Bond Age *Similarity*. Another piece of evidence that can be rationalized by learning about ex ante underwriter monitoring actions relates to the similarity of bonds in terms of age. Suppose that underwriter screening effort varies over time. This could happen if underwriters improve their monitoring abilities with experience or if incentives to monitor (e.g., reputation concerns) vary over time. Contagion between defaulting and non-defaulting bonds that share an underwriter could be larger when the bonds were underwritten closer in time to each other. This is because the default of one bond would be more informative about other bonds underwritten closer in time to the defaulter.

I test this in Table 9 using a subgroup analysis. Conditioning on the subsample for which the

Table 8: The Effect of Avoiding Default in a Selective Default

	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta \ln(P^D_{ie})$	0.013	0.030***	0.037**	0.043***	0.042**	0.041***
	(0.017)	(0.010)	(0.014)	(0.015)	(0.015)	(0.015)
1[Shared$_{ie}$]	-1.926***	-1.770***	-1.852***	-2.252***	-2.436***	-2.638***
	(0.480)	(0.485)	(0.494)	(0.638)	(0.683)	(0.657)
1[Good Bank$_{ie}$]	-0.503	-0.123	-0.331	-0.211	-0.288	-0.389
	(0.305)	(0.320)	(0.284)	(0.320)	(0.234)	(0.287)
1[Shared$_{ie}$] $\times \Delta \ln(P^D_{ie})$	0.330***	0.325***	0.351***	0.369***	0.354***	0.353***
	(0.084)	(0.087)	(0.080)	(0.091)	(0.097)	(0.101)
1[Good Bank$_{ie}$] $\times \Delta \ln(P^D_{ie})$	0.131***	0.117***	0.110***	0.097**	0.099**	0.102**
	(0.038)	(0.037)	(0.035)	(0.039)	(0.038)	(0.040)
Obs.	10603	10603	10603	10603	10603	10603
R2	0.063	0.086	0.104	0.260	0.424	0.446
Country FE	✓	✓	✓			
Year FE		✓	✓	✓		
Def. Country FE			✓			
Country $\times$ Def. Country FE				✓	✓	✓
Country $\times$ Year FE					✓	✓
Bond FE						✓

Note: This table uses the subsample of selective defaults and adds two regressors: an indicator for whether a non-defaulting bond's underwriter avoided default (a "good" underwriter) and its interaction with the defaulting bond's price change. The outcome variable is the change in a non-defaulting bond's price ($\Delta \ln P_{ie}$). The explanatory variables are: the change in the defaulting bond's price ($\Delta \ln P^D_e$), an indicator for sharing the defaulting bond's underwriter (1[Shared]$_{ie}$), and the interaction of these two variables. Price changes are measured as the difference in log prices between the current month and the previous month. The coefficient on the shared underwriter indicator is scaled by 100 so that its units correspond to log points. The defaulting bond's price change is demeaned prior to regression. Standard errors are two-way clustered by time (year-month) and bond. Statistical significance: 0.1*, 0.05**, 0.01***.

time since issuance (bond age) is known for both the defaulting and non-defaulting bonds, the average contagion is a 1.78% decline when sharing the defaulter's underwriter (column 2). Columns 3-7 restrict to bonds underwritten at least 1, 3, 5, 7, and 9 years apart (respectively). The estimated contagion generally shrinks as the bonds are underwritten further apart in time. It declines from 1.78% in the full sample (with available bond age data) to 1.37% when the bonds are underwritten at least 9 years apart. Such heterogeneity is not obviously predicted by a financial loss-based mechanism. However, these results can be rationalized by learning about ex ante underwriter monitoring actions.

Variation with Default Type. I next examine how contagion varies with the type of default: missed payments versus conversions. Missed payment defaults occur when the sovereign fails to make a scheduled payment on its bonds (either coupon, principal/sinking fund payments).

Table 9: Heterogeneity by *Difference* in Bond Age

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\Delta \ln(P_{ie}^D)$	0.042***	0.041**	0.041**	0.051***	0.057***	0.061***	0.061**
	(0.014)	(0.018)	(0.018)	(0.019)	(0.019)	(0.021)	(0.026)
$1[\text{Shared}_{ie}]$	-1.284***	-1.778***	-1.835***	-1.908**	-1.679**	-1.541*	-1.372*
	(0.441)	(0.613)	(0.619)	(0.753)	(0.742)	(0.821)	(0.758)
$1[\text{Shared}_{ie}] \times \Delta \ln(P_{ie}^D)$	0.252***	0.322***	0.318***	0.308***	0.269**	0.277**	0.201*
	(0.078)	(0.097)	(0.097)	(0.115)	(0.113)	(0.122)	(0.109)
Obs.	21921	19819	18958	15784	13447	11429	9573
R2	0.386	0.402	0.403	0.409	0.421	0.439	0.459
Country $\times$ Def. Country FE	✓	✓	✓	✓	✓	✓	✓
Country $\times$ Year FE	✓	✓	✓	✓	✓	✓	✓
Bond FE	✓	✓	✓	✓	✓	✓	✓
Bond Age Diff.	Baseline	Non-Missing	≥ 1	≥ 3	≥ 5	≥ 7	≥ 9

Note: The first column reproduces the baseline specification (the rightmost column of Table 3). The other columns estimate the same regression using a subset of the sample. Column 2 reports estimates for the subsample for which both the non-defaulting and defaulting bonds' ages are known. Columns 3-7 restrict the sample to bonds with increasingly large differences in their ages. The outcome variable is the change in a non-defaulting bond's price ($\Delta \ln P_{ie}$). The explanatory variables are: the change in the defaulting bond's price ($\Delta \ln P_e^D$), an indicator for sharing the defaulting bond's underwriter ($1[\text{Shared}]_{ie}$), and the interaction of these two variables. Price changes are measured as the difference in log prices between the current month and the previous month. The coefficient on the shared underwriter indicator is scaled by 100 so that its units correspond to log points. The defaulting bond's price change is demeaned prior to regression. Standard errors are two-way clustered by time (year-month) and bond. Statistical significance: 0.1*, 0.05**, 0.01***.

Conversions are modifications bond contract terms (e.g., lowering coupon rates).

Table 10 augments the baseline specification to include an indicator for a default being a missed payment default (and its interaction with the shared underwriter indicator). Recall that these estimates condition on the defaulting bond's price change. Therefore, shared bank indicator and its interaction with default type indicator compare average contagion across default types with similar defaulting bond price responses.

The results suggest contagion is similar across the two types of defaults. Average contagion is a 1.21% price decrease when sharing the defaulter's underwriter in a conversion. However, while similar in magnitude to the original estimate of -1.28%, this estimate is somewhat imprecise (perhaps not surprisingly, as conversions comprise around 30% of defaults). The coefficient on the missed payment interaction is -0.12% (and also not precisely estimated). The point estimate suggests that contagion in missed payments defaults is either similar or, if anything, milder.

To the extent that missed payment defaults entail a larger cash flow shock than conversions, a financial loss mechanism could lead to more contagion in missed payment defaults. Relatedly, missed payments are also cases where conceivably emergency lending from the underwriter could have prevented default. If these kinds of transfers were a primary action an underwriter could

Table 10: Heterogeneity by Default Type

	(1)	(2)
$\Delta \ln(P_{ie}^D)$	0.042***	0.041***
	(0.014)	(0.015)
1[Shared$_{ie}$]	-1.284***	-1.209
	(0.441)	(0.732)
1[Shared$_{ie}$] $\times \Delta \ln(P_{ie}^D)$	0.252***	0.251***
	(0.078)	(0.084)
1[Missed Payment$_e$]		-0.013
		(0.317)
1[Shared$_{ie}$] $\times$ 1[Missed Payment$_e$]		-0.120
		(0.838)
Obs.	21921	21921
R2	0.386	0.386
Country x Def. Country FE	✓	✓
Country x Year FE	✓	✓
Bond FE	✓	✓

Note: This table adds two regressors: a categorical variable that indicate the type of default (conversion or missed payment) and its interaction with the shared underwriter indicator. The omitted category is conversion. The outcome variable is the change in a non-defaulting bond's price ($\Delta \ln P_{ie}$). The explanatory variables are: the change in the defaulting bond's price ($\Delta \ln P_e^D$), an indicator for sharing the defaulting bond's underwriter (1[Shared]$_{ie}$), and the interaction of these two variables. Price changes are measured as the difference in log prices between the current month and the previous month. The coefficient on the shared underwriter indicator is scaled by 100 so that its units correspond to log points. The defaulting bond's price change is demeaned prior to regression. Standard errors are two-way clustered by time (year-month) and bond. Statistical significance: 0.1*, 0.05**, 0.01***.

take to prevent default, which entails a financial cost, we would expect contagion to be higher in missed payment defaults. The similarity between these types of defaults is at odds with these two scenarios. Reputation, however, does not have obvious predictions about different default types.

