Feeling the blues

Moral hazard and debt dilution in Eurobonds before 1914

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Abstract

Debt mutualisation through Eurobonds has been proposed as a solution to the Euro crisis. Although this proposal found some support, it also attracted strong criticisms as it risks raising the spreads for strong countries, diluting legacy debt and promoting moral hazard by weak countries. Because Eurobonds are a new addition to the policy toolkit, there are many untested hypotheses in the literature about the counterfactual behaviour of markets and sovereigns. This paper offers some tests of the issues by drawing from the closest historical parallel–five guaranteed bonds issued in Europe between 1833 and 1913. The empirical evidence suggests that contemporary concerns about fiscal transfers and debt dilution may be overblown, whilst creditors' moral hazard may be as much of a problem as debtors'.

JEL Codes: F34, H63, H77, N24, N44

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1. Introduction

The recent debate on the European sovereign debt crisis has attracted different proposals in policy fora. These involve mostly unpopular solutions ranging from structural reforms, stronger federalism and higher inflation targets to debt mutualisation (Eurobonds). Having appeared under different labels and guises, the Eurobonds proposal, in essence, recommends the governments of the EU countries to pool all or a certain portion of their debts together. This would presumably reduce borrowing costs for sovereigns and induce much needed stability to the European sovereign debt market. Although this proposal found some support, it also attracted strong criticisms for its potential negative impacts, particularly the risks of moral hazard and the dilution of current outstanding debt.

Compared to other tried solutions for fiscal crises, such as debt restructuring or default, inflation and devaluation, possibly combined with liquidity assistance and stabilisation plans from multilaterals, there is precious little evidence on the potential effectiveness of the Eurobonds proposal. The bailout and recapitalisation programmes organised since 2010 offer some suggestions of how Eurobonds could fare in the market, particularly after the reduction in mid-2011 of the interest paid by programme countries to close to the effective cost of funding of multilaterals. However, it is questionable whether the relatively short experience with these loans is a good estimate of the consequences of debt mutualisation for the future of European financial stability. The debate has therefore been mainly informed by untested hypotheses about the behaviour of financial markets and sovereigns after the issue of Eurobonds (Claessens 2012).

This paper aims at contributing to this debate by drawing on the history of a set of guaranteed bonds issued by several countries before 1914. Somewhat ironically, these operations started with a Greek loan in 1832, which can arguably be considered the first Eurobond in history. The bonds we study here were issued with the guaranty of other sovereigns, usually a combination of the great powers of the time (Britain, France, Germany and Russia) and were perceived by the market as instances of debt mutualisation, unlike the current European programme bonds (EFSM, EFSM and ESM). Perhaps because of the risks involved, these loans were raised very sparsely and often only after overcoming considerable political opposition within the guarantor countries themselves. After the first Greek loan, there were only four other guaranteed loans issued in our period of study – for Turkey (Ottoman Empire) in 1855, Egypt in 1885, China in 1895, and Greece again in 1898.

In this paper, we use the long historical record of these loans to address three main questions – how the introduction of guaranteed bonds impacted existing creditors, how they were initially received by the markets, and how markets priced guaranteed debt relative to the other financial liabilities of the nations involved.

The first two questions focus on the short-time horizon around the announcement and flotation of guaranteed bonds. By using an original dataset of daily market prices, we investigate the direct dilution of previous claims on the sovereign, which depended on the relative shares of 'blue' (guaranteed) and 'red' (non-guaranteed) bonds, seniority dispositions, possible write-downs of existing debts, liquidity of the new issues, and, when included, the benefits from foreign-imposed conditionality. We also compared the issue yields of guaranteed bonds to the marginal costs of funding of the guarantors.

The second question has to be addressed over longer time horizons. In this part of the paper we quantify the evolution of the spreads of guaranteed bonds relative to other non-guaranteed domestic bonds, and investigate the relation between the yields of guaranteed bonds, their non-guaranteed cousins, and their avuncular guarantors. These spreads are informative of the structural impact of these debt relief operations on the fiscal positions of the recipient nations and should help with addressing the contemporary criticisms about debtor's moral hazard from the issue of Eurobonds.

Our paper also relates to the literature on non-sovereign borrowing and foreign financial intervention in the pre-1914 period. Two of the countries under study here (China and Egypt) were under a status of informal colonial dependency from outside Powers. Nevertheless, we will show that guaranteed bonds of these countries were perceived differently in the market from other colonial issues, in that they were not priced entirely on the fiat of the colonial power. Colonial issues were more than guaranteed by the coloniser, as the latter reserved complete control over colonial finances (Accominotti et al. 2010). A different category of bonds were those issued under the financial (and sometimes political) control of foreign creditors, where the latter controlled the domestic sources of revenue set aside to service the foreign debt (Mitchener and Weidenmier 2010). Two of the case studies in this paper (Egypt in 1885 and Greece in 1898) fall in this category, but differ from it in the sense that foreign creditors not only took control of local finances but provided additional support through guaranteed loans. Foreign control certainly increased the credibility of each sovereign; however it did not *guarantee* any repayments as in guaranteed bonds. Moreover, there was not a perfect overlap between the list of guarantors and the Powers with a say in financial control. For instance, the Greek 1898 bond was guaranteed by France, Britain and Russia and floated simultaneously with the imposition of external control, where not only the guaranteeing powers were represented but also Austria, Germany, and Italy.

The next section describes and compares the current proposals for the issuance of Eurobonds with the corresponding debate in the nineteenth century, emphasising the similarities between the two. Section 3 provides a simple framework to think about the relation between debt dilution and fiscal discipline in terms of their impact on sovereign spreads. Section 4 provides historical detail on the five bonds studied in this paper. Section 5 contains the empirical analysis split into two parts. In a first part we use structural breakpoint methods to identify the short-run impact of the introduction of guaranteed bonds on the previous debt stock. In the second part we investigate the pricing relations between guaranteed and non-guaranteed bonds with the help of factor analysis and dynamic panel VARs. A conclusion follows.

2. The policy debate

2.1 Today: Eurobonds

Although the idea of increased coordination of public debt in Europe had been floated around the introduction of the Euro, it did not get much mileage at the time. The report of the Giovannini Group (2000) was mostly sceptical about the purported benefits. The proposal re-emerged in the very different context of the Euro crisis. Whereas the Giovannini group had concentrated on the long-

term or steady-state costs and benefits, the new debate focused more on stabilising the European market for sovereign debt and the financial system (Brunnermeier et al. 2011, Angeloni and Wolff 2012).

Since September 2008 a half-dozen alternative plans to implement some version of Eurobonds emerged in the literature from academics, trade associations and official organisations. All aim to fulfil a combination of four objectives: manage the current crisis, reinforce financial stability and facilitate the transmission of monetary policy in the Euro area, improve market efficiency, and enhance the international role of the Euro. Despite the commonality of objectives the various plans diverge on several levels, especially on the questions of coverage and guaranties.

The majority of plans recommend that Eurobonds cover only partially the funding requirements of member countries. The exceptions are Dübel (2011) and Beck, Wagner and Uhlig (2011) and Brunnermeier et al. (2011), who propose to swap the entirety of existing debt into two tranches of joint bonds.[1] A related question is whether Eurobonds should be issued only in the primary market or also to swap for existing debt. In the first case, only the marginal cost of funding would be affected for participating countries, whereas in the second the average cost would also fall if yields on Eurobonds were lower, as expected.

The most salient proposals for the partial issue of Eurobonds are the 'blue/red bonds' of Delpla and von Weizsäcker (2010) and the 'safe bonds' of Bofinger et al. (2011). The two have diametrically opposed approaches. Blue bonds, jointly issued would be capped at a fraction of GDP (possibly 60% as in the Maastricht criteria), whereas any excess debt would remain the responsibility of individual countries that continued to issue their own 'red' bonds. Bofinger et al. (2011) only mutualise the excess debt above 60% of GDP, though in the context of a redemption plan to extinguish it over the medium-term.

The second main choice relates to the attachment of guaranties to the common bonds. Some proposals require joint responsibility for common bonds, despite its likely violation of the no-bailout clause of the European treaties (Delpla and von Wiezsäcker 2010, Jones 2010, Barclays Capital 2011, Favero and Missale 2011). Precisely because of this, other authors consider that several guaranties, where each country is only responsible for the service of its share of the common bonds, would be enough (De Grauwe and Moesen 2009, Brunnermeier et al. 2011). Some authors provision for further guaranties in the form of seniority clauses over pre-existing debt, or credit enhancements, such as shock-absorbing collateral (cash or gold reserves) – particularly with a view to ensure that the new Eurobonds would be rated AAA by credit ratings agencies.

Given the breadth of these proposals it is not surprising that the expected impacts of their undertaking also vary considerably, namely when compared with the four objectives listed at the beginning of this section. The most obvious beneficiaries are the 'weak countries' currently facing a widening of spreads.[2] Either through pooling, diversification, seniority or credit enhancements, the new Eurobonds are expected to pay lower yields than most national debts, thereby allowing countries a cheaper access to funds. This is especially important during financial crises, when

[1] However, only the first or senior tranche (ESBies) would be virtually safe from default, whereas the second tranche of junior bonds (EJBs) would take any losses first.

[2] Nevertheless, all proposals exclude the programme countries, undergoing bailout arrangements with the 'troika' (ECB, EC, and IMF), at least until these programmes are completed.

markets can no longer price risk efficiently and may spread financial trouble through contagion, a problem to which the Delors (1989) report already alerted. Furthermore, the yields effectively paid by participating countries could be adjusted relative to the cost of funding of the Eurobonds-issuing agency so as to incentivise fiscal consolidation (Bonstra 2010, Dübel 2011, Muellbauer 2011 and 2013, European Commission 2011). Countries pursuing 'bad fiscal policies' would face an increasing schedule of funding costs, whilst others would be compensated for their fiscal efforts. This would also help preventing the build-up of unsustainable debt problems, similar to what happened after the introduction of the Euro when markets were not able to screen sovereign risk adequately.

'Strong countries' with normal access to wholesale markets would also benefit indirectly, and perhaps even directly, from the creation of Eurobonds. The main indirect benefits are financial stability and greater efficiency in monetary policy transmission within the Eurozone, once the home bias in banking portfolios of sovereign debt is replaced with the issue of a safe(r) asset on which the whole financial system can base itself. More pointedly, Jones (2010), Brunnermeier et al. (2011) and Varoufakis and Holland (2011) consider that Eurobonds would be an efficient way of recycling surpluses within the Eurozone without destabilising current accounts, and allowing countries such as Germany to continue pursuing their export-led growth. Direct benefits would come in the way of greater liquidity of the joint bonds, as well as a greater international role for the Euro.[3] Interestingly, although mentioned by all proposals, the estimates of liquidity gains are very limited, ranging from 30 to 70 basis points in the more optimistic assessments to close to nothing in the more conservative estimates of the European Commission's (2011) Green Paper and Favero and Missale (2011).[4]

This raises the question of how to motivate the participation of stronger countries in the Eurobonds issuance, as the liquidity gains might not compensate for the increase in funding costs from pooling risk with weaker nations. Several proposals address this issue by including explicit mechanisms to redistribute a share of the gains to the stronger nations, such that all participants benefit from the system (De Grauwe and Moesen 2009, Boonstra 2010, NATIXIS 2011). Although theoretically and algebraically conceivable, these redistribution rules raise practical implementation questions. Two of the most important are the time consistency of these rules and their consistency with fiscal stabilisation in the Eurozone.

Moreover, there is also considerable scepticism in the literature about the net advantages of the Eurobonds proposals, not to mention about the political feasibility of the idea currently in Europe. Starting with tranching and seniority, several studies point out that a Modigliani-Miller effect may apply with negative consequences for nations' ability to roll over their stocks of 'red debt.' By virtue of the issue of Eurobonds nothing is changed in the underlying fiscal position of individual countries, consequently if a tranche of 'blue', 'safe', or 'synthetic' bonds is carved out of their debt stocks with seniority and enhanced guaranties, the remaining debt stock will have to bear the brunt of greater illiquidity and risk premia (Kopf 2011, Brunnermeier et al. 2011, Claessens et al. 2012). The obvious way of avoiding this would be to swap the full stock of 'legacy debt' with Eurobonds, but that raises

[3] The two are related in the sense that some authors consider that the role of the Euro as reserve currency is hampered by the fragmented issue of sovereign bonds in the Eurozone that does not allow for the creation of a benchmark asset comparable to the US T bonds.

[4] However, the latter estimates may be contaminated by the fact that the German Bunds and the bonds of other AAA Euro-members have already benefited from a 'safe haven' status since 2009.

equally obvious concerns about moral hazard. However, the maintenance of stocks of national debt is seen as a way of distinguishing between liquidity and risk premia, since the latter would continue to be priced by the markets. An intermediate solution requires a careful calibration of the relative size of multilateral and national bonds. The share of 'blue bonds' has to be large enough to improve fiscal sustainability ratios, but small enough to allow countries to maintain market access at affordable interest rates (Gros 2010).

Moral hazard concerns loom large among the criticisms of Eurobonds, particularly since the recent experience of the SGP implies that even ex-ante firm rules are time inconsistent in the context of a financial crisis, and all the more because of the high level of cross-border financial integration in the EU (see Issing 2009, Gros 2011 and Favero and Missale 2011, among many). Kopf refers to this as "an illusion of seniority that cannot be enforced in times of crisis. In the end, member countries that wish to remain current on their own obligations may end up having to pay for Portuguese, Greek or Irish sovereign debt."[5]

This incentive problem might completely negate the expected liquidity gains of a common Eurobond benchmark issue. In a survey conducted in 2008, primary market dealers and credit rating agencies were uniformly averse to joint guaranties of Eurobonds, as well as to insurance mechanisms that pool risk between strong and weak nations (EPDA 2008). These mechanisms were seen a new incarnation of the structured products behind the financial crisis of 2008. However, Eurobonds with several guaranties are not immune from problems either, as credit rating agencies such as Standard & Poor's have warned that their rating may not be above (as desired), or even at the level of the average ratings of the participating nations, but in fact below, and possibly as lower as the lowest individual rating. This has a counterpart in the convexity of risk premia, which may rise more than proportionally than underlying risk factors, such that the average risk premium of a portfolio of bonds may be higher than the premium charged to an individual country with the same average risk. We will return to these considerations in the next section.

2.2 Back then: guaranteed bonds

Although the discussion over Eurobonds has taken place with very limited historical reference, the sovereign debt market before 1914 had several striking parallels to the proposals listed above. The emergence of an international bond market and the boom in foreign securities during the 1820s marked an important milestone in the evolution of sovereign debt contracts. This was also the case after the debt crises of the 1870s, which led to new ways of dealing with defaults.[6] One common way of ensuring repayment of government bonds was to link each issue to a form of security. These security clauses served the interest of creditors, as they safeguarded the interest and capital payments of a loan in the absence of a multilateral enforcement mechanism. Similarly, borrower governments had positive incentives to provide such securities given that their quality and extent could be an important determinant of the cost of credit.

[5] Kopf (2011: 9).
[6] Wynne (1951), Suter (1992), Neal (1998), Neal and Davis (2006), Flandreau and Flores (2009).

From the 1820s to 1914 there was considerable variation in the methods for securing sovereign bonds. These methods involved assigning the real estate of sovereigns as collateral, using tangible assets or pledging part of or the entire state revenues of the debtor.[7] For instance, the Greek independence loans of 1824 and 1825 were both secured by "all revenues and the whole national property of Greece".[8] Although assigning government revenues looked like an attractive solution to increase the credibility of a sovereign, it could also reduce its future borrowing capacity.

This issue of debt dilution could lead to legal problems in the case of a default or debt readjustment as the seniority between bonds was not clearly assigned. Sovereign immunity also raised questions about enforcement –except if creditors had direct control over the specific assets or revenues pledged. In the second half of the nineteenth century these enforcement problems encouraged bondholders to establish revenue administrations in Tunisia, Egypt, the Ottoman Empire, Serbia and Greece, among others. Through them creditors were granted direct access to the revenues assigned for the service of the debt. Although these revenue administrations had a positive impact on the credibility of debtor countries and increased their borrowing capacity, their success relied on the cooperation of debtor governments, thus they did not guarantee any future repayments for creditors.[9]

The focus of this paper is the issuance of guaranteed loans, which was a stronger way of securing bonds as it directly relied on the credit of other states acting as guarantors. For the pre-1914 period we identified five guaranteed bonds, as described in Table 1. The Table summarises the main features of each bond, namely, the guarantor states and their average cost of funding, the nature of each guaranty, the nominal value, interest rate and issue price of each bond, and the previous debt stock of the borrower country.

