# Institutions, Deficits, and Wars: The Determinants of British Government Borrowing Costs from the End of the Seventeenth Century to 1850

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September , 2012

## Abstract

We present historical data on sovereign bond spreads drawn from 300 years of data (from the late seventeenth century to the late twentieth century), which appear to be inconsistent with the North and Weingast (1989) view that institutional changes and reforms can reduce the cost of government debt soon after they are implemented. Extended time series data on British government debt from the late seventeenth century until 1850 show that, for over a century after the Glorious Revolution, and even in the nineteenth century, wars and episodes of instability were a significant and robust determinant of the risk premium on British government debt. Furthermore, we show that the effect of wars on the cost of debt is due in part to an increase in "country risk," not only to war-induced budget deficits. This evidence is inconsistent with the claim made by Barro (1987) according to which the increase in interest rates was due to temporary increases in government spending. Results reproduced from Sussman and Yafeh (2000) suggest that in nineteenth century Japan, as well as in large samples of emerging markets in the period 1870-1913 and in the 1990s (Mauro, Sussman and Yafeh, 2006) wars and political instability were strongly correlated with the cost of debt, whereas institutional changes were not. Our overall reading of the historical evidence is therefore that institutional reforms rarely have a rapid and significant impact on bond spreads which tend to respond, at least in the short run, primarily to crises and instability.

**KEYWORDS:** Institutional reforms; credible commitment; sovereign debt; bond yields.

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We thank Roi Azoff and Tomer Yafeh for excellent research assistance. Some of the material presented in this paper draws on the book *Emerging Markets and Financial Globalization: Sovereign Bond Spreads in 1870-1913 and Today* (by Paolo Mauro and the present authors, Oxford University Press, 2006), as well as on two earlier articles by the present authors (Sussman and Yafeh 2000 and 2006). Both authors are of the Hebrew University of Jerusalem and CEPR. Yafeh is also affiliated with ECGI. Financial support from Krueger Center at the Hebrew University (Yafeh) is gratefully acknowledged.

## I. Introduction

What determines differences in interest rates faced by borrowing developing countries? In light of the immense interest in the effects of institutions on economic development following North (1990) and North and Weingast (1989), this paper uses historical data on sovereign debt drawn from various periods and countries from the 1690s to the 1990s to examine the extent to which changes in institutional quality have an immediate and direct impact on the cost of debt of borrowing nations, in comparison with the role played by wars and episodes of violent political turmoil. Our main conclusion is that, throughout historical periods, geographic zones, and data sets, wars and instability consistently affect borrowing costs, whereas institutional reforms typically do not elicit investor response in the short run, perhaps because a long period of time is needed to establish their credibility, or because the very nature of the reform process is gradual and cumulative.

We begin by revisiting our earlier work that focused on Britain following the Glorious Revolution (Sussman Yafeh, 2006) and extend the time series data on the cost of Britain's debt to 1850: During that period, the cost of British government debt increased substantially. While Barro (1987) attributes the higher borrowing rates to the effect of temporary military spending on crowding out of private consumption, we demonstrate that the rising cost of debt reflects mainly a direct increase in the risk premium due to the uncertainty associated with the outcome of the war. We introduce a novel variable — the size of the British navy — that, we argue, is a direct measure of the effect of war-induced risk on

government borrowing costs.[2] These findings confirm that risk associated with wars was the primary driver of variation in the cost of Britain's government debt even when the country was already (relatively) rich, industrialized, and institutionally developed.

In the rest of the paper we present, in a unified framework, results from different data sets and time periods presented in our own previous research (Sussman and Yafeh, 2000, Mauro, Sussman and Yafeh, 2002, Mauro, Sussman and Yafeh, 2006, and Sussman and Yafeh, 2007). Our findings for Britain are also echoed for Japan, which, following the dramatic victory over Russia in 1904-1905, enjoyed nearly unrestricted access to foreign capital markets. Apparently, Japan's surprising military victory over a European power reduced the uncertainty related to the sustainability of Japanese economic development and debt repayment capacity much more than nearly three decades of institutional and economic reforms. Finally we move on to a large sample of other developing countries of the period 1870–1913, and conclude our investigation in the 1990s (Mauro, Sussman and Yafeh, 2006). For all of these countries and time periods, we study the determinants of spreads on government bonds and find that institutional changes and reforms have never been a major driver of the cost of capital of borrowing nations. Instead, the primary determinant of the cost of capital is peace and political stability. While good institutions are likely to contribute to economic growth in the long run, the historical support for the mechanism proposed by North and Weingast (1989) — that institutional reforms lower the cost of capital in the short run and hence foster financial and economic development — is limited.