Variation with Number of Defaulter's Underwriters. Lastly, I examine how contagion varies with the *number* of underwriters per defaulting bond. While a majority of bonds have one underwriter, it is not uncommon for bonds to be underwritten by a syndicate of (typically) 2–4 banks. The signal sent about a given underwriter of a defaulting bond can be weaker when more banks are involved if the presence of multiple banks makes it harder to attribute responsibility to one particular underwriter. Therefore, defaults with multiple underwriters per bond may send a less informative signal and lead to less contagion.

I investigate this in a subgroup analysis in Table 11. Columns 2-4 restrict to subsamples where the defaulting bond(s) has no more than 3, 2, and 1 underwriters (respectively). Overall, the fewer underwriters are involved, the larger is the estimated contagion. This is consistent with fewer underwriters making it easier to attribute responsibility to a particular underwriter, leading to more contagion.

Table 11: Heterogeneity by Defaulting Bond's Number of Underwriters

	(1)	(2)	(3)	(4)
$\Delta \ln(P_{ie}^{D})$	0.042***	0.039**	0.018	-0.050*
	(0.014)	(0.019)	(0.013)	(0.026)
1[Shared$_{ie}$]	-1.284***	-1.407**	-1.800***	-1.958***
	(0.441)	(0.632)	(0.647)	(0.627)
1[Shared$_{ie}$] $\times \Delta \ln(P_{ie}^{D})$	0.252***	0.286***	0.397***	0.212**
	(0.078)	(0.097)	(0.103)	(0.093)
Obs.	21921	19582	16150	8819
R2	0.386	0.415	0.482	0.629
Country $\times$ Def. Country FE	✓	✓	✓	✓
Country $\times$ Year FE	✓	✓	✓	✓
Bond FE	✓	✓	✓	✓
# Def. Underwriters	Baseline	≤ 3	≤ 2	≤ 1

Note: The first column reproduces the baseline specification (the rightmost column of Table 3). The other columns estimate the same regression using a subset of the sample. Columns 2-4 restrict te sample to bonds in defaulters where the defaulting bond(s) had fewer and fewer underwriters (from a max of 3 to a max of 1). The outcome variable is the change in a non-defaulting bond's price ($\Delta \ln P_{ie}$). The explanatory variables are: the change in the defaulting bond's price ($\Delta \ln P_{e}^{D}$), an indicator for sharing the defaulting bond's underwriter (1[Shared]$_{ie}$), and the interaction of these two variables. Price changes are measured as the difference in log prices between the current month and the previous month. The coefficient on the shared underwriter indicator is scaled by 100 so that its units correspond to log points. The defaulting bond's price change is demeaned prior to regression. Standard errors are two-way clustered by time (year-month) and bond. Statistical significance: 0.1*, 0.05**, 0.01***.

In terms of financial loss-based contagion, if having more underwriters involved corresponds to a wealth effect that is distributed over more bondholders, one would expect the same empirical result. Therefore, this pattern could be rationalized by either monitor reputation or financial loss-based contagion.

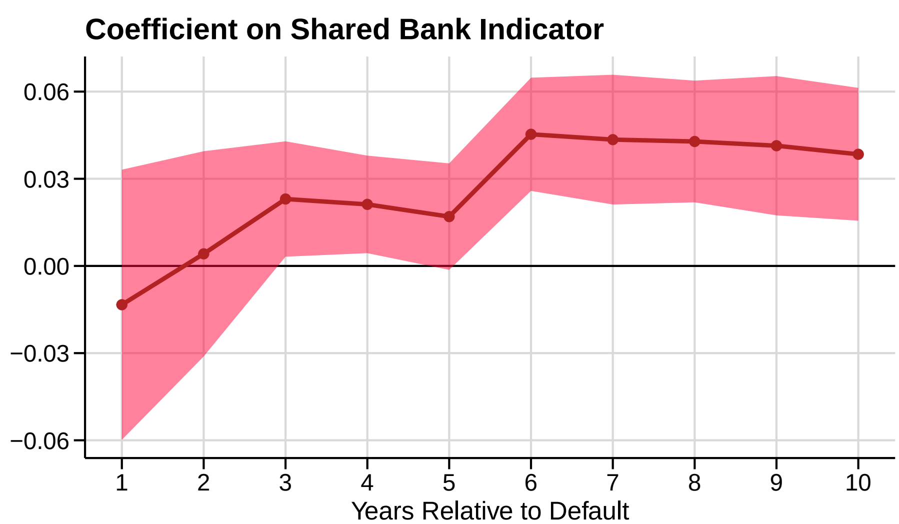
5.2 Mechanism: Monitor Reputation versus Shared Risk Exposures

I next consider another alternative mechanism: shared risk exposure among bonds sharing the same underwriter. This could arise if bonds sharing an underwriter tend to have similar characteristics and thus load similarly on global risk factors. Section 4.4 shows that bonds are generally balanced along a large set of observable characteristics, suggesting such a scenario is unlikely. Additionally, country-year fixed effects account for this to the extent it occurs at the borrower/sovereign level. This section provides further evidence in line with monitor reputation driving the contagion that I document.

Default in the Long-Run. I first examine whether default on one bond is predictive of future default for other bonds sharing its underwriter. If so, this would be consistent with default truly being an informative signal that rational investors would incorporate into prices. To test this, I use local projections estimation. The specification mirrors Equation (1), with the covariates interacted with a years-since-default indicator. The outcome variable is an indicator for whether a default has occurred by a given time horizon. The regression estimates the difference in the chances that a non-defaulting bond enters default in the future as a function of whether it shares the (original) defaulter's underwriter.

Figure 6 plots the coefficients on the shared underwriter indicator for different time horizons. Within the first two years of the original default, there is not an economically or statistically significant difference in the likelihood of bonds sharing the defaulter's underwriter entering default. However, in the long-run default is more likely. Within 10 years, there is a 4-5% higher rate of default among bonds that share the original defaulter's underwriter.

Figure 6: Difference in Default Rates when Sharing a Defaulter's Underwriter



Note: This figure plots regression coefficients (and their 95% confidence intervals) for local projections estimates regressing default on sharing a defaulter's underwriter. Specifically, the coefficients describe how the probability of a non-defaulting bond entering default in the future varies with whether the non-defaulting bond shared the defaulter's underwriter in a default occurring at time 0. The specification has the same clustering and fixed effects and at the rightmost column in the main analysis (Table 3). The outcome variable is the probability of default on or before the time specified on the x-axis; it reflects the cumulative probability of default.

If contagion at the time of default was driven by shared exposure to risk factors changing during this period, we would expect to instead see elevated default risk within the first year or two of the original default, rather than elevated long-run risk. This is evidence against there being an acute unobserved shock causally increasing default risk among bonds sharing the defaulter's underwriter. Instead, this evidence is consistent with contagion due to investors rationally learning about future (long-run) default risk.

Learning about Specific Underwriters or the Class of Low-Reputation Underwriters. Is default a signal specifically about the underwriter involved or about "risky" underwriters more broadly? To test this, I modify the baseline regression to include an indicator for whether the *non-defaulting* bond's underwriter(s) were associated with a default in the past two years (excluding the current default). I also interact this indicator with the defaulting bond's price change. This enables a "horse race" that compares whether sharing an underwriter or simply having a low-reputation underwriter drives contagion.

Table 12 gives the estimation results. The coefficient on the uninteracted recent default indicator is positive; the bonds of low-reputation underwriters tend to rise an additional 0.54% in price during defaults. This positive effect could arise if global financial conditions are an important driver of default and avoiding default is an especially positive signal for bonds underwritten by underwriters with a worse track record. The coefficient describing average contagion (the shared bank indicator) remains similar (at -1.22%) to its baseline estimate. The interacted coefficient is positive and small, indicating that bonds associated with a recent default experience 7.4% ($= 2.5\% + 4.9\%$) pass-through of the defaulting bond's price decrease. The coefficient on the shared underwriter interaction remains nearly unchanged (25% versus 24%).