Table 1 here

There are three main characteristics of these bonds. First, the relationship between guarantors and debtors was usually determined by political considerations of the guarantor states –mostly one or a combination of the great powers of the time, i.e. Britain, France, and Russia. In fact, all guaranteed bonds issued between the 1832 and 1914 were linked to some sort of political turmoil.[10] The guaranteed bond, issued in support of Greece after its independence from the Ottoman Empire in 1833 was the first example of the involvement of the great powers into such an arrangement. The Greco-Turkish war of 1897 was also the cause for the 1898 Greek loans, similarly to the Crimean War for the 1855 Ottoman loan, and the Sino-Japanese war for the 1895 Chinese loan. Even in the case of the Egyptian loan of 1885, the main cause of the financial need of the country was the payment of war expenditures and associated indemnities from the Urabi revolt. Although the motivation for the issue of Eurobonds today is different, political and financial stability were closely associated in the 19th century –especially in the Eastern Mediterranean, an area of ongoing tension between powers and that would lead up to World War I. Leading merchants banks of the time co-operated to prevent

[7] These revenues could be from any source. State monopolies, custom and railway revenues, or even tithes could be used to secure new loans. See Borchard (1951), Cannon (1972), Hoyle (1986).
[8] Wynne (1951: 285).
[9] On this see Deville (1912), Hyde (1922), Andreades (1925), Wynne (1951: 279) and Tuncer (2011).
[10] Viner (1928), Jeze (1924).

political conflict in Europe from destabilising the capital markets (Polanyi 1944, Flandreau and Flores 2011), but in the cases studied here a greater degree of political involvement by the powers was needed to settle disputes and maintain stability. The real motives behind guaranteed bonds were obvious to contemporary observers. In response to the claims that the Egyptian guaranteed loan was issued on financial grounds, the *Economist* had the following to say:

> "The idea that the Powers have been influenced by purely financial motives in pressing their services upon Egypt is really too absurd to be entertained. They have all of them quite enough to do to manage their own monetary affairs, and they are not so foolishly generous as to insist upon burdening themselves with fresh financial obligations, except in the hope and expectation of gaining some advantage thereby. And the advantage they expect to gain is sufficiently obvious. They are acting on the sound principle that financial responsibility involves financial control, and the control of the finances of necessity implies control of the Government."[11]

Despite this acknowledgement of *Realpolitik*, guaranteeing a loan was not always a straightforward decision from the perspective of the guarantor states. For instance, while the French chamber quickly approved the guaranty of the 1855 Ottoman Loan, the consent of the British parliament hanged by a thread. The House of Commons raised serious objections to the loan given the poor credit of the Ottoman Empire at the time and the negative memory of the Greek guaranteed loan of 1833.[12] After lengthy discussions, the guaranty was passed by a majority of only three, despite the fact that France and Britain were allied to the Ottomans in fighting Russia in the Crimean war.

At the same time, guaranteed loans sometimes infringed on the debtors' sovereignty, particularly given their political nature. Again there was no standard procedure for this and it could vary from none or very weak interference to foreign financial control. For instance, the guaranty for the 1855 Ottoman Loan required that the proceedings of the loan were entirely used for war purposes.[13] The 1898 Greek guaranteed loan was harsher in this regard and it came together with a Law of Control, which enabled the establishment of an international financial control over certain revenues of the Greek state.[14] In the case of the 1885 Egyptian loan, however, the order of events was the other way around. This bond was issued with the extra guaranty of Britain and France, which already held the control of Egyptian finances since 1876.

The second feature of a guaranteed loan was the relationship between guarantor states and creditors, where the intention of the guarantor to make the debt of the borrower his own obligation gave it a distinct character. This was clearly the case with the 1855 Turkish loan and the 1885 Egyptian loan, which were grouped together with the British funds in the official list of the London stock exchange. Therefore, guaranteed bonds were priced in the secondary market differently from other issues of the debtor, not only because of the value of the guaranty itself, but also because of the externality that their issue imparted on previous bonds, either through explicit seniority clauses, specially assigned revenues, or simple debt dilution effects.

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[11] "The Proposed Egyptian Settlement", The Economist (London, England), Saturday, March 21, 1885; pg. 343; Issue 2169.

[12] The Greek guaranteed loan of 1833 went into default in 1836. It was finally redeemed in 1871 after a significant reduction in the outstanding interest. See Levandis (1944: 28), HCPP (1864) No. 144 and HCPP (1864) No. 3346.

[13] The British and French governments duly appointed commissioners to verify the treasury accounts and ensure the funds were spent in support of the army (Kiray 1988, Al 2007).

[14] Andreades (1925), Tuncer (2011).

The third and final characteristic was the relationship between guaranteeing powers, which also depended on their political motives. A first consideration here was how the different credit standing of the guarantors reflected on the yields of the guaranteed bonds. The worries about 'convex scenarios' in yields was already present in the nineteenth-century debates. The *Economist* used precisely this argument in condemning the guaranty of the 1885 Egyptian loan as disadvantageous to the UK: "It would be easy to show that the proposed international guaranty is unfair to us, because, if left to ourselves, we could raise the money at a lower rate than when our credit is impaired by being mingled with that of a country like Russia."[19]

Secondly, the extensive rivalry between the powers could also make the conditions of the loan more favourable for the borrower country. In 1895, following the defeat in the war with Japan, China needed funds to meet the first instalment of the war indemnity.[20] After the imposition of the peace treaty, the Chinese government considered the issuance of a loan, and contemplated the appointment of the British diplomatic representative in China, Sir Robert Hart, to take charge of the financial arrangements. However, this proposal met with strong resistance from Russia, which was keen on providing a loan to China through a joint Franco-Russian consortium. [21] As *The Economist* of the time put it:

> "it is somewhat ludicrous to observe the struggle which is going on among European financiers for the privilege of supplying China with the money she requires to pay the indemnity demanded by Japan. Indeed, the Chinese government would be more than mortal if it missed such a brilliant opportunity of getting all the assistance it requires."[22]

In the end a loan for 400 million francs was issued under formal Russian guaranty. The conflict between guarantors was more serious in the case of the Greek loan of 1833, namely because the guarantors went to war with each other in 1853! The fact that this loan was issued under a several guaranty only also contributed to creditor moral hazard. As each guarantor was only responsible for a third of the loan it had less of an incentive to lobby the Greek government to remain current on its obligations to the other two powers. Worse than that, the powers repeatedly supported the Greek government in selectively defaulting against their opponents or used their share in the 1833 loan to court political favour in Greece.[23] Unsurprisingly, this set-up did not help with the governance of Greek debt. Not only did Greece remain in default on its non-guaranteed bonds until 1879, but it also ended up paying back very little of the 1833 loan itself.[24]

Another source of moral hazard was the non-overlapping composition of guarantors and countries participating in foreign control organisations. The second Greek loan of 1898 is a good case in point. Germany, a country with little financial interest in Greece at the time was nevertheless very involved in the negotiation of the Greek debt workout. Despite not being one of the guarantors of the 1898 loan, it acquired a seat in the International Financial Commission (IFC), which controlled Greek finances from then on. In a sense, Germany got something for nothing in this operation, as the

[19] Issue of 21 March 1885, p. 344.
[20] FO (1895) Miscellaneous Papers, Vol. 48, p.160.
[21] FO (1895) Miscellaneous Papers, Vol. 48, p.336 and MacMurray (1921: 40-41)
[22] "The Coming Chinese Loan", The Economist (London, England), Saturday, June 8, 1895; pg. 749; Issue 2702.
[23] Levandis (1944), Kofas (1981).
[24] In 1864 Greece reached an agreement with the powers to retire the 1833 loan. According to Wynne (1951), by then Britain had paid £1.2 million on charges of the loan and had only received £100,000 from Greece.

financial guaranty of the other Powers allowed Greece to pay the war indemnity to Turkey, a country in which Germany was acquiring a large investment position. Consequently, it lobbied for a harsher deal for Greece than what Britain, France and Russia were initially prepared to settle for.[25] Here too one is drawn to see parallels with the consequences of the non-overlapping architecture of the EU and the Eurozone for the evolution of the European debt crisis. Whilst financial stability in the Eurozone has positive externalities for the rest of Europe and the World, financial responsibility has mainly remained within the member countries.[26]

Turning to the scale of these operations, in 1833 Greece received guaranteed bonds worth 57% of its previous loans. Greece again in 1898 was granted guaranteed bonds corresponding to 19% of its outstanding debt. However, as the guaranteeing powers imposed a 61% haircut, the share of guaranteed bonds rose to close to half of the new debt stock (Esteves 2013). These fractions were even higher in the cases of Turkey in 1855 and China in 1895 and are comparable to the contemporary projects for the issue of Eurobonds. Applying Delpla and von Weizsäcker's (2010) proposal of issuing blue bonds up to 60% of GDP would imply, in 2011, a stock of Eurobonds worth 35% of the pre-existing Greek debt, and more than 50% of the Irish or Portuguese ones.

Where the historical cases depart mostly from the current Eurobond proposals is on the scale of mutualisation relative to the guarantors' own debt stocks. The same application of Delpla and von Weizsäcker's proposal would involve a mutualisation of more than 4% of the Eurozone's debt in the case of Greece and slightly more than 2% each in the Irish and Portuguese cases. In contrast, the scale of the historical operations was usually below 1% of the guarantors' joint debt stocks.[28] Consequently, the results of this paper are possibly more informative of the impact of mutualisation on the 'weaker' or smaller members of the Eurozone, rather than on the 'stronger' ones. Having said that, a first conclusion to take from the historical data is the absence of 'convex scenarios' in the issue of mutualised debt. As shown in Table 1, not only were guaranteed bonds issued with an effective interest close to the average cost of funding of the guarantors, but in two cases the rate was below the average (Egypt in 1885 and Greece in 1898). The only possible support for the concern that the credit of more reputable countries might be mixed with that of less reputable ones is the first Greek loan of 1833. The effective interest rate of this loan (5.3%) was 126 basis points above the average cost of funding of the three guarantors. However, there are two alternative candidates to explain this. First is the fact that the loan only had a several guaranty. In second place, this spread may also be driven by the refusal of the London stock exchange to list the new loan pending the settlement of the previous independence loans, which were in default since 1826. As shown by Flandreau (2013) the failure to list at the LSE involved a significant liquidity penalty, which the author estimates in the order of 150 to 200 basis points.

In studying the yields of Italian bonds before and after the unification of the country in 1861, Collet (2012) reaches a more pessimistic conclusion. She finds that the unified bonds were initially priced more harshly than the bonds of the legacy Italian states prior to unification. The difference between the weighted average of the pre-unification yield of the legacy debts and the post-unified yield stood at 155 basis points, which the author interprets as a unification premium. However, the initial yield post-unification was actually above the maximum of the pre-unification yields, which

[25] Levandis (1944), Wynne (1951).
[26] With the exception of the bilateral British loan to Ireland in 2010.
[28] The exception was the Chinese loan of 1895, which represented 2.5% of contemporary Russian debt.

would imply a 'super-convex' scenario. More likely, this unification premium reflected other risk considerations beyond the simple pooling of risks of the legacy debts and probably overstates the convexity of the yields. In other words, Italy was initially treated by the markets as more than the convex average of its parts.

As mentioned in the Introduction, the closest contemporary comparators are the bonds issued for the several bailout and banking restructuring programmes since 2010. The combined value of the European share of these operations is worth c. 4% of the total debt stock of the Eurozone today.[29] Despite the great variation in the credit standing of the nations guaranteeing these bonds, they were initially well received by the markets and were priced at yields substantially lower than the average of the guarantors and easily acquired AAA ratings.

3. Debt dilution, fiscal discipline and spreads

In this section we lay down a simple framework to think about the consequences of issuing guaranteed bonds. As mentioned previously, the addition of a senior tranche of guaranteed bonds may difficult the access of the sovereign to refinance by issuing its own bonds in the market. However, this 'Modigliani-Miller' effect may be abated if domestic fiscal discipline is improved in the process, namely if access to multilateral guaranties is tied up credibly to conditionality. If the cost of credit increases to prohibitive levels after the introduction of guaranteed bonds, the best policy option is not to provide multilateral funds (or not only) but to force a debt restructuring. This underscores the need to calibrate the size of multilateral support, in order not to discourage continued private lending.

Debt dilution is a well-studied topic in corporate finance, at least since Fama and Miller (1972), with effort concentrated on identifying the optimal seniority structure to address it (White 1980, Schwartz 1997). The cases we deal with here violate this optimal structure by imposing a 'reverse seniority' clause in favour of new guaranteed bonds. Even though we do not discuss the ex-ante consequences of the availability of guaranteed bonds, it is possible that they could work to compound the sequential contractual externality leading to overborrowing, also identified in the context of sovereign debt (Tirole 2002).[30] In the closest analysis to our paper, Saravia (2010) discusses the conflict between private and official creditors in the wake of IMF programmes. Despite the theoretical attention that this subject has attracted in the sovereign debt literature, Claessens et al. (2012) consider, in their review paper on the Eurobonds debate, that there is a dearth of analytical and empirical analysis of these effects, and we seek here to bring out some historical evidence to bridge that gap.

Let s_g be the fraction of total debt guaranteed ex-post. Also, assume that the new debt stock is a multiple of the original $B' = (1+\delta)B$, where δ can be both positive or negative. If multilateral guaranteed debt is simply added to the debt stock then $\delta > 0$. If, however, the multilateral assistance

[29] According to Eurostat data. We added the bilateral loans to Greece and the loans organized under the EFSF, EFSM and ESM for Greece, Ireland, Portugal and Cyprus, while deducting the IMF share of the latter. The outcome is €340 billion.

[30] On this see Detragiache (1994), Roubini and Setser (2004), Bolton and Jeanne (2009) and Hatchondo, Martinez and Padilla (2012), among others.

comes with a debt write-down, it is possible that $\delta < 0$. As the new guaranteed bonds are issued with seniority and the explicit multilateral guaranty, their yield must be lower than that paid by the country on its own debt *before* the announcement of the financial assistance: $r_g < r$. Over longer horizons other considerations are likely to interfere in the pricing of guaranteed and non-guaranteed bonds.[31] Nevertheless, we may still recover the short-run dilution effect from the timing of the announcement of the issue of guaranteed bonds. This depends on the functional form of the relation between sovereign yields and fiscal fundamentals.

We will consider two possible models – a linear and an exponential relation. The first simply assumes that yields vary proportionally with markers of fiscal sustainability. In the second, there is a more than proportional effect of fiscal deterioration in spreads. Flandreau, Le Cacheux and Zumer (1998) call this a 'punishing model' of spreads. We can represent the linear model by a simple relation between yields and debt stocks: $r = \alpha B$. In that case, the new yield for the sovereign debt would simply be $r' = \alpha (1 + \delta) B = (1 + \delta) r$. Of course, this is only a shadow yield, as the change in the total debt stock is still influenced by the issue of guaranteed bonds. Consequently, the following relation should hold ex-post:

$$(1+\delta) r = s_g r_g + (1 - s_g) r_o \tag{1}$$

where r_o stands for the ex-post yield on the legacy debt. This identity expresses the Modigliani-Miller effect, according to which the composition of the new debt stock (the right-hand side) should not impact the average cost of funding, once changes in the total stock are taken into consideration (left-hand side). We can now solve (1) for the spread between the guaranteed and the non-guaranteed bonds:

$$r_o - r_g = r - r_g + \left(\frac{1}{1 - s_g} - 1 \right) (r - r_g) + \frac{\delta}{1 - s_g} \tag{2}$$

This new expression decomposes into three parts. The first term in the right-hand side is simply the ex-ante spread between the country's own bonds and the aggregate yield on the guarantors' debt. The second term is a pure debt dilution effect, since it does not depend on δ, but only on the share of guaranteed debt. A large s_g will place pressure on yields of legacy debt and, ceteris paribus, also on the cost of funding. Finally, the third term represents the increase (decrease) in spreads due to an increase (decrease) in the total debt stock. This means, for instance, that a debt write-down that adjusts the country's liabilities to its ability to pay could decrease ex-post yields on its bonds.

In the exponential or 'punishing' case, we assume that yields rise exponentially with debt: $r = e^{\alpha B}$ and $r' = e^{\alpha B(1+\delta)} = r^{1+\delta}$. In this case it is easier to work with logarithms and write $\ln r' = (1+\delta) \ln r$. A similar expression to (1) then applies:

$$(1+\delta) \ln r = s_g \ln r_g + (1 - s_g) \ln r_o \tag{3}$$

which implies an expression for the ex-post log spreads decomposed into three equivalent terms:

[31] A clean measure of r may also be hard to get from the secondary market prices if the country was already in default prior to the financial assistance operation.

$$\ln r_o - \ln r_g = \ln r - \ln r_g + \left(\frac{1}{1-s_g} - 1 \right) \left(\ln r - \ln r_g \right) + \frac{\delta}{1-s_g} \tag{4}$$

These are, of course, not the only determinants of the yields on the two classes of bonds, but the remaining factors are likely to cancel out in the expressions for spreads (2) and (4). A way of seeing this is to decompose the yields of the several classes of bonds from first principles:

$$\begin{aligned} r_p &= r_f + \tilde{r}_{liq} + \tilde{r}_{risk} \\ r_g &= r_p + \left(r_{liq} - \tilde{r}_{liq} \right) \\ r_o &= r_f + r_{liq} + r_{risk} + r_s + r_\delta \end{aligned} \tag{5}$$

where r_p stands for the cost of funding of the guarantors, which is above the risk-free rate r_f, by their aggregate risk and liquidity premia. This is not necessarily the average of the individual premia, because of convex scenarios or because markets may discount bonds issued with several but not joint guaranties.