[2] O'Brien and Duran (2010) independently claim originality for the use of naval strength data in their work. However, the focus of their paper is quite different than ours.

The present paper is naturally related to previous studies which have cast some doubt on the importance of institutional changes in seventeenth and eighteenth century Britain in comparison with other changes.[3] The present study is also closely related to studies of the relation between the cost of capital, institutional changes, and political events: for example, Epstein (2000) studies Europe between 1300 and 1750 and argues that differences in formal constitutional arrangements do not account for differences in interest rates. Summerhill (2005a and 2005b) studies Brazil in the nineteenth century and finds some impact of institutional changes on the government's ability to borrow (mostly domestically), although most of the "structural breaks" he identifies seem to be closely related to revolts and instability. Finally, Saigheh (2009) examines the case of Argentina and argues that the Constitution of 1859 did lead to a "break" in Argentina's cost of capital. The evidence in this literature on this issue is therefore mixed.

The remainder of this paper is structured in chronological order. The next section, the main empirical section of the paper, presents the data and evidence for Britain between the end of the seventeenth century and the middle of the nineteenth century. Section III reproduces the evidence for Meiji Japan. Section IV discusses other emerging markets in the pre-World War I era, and Section V presents (very briefly) evidence from the 1990s. In presenting the findings for the various periods, we focus primarily on simple statistics and graphical presentations and refer the reader to more rigorous econometric analyses presented elsewhere. Section VI concludes the paper.

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[3] See, for example, Brewer (1990), Ferguson (2001), O'Brien (2002), and Stasavage (2002, 2003, and 2007). All of these are reviewed in more detail in Sussman and Yafeh (2006).

## II. Britain: from the Glorious Revolution to Waterloo

Figures 1A 1B (reproduced from Sussman and Yafeh, 2006) display estimates of the cost of British government debt starting soon after the institutional changes of the late seventeenth century, highlighted by North and Weingast (1989). Figure 1A presents several estimates of the absolute cost of British debt (interest rates), and Figure 1B presents the interest rate differential ("spread" in modern parlance) between British government debt and debt issued by the Province of Holland.[4] Both figures suggest that early in the eighteenth century, when Britain was involved in military conflicts, its cost of debt was high: Despite the newly established institutions, the four decades following the Glorious Revolution can be characterized as a period of a high and fluctuating cost of capital, rather than as an era of permanently low interest rates, suggesting that wars and military conflicts had a more direct effect on interest rates than the establishment of "good" institutions. Subsequent major wars, e.g. the Seven Years War (1756-1763) and the American War of Independence both had noticeable effects on Britain's cost of debt nearly a century after the institutional changes of the Glorious Revolution.

To capture the effect of war intensity and the potential effect it had on the risk premium Britain had to pay on its debt, we collect data on the number of enlisted men in the navy and land army, drawn from the British Parliamentary Papers. Figure 1C shows that throughout the 18$^{th}$ century until the end of the Napoleonic wars, the number of men in the British navy during peace time was fairly low and stable at around 20,000 sailors. During

[4] See Sussman and Yafeh (2006) for details on the construction of the various series used in these figures, as well as for comparisons of Britain's cost of debt with that of several Continental European countries.

war times, navy manpower increased dramatically, by a factor of three to seven, corresponding to the varying degrees of intensity of the different wars. Figure 1C suggests that the pattern by which wars were the primary driver of fluctuations in the cost of capital of Britain, the most economically and institutionally advanced country of the time, continued well into the nineteenth century. Consol yields (interest rates on perpetual government bonds) during war times throughout the 18th century increased and hovered around 6 percent during periods of turmoil (in the 1780s and in the first decade of the nineteenth century), levels roughly similar to those of the 1720s.[5] Moreover, Figure 1C suggests also that the cost of British debt co-moved fairly closely with the number of enlisted men in the British navy, a proxy for the wars and the intensity of actual and impending military conflicts.[6]