These results suggest that investors may also learn from default about the risk of bonds with "worse" underwriters. However, it also indicates this is not the mechanism behind the contagion between bonds sharing an underwriter. Rather, contagion within an underwriter's bonds appears to be driven by learning about that underwriter specifically.

These patterns are also at odds with the original contagion estimates being driven by low reputation underwriters' bonds being more sensitive to the global financial cycle. If this was the case, we would expect the original interaction term's coefficient to significantly decrease after adding the interaction with the recent default indicator.

5.3 Do Reputable Monitors Reduce Contagion?

The main results show that monitor reputation can be a quantitatively significant source of contagion. Given the importance of this channel of contagion, it is important for policymakers to understand what mitigates it. To shed light on this, I examine how the size of contagion varies with the reputation of the defaulter's underwriter.

The model discussed in Section 4.1 implies a non-monotonic relationship between initial reputation and the size of contagion if investors update their beliefs using Bayes' rule. Specifically, there is a U-shaped relationship between the price change following default and initial reputation. Figure 7 illustrates this relationship. This result is formalized in Proposition 2 in Appendix B.

At lower levels of reputation, a higher reputation leads to *more* contagion. The most severe contagion occurs for an intermediate value of reputation. At higher levels of reputation, contagion decreases with reputation. Intuitively, this is because there is the least learning when investors already have strong priors. If investors are confident that the underwriter is a bad (or good) monitor, news about default does not cause a large revision in beliefs. In contrast, when investors are more uncertain about the underwriter's type, default leads to larger revisions in beliefs.

Table 12: Heterogeneity by *Non-Defaulting* Bond's Underwriters' Recent Default Record

	(1)	(2)
$\Delta\ln(P^D_{ie})$	0.042***	0.025*
	(0.014)	(0.013)
$1[\text{Shared}_{ie}]$	-1.284***	-1.223***
	(0.441)	(0.440)
$1[\text{Shared}_{ie}] \times \Delta\ln(P^D_{ie})$	0.252***	0.235***
	(0.078)	(0.079)
$1[\text{Recent Def.}_{ie}]$		0.544**
		(0.266)
$1[\text{Recent Def.}_{ie}] \times \Delta\ln(P^D_{ie})$		0.049**
		(0.023)
Obs.	21921	21921
R2	0.386	0.388
Country x Def. Country FE	✓	✓
Country x Year FE	✓	✓
Bond FE	✓	✓

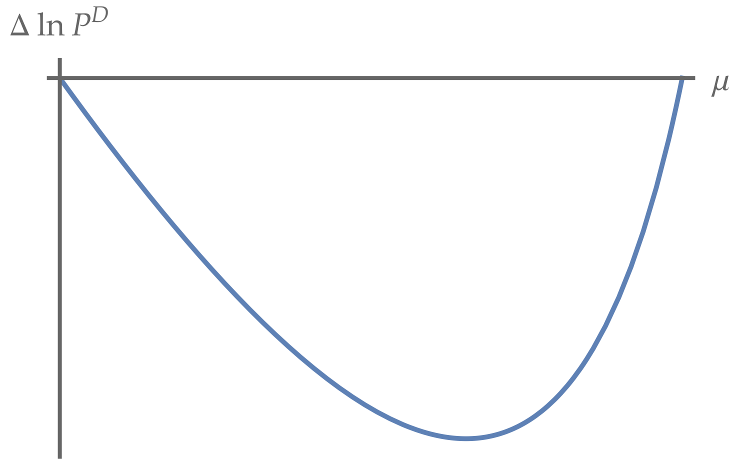
Note: This table adds two regressors: an indicator for whether any of a non-defaulting bond's underwriter(s) were associated with a default in the past two years years (excluding the current default, if applicable) and its interaction with the defaulting bond's price change. The outcome variable is the change in a non-defaulting bond's price ($\Delta\ln P_{ie}$). The explanatory variables are: the change in the defaulting bond's price ($\Delta\ln P^D_e$), an indicator for sharing the defaulting bond's underwriter ($1[\text{Shared}]_{ie}$), and the interaction of these two variables. Price changes are measured as the difference in log prices between the current month and the previous month. The coefficient on the shared underwriter indicator is scaled by 100 so that its units correspond to log points. The defaulting bond's price change is demeaned prior to regression. Standard errors are two-way clustered by time (year-month) and bond. Statistical significance: 0.1*, 0.05**, 0.01***.

This suggests that a paradox can arise if monitor reputation tends to be in the leftmost region. Reputable underwriters may be more able (and motivated) to prevent a default. However, when default occurs, contagion can be more severe because it is more *surprising*. Trust in our financial institutions can make us more vulnerable to contagion when they fail. In this scenario, more potent contagion would be a cost to policies that incentivize reputation building.

Alternatively, if monitor reputation tends to primarily be in the rightmost region, higher reputation can enhance financial stability. In this region, as monitors become more reputable, contagion decreases. There, investors are sufficiently confident in monitors so that default does little to change their beliefs and contagion is limited. In this scenario, policies that incentivize reputation building would be more desirable, as they have the added benefit of reducing the size of contagion.

Motivated by these implications, I explore how the size of contagion varies with the initial reputation of the defaulter's underwriter. I proxy for initial reputation using the number of defaults

Figure 7: Effect of Initial Reputation on Price Response



Note: The figure depicts an example of the U-shaped relationship between the price response ($\Delta \ln P^D$) and initial reputation (μ). The example is generated using $\alpha = 0.75$ and $\delta = 0.15$ (definitions for these parameters is given in Appendix A).

over the past two years associated with that underwriter.[28] I then conduct a subgroup analysis, splitting the sample based on whether the defaulter's underwriter had many or few recent defaults (low and high reputation, respectively). Figure 8 displays the estimated coefficient on the shared underwriter indicator.

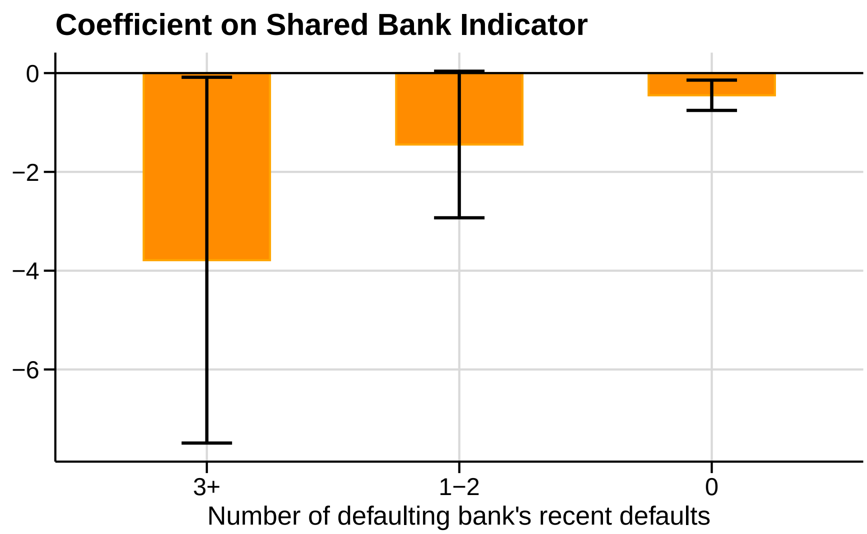
I find contagion decreases as underwriter reputation improves. This is consistent with early sovereign bond underwriters having sufficient reputation be on the rightmost side of Figure 7. Contagion is on average 4% when the defaulter's underwriter had three or more recent defaults. It is around 1% when the defaulter's underwriter had 1–2 recent defaults. It is smallest, around 0.5%, when the defaulter's underwriter had no recent defaults. This suggests that monitor reputation was stability enhancing, rather than destabilizing, in this setting. One reason we may not find monitors on the leftmost side of the Figure 7 is because such low reputation monitors may be unable to underwrite bonds in equilibrium, as investors may be unwilling to purchase their bonds.

These findings relate to those of de Jong et al. (2022), which shows in another historical setting that reputation concerns can make underwriters more disciplined, reducing misrepresentation of financial risks and issuing less fragile securities. Their findings suggest another channel through which reputation can enhance financial stability.

An important direction for future research is to both theoretically and empirically investigate how to best mitigate financial stability risks associated with monitor reputation. The dominant policy framework for limiting contagion, macroprudential policy, focuses on curtailing financial contagion (i.e., spread via financial losses). However, intangible assets like monitor reputation, can also also be an important source of informational contagion (i.e., spread via changes in be-

[28] I exclude the current default. In the case of multiple underwriters, I take the maximum number of defaults associated with its underwriters.