In the second line, the yield on the guaranteed bonds is not simply given by r_p because the guarantors only mutualised a fraction of their own debt stocks with these operations, so the gain in liquidity from the issue of guaranteed bonds was likely to be insignificant for the sovereign receiving external assistance. Finally, the ex-post yield on previous bonds depends on the same country-specific liquidity premium, the country-specific risk premium, and the two terms r_δ and r_s, which represent the effects of the change in the debt stock and dilution in expressions (2) and (4). Note that we separate r_{risk} from the two last terms since it represents the risk assessment of the country *prior* to the changes in composition (r_s) and size (r_δ) of the total fiscal liabilities of the country. In this notation, the spread between guaranteed and non-guaranteed bonds is simply:

$$r_o - r_g = \left(r_{risk} - \tilde{r}_{risk} \right) + r_s + r_\delta = r - r_g + r_s + r_\delta \tag{6}$$

which is consistent with expressions (2) and (4). In section 5, we quantify the effects of dilution and change in debt stock from short-run price movements for legacy bonds. But another implication from (5) is that seniority and guaranties included in the guaranteed bonds should affect the long-term relationship between guaranteed and non-guaranteed bonds. In particular, whilst r_g is priced on the risk of the guarantors, r_o still reflects the country-specific credit risk. Hence, r_g should be affected by $\tilde{r}_{risk}$ and less so by r_{risk}. We will test these hypotheses from the time series behaviour of the various bond yields.

4. Guaranteed bonds before the Great War

4.1 The Greek guaranteed loan of 1833

The modern state of Greece came into existence as a result of a lengthy war against the Ottoman Empire between 1821 and 1832, and the Greek guaranteed loan of 1833 was an outcome of this conflict. Prior to the issuance of this loan, the Greek government had already contracted two loans in London, known as the Independence loans of 1824 and 1825, amounting together to £2.8 million,

with the support of the London Philhellenic Society. However, the newly founded Greek state did not have enough resources to service the debt and very soon suspended interest payments.[32]

In February 1830, with the intermediation of the three powers Britain, France and Russia, the first steps towards the independence of the Greek state were taken in a conference held in London. In particular, the three protecting powers agreed to guarantee a loan of 60 million francs for Greece, which the government wanted to raise for the purpose of maintaining a military force essential to the safety of the country. This agreement was followed by a convention drafted during the London Conference of April 1832 where the three powers specifically stated the conditions under which financial assistance was to be granted. These provisions were embodied in the treaty of May 1832, according to which Russia, Britain and France granted a loan of 60 million francs under the following conditions:

1. The loan was to be raised by three instalments of 20 million francs.
2. In each instalment the three guaranteeing states were to become responsible for the payment of one third of the annual amount of the interest and sinking fund of the relevant instalment.
3. Independently of the guaranty of three states, the payment of the annual interest and sinking fund was first secured upon the revenues of the Greek state.
4. The service of the new bond was to be senior to the independence loans of 1824 and 1825.
5. The diplomatic representatives of the three guaranteeing countries in Greece would be specifically charged with supervising the fulfilment of these conditions.[33]

After the official grant of guaranty by the three powers, a loan agreement was reached with the house of Rothschild, and the contract was signed in Paris in May 1833. The issue price was fixed at 94 percent with a 5 percent coupon. The effective interest rate was therefore 5.3%, which was more than 100 basis points above the average cost of funding of the guarantors, as measured by the secondary market prices of their benchmark bonds. Be it because of a 'convex scenario' or the liquidity costs of not listing at the LSE, this lesson was not lost on the contemporaries. In 1855, when the Turkish Loan Bill was being discussed in the House of Commons, the Chancellor of the Exchequer remembered the 1833 arrangement as follows:

> "Those who managed this loan for the Greek Government, guaranteed by the credit of the three Powers, contrived it so that, in the contract which threw all the credits together, that joint credit was lower than the credit of any of the three guaranteeing Governments, and the Greek Government lost the advantage of the comparatively high price of the English and French funds. For myself, I can hardly conceive a financial arrangement more ruinous to the State it proposes to assist, or less calculated to obtain the benefit of the guarantee afforded by those Governments."[34]

Although the original agreement authorised only the first instalment, as the needs of Greece were urgent, the powers consented to the floatation of the second series at the same time. More than one third of these funds were immediately spent on the war indemnity to Turkey. In 1835 and then

[32] Kofas (1981: 1-20), Wynne (1951: 281-283).
[33] HCPP 1831-32 (007) *Protocols of conferences held in London relative to the affairs of Greece.*
[34] HCH 1855 "Turkish Loan Bill", Vol. 139, Commons Sitting of Friday, 27 July 1855, columns 1469-1470 url: http://gateway.proquest.com/openurl?url_ver=Z39.88-2004&res_dat=xri:hcpp&rft_dat=xri:hcpp:hansard:CDS3V0139P0-0026

in 1836 the Greek government pressed for the issue of the third instalment, however due to disagreement between the three powers the advance of the remaining funds was delayed. Eventually in 1836 the third issue was approved, but the proceedings were devoted to the service of the two first instalments.[35]

Due to continuous fiscal difficulties, in 1836 the Greek government deferred the payment of the guaranteed loan until 1840, when the payments were resumed, but only to be suspended again in May 1843. As a response, the three guaranteeing states demanded that the Greek government scaled down all public expenditure and assigned the custom proceeds of the port of Syra as a guaranty for the future service of the loan. Greece eventually agreed to these conditions in September 1843 but due to political turmoil the ratification of this agreement was delayed until 1845.

This situation did not change until the Crimean War, after which Britain, France and Russia appointed their diplomatic representatives in Athens to act as a financial commission to investigate Greek finances. The commission proposed an extensive fiscal reform targeting both government spending and revenue. Moreover, the commission agreed that Greece could allocate annually a minimum sum of 900,000 francs for servicing the guaranteed debt without hindering its public services. Although the Greek government accepted this arrangement in June 1860, the payments did not follow. Overall, the problem of 1833 loan remained unsolved since the Commission did not have any supervisory or administrative role over the finances of the Greek government.[36]

In 1862, at last, the conditions changed due to dethronement of the Greek king Otto, whose rule had been characterised by fiscal difficulties, lack of financial and monetary reforms, and his "inability to dissolve the nation's foreign debt".[37] The second son of the King of Denmark, who was put forward by Britain, eventually filled the vacancy. As a gesture to the new king, in 1864 the three powers agreed to abandon a total of £12,000 a year from the debt charge. This sum was equal to one third of the prescribed minimum annuity of 900,000 francs. These funds were dedicated to the service of the 1833 guaranteed loan, and its amortisation was finally completed in 1871. By that time the indebtedness of Greece to the powers for their payments on account of interest and sinking fund amounted to about 92 million francs.[38] Moreover, according to the terms of 1864 agreement:

1. A new 5 % bond to the value of £1,200,000 was to be issued for the conversion of each £100 of 1824 and 1825 bonds at rates of 31.6 percent and 30.5 percent.
2. New bonds were also issued to exchange for 11.6 percent of the interest arrears.
3. Service of the new bonds amounting to £75,000 a year was to be secured by the customs of Corfu and by a second charge on the stamp duty.

[35] Wynne (1951: 284).
[36] Levandis (1944: 44-51).
[37] Kofas (1981: 132)
[38] HCPP 1864 (144) *Greek loan. A bill for authorizing the relinquishment in favour of the King of the Hellenes of certain money payable in respect of the Greek loan;* HCPP 1864 [3346] *Papers relating to the arrangement concluded at Athens in June 1860 respecting the Greek loan.*

As for the independence loans an agreement was finally concluded in September 1878; by then the nominal amount of debt, including accumulated arrears had grown to about £10,000,000.[39]

4.2 The Turkish 4% loan of 1855

Although the origins of the Ottoman Empire's attempts to contract a loan in international markets can be extended back to the 1780s, it issued its first bond in 1854 in order to finance the Crimean War.[40] The underwriter (Palmer and Goldschmidt) initially demanded that the British government acted as guarantor, however the British prime minister, Palmerston, was reluctant to provide financial help in the form a guaranty.[41] The payments of this bond were secured by part of the Egyptian tribute. The authorised amount for this issue was £5 million, but the Ottoman government only raised £3 million. However, by 1853 the war expenditure had reached almost 67 per cent total government spending and on the 5 April 1855 the Ottoman government officially requested the remaining £2 million and asked the British and French governments to jointly guarantee the issue.

The situation worsened by May due to the collapse of the peace negotiations in Vienna and with the prospects of more extensive military operations, it was decided that a bigger sum was needed. A new loan of £5 million was organised under the joint guaranty of Britain and France. After lengthy discussions in the House of Commons on 20 July the financial resolution authorising the guaranty was passed by a majority of only three.[42] According to the convention signed between French, British and the Ottoman governments, the service of this loan was to be met by the remaining part of the Egyptian tribute together with the customs of Izmir and Syria. Moreover, in case of default, the interest and repayments were guaranteed jointly and severally by Britain and France.[43]

This joint guaranty enabled the issue of the bond above par and at an interest rate of 4 per cent. The net interest was 3.9%, almost exactly the average cost of funding of the guarantors, which in the month prior to the issue averaged just 3 basis points below the effective rate on the Egyptian bond. But these favourable terms came with several conditions. One condition of the guaranty was to use the proceedings entirely for war purposes. In order to supervise the expenditure, Lord Hobart and the Marquis de Ploeuc were assigned as British and French representatives. The role of these commissioners, who were sent to Istanbul despite the opposition of the Ottoman government, was to verify the treasury accounts and ensure the funds were spent in support of the army.[44] However, due to the diplomatic resistance of the Ottoman Empire, the work of the commission started only in

[39] Levandis (1944:28).
[40] Akar and Al (2003).
[41] Anderson (1964: 47-51)
[42] Anderson (1964: 55)
[43] HCPP 1968 *Declaration exchanged between the British and French governments relative to the Turkish loan. Signed at London, July 27, 1855*" and HCPP 1961 *Convention between Her Majesty, the Emperor of the French, and the Sultan, for the guarantee of a loan to be raised by the Sultan. Signed at London, June 27, 1855*.
[44] Kiray (1988) and Al (2007).

January 1856, after several army contracts had already been signed in order to evade its control. By September 1856 all funds were spent and the commission finished its work.[45]

In October 1875, when the Ottoman Empire defaulted on the interest payments on its outstanding debt of c. £200 million, the Porte also suspended the prescribed sinking fund of one per cent of the guarantyd loan. However, the sums due were regularly advanced by the Bank of England to the bondholders.[46] Nevertheless, the tribute payable by Cyprus to the Turkish Government had been retained from 1878 by Great Britain and applied to the service of the loan. This bond was eventually retired in 1943.[47]

4.3 The Egyptian 3% loan of 1885

The Egyptian government contracted its first "state loan" in 1862, and from this year to 1873 the total amount of loans raised in international financial markets reached to sum of £E68 millions.[48] In 1873, the government issued a large external loan, amounting to £E32 millions, with the Imperial Ottoman Bank, Bischoffsheim, Société Générale and other banking houses. This loan was secured by all the revenues of the railways of Lower Egypt, the proceeds of the personal and indirect taxes, the salt tax, as well as a share of the receipts from the Moukabala.[49] Taken together with the previous guaranties, this covered almost all the general revenues of the Egyptian government. Although the loan of 1873 was seen as a success for the government, the 1876 financial crisis, which led to the bankruptcy of the Ottoman Empire and several other states, had an immediate effect on Egyptian credit, and the government suspended the payments on outstanding debt.

A settlement was reached on the same year, whereby an institution named the "Caisse de la Dette Publique" was established, under the direction of foreign commissioners nominated by their respective governments; these commissioners were authorized to receive the revenues intended to service the debt directly from the local authorities. Taxes from several Egyptian provinces, monopolies along with customs revenues were assigned to the Caisse for the purpose of servicing various public loans. Moreover, the debt settlement established an Anglo-French control over the finances of Egypt. Finally, the agreement called for the unification of the entire debt stock, which at the time stood at £91 million. Apart from its financial consequences, this settlement marked the beginning of a set of historical events, which in the end led to the military takeover of Egypt by Britain in 1882. Within a few months of the British taking over, the Anglo-French control was abolished. The British Consul-General was given overall authority and English advisers were placed in the Egyptian ministries.[50]

[45] Anderson (1964:61) and Badem (2010: 326-327)
[46] HMT 1916 "Turkey: Ottoman public debt 1854-1914: External Guaranteed Loan 1855: memoranda by S A Armitage-Smith"
[47] Wynne (1951: 393-395).
[48] Crouchley (1938: 120), CFB, 1914
[49] This name was originated from the "compensation" introduced by the Egyptian government in 1871 which provided landowners the option of paying six years' land tax in advance with a discount. See McCoan (1877: 122)
[50] Cromer (1908), Sayyid-Marsot (2007).

The first thing that the new British administration faced with was a budget deficit due to the costs of the military campaign. The net revenues from the Daira[51] and the domains were insufficient for the amounts required to service the loans secured by these properties. In 1884 the government was in need of a new foreign loan and recognised that it had to expand state revenues to maintain a minimum level of public works and handle the heavy expenditure on account of the war in Sudan. According to Edgar Vincent, then financial adviser to the Egyptian government, "the financial history of the year [1884] may be summed up in the statement that it consisted in a long struggle to stave off bankruptcy".[52] In fact, from early 1884 the Rothschilds had already started advancing funds to the Egyptian government in order to prevent a default and the British government was quite keen that they carried on this arrangement. Rothschilds requested that the British government guaranteed a new loan to consolidate the debt, but the government refused on 6 August 1884 by stating that "her majesty government have no authority to guarantee the repayment of any debt of the government of Egypt, nor can they determine of present the precise amount of the influence to be exercised by them with regard to the financial engagement of that country". Nevertheless, the foreign secretary Lord Granville reassured that the government did "not entertain any doubt that the advance of your house ought to be and will be repaid".[53] As a consequence, the Rothschilds continued renewing their advances to the Egyptian government until an agreement for a new loan was reached in July 1885.[54]

To this effect, the British government invited in April 1884 the representatives of five other powers (Germany, Austria, Russia, France and the Ottoman Empire) to a conference in London. After prolonged negotiations regarding the nature of the guaranty, an agreement was signed by the six powers in March 1885, according to which the Egyptian government was authorized to take out a new loan not exceeding £9 million and at a rate not to exceed 3.5 per cent. This loan was jointly and severally guaranteed by the governments of Germany, Great Britain, Austria-Hungary, Russia, France and Italy.[55] The effective interest rate at launch was a very moderate 3.1%, which compares favourably with the average cost of funding of the guaranteeing powers, which in the month prior to the issue of the Egyptian bond stood at 4.2%.[56] Even the average of just the yields of Britain and France was 3.4% in the same month. Despite renewed concerns about 'convex scenarios,' the loan was floated but 13 basis points above the yield of consols at the time.[57] The heavy involvement of the British government in preventing an Egyptian default prior to the agreement to issue the

[51] Dairas or "administrations" refer to the large estates of the Egyptian Khedive and his family. See McCoan (1877: 146)

[52] FO 1885 "Reports on the State of Egypt and the Progress of Administrative Reforms", Egypt, No.15 [C. 4421.] p.51-52

[53] RA 1884 "Egyptian loan 1884- 1885 private correspondence Nathaniel de Rothschild and Lord Granville and Egyptian Finance Minister" XI/111/16

[54] FO 1885 "Reports on the State of Egypt and the Progress of Administrative Reforms", Egypt, No.15 [C. 4421.] p.51-52, pp.85.

[55] HCPP [C.4341] Egypt. No. 7 (1885). Convention between the governments of Great Britain, Germany, Austria-Hungary, France, Italy, Russia, and Turkey, relative to the finances of Egypt. Signed at London, March 18, 1885.

[56] The bonds used were the 3% British consols (yield of 3%), the 3% French *Rentes* (3.7%), the 4% Russian Nicholas Railway (5%), the 4% Prussian consolidated (3.9%), the 4% Austrian Gold *Rentes* (4.9%) and the 5% Italian *Rendita* (4.6%).

[57] See the *Economist*, 21.3.1885, p. 344.

guaranteed loan is a striking example of the political nature of these operations and probably explains the low yield at issue.

The 1885 convention also introduced a few other adjustments to the financial position of Egypt. During the negotiations, Britain had advocated a permanent reduction of interest on the old debt while France had opposed any reduction. As a compromise, the convention provided a temporary tax of 5 per cent on the coupons of the Preference and Unified debts due in 1885 and in 1886 to supplement the funds available to the Egyptian government.[58]

From 1885 onwards Egyptian finances started to improve, and by 1890 the budget yielded a surplus. During the period 1885-1903 the Egyptian government contracted another four foreign loans with an average effective interest rate of 4 per cent. The final major event of the period was the agreement between Britain and France in April 1904. On the eve of this agreement, four separate debts remained: the Guaranteed Debt created in 1885; the Privileged Debt, bearing interest (since the conversion of 1890) at 3 per cent; the Unified Debt, bearing interest at 4 per cent and finally the Daira and Domains Loans. The agreement maintained the existing structure and only changed the revenues assigned for the service of these debts.[59]

4.4 The Chinese 4% (French-Russian) loan of 1895

Prior to 1895 the majority of Chinese external bonds were small sums issued by the provinces and secured by the corresponding receipts of the Chinese Maritime Customs. A significant part of these external loans were contracted in order to pay indemnities and to finance war, especially with Japan.