The effect of wars on British long term interest rates has been studied before. Barro (1987) claims that war finance accounts for most of the variation in long term interest rates in Britain from 1700 to World War I. His interpretation is that wartime spending is largely unanticipated and therefore crowds out investment and consumption. Consequently short term real interest rates should rise at the end of a war, reflecting the higher return to the unexpected lower levels of capital; Long term interest rates which, by assumption, incorporate the anticipated term structure, should rise immediately at the beginning of a war. Barro's empirical analysis is consistent with this hypothesis; however, it cannot reject the traditional view that interest rates increase due to budget deficits that have to be financed by

[5] The comparison of absolute interest rate levels should be treated with caution; the series for the early eighteenth century are based on a variety of indirect estimates described in Sussman and Yafeh (2006). Consol yields, which are used in Figure 1C, are only available starting in the middle of the eighteenth century.

[6] In the analysis below we show that the number of seamen in the navy is more closely correlated with borrowing costs than the number of soldiers in the Army.

debt (i.e. a temporary effect), and also with an increased debt to GDP ratio (a longer term effect). In order to disentangle the effects of deficits and temporary unanticipated spending, and in order to argue for his interpretation, Barro notes that

> "Over the sample of more than two hundred years, I found two examples of major budget deficits that were unrelated to wartime (or the business cycle). One episode featured compensation payments to slave-owners in 1835-36, and the other involved a political dispute over the income tax in 1909-10. Because of the 'exogeneity' of these deficits, it is interesting that interest rates showed no special movements at these times." (Barro, 1987, p. 246).

In light of the evidence presented above, we interpret Barro's findings in a different way: Wars had an additional effect on the British *risk premium* above and beyond the direct economic costs associated with temporary military spending. While Barro claims that ordinary temporary deficits did not have an impact on long term bond prices, those associated with wars did. This suggests that wars introduced a component of uncertainty regarding the future ability to repay the loans, which could explain why investors reacted differently to deficits caused by wars in comparison with deficits of similar magnitudes driven by other reasons.[7]

We now proceed to test more formally our hypothesis that wars had an independent effect on the cost of capital beyond its fiscal implications in the period 1730 to 1850.[8] We use Mitchell (1988) to reconstruct Barro's measure of military spending to GDP and to obtain

[7] Note that the Barro (1987) analysis holds for a closed economy; Sussman Yafeh (2006) show that Britain's capital markets were integrated with markets in Europe. Also, Barro (1987), acknowledges the possibility of a rising risk premium owing to the war, but ignores it in the rest of his paper.

[8] Annuities become available then for the first time. Consols were introduced in 1753.

fiscal and export data. We also include measures of manpower voted by Parliament to the navy and the land army.[9]

Table 1A presents the results obtained from univariate regressions of the Consol yield on the likely explanatory variables: Barro's measure of military spending; the lagged debt to GDP ratio; the current budget deficit to GDP ratio; the real value of exports (a proxy for the ability to repay debts). Finally we introduce two direct measures of the intensity of warfare: the size of the land army and the size of the navy. We can readily see that (with the exception of exports) the unconditional correlation of these variables with Consol yields is significant and, more interestingly, the correlation with the highest statistical significance is the one between yields and the number of navy seamen.

We proceed to the multivariate analysis and test directly for the added explanatory power of the number of seamen in the navy, conditional on the standard variables affecting the cost of sovereign borrowing. We begin by testing for the explanatory power of Barro's hypothesis vs. the standard deficit to GDP variable. In our sample, the deficit to GDP ratio has more explanatory power than the measure of military spending (Table 1B, column 1).[10] When we include additional explanatory variables (column 2), the military spending ratio is insignificant. In the remaining specifications we use the government deficit to GDP ratio and observe (columns 3 through 5) that the number of seamen in the navy has an independent effect beyond that of the standard fiscal measures analyzed in our previous work (Sussman

[9] British Parliamentary papers 1868-69 (366) (366-I); Estimates of land army personnel are for 1869-70.