Figure 8: Heterogeneity by *Defaulting* Underwriter's Recent Defaults



Note: This figure plots regression coefficients (and their 95% confidence intervals) regressions run on subsamples of the main analysis sample. The sample is partitioned based on the defaulting underwriter's recent number of defaults (number of other defaults in the past two years). The number of recent defaults is a proxy for the reputation of the underwriter. The graph can be read from left to right as describing how the effect of sharing a defaulter's underwriter changes as reputation improves. The specification has the same clustering and fixed effects and at the rightmost column in the main analysis (Table 3). The outcome variable is the log price change relative to period -1, therefore the graph describes the cumulative price change.

liefs). It would valuable to explore whether the same macroprudential tools mitigate reputation-based contagion. And are there other tools that are more effective at mitigating contagion from monitor reputation? One possible avenue would be policies that incentivize reputation building. Empirically and theoretically studying policies that affect incentives to build reputation (or other alternatives to standard macroprudential tools) could identifying new ways to improve financial stability.

6 Conclusion

Financial institutions play an important role in facilitating access to financing, not only by lending but also by acting as a monitor of issuers. Having a reputable monitor can be an important determinant of investor willingness to provide financing. In this sense, financial institutions do not only lend financial capital but can also "lend" their reputation. However, default can be a powerful signal to investors, not only about the issuer, but also about its monitor.

Contagion can arise when default damages the reputation of a monitor. Non-defaulting securities sharing the monitor of a defaulter can fall in price after investors learn about default. The existing literature on contagion focuses on the role of financial losses in transmitting contagion through shared intermediaries. However, this paper shows that *intangible* assets like reputation for monitoring can also be a quantitatively significant source of contagion. Additionally, the findings highlight the importance of monitors to financial market participants.

In its historical context, the results also indicate the underwriters were an important party and, ultimatley, important source of contagion in early sovereign bond markets. The new data collected for this paper could be used for further research on early soveriegn bond markets.

Importantly, the economics of this historical setting are not unique to this period. Many modern financial institutions have monitoring responsibilities. These include credit rating agencies and institutions that tend to both monitor and lend (such as VCs, underwriters, and lead lenders in syndicates). Because monitoring, both historically and in modern times, can be difficult for investors to directly observe, investors can learn about monitoring through default. Hence, reputation-based contagion could arise in modern settings. Applying the same empirical strategy in a modern setting would be difficult, as it would be harder to separate the influence of reputation versus financial loss-based contagion.

Nonetheless, a useful direction for future research would be to study this channel of contagion in modern settings. For example, did the fire sale of AAA-rated securities break trust in credit rating agencies during the financial crisis, deepening price declines across asset classes? Does learning about a major fraud at a start-up damage the reputation of its VC, limiting funding access to other firms in its portfolio? Does learning that banks made bad investments depress the price of their other investments through reputation damage (in addition to financial losses)?

Another potentially important avenue for future research is to study how to dampen the financial stability risks associated with monitor reputation. Existing regulatory frameworks (namely, macroprudential plicies) are designed with financial loss-based contagion in mind. Policies like leverage and liquidity rules may not incentivize reputation building, as intangible assets like reputation are difficult to measure. Moreover, theoretically it is not obvious how much reputation is optimal. Too-reputable monitors may be tempted to slack if there is limited scope to improve their reputation. Alternatively, improving reputation from an intermediate level can make contagion more severe if investors are more surprised by defaults. It would be useful for theoretical work to study optimal policy in the presence of contagion via monitor reputation. This line of inquiry could identify new tools for improving financial stability.

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Bad News Bankers: Evidence from Pre-1914 Sovereign Debt Markets on Monitor Reputation and Contagion
Online Appendix

Sasha Indarte

Contents

A Model of Monitor Reputation

This section presents a stylized dynamic game between an underwriter and investors with incomplete and imperfect information. The underwriter underwrites a bond issued by a risky sovereign that investors choose whether to purchase. The model predicts that asset price contagion can arise through damage to the underwriter's reputation for monitoring a sovereign borrower. The game is presented below, then comparative statics on reputation formation are discussed.

Setting. An underwriter encounters a sequence of potential investors. Each period t, the underwriter brings to market a new sovereign bond issue and connects with a potential investor. At the beginning of the stage, the investor chooses whether to buy the bond. If not buying, no further actions occur. If buying, the investor faces a risk of not being repaid (in the event the sovereign defaults).

The bond costs $Q > 0$. If the bond is issued, the underwriter receives a payment λQ where $\lambda \in (0, 1)$. If the sovereign does not default, the investor receives $R > Q$ at the end of the period. For simplicity, I assume that Q, λ, and R are exogenous.

Default. Default can occur if the sovereign encounters an economic crisis, which happens with probability $\delta \in (0, 1)$. After issuing a bond, the underwriter privately observes the state of the sovereign's economy, which is summarized by $\kappa_t \in \{\kappa_C, \kappa_{NC}\}$ (crisis and no crisis, respectively). Conditional on this information, the underwriter chooses to either fight ($a_t = F$) or allow the crisis to proceed ($a_t = A$).[29] A crisis causes a default with probability one if the underwriter does not fight. But if the underwriter fights, it prevents the crisis from turning into a default with probability $\alpha \in (0, 1)$. Fighting entails a cost $\phi \geq 0$, while allowing the crisis to proceed is costless.

The underwriter has one of two types—a "good" type with a low cost of fighting ($\phi^G \geq 0$) or a "bad" type with a high cost of fighting ($\phi^B > \phi^G$). The underwriter's type is private information.

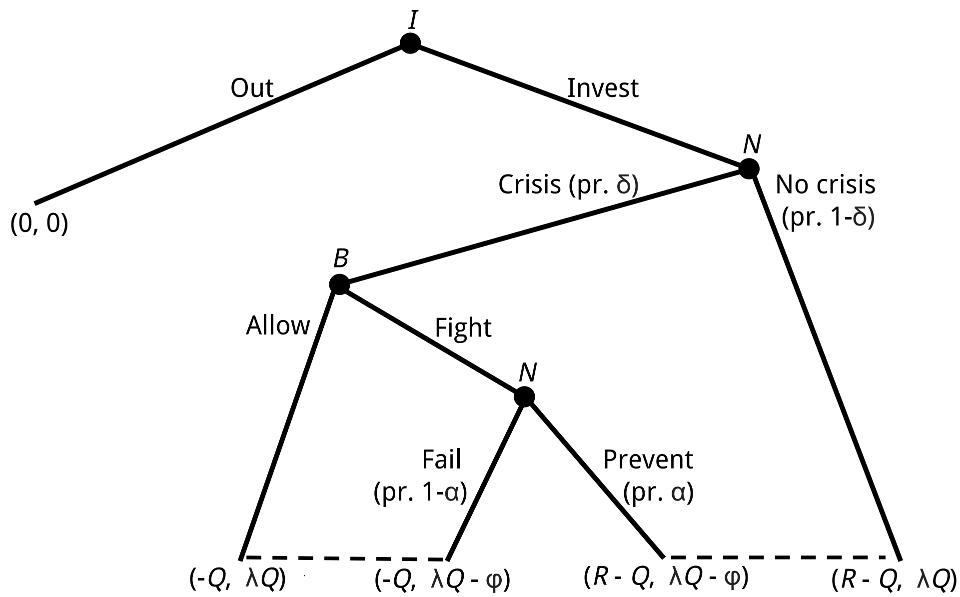
Stage Payoffs. The underwriter's payoffs in each stage depend on whether the investor buys the bond and whether the underwriter fights a crisis. The underwriter receives zero if the investor does not buy the bond. If the underwriter issues the bond and does not fight a crisis, it receives λQ. If it issues the bond and does fight a crisis, it receives $\lambda Q - \phi$. The payoff to an investor depends on whether the investor buys the bond and whether default occurs. If not buying the bond, the investor's payoff is zero. If buying the bond, the investors receives on net $R - Q$ if the sovereign does not default and $-Q$ if the sovereign defaults. Figure A.1 shows the stage game.