In 1895, following the defeat in another war with Japan, China needed funds to meet the first instalment of the war indemnity of 200 million kuping taels. According to the Shimonoseki Treaty signed on 17 April, China was required to pay half of the war indemnity in one year, and the rest in 7 years with 5 per cent interest.[60] After the imposition of the peace treaty, the Chinese government considered the issuance of a loan, and contemplated the appointment of the British diplomatic representative in China, Sir Robert Hart, to take charge of the financial arrangements. However, this proposal was met with strong resistance from Russia, which was keen on providing a loan to China through a joint French-Russian consortium. Consequently a loan amounting to 400 million francs was issued at 96.5 per cent and carrying an interest of 4 per cent. The effective interest of 4.15% stood about 27 basis points above the contemporary yields of Russian bonds. Maturity was 36 years and it was secured by the revenues of the Maritime Customs of China, with priority over all subsequent loans.[61] Moreover, in the event that the service of the loan was delayed or suspended, the Imperial Russian Government guaranteed to pay any amount due. In order to ensure the timely payment of the loan the Chinese government also committed not to use the receipts of the Chinese Maritime Customs for the issue of new loans until the payment of 1895 loan was to be completed.[62]

[58] Wynne (1951: 621) and RA 1885 "Egyptian Guaranteed Loan Contract – 3% £9,424,000 24/8/85-23/4/87", 000/401D/7
[59] Crouchley (1938: 169-171); Feis (1972: 393); Brunyate (1906).
[60] FO 1895 Miscellaneous Papers, Vol. 48, p.160.
[61] Viner (1928), Feng-Hua (1919: 27), Kimber, (1920: 362).
[62] FO 1895 Miscellaneous Papers, Vol. 48, p.336 and MacMurray (1921: 40-41)

The fact that all issues were secured by the proceeds of the Maritime Customs raised concerns among the contemporary investors:

> "Pledging the maritime customs the Chinese government is alienating a source of revenue upon which it will probably find it very difficult to get on without… The broad fact is, that the one really good security which China has to offer has already been charged pretty heavily, and the idea which seems to prevail at present that she may safely be trusted to almost any extent is utterly fallacious."[63]

Contrary to the expectations, however, the problem with the 1895 guaranteed loan was not China or the Maritime Customs administration but Russia, which was not in a favourable fiscal condition. Uncharacteristically, the yields of Chinese guaranteed bonds performed better than the loans of its guarantor state Russia during the Russo-Japanese War 1904-1906.

4.5 The Greek guaranteed loan of 1898

The settlement of the independence loans in 1879 marked the reappearance of Greece in the financial markets of Europe, followed by an era of rapid debt expansion, which eventually culminated in another default in 1893.[64] Immediately after the default, in December 1893, the Corporation of Foreign Bondholders and bondholder representatives of other countries appointed a committee to start negotiations with the Greek government.[65] The formal negotiations had a slow start because of the Greek demand of an extensive reduction in the capital and interest of the outstanding debt.

The defeat in the 1897 war with Turkey over Crete added up to the Greek financial troubles. According to the peace terms, determined through the mediation of six powers (Austria-Hungary, France, Germany, Great Britain, Italy and Russia), Greece was condemned to pay a war indemnity, which made the financial position of the country even worse. In accordance with the preliminaries of peace, in 1898 the powers assembled a commission to report on the financial condition of Greece.

On the basis of this report, Greece agreed to sign the 1898 Law of Control with the representatives of the foreign powers and consented to the creation of an International Financial Commission. Moreover, it agreed to pledge the gross proceeds of the monopolies (salt, petroleum, matches, playing cards and cigarette paper), tobacco dues, stamp dues and the Piraeus customs duties to the service of the gold loans. The collection of these revenues was placed in the hands of a company registered in Greece, under the effective control of the Commission. In return, the powers agreed to guarantee a new loan to allow Greece to pay for the indemnity. The maximum amount of the loan was fixed at £6.8 million, but the actual amount issued was £6,023,700.[66] In order to ensure a favourable rate, the three governments agreed to make their guaranty "joint and several" -instead of only several as they had done in 1833. As a result, the bonds, bearing 2.5 per cent coupons were marketed at a small premium and oversubscribed. Once more, the combination of guaranteeing powers of different credit standing did not markedly affect the effective yield on the guaranteed

[63] "Chinese Borrowing" The Economist (London, England), Saturday, July 13, 1895; pg. 907
[64] Levandis (1944: 58-68).
[65] CFB, 1893, Annual Report, Vol. 21, p.85.
[66] HCPP, 1898 [C.8778] Greece. No. 1 (1898). Despatch from Her Majesty's minister at Athens, inclosing the Greek law of control.

bonds. The average yields of the three powers were 2.9% before the floating of the new Greek bond and, in particular, British consols paid but two basis points below the Greek guaranteed bond. In the post-1898 period, Greece was able to contract eight more external loans, totalling £28 million. More than half of this value was used to finance the Balkan Wars in 1912-1913.

5. Empirical analysis

5.1 Data

In our empirical analysis we use 19 bond series, comprising 7 guaranteed bonds, 7 non-guaranteed domestic bonds, and 5 bonds from the main guaranteeing powers (the UK, France, and Russia).[67] We will conduct two empirical exercises in this section. The first focuses on the short-term dynamics of adjustment to the issue of guaranteed bonds. For that purpose we use daily prices of the bonds described in Table 2. The second part of our analysis studies the long-term relation between guaranteed and non-guaranteed bonds. Because of the length of the periods considered, we revert to using monthly data, as described in Table 3.

Tables 2 and 3 here

The figures in Table 2 are expressed in simple yields (coupon/price). We understand that this is not an accurate measure of the yield as we ignore the maturity of the bonds and do not try pricing the callable options included in many bonds at that time. Nevertheless, in looking for the short-run impact of guaranteed bonds, we are really interested in the short-run reaction of the prices of existing bonds, which are immune to these biases.

However, this option is less defensible for the monthly dataset (Table 3), which covers a long period approaching the maturity of some of the bonds used in the analysis. Consequently, we considered two alternative yield measures: yield-to-maturity (YTM) and yield-to-call (YTC). The advantage of using YTM rather than simple yields is to take account of the different maturities of the bonds, whilst some of the bonds had implicit callable options which distort yields, unless we use the YTC. The practical consequences of these two considerations are described in the Appendix, but on inspection we decided to use the concept of YTM for our long-run analysis. The main reason is that, for reasons explained in the Appendix, the use of YTC would underestimate the spread between non-guaranteed and guaranteed bonds $r_o - r_g$, while simple yields would overestimate it.

The choice of comparator bonds (non-guaranteed) was guided by two principles. First, for the non-guaranteed bonds, we sought to identify the most liquid issues outstanding at the time of the introduction of the new guaranteed bonds. In particular, we only considered external bonds regularly quoted in London or Paris. This should minimise any differences in liquidity premia between r_g and r_o but, more importantly, it should give as close a measure as possible of the marginal cost of funding for the sovereign before and after the new issue. Second, for the guaranteeing powers, we chose the benchmark issues, for similar reasons, but paying attention to

[67] We have seven series for the five guaranteed bonds because the Greek 1833 bond was quoted separately for the shares guaranteed by Britain, France and Russia.

avoid the effect of expected imminent conversions on the simple yields of bonds (as described in Flandreau and Zumer 2004).

The daily prices in London were extracted from Wetenhall's *Course of the Exchange*. The only exception was the Chinese 4% guaranteed loan, which was only quoted in Paris. The prices of this loan were retrieved from two French sources: the *Tableau des titres cotés à la Bourse de Paris* and the *Bulletin de la Cote*, published by the Compagnie des agents de change. Again with the exception of this Chinese loan, all monthly data (Table 3) were obtained from the tables of the *Investor's Monthly Manual* (IMM), published by the *Economist* since 1869.

5.2 Short-term: dilution

In this section we seek to identify the reaction of pre-existing or 'red' bonds to the introduction of the five guaranteed loans, particularly the dilution effect from the issue of senior debt. The validity of this exercise depends on an accurate timing of the event, namely, the dating of the period when the details of each guaranteed loan were either rumoured for the first time, or confirmed. As we use market prices, we seek a source of public information, for which we use the British and French daily press, especially the issues of *The Times*.

To formally identify breakpoints in the price series we resort to Bai and Perron's (1998, 2003) methodology. After establishing that at least one structural break exists from the UD and MD statistics, we select the number of breaks from the sequential procedure, stopping at the last significant sup $F_T(l+1|\ l)$ statistic. Table 4 lists the break dates.

Table 4 here

In the table we also provide possible reasons for the breaks, from our reading of the press. We need to interpret the identification of news from the press with care for two reasons. First, we cannot observe insider information which might be reflected in the bond prices before it became public and made it into the pages of the dailies. Nevertheless, the lag between these two events should not have been too long as to invalidate the exercise. Moreover, Bai and Perron's method also provides confidence intervals for the breakpoint estimates, which are represented by the shaded areas in Figures 1-5.[68]

Figures 1-5 here

In these five figures the red vertical lines mark the point estimates of structural breaks, whereas the two vertical blue lines date the first day when the press reported the intention to issue a guaranteed bond (solid line) and the date when the loan was effectively floated in the market (dashed line).

The second caveat of this exercise has to do with the usual errors in statistical inference. On the one hand, there is a type I error problem–as we only concentrate on the dates identified by the statistical procedure, we may be ignoring other relevant pieces of public information published on dates which were not picked up by our breakpoint dating method. A clear example of this is the

[68] Some of these areas overlap, but that is essentially because we used more than one comparing bond for some countries.

sudden jump in Egyptian yields shortly after the announcement of the guaranteed loan (Figure 3). Table 4 lists other four cases in bold. Then, there is also the question about the power of the breakpoint test, which may overidentify breaks.[69] On visual inspection, the second break in the Chinese series (Figure 4) could be a case in point. Nevertheless, the dates identified as structural breaks have general support on the contemporary flow of public information, as described in Table 4 and the reaction of the bond prices also accords with the nature of the information published by the daily press.

Only on two occasions did yields rise markedly on legacy bonds: the early Greek case and the Egyptian convention of 1885. In the first case, the yields of the independence loans rose by about 29% immediately after the convention to issue a guaranteed loan was made public. However, this initial reaction was quickly reversed, no doubt on the force of the encouraging noises coming from the several governments involved (Levandis 1944, Kofas 1981). The unusually long gap between the announcement of the convention and the actual issue of the guaranteed bond (12 months) allowed bondholders plenty of time to inform themselves of the details of the financial operation and, in particular, of its consequences for their own claims. Even though the yields on the independence loans fell all the way until the issue of the new loan, in July 1833, the bondholders' expectations were quickly shattered on 10 October, when the Greek regency informed them it did not recognise their claims. On that date, the yield on Greek bonds almost exactly matches the prediction of equation (2). The formula predicts a yield of 21.9% for the independence bonds against the 22.2% effectively priced on the market.[70]

Despite this dramatic reversal, the prices of Greek bonds recovered quickly and stabilised at a level similar to that prior to the announcement of the financial guaranty from the three powers. Another interesting feature of this case is that since the guaranteed bond was issued with only a several guaranty, the markets priced separately the tranches guaranteed by the three powers. Figure 1 shows that there was a fairly consistent premium of about 55 basis points between the Franco-Russian tranches and the British tranche, whilst there was no difference between the French and the Russian-guaranteed tranches. It is tempting to see this as the liquidity or 'safe-haven' discount enjoyed by Britain, which falls nicely within the range of values estimated for today, i.e. between 30 and 70 basis points. However, the press of the time explained this premium with the fact that the coupons were paid at a fixed exchange rate, which was less favourable than the actual exchange of sterling against the franc. Consequently, bondholders had an advantage in cashing in their coupons in London, rather than in Paris, which was reflected in the bond prices in the two markets.[71]

The second case of adverse yield reaction, also short-lived, occurred after the Egyptian convention of 1885, when the yields of the unified and state domain bonds rose by 15% on average between the announcement that all powers had accepted to guarantee the new Egyptian bond (on 19 March) and the end of April. This rise too was entirely reversed over the rest of the year.

[69] There were four breaks for which we could not find any significant piece of published news (see Table 4).

[70] The new guaranteed loan added one third to the total debt outstanding (δ = 0.33), the fraction of 'blue' bonds was therefore a quarter (s_g = 0.25), the average yield on the guaranteed bond in September 1833 had been r_g = 4.8% and, finally, the yields on the independence loan had averaged r = 13.2% over the same period. Applying expression (2) results in an ex-post prediction of r_o = 21.9%.

[71] The exchange rate premium of London over Paris was of c. 50 basis points (*The Times*, 28.2.1833, p.5).

However, the identification of the start of the 'Egyptian event' is less clear than in the early Greek case because the British government had been pressing ahead with the idea of a new loan under international guaranty since at least April 1884. It is therefore possible that markets priced dilution not on March-April 1885, but on April-June of the year before, when yields also increased markedly – by 20% for the unified debt and 11% for the state domain loan.[72]

By contrast, yields reacted favourably on the three other cases. This is especially clear in the later Greek episode and less so in the Chinese case, where the yield of the (non-guaranteed) Cassel loan dropped but by a small fraction. The introduction of international financial control simultaneously with the Greek 1898 loan is certainly not immaterial to this result and the subsequent reduction in Greek yields until the end of 1899. The assurance of greater control and transparency of Greek finances would surely improve foreign bondholders' expectations. Moreover, and unlike the 1833 operation, the guaranteeing powers imposed debt write-downs worth c. 15% of the previous debt stock and interest rate reductions representing between a third and 60% of the pre-default interest bill. In other words, the guarantors calibrated the issue of the 'blue bonds' such as not to burden Greece with a new debt stock it could not service. The parallels between the two Greek guaranteed bonds of 1833 and 1898 and today's debate on the financial effects of the two Greek bailouts since 2010 are very close. Indeed, unlike the first bailout, the second Greek bailout expressly imposed a debt writedown to calibrate the new debt stock to a level that was considerable repayable.

Turkish yields are harder to interpret as they also reacted to the news about the Crimean war, for which the 1855 guaranteed loan had been raised. In that sense, the issue of the new loan could count as good news for the bondholders as it signified the commitment of Britain and France to stand by their ally in the war against the Russian Empire.

As a final test of the dilution hypothesis, we conducted an event study. We follow the standard methodology in studies of dilution from seasoned equity issues–the comparison period returns approach (Masulis 1980, Asquith and Mullins 1986). In this method we compare the average daily returns of pre-existing bonds during the announcement of the issue of guaranteed bonds with their returns over a window before and after the announcement. Under regularity conditions, a simple t-test for the equality of means in the announcement and comparison periods can be used to test our hypothesis.[73] The usual assumption in this literature is that although published on a given day, the information contained in the announcement could have been public the day before (essentially because of printing lags of newspapers). Hence, the length of the announcement period is set at two days. For the comparison period we tried two options – 30 and 60 days before and after the announcement period. Table 5 lists the mean returns and their standard deviations for the two periods. The last column has the t- statistic for the test of equality of means.[74]

Table 5 here

[72] In that case, the jump in yields in 1885 could be a reflection instead of the unexpected addition to the financial convention of a temporary tax on the coupons of existing bonds for two years.

[73] On these regularity conditions see Masulis (1980). We used the returns ex-dividend, where applicable.

[74] The statistic is: $t = (r_1 - r_0) \Big/ \left(\sqrt{\frac{(T_1 - 1)s_1^2 + (T_2 - 1)s_2^2}{T_1 + T_2 - 2}} \sqrt{\frac{1}{T_1} + \frac{1}{T_2}} \right)$, which is t distributed with $T_1 + T_2 - 2$ degrees of freedom. The *r* variables stand for the mean returns in the two periods (*s* standard deviations), whilst the *T*s are their lengths.

Since we are specifically interested on whether the issue of guaranteed bonds diluted previous claims, we use a one-sided test, i.e. the alternative hypothesis is that returns to non-guaranteed bonds fell after the announcement, relative to the comparison period. However, as shown by the p-values under the t statistics, we cannot reject the equality of mean returns. Moreover, the statistic has the wrong sign, suggesting higher mean returns during the announcement period than away from it. We are unsure about the power of this test, because the size of the portfolios is small (up to 6 bonds) and also because we cannot be sure that the information was not available more than a day prior to publication. As an alternative, we define the announcement period by the 95% confidence intervals of the breakpoints closer to the announcement (see Table 4).[75] The final rows of Table 5 show that even under this setting there is no significant difference in means, although the statistic has now the expected sign.

The conclusion from this analysis must therefore be that, although present, dilution effects were either second-order or temporary in the cases studied in this paper. Furthermore, in all cases under study, the introduction of an international guaranty was a response to desperate financial positions brought about by extraordinary political circumstances. As mentioned in section 2, many of the advocates of Eurobonds explicitly separate them from the resolution programmes for countries under financial duress, which would not be eligible to issue Eurobonds until after having solved their fiscal crises. Consequently, the historical evidence suggests that debt mutualisation in Europe excluding programme countries would doubtfully involve significant dilution effects.

5.3 Long term pricing of guaranties

As we described in section 3, the different underlying risk structure of guaranteed and non-guaranteed bonds should have affected their long-term relationship. In this section we test the hypothesis that long after their issue, guaranteed bonds continued to be priced differently from the remaining debt of the sovereigns. In particular, we will test the assertion that guaranteed bonds were priced on the credit risk of the guarantors ($\tilde{r}_{risk}$), rather than on the country-own risk r_{risk}. But before that, we start by quantifying the shadow long-term discount of guaranteed debt as the difference between the secondary market yields (YTMs) of non-guaranteed and guaranteed bonds. This extends the similar comparison we did for the short-run in the previous sub-section.

Table 6 and Figure 6 represent the long-term evolution of the net yield discount of guaranteed bonds for four out of the five cases we discuss in this paper. We left the initial Greek bond out of the comparison as the 5% independence bonds were in default until 1879 and, consequently, are not a good measure of the marginal cost of funding for the Greek sovereign. Likewise, the 1833 guaranteed bond itself remained in default over part of the period, until finally paid off by the guaranteeing powers in 1871. For the same reason, we also excluded the period when Turkey went on default (from October 1875 to December 1881).