[10] Barro's (1987) study includes the First World War and his regression results slightly favor the military spending hypothesis but he concludes that "… the principal finding is an inability to disentangle the effects of spending from the effects of budget deficits" (p. 243).

and Yafeh 2006). The marginal effect of increasing the number of seamen in the navy by 10,000 increases the cost of government borrowing by up to 15 basis points (column 2). Thus, in 1813 when naval forces reached a maximum of about 100,000 men above their average, our estimates suggest that the risk premium was up to 150 basis points higher than normal, a very high figure given that consol coupon yields at the time were 3%.

We briefly relate our findings to recent work by O'Brien and Duran (2010) who emphasize the importance of British naval power in explaining the success of the Industrial Revolution. While our results imply that the British navy was perceived as crucial for the defense of the realm (and indirectly for economic growth), the increasing number of seamen in the navy had a crowding out effect on investment through an increase in the cost of capital. In column (5) we introduce a variable measuring the "efficiency" of naval forces in securing exports by taking the ratio of exports to seamen in the navy. The results indicate that whenever this ratio of goes up, long term borrowing rates go up as well, potentially crowding out private investment.

Consol yields, as well as most other explanatory variables, contain unit roots and therefore one cannot reject the presence of serial correlation. We address the unit root problem by finding a single co-integrating equation using the Johansen procedure; and we address the issue of serial correlation by estimating ARMA regressions (Table 1C): Using both specifications, with deficits (column (1)) and with Barro's measure of military spending (column (2)), we confirm the statistical significance of the effect of the size of the navy, our proxy for war intensity.

Finally, we also test our hypothesis by using difference equations, thereby also addressing potential concerns due to the unit root properties of the levels of the variables.

The difference regressions presented in Table 1D show that our hypothesis still holds. For a given level of budget deficit, debt to GDP levels and military expenditures, an increase in the number of men serving in the navy increases the British government's cost of borrowing.

We proceed to provide some more direct measures of the effects of war on long term yields by focusing on the period of the Napoleonic wars. Using data on the actual dates of major battles, as well as on the dates in which battles were reported in the *London Times* (depending on the location of the battles, these dates could be far apart), the regressions in Table 2 suggests that, on average, a naval battle raised the yield much more than a land battle, presumably because the navy was regarded as the "wooden wall" of Britain whereas the army fought mainly overseas.

The regressions in columns 2 and 3 include both the size of the navy (log of the number of enlisted men, column 2) and the size of the army (column 3). In line with our previous findings, the size of the navy seems to be a particularly important explanatory variable because its size could be viewed as a proxy for the extent of foreign threats on Britain itself.[11] Dummy variables that take the value one on the dates of the Truce of Amiens (1801) and of war declarations (1803 with France, 1812 with the United States) have the expected signs (negative and positive, respectively). All of these results are consistent with the views that changes in the cost of capital associated with wars reflect more than their fiscal effects. In column (4) we allow for the possibility that it took some time before investors

[11] Interestingly, the (log of the) number of enlisted men in the navy and in the army are not very highly correlated, with a correlation coefficient of about 0.28.

reacted to events news reports and find that at most a week was needed to affect investor behavior.

Table 3 presents a "search for structural breaks" in the (daily) consol yield series for the years 1790-1815 (see Sussman and Yafeh, 2000, for a detailed description of this statistical procedure). Peace is associated with significant declines in consol yields and wars, or preparations for them, are associated with increases in yields. This is not surprising; the interesting finding here is that, more than a century after the fundamental institutional changes of the seventeenth century, British yields were still quite volatile and sensitive to political and war-related events, despite the institutional superiority of Britain over its rivals.

Moving to an international comparison, Table 4 suggests that the institutionally under-developed United States, soon after its independence, borrowed at rates which were comparable to those of Britain: Controlling for standard macroeconomic variables such as debt per capita and the government deficit (a proxy for the risk of default), Britain did not borrow at lower rates than the United States (the constant term in column 3 is not statistically different from zero). This finding echoes the comparisons made in Sussman and Yafeh (2006) between the cost of debt of institutionally developed Britain of the seventeenth century and its Continental European counterparts – Britain did not borrow more, or at a lower cost, than the Netherlands or other European powers.