Public Information. Let $s_t \in \{D, H\}$ denote whether or not the sovereign defaults or honors its debt (respectively) in period t. Investors observe the entire history of defaults and can infer that a crisis occurred in t if $s_t = D$. But when $s_t = H$, it could be either that the underwriter prevented a default or that there was no crisis. The public outcome s_t does not reveal the action $a \in \{F, A\}$ chosen by the underwriter. Let $s^t = \{s_t, s^{t-1}\}$ denote the public history. When default occurs the investor does not know whether the investor (unsuccessfully) fought the crisis or if the underwriter allowed it to proceed. Similarly, if repayment occurs, the investor does not know if the underwriter fought a crisis or if there was no crisis.

Player Objectives. The underwriter is a dynamic player and seeks to maximize the expected NPV of stage payoffs (discounted with a discount factor $\beta \in (0, 1)$). Each investor is a short-run

[29]The underwriter takes no action in when $\kappa_t = \kappa_{NC}$.

Figure A.1: Stage Game



Note: Above, I, N, and B identify actions taken by the investor, nature, and the underwriter (respectively). The dashed lines indicate the investor's information sets. Nothing is learned if the investor chooses not to participate.

player that seeks to maximize the expected payoff from a one-shot encounter with the underwriter.

Equilibrium Behavior. Suppose that the following are true:

$$(1 - \delta + \delta\alpha)R - Q > 0 \tag{2}$$

$$(1 - \delta)R - Q < 0. \tag{3}$$

The first equation is the investor's expected payoff if the underwriter fights a crisis. The second equation is the investor's expected payoff if the underwriter does not fight a crisis. These inequalities imply that the investor would invest if they believe with probability one that the underwriter would fight a crisis and they would not invest if they knew with probability one that the underwriter would not fight.

The underwriter will fight a crisis if the expected payoff from fighting is greater than the expected payoff from not fighting. The payoff is only positive if the investor will still be willing to invest in the future. The possibility of future bond issuances is what gives the underwriter an incentive to fight.

Evolution of Beliefs Let $\mu(s^{t-1})$ denote the common belief among investors that the underwriter will fight, given history s^{t-1}. Investment will cease if

$$\mu < \frac{Q/R - (1 - \delta)}{\alpha\delta} \equiv \mu^*,$$

that is, if investors are sufficiently skeptical that the underwriter will fight.[30]

[30] Note that (2) and (3) imply $\mu^* \in (0, 1)$.

In any sequential equilibrium, in order for investor beliefs to be consistent they must obey Bayes' rule on path. This means that beliefs are updated in the following manner upon observing either a default or repayment:

$$\mu_{t+1}(D, \mu_t) = \frac{(1-\alpha)\mu_t}{(1-\alpha)\mu_t + (1-\mu_t)}$$
$$\mu_{t+1}(H, \mu_t) = \frac{(1-\delta+\delta\alpha)\mu_t}{1-\delta+\alpha\delta\mu_t}$$

Notice that $\mu_{t+1}(H, \mu_t) > \mu_t > \mu_{t+1}(D, \mu_t)$, meaning that avoiding default improves the underwriter's reputation. Absent uncertainty about the underwriter's payoffs, there still exists a reputational motive due to the imperfect observations of the underwriter's actions. The underwriter has an incentive to keep $\mu_t > \mu^*$ in order to avoid the risk of permanently losing the trust of investors.

Now, for simplicity, suppose that investors believe the underwriter may be one of two types. The underwriter may be either a "good" or "bad" type. A good underwriter always chooses to fight while an bad underwriter always allows the crisis to proceed.[31] Since the ultimate interest of this paper is the behavior of secondary market bond prices, I focus on how investors update their beliefs in response to default. To simplify doing so I abstract away from making explicit assumptions about the structure of the underwriter's payoffs and refrain from deriving their best responses for any particular structure.[32]

Using the consistency property of any sequential equilibrium with these beliefs, we can derive several comparative statics to see how the structure of the game influences reputation formation. First, note that $\mu_{t+1}(D, \mu_t) = \frac{(1-\alpha)\mu_t}{(1-\alpha)\mu_t+(1-\mu_t)}$ does not depend on δ. Default has the same effect on reputation regardless of the likelihood of a crisis. This may seem surprising, but this follows from assuming that the likelihood of a crisis is unrelated to the underwriter's type. Conditional on witnessing default, only the investor's prior beliefs and the effectiveness of fighting in preventing default (α) are useful for updating beliefs.

Taking derivatives of $\mu_{t+1}(D, \mu_t)$ we can also see

$$\frac{\partial \mu_{t+1}(D, \mu_t)}{\partial \mu_t} = \frac{1-\alpha}{(1-\alpha\mu_t)^2} > 0$$
$$\frac{\partial \mu_{t+1}(D, \mu_t)}{\partial \alpha} = \frac{-(1-\mu_t)\mu_t}{(1-\alpha\mu_t)^2} < 0.$$

Reputation is less harmed by default when investors already have a strong prior that the underwriter was the good type. Once an underwriter has secured a good reputation, default does less damage to reputation. Default also harms reputation less when α is lower. Intuitively, when it is harder to prevent a crisis, an underwriter is punished less when a default occurs.

Next, consider $\mu_{t+1}(H, \mu_t) = \frac{(1-\delta+\delta\alpha)\mu_t}{1-\delta+\alpha\delta\mu_t}$. In contrast, the likelihood of a crisis, δ, is relevant here. Intuitively this is because the ability of the underwriter to prevent a crisis, α, and thus

[31] Note this game admits sequential equilibria with mixed strategies. We could instead assume good underwriters play F with a probability on average greater than μ^* and opportunistic underwriters play it on average with a probability less than μ^*. What is relevant for this analysis is that there is adverse selection—investors stop investing once confident enough that the underwriter is opportunistic.

[32] Note that characterizing a sequential equilibrium in these types of dynamic games featuring reputation is in general an unresolved problem in a discrete-time setting. This is however feasible in continuous-time environments as shown in Faingold and Sannikov (2011). For ease of exposition, I consider a sequential equilibrium that is analogous to what one could derive in a continuous time game as my main focus is on describing a channel of contagion between bonds.

the probabilistic benefit of investing with the good type is proportional to δ. Derivatives of the posterior are given below:

$$\frac{\partial \mu_{t+1}(H,\mu_t)}{\partial \mu_t} = \frac{(1-\delta)[1-\delta(1-\alpha)]}{[1-\mu_t(1-\alpha\delta)]^2} > 0$$
$$\frac{\partial \mu_{t+1}(H,\mu_t)}{\partial \alpha} = \frac{\mu_t\delta(1-\delta)(1-\mu_t)}{[1-\delta(1-\alpha\mu_t)]^2} > 0$$
$$\frac{\partial \mu_{t+1}(H,\mu_t)}{\partial \delta} = \frac{\alpha(1-\mu_t)\mu_t}{[1-\delta(1-\alpha\mu_t)]^2} > 0$$

As before, a higher initial reputation μ_t leads to a higher updated reputation. In contrast, now an improved ability to thwart default (higher α) leads to greater reputational benefits when debt is honored, which may appear counterintuitive. The reason for this relationship is that when α is low, the investor finds it less likely that default was avoided due to an underwriter choosing to fight. Knowing we avoided default is a less powerful signal when it more rarely means that a good underwriter prevented a crisis. Thus, a lower α corresponds to a smaller reputational gain. Another important difference is that the probability of a debt crisis does affect the reputational gain to avoiding default. When a crisis is more likely (higher δ), the underwriter gains more in terms of reputation when default is avoided.

Asset Price Implications. The data analyzed in this paper (discussed in detail in the following section) are secondary market prices for bonds. The price Q in the previous model corresponds to a primary market or IPO price and λQ is a proportional finders fee garnered by the underwriter for intermediating the transaction. We can extrapolate from the above results on belief formation to consider how prices in a secondary market for bonds are affected by another bond's default.

For ease of exposition, consider a perpetuity (infinite maturity) bond $i \in I(b)$ where $b \in B$ is an underwriter and $I(b)$ is the set of bonds issued by underwriter b. Denote the price at time t as $p_{i,t}$ and coupon payments as $c_{i,t}$. Modifying our earlier notation, let $\mu_t(b)$ denote the investors' belief that underwriter b would attempt to prevent default should a crisis arise. When the bond defaults, the sovereign fails to make a coupon payment ($c_{i,t} = 0$), otherwise $c_{i,t} = c_i$. With no arbitrage we can write the secondary market price of the bond as below

$$\begin{aligned} p_{i,t}[\mu_t(b)] &= \mathbb{E}_{\mu_{t(b)}}[c_{i,t} + \beta p_{i,t+1}] \\ &= \mathbb{E}_{\mu_t(b)}\left[\frac{c_{i,t}}{1-\beta}\right] \\ &= \frac{c_i[(1-\delta)+\delta\alpha\mu_t(b)]}{1-\beta}. \end{aligned}$$

The second equality follows from a no-bubble condition $\lim_{j\to\infty}\mathbb{E}_{\mu_t(b)}\beta^j p_{t+j} = 0$ and the law of iterated expectations.