Table 6 and Figure 6 here

[75] Because the length of the announcement periods varied with the bonds, we took the minimum length (14 days) to minimise the type I error, although the test would still not reject the equality of means with the maximum length.

With the exception of China, guaranteed bonds start off with a very high discount of close to 300 basis points against pre-existing bonds of the assisted sovereign.[76] With time the discount converged to lower values, especially in the cases of Egypt and Greece. Interestingly, despite being issued already under foreign financial control (the *Caisse de la Dette Publique Egyptienne*), the Egyptian 3% guaranteed loan started off with a particularly high discount, which only came down to 100 basis points after five years. Markets apparently took time to be persuaded of the benefits of international control in terms of the consolidation of Egyptian finances. Similarly, the inauguration of the *Dette Ottomane*, after the Turkish default, had a moderate impact on the spread between guaranteed and non-guaranteed bonds, which fell by little more than 80 basis points between the pre-default and the post-workout periods. However, it is likely that the discount before 1876 already included the expectations of imminent default, biasing up the estimate of the marginal cost of funding just before default. Consequently, the true immediate impact of the inauguration of foreign control over the Ottoman finances was likely to be lower than 80 basis points. A more significant compression in the spread between guaranteed and non-guaranteed bonds occurred after 1888. This is surely related to a further handover of fiscal sovereignty from the Ottoman government to the *Dette Ottomane*, which occurred in 1889. On that year, the government transferred to the *Dette* the collection of a number of state revenues not included in the original agreement of 1881. The spread opened up again after 1890 in a seeming reflection of the Barings crisis.

Some of the discount series exhibit systematic changes, such as the drop in the Chinese discount after 1903, which is entirely driven by an increase in the yields of the guaranteed bonds. This was in turn caused by the widening of spreads on the bonds of the guaranteeing power, Russia, with the start of the Russo-Japanese war in 1904. The Greek series also reacted to the less of quality of the Russian guaranty, and shows the effect of the same short-run adjustment to the introduction of international financial control in 1898 discussed in the previous sub-section. The longer term data, however, show that the initial drop in the spreads of non-guaranteed debt was not only quickly reversed by mid-1899 but persisted throughout the early 1900s. The two step jumps in the discount in October 1906 and July 1907 can be associated with adverse fiscal and political news.[77] Similarly, the isolated spike in December 1905 could be a reaction to the publication in mid-November of a damning report on the condition of Greek finances by the British representative in the International Financial Commission.[78]

In analysing the long-term relation between guaranteed and non-guaranteed bonds, we follow two approaches. In the first place, we use factor analysis to identify the common factors to each

[76] In the case of Turkey the values in Figure 6 do not go back to the issue of the guaranteed bond, in 1855, though the initial spread did hover around 300 basis points (see Figure 2). This is essentially because the IMM only started publication in 1869. The data also ends in June 1894 not to have a disproportionally long sample compared to the other three cases. The results do not change materially, though when we extend the Turkish time series to December 1907.

[77] Trawling through the pages of the *Economist* and *The Times*, we found a few candidates: on 22 June 1907 the Economist referred to a report by the IFC on the unreliable Greek budget figures, which despite showing surpluses since 1898, had actually been on deficit on every year till 1905. July 1907 was also a period of intense diplomatic pressure on Greece because of the suspicions of Greek armed infiltrations in the Ottoman province of Macedonia, flaring up concerns of renewed conflict in the Balkans (*The Times* 8 July 1907, p. 8). Finally, the fall of 1906 was a transition period for the artificial state of Crete, with the replacement of the Greek high commissioner widely seen as a prelude to a Greek takeover.

[78] See *The Economist*, 11 November 1905, p. 1795.

country's bonds as well as those of its guarantors. We then confirm and extend our results in the context of panel VARs (PVAR) for the same bonds. Table 7 and Figure 7 summarise the results of the factor analysis.

Table 7 and Figure 7 here

We chose the number of factors for each case from Kaiser's rule of retaining only factors with eigenvalues larger than 1.[79] We also rotated the factors by using an orthogonal rotation method (varimax) to maximise the variance of the squared loadings of each factor on to each series of spreads. Table 7 lists the numbers of factors retained, the factor loadings of each variable and its uniqueness. Uniqueness is generally low, which implies that the individual bond spreads are adequately explained by the factors retained. The factor loadings of the first factor on comparator national bonds are usually smaller than those on the guaranteed bonds or the bonds of the guaranteeing powers. The converse is true of the second factor, when retained, so that we may interpret the first factor as capturing world or exogenous cost of credit, and the second the domestic risk component.

This interpretation is also confirmed when we plot the factor loadings for the two countries for which we retained two factors. Figure 7 clearly shows the association between the guaranteed bonds and the bonds of the guaranteeing powers – Britain and France. Interestingly, there is but feeble evidence of the influence of Russian bonds on the Greek guaranteed loan of 1898. Also, the pricing of domestic bonds is plainly driven by the second factor, which is orthogonal by construction to the first. The exception is China, where the Cassel loan has a larger factor loading than the guaranteed Franco-Russian loan of 1895. This, however, is probably due to the peculiar political situation of the Chinese Empire, formally sovereign, but dependent in practice on the political inroads of a number of foreign powers. Although not guaranteed, the Cassel loan was interpreted as the German-British reaction to the Franco-Russian guaranteed bond. As will become evident from the PVAR results below, the two Chinese bonds did react in tandem with the credit of the two competing European groups of powers, in a seeming financial extension of the spheres of influence being carved out by foreign nations in China at the time.

Panel VARs combine the traditional VAR approach, which treats all the variables in the system as endogenous, with the panel-data approach, which allows for unobserved individual country heterogeneity. We specify a first-order VAR model as follows:

$$Y_{i,t} = \Gamma_0 + \Gamma(L)Y_{i,t} + \nu_i + \varepsilon_{i,t}, \tag{7}$$

where $Y_{i,t}$ is a vector of endogenous variables (bonds yields), Γ_0 is a vector of constants, $\Gamma(L)$ is a matrix polynomial in the lag operator, ν_i is a matrix of country-specific fixed effects, and $\varepsilon_{i,t}$ is a vector or error terms (with zero mean and country-specific variance).

However, the correlation between the fixed effects and the regressors due to lags of the dependent variables implies that the commonly used mean-differencing procedure creates biased coefficients (Holtz-Eaking et al. 1988). This drawback can be avoided by a two-step procedure. First,

[79] The share of variance explained by the first factor was 87% in the Turkish case, 69% in the Egyptian, 80% in the Chinese and 76% in the Greek.

we use the "Helmert procedure", that is, a forward mean-differencing approach that removes only the mean of all future observations available for each country-year (Arellano and Bover 1995).[80] Second, we estimate the system by GMM and use the lags of the regressors as instruments, as the transformation keeps the orthogonality between lagged regressors and transformed variables unchanged (Arellano and Bond 1991). In our model, the number of regressors is equal to the number of instruments. Consequently, the model is "just identified" and the system GMM is equivalent to estimating each equation by two-stage least squares. We tested all transformed variables for unit roots by using a Fisher-type test that allows for large T-small N panels (Choi 2001) and could reject them for all panels.

Another issue that deserves attention refers to the impulse-response functions. Given that the variance-covariance matrix of the error terms may not be diagonal, we need to decompose the residuals so that they become orthogonal. We follow the usual Choleski decomposition that order variables such that any potential correlation between the residuals of two elements is allocated to the variable that comes first. In all cases we ordered the bonds of guaranteeing powers first, starting with Great Britain and following with France and Russia. Because of the nature of international guaranties, we ordered the guaranteed bonds second, and the non-guaranteed domestic bonds last. We also experimented with different orderings within these three groups of bonds, where possible, but the results did not differ materially. Finally, given the relatively low frequency of the data, we only ran the models with one monthly lag. The results are described in Table 8, which lists the four models horizontally, i.e. each row identifies a left-hand side variable and the coefficients of the lags of itself and the other endogenous variables (listed in the columns), as appropriate.

Table 8 here

With the exception of Greece, the models are almost diagonal. This is understandable given the low frequency of the data, which makes it harder to identify lagged effects of yield changes on to other bonds' yields. This structure appears consistent with the ordering of the bonds, which is also confirmed by the impulse response functions (IRF) that come out of this exercise. These are represented in Figures 8-11 for up to six months, with 95% confidence intervals computed from Monte Carlo simulations.

Figures 8-11 here

Despite the low data frequency, the IRFs are consistent with the ordering of the variables in the PVARs in the sense that the variables ordered first do not respond to shocks to variables ordered later. For instance, the yields of British long-term bonds (consols), arguable the world benchmark, do not react to any other yields in the systems. French yields only react to shocks to British yields, and so on. In general, a shock to British yields has positive and long-lasting effects on all other bonds, which is in accordance with their benchmark status. The size of the effects is consistently below one,

[80] That is, for bond *i* and time *t*, the Helmert transformation is given by $\tilde{y}_{it} = \left(\frac{T_i - t}{T_i - t + 1} \right)^{1/2} \left(y_{it} - \frac{\sum_{\tau=t+1}^{T_i} y_{i\tau}}{T_i - \tau} \right)$. We also tried simply time-differencing the yields and the results were similar.

meaning that increases in the benchmark yield actually narrowed spreads, as has been found elsewhere (Eichengreen and Mody 2000). However, this can also be driven by the monthly frequency of the data, as most of the adjustment to a shock to British bonds might happen faster than after a month.[81]

Shocks to the yields of other guaranteeing powers had permanent effects on guaranteed bonds but, generally, not on other domestic bonds. Or, when the impacts are statistically significant, they are either very small in economic terms (e.g. the IRF of the two Egyptian bonds–unified and state domain–to shocks to French yields) or non-persistent, as in the reactions of the Turkish and Greek non-guaranteed bonds to shocks to French or Russian yields. The size of the reactions of the yields of guaranteed bonds was also consistent with the ordering of the guaranteeing powers, being larger in the IRF to shocks to British yields than to French and Russian. This then establishes a pecking order of guarantors, with British bonds clearly setting the benchmark for all other countries' yield curves. It also reinforces the conclusion we got from factor analysis, in terms of the distinction in the way markets priced guaranteed and non-guaranteed bonds. The former reacted to the cost of credit of the guaranteeing powers, whereas the latter did not – with the exception of the British benchmark. Moreover, with but one exception, the yields on guaranteed bonds also did not react to shocks to the yields of non-guaranteed domestic bonds, further underscoring the separation of the two classes of bonds over the long-run.[82]

The same interpretation is confirmed by decomposing the variance of the individual yield series in Tables 9-12, where British yields dominate among the share of variance explained by foreign powers.

Tables 9-12 here

The remaining information in the variance decomposition tables confirms the results of the IRFs and of the factor analysis. In all four cases, the variance of the yield of guaranteed bonds reacted more to the yields of the guaranteeing powers than of non-guaranteed bonds. Conversely, the variance of non-guaranteed bonds is hardly explained by the behaviour of the guaranteed bonds and reacts more to domestic developments, although not escaping the impact of changes in the market benchmark, the British consols. Coming back to the Chinese case, Table 11 shows how the variance of the British-German Cassel loan was very dependent on British consol yields. Actually, the formally Russian-guaranteed 4% loan of 1895 was even more dependent on British yields. The Cassel bonds also reacted slightly less to Russian yields than the guaranteed bond, as expected, although the credit of this guaranteeing power barely explains 6% of the variance of both loans. This is suggestive, as mentioned previously, of the existence of financial spheres of influence as expressed in bond prices, but it also reveals the smaller relevance of a formal guaranty by a power of dubious credit itself.

6. Conclusions

[81] This would be consistent with Uribe and Yue's (2006) model of overshooting spreads.
[82] The exception is the IRFs of the Egyptian 1885 guaranteed bond to the unified debt (Figure 10).

This paper contributes to the debate on Eurobonds as a solution to the fiscal crisis in the Eurozone by providing the first empirical analysis of the closest historical parallels – the guaranteed bonds issued before World War I. We started by uncovering a nineteenth-century debate, which shares uncanny similarities with the current arguments pro and against Eurobonds. Despite occasional domestic opposition, the European powers got involved in these operations mainly to achieve financial and political stability in sensitive areas of the continent. As envisaged by today's proposals, these bonds were seen by the markets as instances of debt mutualisation. On the basis of this parallel, we then used market data for these bonds to reach three policy-relevant conclusions.

First, that the fears about short-run dilution and destabilisation of the debt market of weaker participants in a joint issue of Eurobonds may be overplayed. On the one hand, hardly anyone proposes the introduction of Eurobonds without concomitant moves towards greater fiscal discipline (or federalism), while excluding programme countries from the joint issue. On the other, our historical case studies show that even for countries in desperate financial condition, debt dilution and rationing of 'red bonds' were either absent or temporary. This is not because the guaranteed issues were small compared to the contemporary debt stocks in the Eurozone. In fact, the shares of guaranteed debt were similar to or higher than today's proposals for the creation of 'blue bonds.' In some cases this was achieved through foreign-imposed fiscal control (a nineteenth-century version of conditionality), though not all countries studied experienced this infringement to their sovereignty. In other cases, writedowns of existing debt were also instrumental in stabilizing the market for sovereign debt after the issue of guaranteed loans.

Second, the combination of guarantors of different credit standing ended up not penalising the yields of the guaranteed bonds significantly. Apart from the first Greek bond of 1833, which was floated with a yield above the average of the guarantors' cost of funding, all other guaranteed bonds were floated below this average and increasingly closer to British yields, whenever the UK was involved. Hence, the worries about 'convex scenarios' for Eurobonds issues may also be exaggerated. In other words, the scale of fiscal transfers from strong countries, like Germany, to weaker nations may be smaller than feared by many. This fact reinforces the anecdotal evidence about debt mutualisation, as the receiving nations were able to fund themselves at close to the cost of credit of the most reputable guarantor.

Third, markets persistently priced mutualised debt separately from the countries' own bonds. Although the spreads between guaranteed bonds and the marginal cost of funding of borrowers varied over time they seldom fell below 100 basis points, even in the stronger cases of external control, such as Egypt or Greece. Given the relatively small size of the guaranteed issues, with respect to the debt stock of the guarantors, this is certainly due to the markets pricing the guaranteed bonds on the basis of the credit risk of the guarantors. This was not always a good thing, as exemplified by the transmission of the credit risks of the Russian Empire since the start of the Russo-Japanese war to the Chinese and Greek bonds guaranteed by Russia. The increases in spreads of the EFSF bonds since late 2011, reacting first to higher French spreads and later to the downgrade of eight of the guaranteeing sovereigns, are a contemporary illustration of this contagion effect.

Nevertheless, the overall tendency in the historical period was for the spread of domestic debt to decrease with respect to guaranteed bonds, which intimates an improvement in the financial condition of the countries after the mutualisation of part of their debt. However, the behaviour of

Eurozone spreads after 1999 should alerts us to the questionable ability of markets to price sovereign risk. Ex post, the debtor countries could have used the good credit of their guarantors as a way of borrowing beyond their limits, as feared by many contemporary critics of Eurobonds. Since the amounts involved in the bonds we study were relatively marginal to the total debt stock of their guarantors, a feedback effect from debtor moral hazard to the guaranteeing powers' credit standing was unlikely. On the contrary, a reverse feedback from moral hazard problems among creditors to the yields of guaranteed debt was more the case. This happened when the nature of the guaranty (several only) did not lead to co-operation among creditors. Or then in situations where foreign control did not overlap with the provision of guaranties, a case not unlike the current non-overlapping architecture of the EU and the Eurozone.

Appendix

In seeking an appropriate measure of market yields, we tried three options. First we used the Investors Monthly Manual (IMM) own estimate of the simple yields, i.e., the ratio of coupon/ price. The IMM was a widely-read publication at the time, and a likely port of call for contemporary investors, so that by using its yield data we will be approaching more closely the market's appreciation of the return on each bond. As a second alternative we calculated the yield-to-maturity (YTM), from the prices reported in IMM and the redemption schedule included in all the bonds via their sinking funds. As a final alternative we tried to price in the callable options implicit in the majority of the bonds by calculating their yields-to-call (YTC). [83] As an example of the impact of these different definitions, we reproduce in Figure A.1 the yields of the Egyptian guaranteed bond of 1885.

Figure A.1 here

As the market price of this bond hovered above par for almost the whole period, the simple yield was below the coupon (3%). The main exceptions were late 1904 as well as most of 1906-7. Although this bond had a long maturity (41 years), there will be a difference between the simple yields and the YTM.[84] Because of the pricing above par, the YTM is usually smaller than the simple yield. Finally, for the same reason, the YTC is also below the two other yields, as prices above par could conceivably lead investors to anticipate a conversion of the bond into a new loan with lower coupon. Conversely, the YTC rose above the simple yield whenever the bonds traded at a discount.

From the two problems with using simple yields –maturity differences and anticipation of calls–, we think that the first is the overriding consideration in this study for two reasons. First, there is sufficient variation in the maturities of the bonds to warrant caution in using simple yields that assume all bonds to be close to perpetuities. Non-guaranteed bonds had shorter maturities than the guaranteed loans and were priced below par most of the time. For discount bonds, the YTM decreases with maturity, such that simple yields (implying an infinite maturity) are lower than the true YTM. And since non-guaranteed bonds had shorter maturity to run than the guaranteed loans, using simple yields would bias *down* our estimates of the discount of guaranteed bonds r_o-r_g.