The basic statistics presented here (and more sophisticated econometric analyses presented in Sussman and Yafeh, 2006) are consistent with the view that macroeconomic variables and wars were crucial for understanding fluctuations in Britain's cost of capital for a very long period after the fundamental institutional change embodied in the Glorious Revolution. As noted before, this conclusion is consistent with the results of Barro (1987),

who documents fluctuations in consol yields during war times between the early eighteenth and early twentieth century, with Wright (1999), who calculates the volume of British debt in periods of war and in periods of peace, and with Brown et al. (2006), who document substantial volatility in consol yields during the eighteenth century, coinciding with military conflicts, in contrast with the stability of the "Pax Britannica" of the nineteenth century. However, our emphasis here is not on the risk that government debt might crowd out private investment (as in Barro, 1987), but on the special effect of military events and spending, especially with regard to the navy and naval battles, which appear to be a better proxy for risk than military spending in general.

**III. Meiji Japan**

Figure 2, reproduced from Sussman and Yafeh (2000), describes the interest rate differential (or "spread") between Japanese government bonds and British consol yields during the Meiji period. The figure suggests that the establishment of most state institutions in Japan (between the late 1870s and the 1890s) was not perceived as "news" with an immediate effect on the risk associated with Japanese government debt in London. Almost none of the significant reforms of the Meiji period, e.g. the establishment of the Bank of Japan and the introduction of "modern" monetary policy, the promulgation of the Meiji Constitution, or the introduction of parliamentary elections, produced any quantitatively significant market response in London. Nevertheless, the adoption of the Gold Standard in 1897 (an institutional change which can be viewed as a "summary statistic" incorporating a number of preceding cumulative reforms) did lead to a dramatic decline in yields and an increase in volume of Japanese foreign debt.

In line with our results for Britain, some international political events affected yields far more than did the introduction of new institutions. For example, with the onset of the 1904 war with Russia, yields on Japanese bonds in London increased significantly. However, Japan's victory in the war was followed by a (not very large) decline in yields to a level below their pre-war level and, more importantly, by a substantial increase in Japan's ability to raise capital abroad, described in considerable detail in Sussman and Yafeh (2007). Even during the war, when military spending was on the rise, commentary in the *London Times* (April 15, 1904) attributed the rising prices (declining yields) of Japanese bonds (and the opposite trends of Russian bonds) to the surprising Russian naval defeat. In early May 1904, a new 10,000,000 pound Japanese loan was in such high demand that the *London Times* expressed regret that its scale was not large enough to satisfy all the investors who wanted to participate. The Japanese victory at Kin-chau elicited praise in the press: "The recognition of the completeness of the Japanese victory at Kin-chau… (led to) praise for Japanese skill, courage,…. Even more than the Japanese valor, does the Japanese deliberation, thoroughness and scientific conduct of their military operations (deserve praise)…." (May 30, 1904, p. 5). Following a sequence of Japanese victories later in the year and commensurate headlines in the British press, the *London Times* commended Japanese bonds precisely because "(military victories) show that Japan is as ready to work on the best modern methods in finance as in war" (August 27, 1904, p. 11). Indeed, the news report generate the impression of a direct link between the enthusiasm for Japanese bonds in London and developments on the front, ranging from relatively minor victories such as the sinking of a Russian battleship in early December 1904 to the fall of Port Arthur, around which Japanese bond prices rose by about 15%. Similarly, "the progress of the Japanese army towards Mukden encouraged the bulls of

Japanese bonds" (March 7, 1905, p. 11), and the swift subsequent military successes raised bond prices (lowered yields) even further because markets were apparently concerned that any Russian military success might prolong the war.

Following the war with Russia, Japan became one of the largest borrowers on the London market, and was able to issue debt in foreign bond markets other than London as well. Moreover, in the years after the victory over Russia, foreign debt was issued not only by the Japanese government itself, but also by quasi-governmental institutions (e.g. Tokyo Harbourworks, Osaka Electric Tramway, the South Manchurian Rail Company, and the Imperial Industrial Bank of Japan), municipalities and even some private Japanese companies (e.g. Kanegafuchi Spinning). And there is yet more evidence on the impact of the war on the perception of Japan on the London market: underwriting commissions on Japanese bonds, another measure of risk, declined by a third after the victory over Russia, and furthermore, the Japanese government was no longer required to back its debt by securities (e.g. customs income) deposited in London (Suzuki, 1994).