Let $\Delta \ln p_{i,t} = p_{i,t+1}[\mu_{t+1}(b)] - p_{i,t}[\mu_t(b)]$. Next, we can characterize how a *change* in beliefs about the likelihood of the underwriter fighting a crisis affects the bond's price:

$$\Delta \ln p_{i,t} = \ln\left[\frac{(1-\delta)+\delta\alpha\mu_{t+1}(b)}{(1-\delta)+\delta\alpha\mu_t(b)}\right].$$

Using the above expression, we can also see how heterogeneity in the chances of crises, the underwriter's ability to prevent a crisis from turning into default, and can affect pass-through. A given change in beliefs $(\mu_{t+1}(b) - \mu_t(b))$ has a smaller effect on prices when $\mu_t(b)$ is larger. When investors are more optimistic that the underwriter is good, the price does not fall as much after a downward revision of beliefs. Additionally, when the ability of the underwriter to thwart default, α, is greater, reputation changes have a stronger effect on bond prices. Lastly, a greater risk of a crisis δ increases the impact of reputation.

Contagion between bonds $i, j \in I(b)$ occurs when i defaults and investors become more skeptical about the willingness of underwriter b to prevent default. Because underwriter b faces the same incentives to prevent the default of either i or j, the default of i is informative about the likelihood of j defaulting. Therefore, the price drop of i is partially passed onto bond j as well.

B Comparative Statics and Proofs

This section presents proofs for the theoretical results discussed in the paper. The following results are proved for the model of Appendix A (or extensions of this model, formulated here).

B.1 Effect of Fighting Ability α on Price Response

Proposition 1 (Fighting Ability Comparative Static). *Denote the price change following default by*

$$\Delta \ln P^D \equiv \ln \left[\frac{(1-\delta) + \delta\alpha\mu'}{(1-\delta) + \delta\alpha\mu} \right]$$

where $\mu' = \frac{(1-\alpha)\mu}{(1-\alpha)\mu + (1-\mu)}$. *If* $\alpha, \delta \in (0,1)$ *and* $\mu \in [0,1]$, *then*

$$\frac{\partial \Delta \ln P^D}{\partial \alpha} < 0.$$

Proof. The derivative is

$$\frac{\partial \Delta \ln P^D}{\partial \alpha} = -\frac{\alpha\delta\mu(1-\mu)[2(1-\alpha\mu)(1-\delta) + \alpha\mu]}{(1-\delta)[(1-\delta)(1-\alpha\mu) + \delta\alpha(1-\alpha)\mu]}$$

Given $\alpha, \delta \in (0,1)$ and $\mu \in [0,1]$ the denominator is positive as

$$(1-\delta)(1-\alpha\mu) > 0,$$
$$\delta\alpha(1-\alpha)\mu > 0.$$

Note also $2(1-\alpha\mu)(1-\delta)$ is positive, as are the additional terms in the fraction. □

B.2 Effect of Initial Reputation μ on Price Response

The proposition below characterizes the effect of initial reputation (μ) on the price change induced by default. The relationship is generally U-shaped. At low levels of reputation, a better reputation means a bigger price decrease following default. The effect size bottoms out at some $\mu^\star \in (0,1)$; for higher levels of reputation, the price change begins to shrink as reputation improves (μ rises).

Proposition 2 (Initial Reputation Comparative Static). *Denote the price change following default by*

$$\Delta \ln P^D \equiv \ln \left[\frac{(1-\delta) + \delta\alpha\mu'}{(1-\delta) + \delta\alpha\mu} \right]$$

where $\mu' = \frac{(1-\alpha)\mu}{(1-\alpha)\mu+(1-\mu)}$. *If* $\alpha, \delta \in (0,1)$, *then there exists a unique* $\mu^\star \in (0,1)$ *such that*

$$\frac{\partial \Delta \ln P^D}{\partial \mu} < 0 \quad \textit{for all } \mu \in [0, \mu^\star)$$
$$\frac{\partial \Delta \ln P^D}{\partial \mu} = 0 \quad \textit{for } \mu = \mu^\star$$
$$\frac{\partial \Delta \ln P^D}{\partial \mu} > 0 \quad \textit{for all } \mu \in (\mu^\star, 1].$$

The proof below proceeds in multiple steps in order to consider several cases.

Proof. First, note that the derivative of the price change with respect to initial reputation μ is:

$$\frac{\partial \Delta \ln P^D}{\partial \mu} = \alpha \left[\frac{1}{1-\alpha\mu} - \frac{\delta}{1-\delta+\alpha\delta\mu} - \frac{1-(2-\alpha)\delta}{(1-\delta)(1-\alpha\mu)+\delta\alpha(1-\alpha)\mu} \right].$$

For $\alpha, \delta \in (0,1)$ and $\mu \in [0,1]$, all three denominator terms above are strictly positive. Therefore the derivative $\frac{\partial \Delta \ln P^D}{\partial \mu}$ defined everywhere on these intervals. Because the $\Delta \ln P^D$ is differentiable everywhere on $\mu \in [0,1]$ it is continuous in μ on that interval.

At the beginning of the interval ($\mu = 0$) the derivative is decreasing in μ while at the end of the interval ($\mu = 1$) it is increasing in μ. That is,

$$\left.\frac{\partial \Delta \ln P^D}{\partial \mu}\right|_{\mu=0} = -\frac{\alpha^2\delta}{1-\delta} < 0$$
$$\left.\frac{\partial \Delta \ln P^D}{\partial \mu}\right|_{\mu=1} = \frac{\alpha^2\delta}{(1-\alpha)[1-(1-\alpha)\delta]} > 0.$$

Given the above and the continuity of $\Delta \ln P^D$, if there is a unique μ that solves $\frac{\partial \Delta \ln P^D}{\partial \mu} = 0$ then the derivative $\frac{\partial \Delta \ln P^D}{\partial \mu}$ is strictly decreasing for $\mu \in [0, \mu^\star)$ and strictly increasing for $\mu \in (\mu^\star, 1]$. To see that there is such a unique $\mu^\star$, we must consider the two cases below.

Case 1: $\alpha \neq 2 - 1/\delta$**.** In this case, there are two solutions to $\frac{\partial \Delta \ln P^D}{\partial \mu} = 0$:

$$\mu^- \equiv \frac{1-\delta-\sqrt{(1-\alpha)(1-\delta)(1-\delta+\alpha\delta)}}{\alpha[1-\delta(2-\alpha)]}$$
$$\mu^+ \equiv \frac{1-\delta+\sqrt{(1-\alpha)(1-\delta)(1-\delta+\alpha\delta)}}{\alpha[1-\delta(2-\alpha)]}$$

However, for $\alpha, \delta \in (0,1)$, only μ^- lies on the interval $[0,1]$ while μ^+ lies strictly outside of this interval. Thus in this case there is a unique $\mu^\star \in [0,1]$ such that $\frac{\partial \Delta \ln P^D}{\partial \mu} = 0$ for $\mu = \mu^\star$.

Case 2: $\alpha = 2 - 1/\delta$**.** In this case, the derivative is:

$$\frac{\partial \Delta \ln P^D}{\partial \mu} = -\frac{(1-2\delta)^2(1-2\mu)}{(1-\delta-\mu+2\delta\mu)(\delta+\mu-2\delta\mu)}. \tag{4}$$

Both denominator terms are nonzero. To see that the first is, assume for the sake of contradiction that $1 - \delta - \mu + 2\delta\mu = 0$, which rearranges to yield $\delta = \frac{1-\mu}{1-2\mu}$. But since $\mu \in [0, 1]$, this would imply $\delta \geq 1$, contradicting $\delta < 1$. The second term, $\delta + \mu - 2\delta\mu$ is nonzero for $\delta \in (0, 1)$ and $\mu \in [0, 1]$.