In second place, we also computed the YTC of each bond and redid the analysis, but the qualitative results did not change. However, we believe that this definition of yield is less appropriate for the bonds we are considering. As mentioned, the non-guaranteed bonds usually traded at a discount, such that investors would not worry about their imminent conversion. In fact, not one of these bonds was converted and the only coupon reductions in our sample period were the outcome of the Turkish default of 1876-81. Likewise, the guaranteed bonds were never converted into lower coupon bonds, despite the fact that they traded above par for long periods. Hence, YTC would be higher than YTM for non-guaranteed bonds and lower for guaranteed bonds. The result would be a bias *up* of our estimates of r_o-r_g. Between the upward bias from using simple yields and the downward bias of YTC, we conservatively chose the middle option of using the YTM.

[83] Although not reporting the YTC, the editors of the IMM were aware of the implications of callable options for bond pricing, as they made explicit on a couple of occasions (see Mauro, Sussman and Yafeh 2006: 42).
[84] The bond came originally with a 0.3425% annual sinking fund, to which was added a supplemental sinking fund of £90,000 per annum.

Table 1: Summary information on guaranteed bonds, 1832-1898

Loans	Cause	Guarantors	Face value (£m)	Previous debt (£m)	Inte-rest (%)	Issue price (%)	Cost of funding (%)	Secured by	Conditions	Redemption
1833 Greek Loan	Greek independence war	Britain, France, Russia	1.6	2.8	5	94	4.36%	Entire state revenues	Seniority clause	1871
1855 Turkish Loan	Crimean war	Britain, France	5.0	2.9	4	102.6	3.9%	Egyptian tribute, customs of Izmir and Syria	Financial commissions to supervise the expenditure of funds for war purposes	1943
1885 Egyptian Loan	British military campaign	Britain, France, Russia, Germany, Austria-Hungary, Italy	9.424	99.0	3	95.5	4.2%	Property tax	5 per cent discount on coupons of 1885 and 1886	1926
1895 Chinese Loan	Sino-Japanese war	Russia, France	16.0	3.3	4	99	4.0%	Maritime Customs	Seniority clause	1931
1898 Greek Loan	Greek-Turkish war	Britain, France, Russia	6.0327	32.0	2.5	100	2.9%	State monopolies	International financial control	1950

Sources and notes: The Greek 5% Loan of 1833: Kofas (1981), Levandis (1944) Wynne (1951), HCPP (1831-32) No. 007. The Turkish 4% Loan of 1855: Akar and Al (2003), Anderson (1964), HCPP (1854-55) No. 1968 and HCPP (1854-55) No.1961, HMT (1916) No. T 208/13A. The Egyptian 3% loan of 1885: Crouchley (1938), Wynne (1951), HCPP (1884-85) No. C. 4421, p.51-52; HCPP (1885) No. C.4341, RA (1885) No. 000/401D/7. The Chinese 4% (French-Russian) loan of 1895: Denby (1916), Feng-Hua (1919), Kimber, (1920), Viner (1928), MacMurray (1921), FO (1895) Miscellaneous Papers, Vol. 48, p.160. The Greek 2.5% loan of 1898: Levandis (1944), CFB (1893), HCPP (1898) No. C.8778.

The average cost of funding is established from the secondary yields of the following loans (when applicable): the 3% British consols, the 3% French *Rentes*, the 4% Russian Nicholas Railway, the 4% Prussian consolidated, the 4% Austrian Gold *Rentes* and the 5% Italian *Rendita* (4.6%).

Table 2: Bonds used in the short-run analysis

Bond	Dates		Simple yields				
	Start	End	N	Mean	St. dev.	Max	Min
5% Greek 1833 (UK)	4/11/1833	31/12/1834	346	4.43	0.05	4.56	4.24
5% Greek 1833 (France)	19/7/1833	31/12/1834	376	4.96	0.09	5.18	4.67
5% Greek 1833 (Russia)	8/11/1833	31/12/1834	343	4.99	0.05	5.19	4.89
5% Greek 1825	17/1/1832	18/11/1834	218	16.99	2.82	25.64	11.83
4% Turkey 1855	20/08/1855	19/12/1856	337	3.97	0.11	4.19	3.74
6% Turkey 1854	23/08/1854	19/12/1856	593	6.68	0.77	8.23	5.58
3% Egypt 1885	28/08/1885	31/12/1885	57	3.09	0.02	3.12	3.04
4% Egypt unified 1880	2/1/1884	31/12/1885	490	6.24	0.28	7.05	5.79
5% Egypt State domain 1878	2/1/1884	30/12/1885	369	5.83	0.20	6.57	5.42
4% Chinese 1895	20/07/1895	31/12/1895	131	3.96	0.02	4.01	3.92
6% Chinese of 1895 (Cassel)	4/5/1895	31/12/1895	139	5.69	0.07	5.90	5.53
2.5% Greek 1898	8/11/1898	25/09/1899	39	2.49	0.03	2.62	2.46
5% Greek 1881†	3/1/1898	25/09/1899	154	3.97	0.26	4.81	3.58
5% Greek 1884†	4/1/1898	25/09/1899	106	3.98	0.27	4.78	3.57

†Interest reduced to 1.6% since 1898 and later increased till 2.2%.

Table 3: Bonds used in the long-run analysis

Bond		Dates		Yield-to-maturity (YTM)				
Name	**Acronym**	**Start**	**End**	**N**	**Mean**	**St. dev.**	**Max**	**Min**
4% Turkey 1855	y1855	1/1869	6/1894	301	3.46	0.69	4.17	0.41
6% Turkey 1854	y1854	1/1869	6/1894	303	7.80	3.92	29.43	2.48
3% Egypt 1885	y1885	3/1886	12/1907	259	2.95	0.17	3.43	2.57
4% Egypt unified 1880	yunif	3/1886	12/1907	262	4.11	0.51	5.96	3.65
5% Egypt State domain 1878	ystate	3/1886	12/1907	262	4.63	0.38	5.66	4.19
4% Chinese 1895	y1895	8/1895	12/1907	149	4.10	0.25	4.81	3.77
6% Chinese of 1895 (Cassel)	ycassel	8/1895	12/1907	147	5.71	0.21	6.48	5.31
2.5% Greek 1898	y1898	10/1898	12/1907	111	2.93	0.18	3.23	2.51
5% Greek 1881†	y1881	10/1898	12/1907	111	5.38	0.47	6.11	4.43
5% Greek 1884†	y1884	10/1898	12/1907	111	5.19	0.45	5.85	4.26
3% UK Consols	ygbr	1/1869	4/1888	229	3.10	0.12	3.35	2.90
2.75%-2.5% UK Consols	ygbr	5/1888	12/1907	236	2.60	0.24	3.09	1.95
4.5% French bond of 1852	yfra	1/1869	3/1871	18	4.47	0.30	5.63	4.30
3% French Rentes	yfra	4/1871	12/1907	438	3.63	0.74	5.85	2.78
4% Russian 1867 (Nicholas RR)	yrus	9/1895	12/1907	148	4.25	0.46	5.55	3.88

†Interest reduced to 1.6% since 1898 and later increased till 2.2%.

Table 4: Dates of structural breaks in bond yields

Case	Date	95% C.I.	Interpretation (from press)
Greece 1833	09/03/1832	04/03-16/04	
	06/08/1832	21/07-13/09	Palmerston introduces the Greek convention bill in Parliament (inc guaranteed bond)
	26/12/1832	26/12-27/01	Bavarian banker Eichthal arrives to Paris "for the purpose of pressing the business of the Greek loan"
	19/02/1833	31/01/-25/02	Rothschild (Paris) is rumoured to have taken the loan contract
	26/05/1833	08/05-27/08	French Chamber ratifies French share of guaranty, after much opposition
	20/07/1833		Floating of bond in London
	09/11/1833	26/09-13/10	Greek regency refuses to recognize claims of bondholders of the two independence loans
	02/04/1834	31/03-20/06	Greek Prime Minister Trikoupis meets with the King William IV
Turkey 1855	06/11/1854	04/11-25/11	News of assaults and naval bombardment of Sebastopol by allied armies
	19/12/1854	07-12-27/12	Final instalment (15%) of Turkish script paid
	27/05/1855	26/05-01/09	Large purchases from Paris on rumours that Turkish government would issue the remaining £2m of the 1854 loan soon
	9/07/1855		Announcement of the Turkish convention (which had been signed on 27jun1855)
	15/07/1855	10/07-23/07	Announcement that the guaranty of the Turkish loan would be joint
	20/08/1855		Floating of bond in London
	25/09/1855	26/08-02/09	Announced the payment of dividends on the Turkish bonds
	23/01/1856	17/01-19/02	Final instalment on the guaranteed loan due
	08/10/1856	02/10-19/12	Rumours that a new Turkish loan was being contemplated
Egypt 1885	14/05/1884†	03/05-17/05	Announcement of the Conference of the Great powers to be held in London to discuss the revision of Law of Liquidation
	27/05/1884‡	20/05-03/06	French proposal to extend the control over Egypt by involving other Great powers
	22/10/1884‡	22/10-29/10	
	24/10/1884†	14/09-14/11	Announcement of the report of British representative Edgar Vincent on the finances of Egypt
	19/03/1885		All Powers agree in principle to provide joint guaranty for future £9m loan
	27/07/1885		Floating of bond in London
China 1895	04/06/1895	06/05-17/06	
	7/06/1895		*Le Matin* announces agreement for Chinese loan guaranteed by Russia
	29/11/1895	28/11-31/12	Franco-Chinese convention ceding a territory to France is presented to the French parliament for ratification
	19/07/1895		Floating of bond in Paris

Case	Date	95% C.I.	Interpretation (from press)
Greece 1898	07/02/1898*	19/01-01/03	
	11/02/1898		Regarded as practically certain that the Greek indemnity loan would have joint guaranty of the three protecting powers
	10/07/1898		Floating of bond in London
	27/11/1898#	27/11-20/12	Representatives of the Great powers formally announces that King of Greece nominated as High Commissioner for Crete
	01/12/1898*	01/12-26/01	Announcement of the details of Greek public sector reforms
	24/01/1899*	16/12-25/01	
	26/01/1899#	23/01-31/01	Kyparissia Earthquake and reports of extensive economic damage
	18/07/1899#	17/06-19/07	The Greek Parliament approves the military reform to be administered by British and German representatives.
	07/08/1899*	23/07-30/08	

Note: all information gathered from *The Times*, except when explicitly mentioned. Dates in bold were not identified as structural breaks. †Breaks in 4% unified bond of 1880 ‡ Breaks in 5% state domain bond of 1878 # Breaks in 5% loan of 1881 * Breaks in 5% loan of 1884.

Table 5: Tests of Dilution

Comparator window (days)	Mean Returns		t Test
	Comparator (r_1)	Announcement (r_0)	(r_1 - r_0)
30	0.0011	0.0067	-1.4249
	(0.0052)	(0.0081)	(0.0823)
60	0.0011	0.0067	-1.6006
	(0.0048)	(0.0081)	(0.0574)
30	0.0057	0.0011	1.0581
	(0.0059)	(0.0104)	(0.8460)

Numbers in parenthesis are standard deviations in the returns columns and p values in the last column.

Table 6: Long-term discount of guaranteed bonds

Sovereign	Period	Mean	Median	St. dev.	Max	Min
Ottoman Empire†	1869-1894	315.81	328.90	85.82	502.69	95.46
Egypt	1885-1907	115.34	108.47	48.60	278.05	51.70
China	1895-1907	161.11	166.43	28.27	228.87	75.75
Greece	1898-1907	245.71	264.13	55.17	331.49	137.57

†excluding the period in default (1876-81)

Table 7: Factor loadings and uniqueness

Country	Bonds	Factor 1	Factor 2	Uniqueness
Turkey	ygbr	0.9144		0.1639
	yfra	0.6967		0.2290
	y1855	0.8190		0.2166
	y1854	0.0982		0.4447
Egypt	ygbr	0.9793	-0.0558	0.034
	yfra	0.7481	0.6224	0.0396
	y1885	0.9323	0.312	0.0267
	ystate	0.0676	0.9864	0.0146
	yunif	0.2087	0.9675	0.0127
China	ygbr	0.1478		0.0418
	yrus	0.8253		0.0387
	y1895	0.8042		0.0028
	ycassel	0.9865		0.0265
Greece	ygbr	0.9863	0.1537	0.0024
	yfra	0.9421	0.3266	0.0033
	yrus	0.5296	0.7703	0.0657
	y1898	0.9642	0.2595	0.0001
	y1881	0.1744	0.9845	0.0003
	y1884	0.2278	0.9734	0.0003

Table 8: GMM estimates of Panel VAR

		ygbr	yfra	yrus	y_g	y_{o1}	y_{o2}
Turkey	ygbr	0.9696***	0.0317**		-0.0228	0.0007	
(N=870)		(0.0108)	(0.0159)		(0.0165)	(0.0012)	
	yfra	0.0214	0.9864***		-0.0743	-0.0272	0.0017
		(0.0271)	(0.0662)		(0.0736)	(0.0050)	
	y1855	-0.0427	-0.0067		1.013***	0.0022	
		(0.0533)	(0.1570)		(0.1719)	(0.0099)	
	y1854	-0.1176	0.2960		-0.0656	0.9333***	
		(0.4806)	(1.3632)		(1.5048)	(0.1049)	
Egypt	ygbr	0.8852***	0.0017		0.1704	0.0092	0.0033
(N=842)		(0.1070)	(0.0316)		(0.2046)	(0.0432)	(0.0151)
	yfra	-0.1028	0.8373***		0.2221	0.2685	0.0163
		(0.1050)	(0.0837)		(0.2174)	(0.0467)	(0.0432)
	y1885	0.0491	0.0971**		0.958***	0.0435	-0.0721
		(0.1079)	(0.0464)		(0.2052)	(0.0451)	(0.0234)
	ystate	-0.1360	-0.0149		0.1770	0.9172***	0.0746
		(0.1069)	(0.0678)		(0.2008)	(0.0651)	(0.0520)
	yunif	0.0151	0.0770		0.0278	0.0771	0.8785***
		(0.1056)	(0.0405)		(0.2056)	(0.0477)	(0.0369)
China	ygbr	0.9883***		0.0092	-0.0091	0.0049	
(N=515)		(0.0308)	(0.0093)	(0.0280)	(0.0378)	(0.0783)	
	yrus	-0.0564	0.9777***	0.0753	-0.0084	-0.0147	
		(0.0753)	(0.0463)	(0.0568)	(0.0525)	(0.1694)	
	y1895	0.0948	0.0357*	0.8141***	0.0511	0.1298*	
		(0.0624)	(0.0225)	(0.0592)	(0.0436)	(0.0767)	
	ycassel	-0.0833	-0.0208	0.1679	0.9213***	0.7714***	
		(0.1114)	(0.0697)	(0.1086)	(0.0873)	(0.1294)	
Greece	ygbr	0.9310***	0.0141	0.0070	0.0307	0.0593	-0.0585
(N=428)		(0.0690)	(0.0592)	(0.0204)	(0.1226)	(0.0936)	(0.0880)
	yfra	0.0306	1.0145***	0.0002	-0.0587	-0.0968	0.0944
		(0.0341)	(0.0341)	(0.0173)	(0.0550)	(0.0692)	(0.0661)
	yrus	-0.1970	-0.1769	0.9802***	0.3765	-0.0965	0.0938
		(0.1301)	(0.1370)	(0.0668)	(0.2475)	(0.2568)	(0.2396)
	y1898	0.1877***	0.1829***	0.0426***	0.5506***	0.0250	-0.0058
		(0.0447)	(0.0474)	(0.0212)	(0.0720)	(0.0994)	(0.0968)
	y1881	0.0123	-0.0696	-0.0530	0.1266	0.3465	0.6192*
		(0.1536)	(0.1781)	(0.0645)	(0.3174)	(0.3808)	(0.3726)
	y1884	0.0019	-0.0037	-0.0049	0.0110	0.0220	0.9550**
		(0.1527)	(0.1715)	(0.0634)	(0.3092)	(0.3866)	(0.3802)

y_g represents the yields of the guaranteed bonds in each case; y_{o1} and y_{o2} stand for the first and second non-guaranteed bond in each case. Standard errors in parenthesis. ***, ** and * denote significant coefficients, respectively at the 1, 5 and 10 % confidence levels.

Table 9: Variance decomposition of Turkish bonds

	ygbr	yfra	y1855	y1854
ygbr	0.9083	0.0210	0.0695	0.0013
yfra	0.5033	0.4321	0.0602	0.0044
y1855	0.0658	0.0016	0.9296	0.0030
y1854	0.0233	0.0362	0.0047	0.9359

Decomposition for 10 periods ahead.

Table 10: Variance decomposition of Egyptian bonds

	ygbr	yfra	y1885	ystate	yunif
ygbr	0.8804	0.0253	0.0888	0.0039	0.0016
yfra	0.6663	0.1946	0.1253	0.0131	0.0006
y1885	0.7269	0.0616	0.1975	0.0067	0.0073
ystate	0.4593	0.0556	0.1166	0.3643	0.0043
yunif	0.6791	0.1066	0.0617	0.0662	0.0865

Decomposition for 10 periods ahead.