Further support for the claim that the military victory over Russia improved Japan's credit rating in subsequent years can be found quite explicitly in news articles published in subsequent years. For example, starting in 1905 there was concern in Britain over the burden of Japan's war expenditures. The *Economist*, however, advised its readers not to worry because "the sagacity with which the finances of Japan have been administered during a period of stress and anxiety is a good augury…" (February 23, 1905, p. 2072). A later *Economist* article, titled "Japan as a Borrower," explained the "phenomenal success" of Japan's loan operations as "…due about equally to the enhanced reputation of Japan by reason of her military and naval exploits, and the skillful manner in which her loan flotations

ha[d] been conducted…" (July 20, 1907, p. 1212). It seems that the reputation acquired during the successful war with Russia made it possible in later years for Japan to withstand investors' concerns (expressed in many news articles) regarding its increasing fiscal deficit. Apparently, the London market for sovereign debt was much more interested in, and impressed by, the outcome of the war against Russia than by the institutional changes and reforms in the decades prior to the war.

**IV. Emerging Markets in the Period 1870-1914**

Mauro, Sussman and Yafeh (2002 and 2006) construct series of sovereign bond spreads (yields above those of British consols) for a large sample of emerging markets in the period from 1870 to World War I. Mauro, Sussman and Yafeh (2006) combine the spread data with newspaper articles from the *London Times* and the Economist's *Investor's Monthly Manual*, and classify them into categories, including institutional reforms and wars and political instability.

Using this database, in Chapter 4, Mauro, Sussman and Yafeh (2006) list the events which corresponded to the largest (absolute) changes in the cost of capital of borrowing nations – most of these events are related to wars and other forms of instability and stability and violence. Because of the large number of listed events, we do not reproduce these results here. Instead, Table 5 (reproduced from Mauro, Sussman and Yafeh, 2002) presents the events associated with "structural breaks" in the spread series of eighteen emerging markets; again, the vast majority of them are associated with rebellions, wars, and instability rather than institutional change. Table 6 presents regression results from one specification out of several examined in Mauro, Sussman and Yafeh (2006). News on wars and instability are

significantly correlated with spreads, unlike news about reforms. This result holds in a variety of regression specifications (including regressions with additional controls for macroeconomic effects), and is consistent with our findings for Britain and for Japan described above.

## V. Emerging Markets in the 1990s

Table 7 presents regression specifications similar to those of Table 6 for a sample of emerging markets in the 1990s (also drawn from Mauro, Sussman and Yafeh, 2006). Although in general, news reports have a weaker effect on bond spreads in the modern period (in part, because of a much larger extent of co-movement in asset prices across countries in the 1990s in comparison with the pre-World War I period, see Mauro, Sussman and Yafeh, 2002), wars and related instability are still associated with higher spreads in this period too, whereas institutional changes are only weakly related to spreads in a manner that is not consistently statistically significant; this result, however, is not completely robust and changes somewhat in alternative regression specifications.[12]

## VI. Conclusions

This short paper presents a comparative analysis of the determinants of the cost of sovereign bonds issued by borrowing governments over three centuries. The main result is

[12] While the effect of war and instability on spreads remains unchanged in a variety of regression specifications, in some specifications which include additional macroeconomic control variables, there is also some limited evidence for an effect of institutional changes on borrowing costs; see Mauro, Sussman and Yafeh (2006), Chapter 5, for further details.

that wars and episodes of politically-motivated violence have the most immediate and pronounced impact on the cost of borrowing. This effect seems to be driven by more than the standard fiscal concerns associated with military spending and is, we believe, a reflection of the instability and risk associated with military conflicts. In contrast, institutional and political reforms (such as the introduction of a constitution) or efficiency-enhancing structural reforms seldom reduce the cost of capital quickly: only in a few instances did reforms of the monetary framework (such as the introduction of the gold standard in nineteenth century Japan or a currency board in Bulgaria of the 1990s) have a rapid and substantial impact on spreads.