For $\delta \neq \frac{1}{2}$, the unique solution to Equation (4) is $\mu = \frac{1}{2}$. We do not need to consider the case $\delta = \frac{1}{2}$ because this case is ruled out by the assumption $\alpha = 2 - 1/\delta$. To see this, note that $\alpha < 1$ and $\alpha = 2 - 1/\delta$ imply $\frac{1}{2} > \delta$. Therefore in Case 2 there is a unique $\mu^\star = \frac{1}{2}$ such that $\frac{\partial \Delta \ln P^D}{\partial \mu} = 0$. $\square$

C Additional Tables and Figures

C.1 Effect of Filters on Default Counts

Table C.1: Impact of Sample Restrictions on Number of Defaults

# Defaults	Filter
240	None
224	Keep if default year is during 1869–1914
187	Drop if month of default is unknown
166	Collapse defaults in the same country-month to a single event
118	Drop if defaulting bond(s) not present in IMM in month of default
102	Drop if defaulter's underwriter or price change is missing, or if filtered out of regression due to outlier removal.

Note: This table describes how sample restrictions affect the number of defaults used in the main analysis.

C.2 Additional Regressions

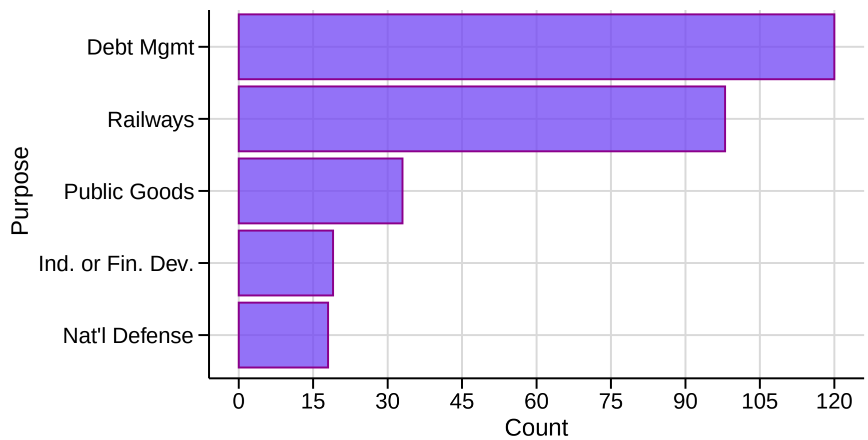
Table C.2: Heterogeneity by Defaulting Bond Total Principal (Interactions)

	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta \ln(P_{ie}^D)$	0.029*	0.046***	0.038***	0.040***	0.041***	0.040***
	(0.015)	(0.012)	(0.013)	(0.014)	(0.014)	(0.014)
$1[\text{Shared}_{ie}]$	-1.100***	-0.997***	-1.169***	-1.142**	-1.317***	-1.451***
	(0.379)	(0.362)	(0.363)	(0.471)	(0.465)	(0.482)
$\ln(\text{Principal}_e)$	-0.225**	-0.110	-0.371**	-0.378**	-0.366**	-0.371**
	(0.106)	(0.133)	(0.161)	(0.165)	(0.142)	(0.143)
$1[\text{Shared}_{ie}] \times \Delta \ln(P_{ie}^D)$	0.234***	0.234***	0.251***	0.253***	0.260***	0.262***
	(0.067)	(0.067)	(0.064)	(0.070)	(0.079)	(0.080)
$1[\text{Shared}_{ie}] \times \ln(\text{Principal}_e)$	0.479	0.408	0.534	0.430	0.465	0.482
	(0.327)	(0.339)	(0.365)	(0.381)	(0.366)	(0.377)
Obs.	21661	21661	21661	21661	21661	21661
R2	0.033	0.056	0.083	0.212	0.377	0.393
Country FE	✓	✓	✓			
Year FE		✓	✓	✓		
Def. Country FE			✓			
Country x Def. Country FE				✓	✓	✓
Country x Year FE					✓	✓
Bond FE						✓

Note: This table adds two regressors: the logged sum of of the defaulting bond's principal and its interaction with the shared underwriter indicator. I exclude defaulting bonds with principal in currency other than the Great British Pound (a small subset of bonds). The logged principal is demeaned and divided by itself standard deviation prior to regression, so its associated coefficients can be interpreted as effect of a one standard deviation change in this measure. The outcome variable is the change in a non-defaulting bond's price ($\Delta \ln P_{ie}$). The explanatory variables are: the change in the defaulting bond's price ($\Delta \ln P_e^D$), an indicator for sharing the defaulting bond's underwriter ($1[\text{Shared}]_{ie}$), and the interaction of these two variables. Price changes are measured as the difference in log prices between the current month and the previous month. The coefficient on the shared underwriter indicator is scaled by 100 so that its units correspond to log points. The defaulting bond's price change is demeaned prior to regression. Standard errors are two-way clustered by time (year-month) and bond. Statistical significance: 0.1*, 0.05**, 0.01***.

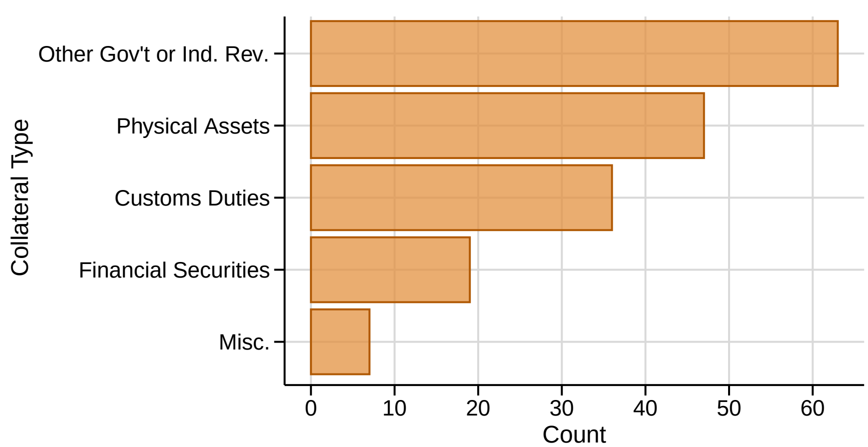
C.3 Bond Characteristics

Figure C.1: Stated Loan Purpose



Note: This figure displays the number of bonds issued for one of five stated purposes. Bonds with multiple stated purposes are counted multiple times. 30.03% of bonds in the analysis sample have a known stated purpose. "Debt Mgmt" is primarily borrowing in order to repay or restructure existing debt. "Railways" is investment in railways. "Public goods" is infrastructure investment, such as development of roads and public utilities infrastructure. "Ind. or Fin. Dev." is investment in domestic industries (financial and non-financial). "Nat'l Defense" is investment in military resources and/or operations.

Figure C.2: Types of Collateral



Note: This figure displays the number of bonds collateralized by one of five types of collateral. Bonds with multiple stated collateral sources are counted multiple times. 14.07% of bonds in the analysis sample have a known collateral type. "Other Gov't or Ind. Rev." is revenue from taxes (often levied on specific industries) or other sources of government revenue. Physical assets include primarily railways, land, and ports.

Table C.3: Number of Bonds by Country

Country	# Bonds	Country	# Bonds
Australia	106	Romania	5
Canada	89	Cuba	4
Argentina	57	New Granada	4
Turkey	49	Peru	4
Britain	39	Trinidad	4
Russia	34	Belgium	3
Brazil	31	British Guiana	3
Chile	24	Honduras	3
Egypt	23	Nigeria	3
New Zealand	23	Sierra Leone	3
South Africa	23	Straits Settlements	3
China	22	Austria	2
Greece	14	Ecuador	2
Mexico	14	El Salvador	2
Japan	13	Germany	2
Natal	13	Ghana	2
India	11	Hong Kong	2
France	10	Ireland	2
Sweden	10	Nicaragua	2
United States	10	Siam	2
Italy	9	St Lucia	2
Mauritius	9	Antigua	1
Spain	9	Barbados	1
Ceylon	8	Bolivia	1
Uruguay	8	Fiji	1
Hungary	7	Finland	1
Norway	7	Grenada	1
Portugal	7	Hawaii	1
Venezuela	7	Liberia	1
Costa Rica	6	Montenegro	1
Denmark	6	Morocco	1
Guatemala	6	Orange Free State	1
Jamaica	6	Persia	1
Bulgaria	5	Santo Domingo	1
Colombia	5	Serbia	1
Paraguay	5	Switzerland	1

Note: This table reports the number of bonds (used in the analysis sample) for each state. There are 72 different states in total.