Table 11: Variance decomposition of Chinese bonds

	ygbr	yrus	y1895	ycassel
ygbr	0.9983	0.0011	0.0001	0.0004
yrus	0.5150	0.4637	0.0212	0.0001
y1895	0.7469	0.0611	0.1664	0.0256
ycassel	0.3964	0.0601	0.0526	0.4908

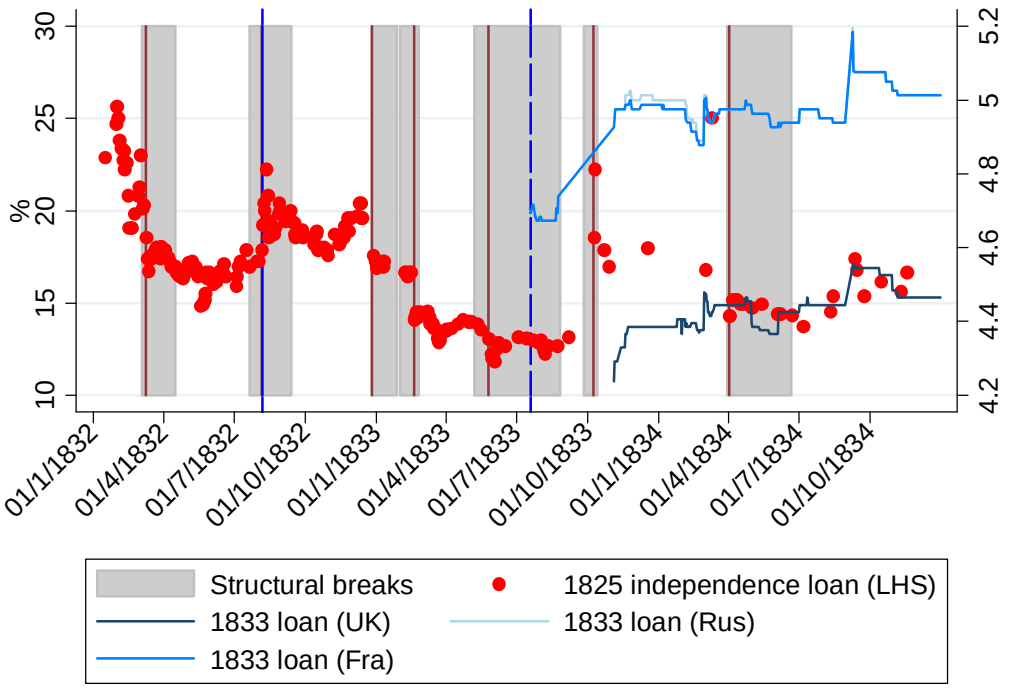
Decomposition for 10 periods ahead.

Table 12: Variance decomposition of Greek bonds

	ygbr	yfra	yrus	y1898	y1881	y1884
ygbr	0.9959	0.0029	0.0006	0.0004	0.0000	0.0002
yfra	0.8766	0.1202	0.0000	0.0014	0.0005	0.0013
yrus	0.5079	0.0490	0.4069	0.0342	0.0010	0.0010
y1898	0.9368	0.0397	0.0062	0.0163	0.0007	0.0003
y1881	0.6142	0.0003	0.0004	0.0064	0.3514	0.0272
y1884	0.6058	0.0000	0.0019	0.0061	0.3484	0.0378

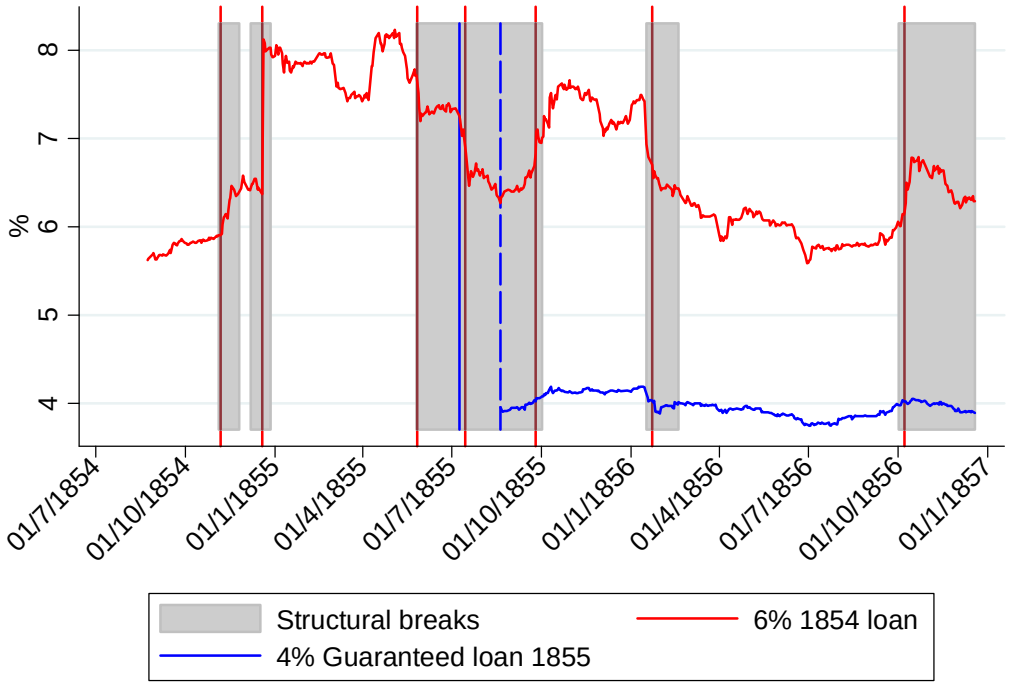
Decomposition for 10 periods ahead.

Figure 1: Greek bonds, 1832-34



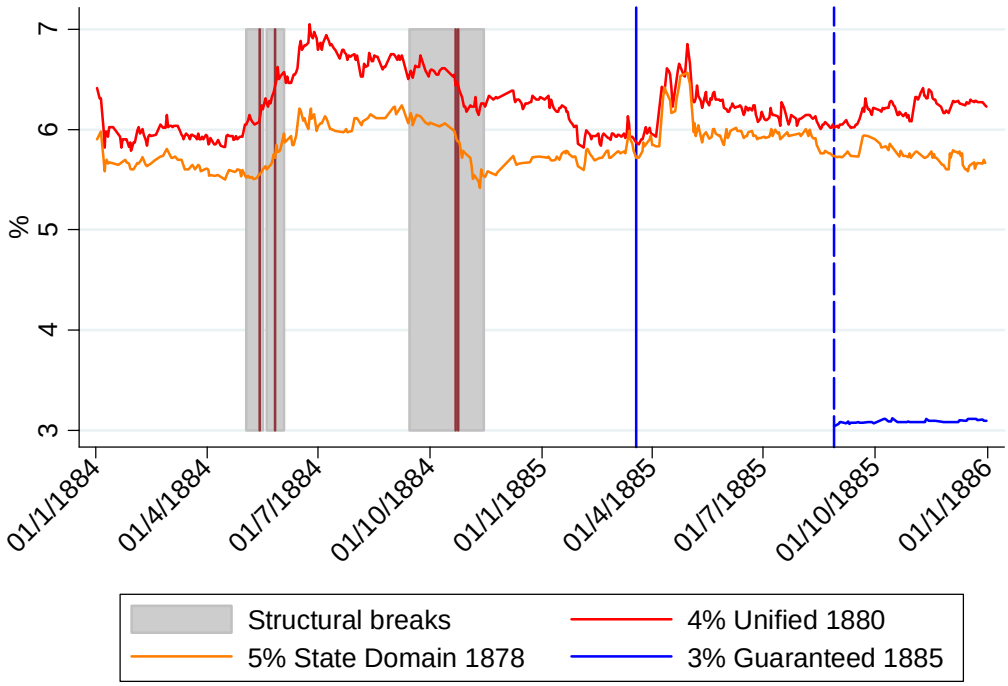
Structural breaks at 5% significance with 95% confidence intervals from Bai and Perron (1998)

Figure 2: Turkish bonds, 1854-56



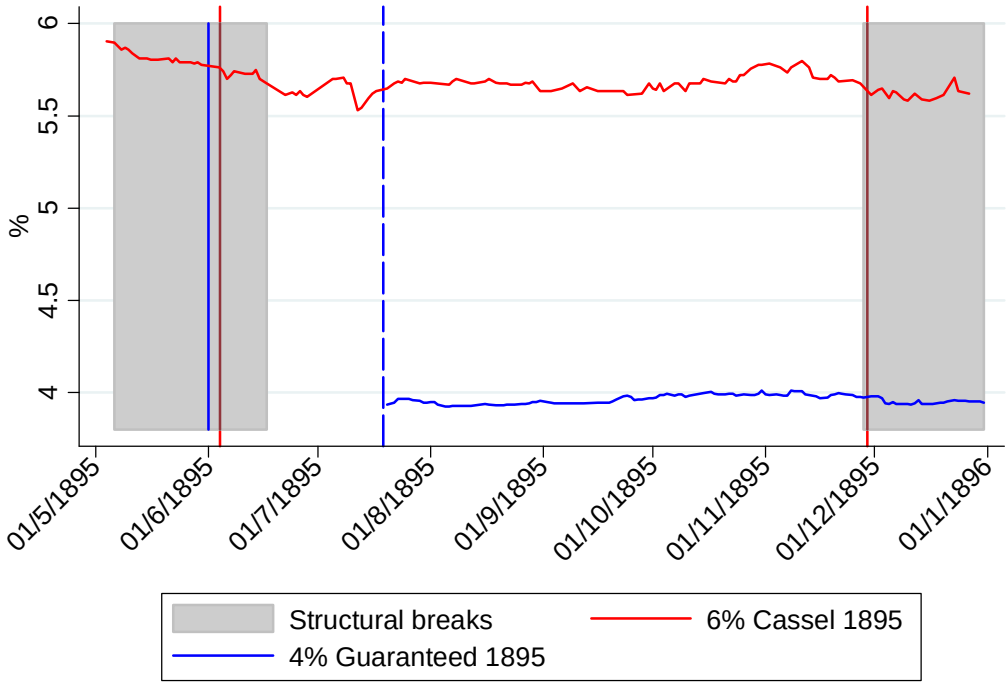
Structural breaks at 5% significance with 95% confidence intervals from Bai and Perron (1998)

Figure 3: Egyptian bonds, 1884-85



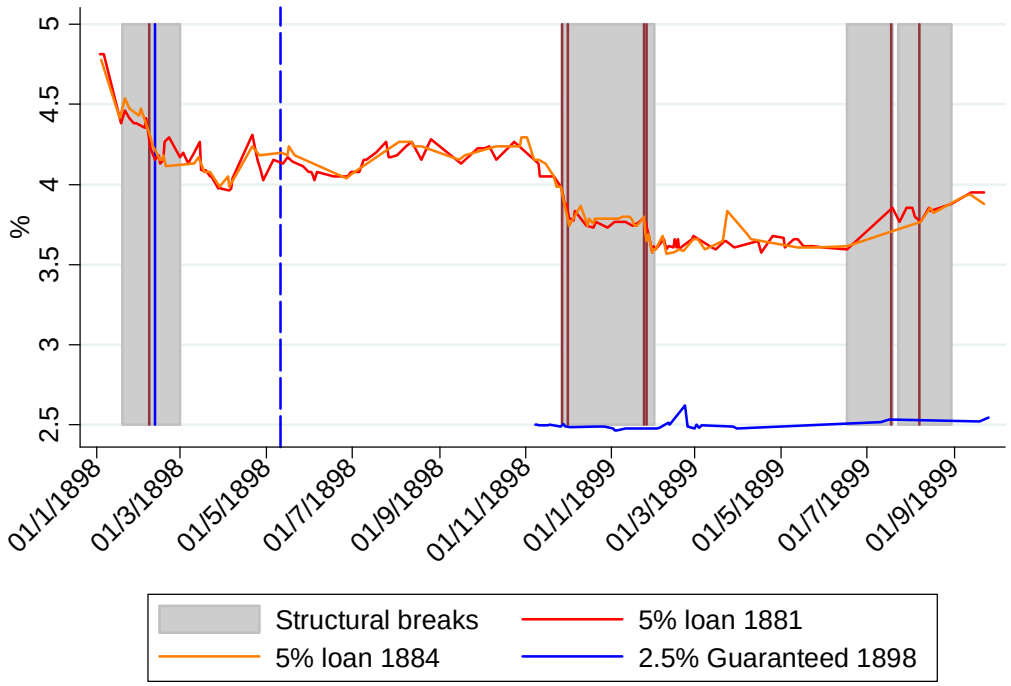
Structural breaks at 5% significance with 95% confidence intervals from Bai and Perron (1998)

Figure 4: Chinese bonds, 1895



Structural breaks at 5% significance with 95% confidence intervals from Bai and Perron (1998)

Figure 5: Greek bonds, 1898-99



Structural breaks at 5% significance with 95% confidence intervals from Bai and Perron (1998)

Figure 6: Long-term difference r_o - r_g

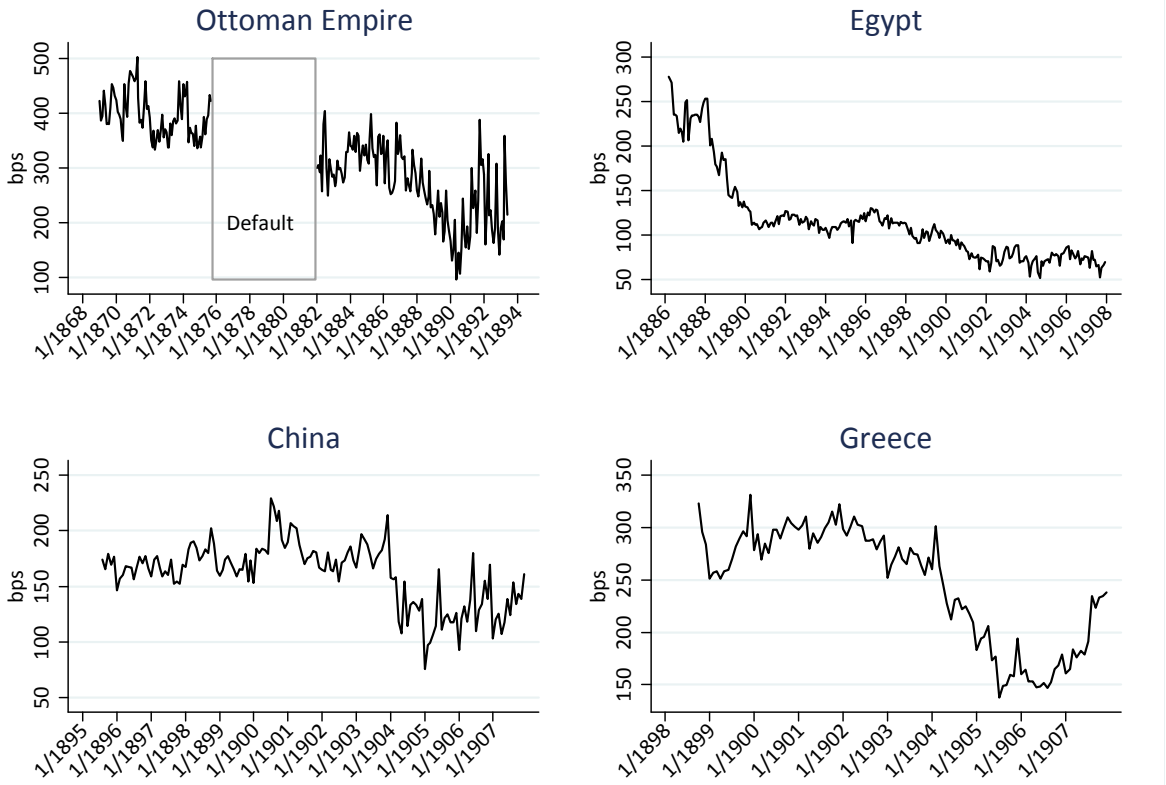
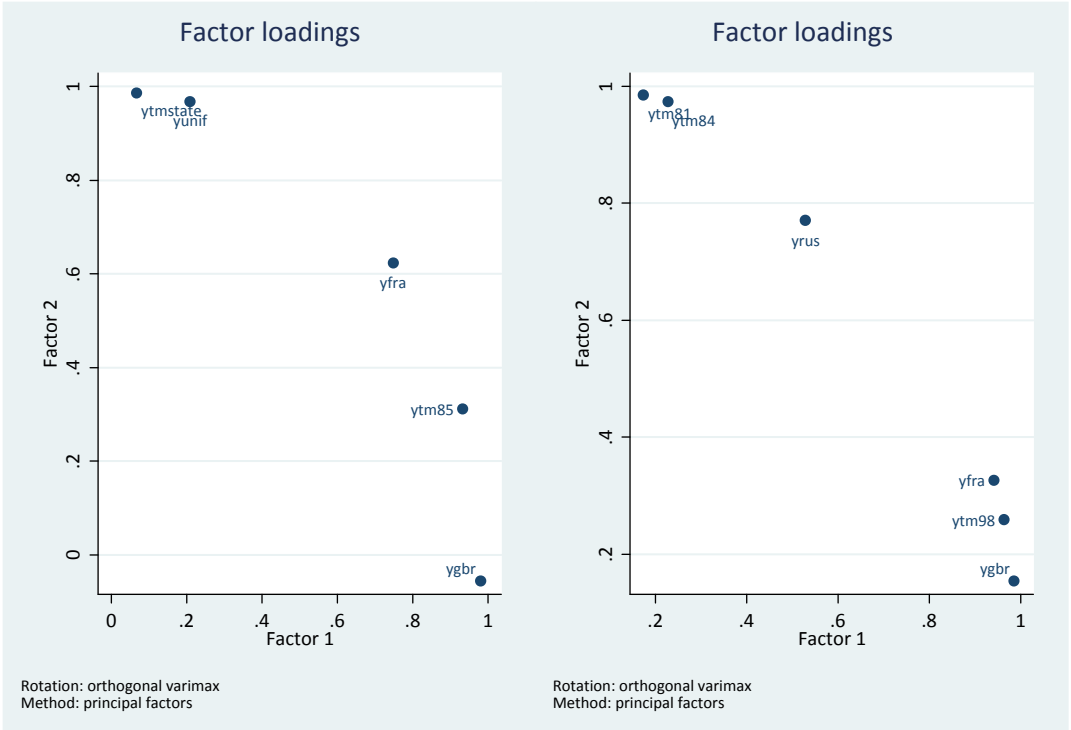
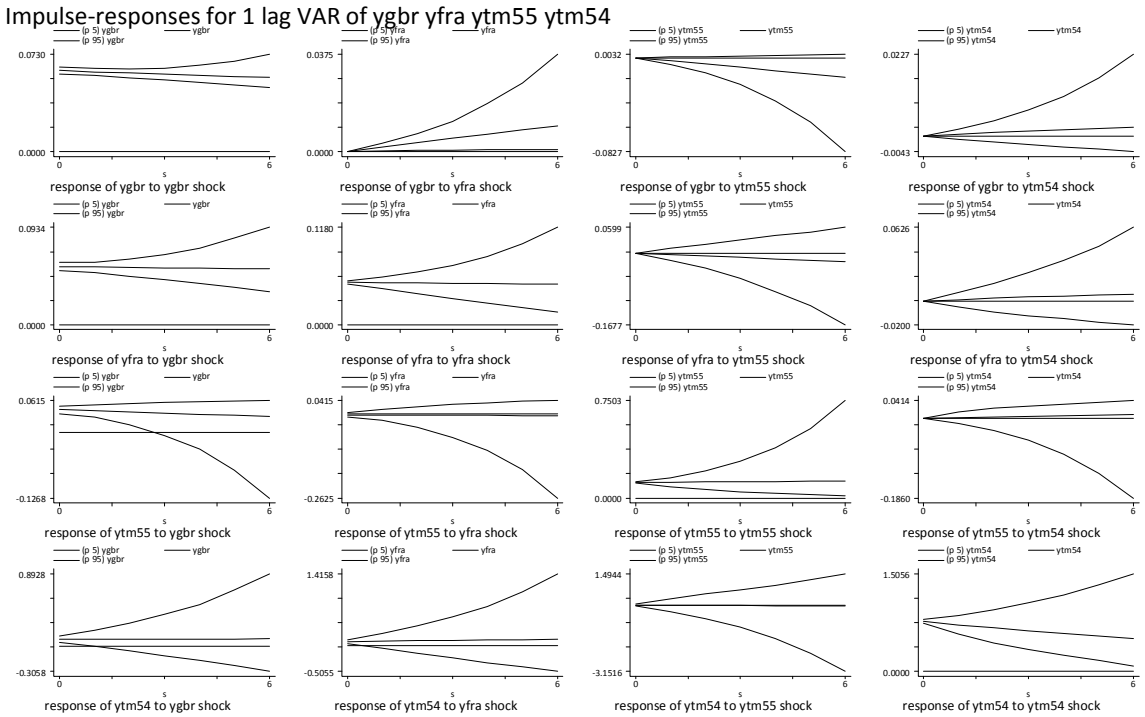