Table C.4: Number of Bonds by Underwriter (1/3)

Underwriter	# Bonds (full sample)	# Bonds (analysis subsample)
Crown Agents	121	103
Barings	116	102
Bank Of England	96	78
Rothschilds	76	70
London & Westminster	61	60
Glyn Mills & Co AKA Glyn Mills Currie & Co	56	51
Imperial Ottoman Bank	53	48
London & County	53	53
Bank Of Montreal	42	42
Hambros	40	35
Bank Of Ireland	29	26
London Joint Stock Bank	26	23
HSBC	21	21
Murrieta & Co	20	19
Schroders	20	14
Bank Of Adelaide	16	16
Stern Bros	16	15
National Bank Of Australia	15	13
River Plate Trust, Loan And Agency Co.	15	15
JS Morgan AKA JP Morgan	14	12
Thomson & Bonar	14	10
Dent & Palmer AKA Palmer, M'killop, & Dent	13	11
Bank Of New South Wales	12	12
Bank Of South Australia	11	6
Raphael	11	8
Yokohama Specie Bank	11	11
Fruhling & Goschen	10	8
Imperial Treasury Paris	10	9
Spanish Government	10	6
Union Bank Of Australia	10	5
Robarts And Lubbock	9	9
Bischoffsheim & Goldschmidt	8	8
Morton, Rose & Co	8	8
Knowles & Foster	7	6
Lloyds Bank	7	7
Oriental Bank Of New South Wales	7	7
Canadian Bank Of Commerce	6	5
Comptoir National D'escompte	6	5
Louis Cohen And Sons	6	6
Oriental Bank	6	6
Portuguese Financial Agency	6	5
Consolidated Bank	5	5
Deutsche Bank	5	4

Note: This table reports the number of bonds by underwriter. The first count ("full sample") is the full linked IMM-CFB sample. The second count are the bonds used in the main analysis. The difference in counts is due to bonds missing needed to be used the main analysis' regression.

Table C.5: Number of Bonds by Underwriter (2/3)

Underwriter	# Bonds (full sample)	# Bonds (analysis subsample)
Erlanger & Co	5	5
Gibbs	5	3
Queensland National Bank	5	5
Speyer	5	5
City Bank	4	4
Devaux	4	4
London & County Bank	4	3
National Provincial Bank	4	3
Parr's	4	4
Russian Bank	4	4
Bank Of Bc	3	3
Chartered Bank	3	3
Coutts	3	3
Isaac & Samuel	3	2
Matheson & Co.	3	3
Maua, Macgregor & Co.	3	0
Minor C. Keith	3	3
Robinson Fleming	3	3
Anglo Italian Bank	2	1
Bank Of Japan	2	2
Council Of Foreign Bondholders	2	2
General Credit Company Of London	2	2
General Credit And Finance	2	2
Gerstenberg	2	1
Holderness, Nott & Co.	2	1
Hope & Co	2	1
Huth	2	2
Imperial Bank Of Canada	2	2
London & Brazilian Bank	2	2
Martin & Co.	2	2
Mccalmonts	2	2
Messrs Palmer And Goldsmid	2	2
Mires	2	1
Morgan, Grenfell & Co	2	2
Newgass	2	2
Oppenheim	2	2
Seligman	2	2
Societe Generale	2	2
Vienna House Of Eskeles	2	2
Banque De Constantinople	2	2
Credit Mobilier	2	2
Agra & Masterman	1	0
Anglo Egyptian Bank	1	1

Note: This table reports the number of bonds by underwriter. The first count ("full sample") is the full linked IMM-CFB sample. The second count are the bonds used in the main analysis. The difference in counts is due to bonds missing needed to be used the main analysis' regression.

Table C.6: Number of Bonds by Underwriter (3/3)

Underwriter	# Bonds (full sample)	# Bonds (analysis subsample)
Anglo South American Bank	1	1
Bank Of Castile	1	1
Bank Of New Zealand	1	0
Bank Of Spain	1	1
Bank Of Turkey	1	1
Banque Commerciale Et Industrielle	1	1
Boulton	1	1
Brit. Lin. Co. Bank	1	1
Capital & Counties	1	1
Chalmers, Guthrie & Co.	1	1
Clydesdale	1	1
Credit Lyonnais	1	1
Credit Mobilier	1	1
Dresdner Bank	1	1
Ethelburga Syndicate	1	1
Fisk	1	1
Frances George Horne	1	0
Franco-Egyptian Bank	1	1
Gordon Barton	1	1
Haslewood	1	0
Heinemann And Co.	1	1
Heywood, Kennard & Co.	1	0
Hme & Col As	1	1
Hullett	1	0
Ionian Bank	1	1
J. B. Medici	1	1
Lawson & Co.	1	1
London & South-Western Bank	1	1
London Agents	1	1
London Bank Of Mexico & South America	1	1
London Bank Of Mexico And South America	1	1
Lumb, Wanklyn & Co.	1	1
Messrs. Philippson And Horwitz	1	1
Messrs. Schneider And Co.	1	1
Midland Bank Ltd.	1	1
Natal Bank	1	1
National Bank Of Greece	1	1
National Bank Of Scotland	1	1
Ricardo & Co.	1	1
Standard Bank Of South Africa	1	1
Teixeira De Mattos	1	1
Union Bank Of Canada	1	1
Victoria Cham	1	1
Banque Austro Ottomane	1	1

Note: This table reports the number of bonds by underwriter. The first count ("full sample") is the full linked IMM-CFB sample. The second count are the bonds used in the main analysis. The difference in counts is due to bonds missing needed to be used the main analysis' regression.

Table C.7: Number of Defaulting Bonds by Underwriter (1/2)

Underwriter	# Bond-defaults	# Bond ever in default
Barings	47	21
Imperial Ottoman Bank	29	20
River Plate Trust, Loan And Agency Co.	28	12
Murrieta & Co	26	13
Rothschilds	20	15
Robarts And Lubbock	14	4
Hambros	13	6
Morton, Rose & Co	12	5
Glyn Mills & Co AKA Glyn Mills Currie & Co	11	7
Bischoffsheim & Goldschmidt	11	6
Thomson & Bonar	10	5
Dent & Palmer AKA Palmer, M'killop, & Dent	10	6
Knowles & Foster	10	3
JS Morgan AKA JP Morgan	8	5
Stern Bros	7	4
Louis Cohen And Sons	6	5
Council Of Foreign Bondholders	6	2
London & County	5	4
General Credit Company Of London	5	2
Schroders	4	4
Fruhling & Goschen	4	3
Portuguese Financial Agency	4	1
Deutsche Bank	4	1
London & County Bank	4	3
Minor C. Keith	4	2
Robinson Fleming	4	2
Bank Of England	3	2
City Bank	3	1
General Credit And Finance	3	1
Societe Generale	3	2
Heinemann And Co.	3	1
Lumb, Wanklyn & Co.	3	1
Midland Bank Ltd.	3	1
Raphael	2	1
Comptoir National D'escompte	2	2
Erlanger & Co	2	1
Gibbs	2	2
Devaux	2	1
Messrs Palmer And Goldsmid	2	1
Oppenheim	2	1
Vienna House Of Eskeles	2	1
Anglo Egyptian Bank	2	1

Note: This table reports the number of defaulting bonds associated with each underwriter. The first count are the number of bond-defaults (i.e., the number of times any bond ever defaults) and the second is the number of bonds that ever default. All bonds are from the analysis sample.

Table C.8: Number of Defaulting Bonds by Underwriter (2/2)

Underwriter	# Bond-defaults	# Bond ever in default
Anglo South American Bank	2	1
Banque Commerciale Et Industrielle	2	1
Credit Mobilier	2	1
Ethelburga Syndicate	2	1
J. B. Medici	2	1
Messrs. Philippson And Horwitz	2	1
Banque Austro Ottomane	2	1
Spanish Government	1	1
Speyer	1	1
Mires	1	1
Morgan, Grenfell & Co	1	1
Seligman	1	1
Banque De Constantinople	1	1
Credit Mobilier	1	1
Bank Of Turkey	1	1
Capital & Counties	1	1
Dresdner Bank	1	1
Fisk	1	1
Lawson & Co.	1	1
Ricardo & Co.	1	1
Teixeira De Mattos	1	1

Note: This table reports the number of defaulting bonds associated with each underwriter. The first count are the number of bond-defaults (i.e., the number of times any bond ever defaults) and the second is the number of bonds that ever default. All bonds are from the analysis sample.