Figure 7: Factor loadings for Egypt and Greece



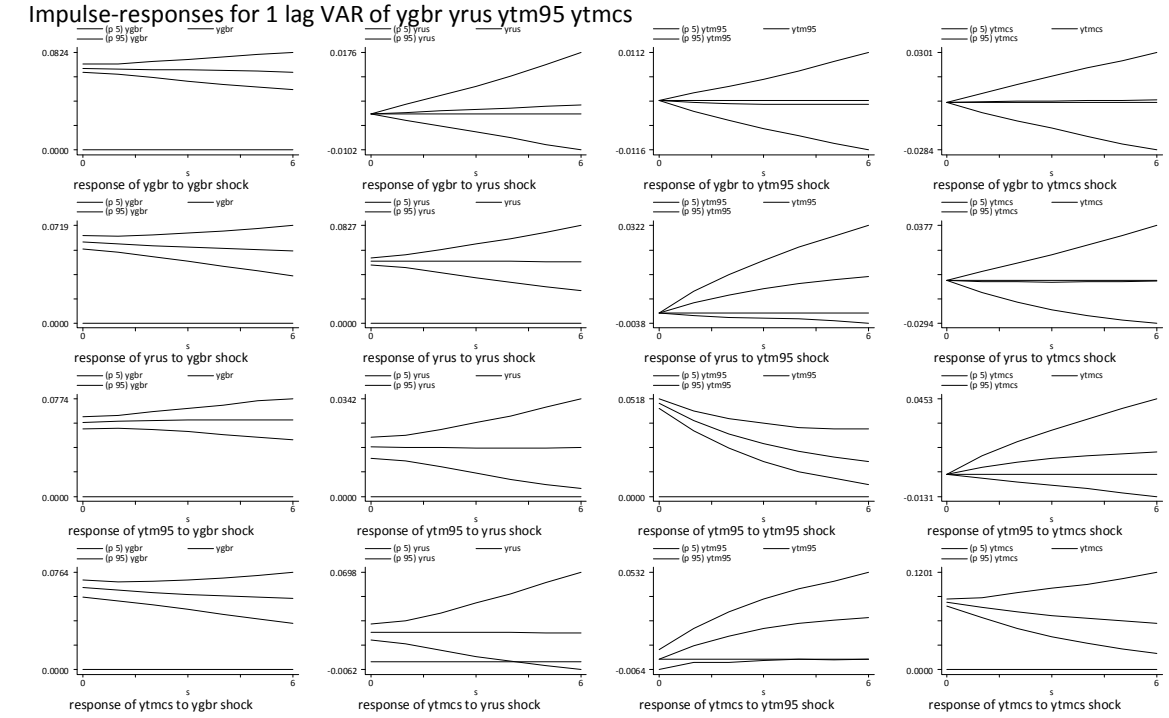
Left: Egypt, 1886-1907. Right: Greece, 1898-1907

Figure 8: Impulse Response Functions for Turkey 1855



Errors are 5% on each side generated by Monte-Carlo with 500 reps

Figure 9: Impulse Response Functions for China 1895



Errors are 5% on each side generated by Monte-Carlo with 500 reps

Figure 10: Impulse Response Functions for Egypt 1885

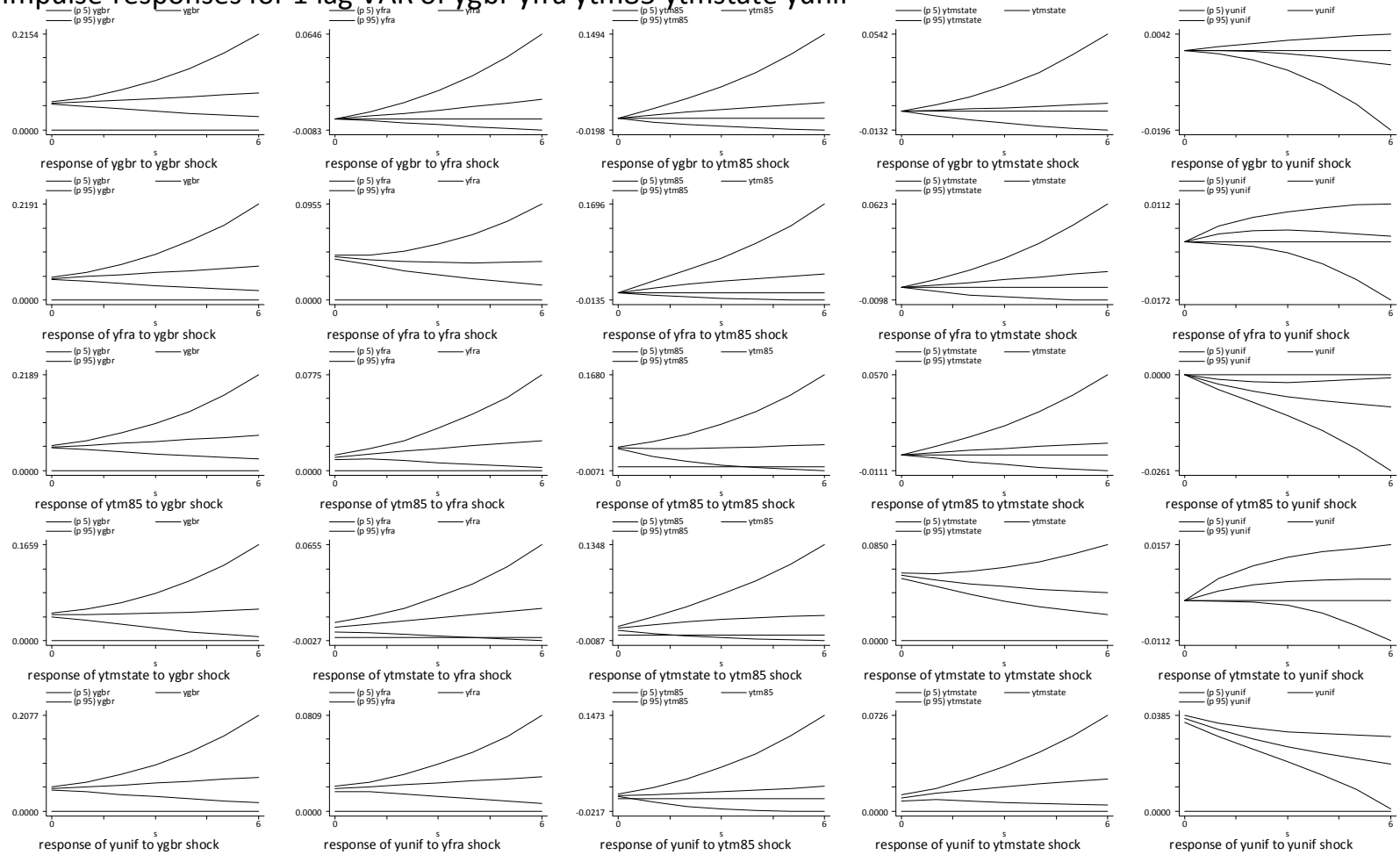
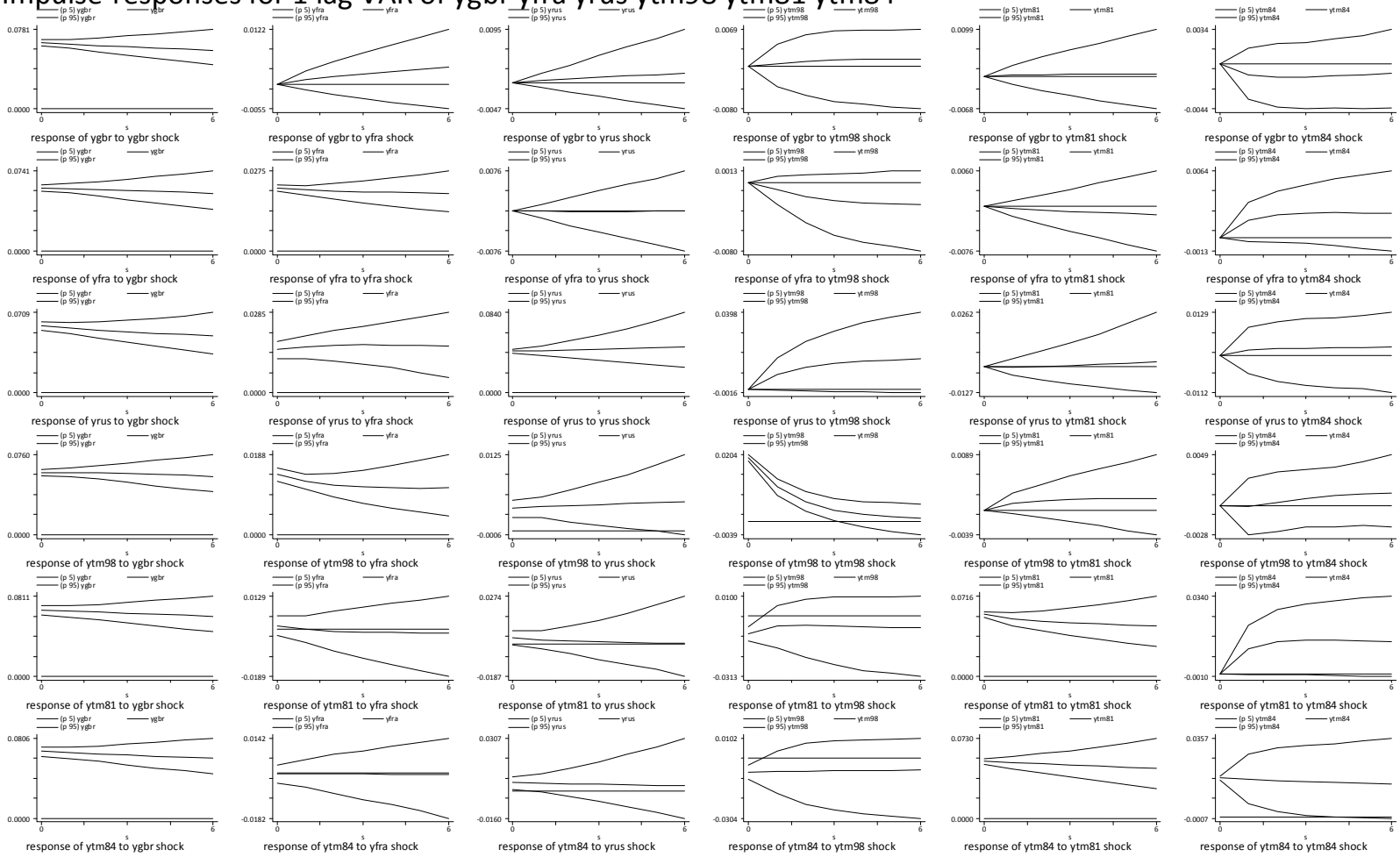


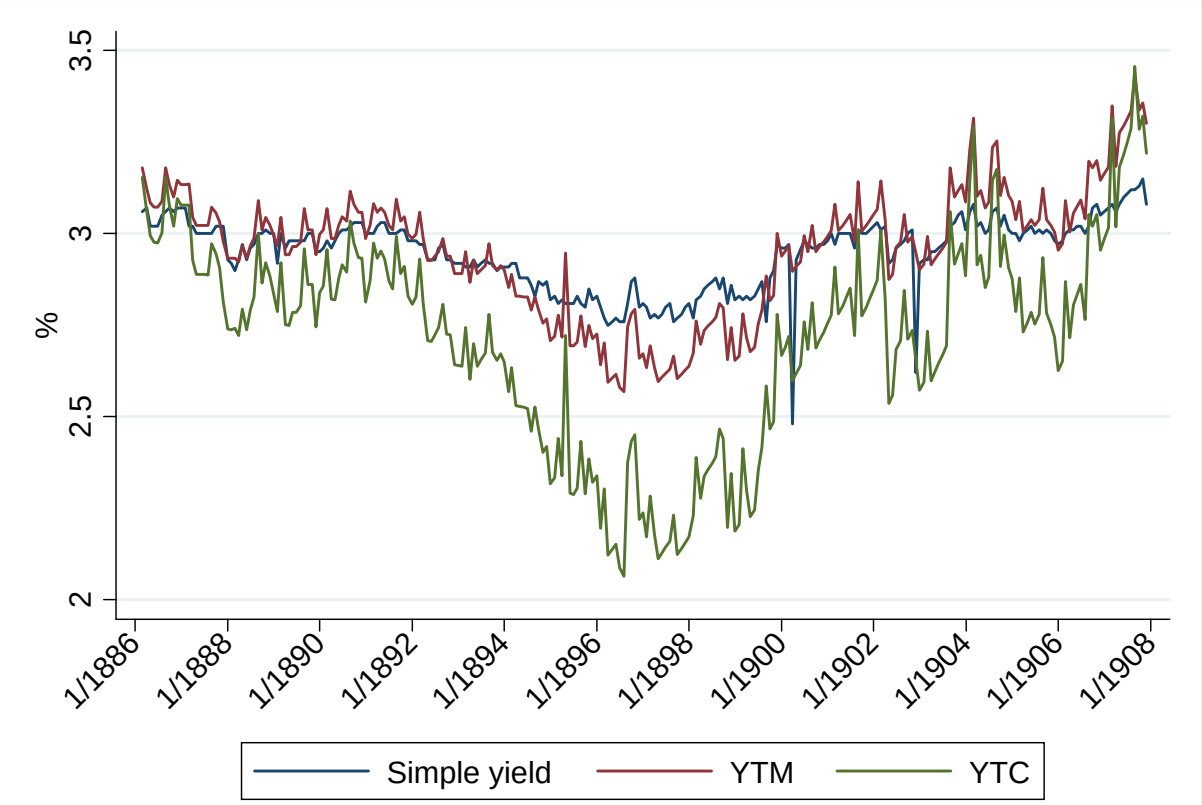
Figure 11: Impulse Response Functions for Greece 1898

Impulse-responses for 1 lag VAR of ygbr yfra yrus ytm98 ytm81 ytm84



Errors are 5% on each side generated by Monte-Carlo with 500 reps

Figure A.1: Alternative yields of Egyptian 3% guaranteed bond of 1885



Monthly data. Source: IMM.

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