Considering the evidence from all periods jointly, in the short run, peace and stability seem to matter more for countries' borrowing costs than does the establishment of investor-friendly institutions. While we do think that appropriate reforms can be beneficial in the long run, their benefits seem to accrue in a gradual manner; novel institutions are rarely rewarded swiftly by financial markets. Thus, on the whole, our impression, on the basis of both the results presented above and in our previous research, is that the aspects of (broadly defined) institutional quality that matter the most relate to ensuring the absence of violence (international wars or domestic turmoil) and, more generally, the quality of *de facto* rather than *de jure* institutions.

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## Figure 1A: Estimates of the Cost of Debt, Britain 1692-1790

Source: Sussman and Yafeh (2006), Figure 1A, where the definitions of the various measures of the cost of capital are provided. War years (shaded) are the following: 1688-1697: War of League of Augsburg; 1701-1712: War of the Spanish Succession; 1718-1720: War of the Quadruple Alliance; 1727-1729: War with Spain; 1740-1748: War of the Austrian Succession; 1755-1763: Seven Years War; 1775-1783: War of American Independence.

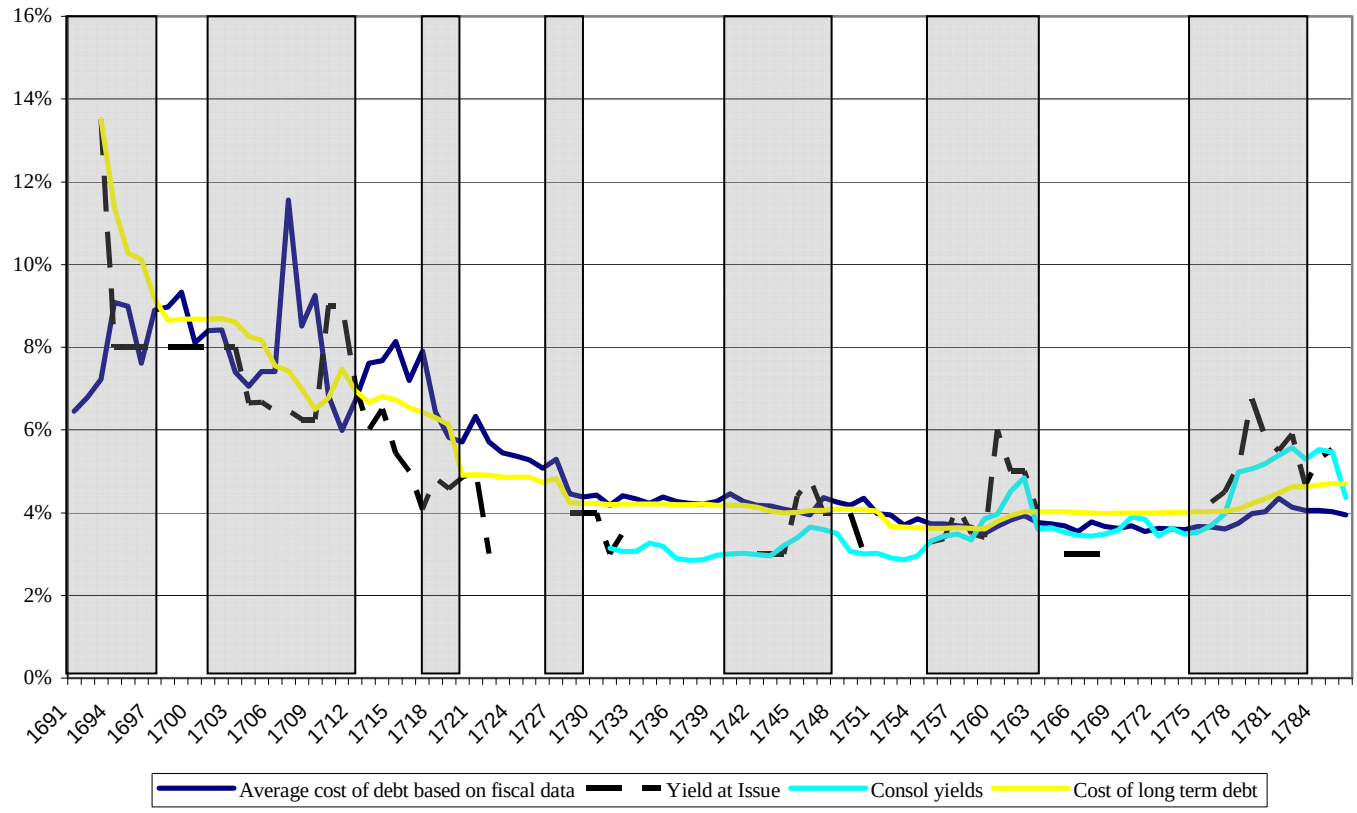
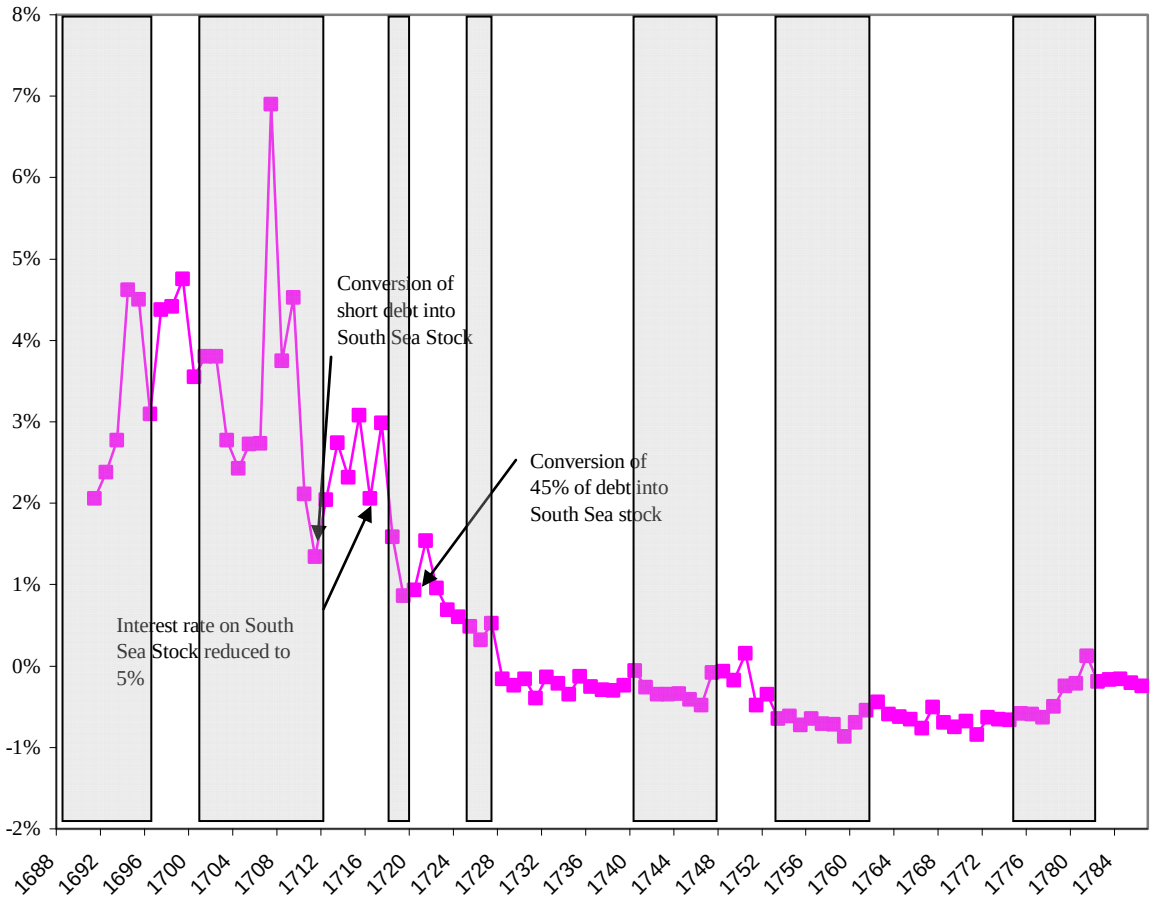


**Figure 1B: Interest Rate Differential, Britain vs. the Province of Holland, 1692-1790**

Interest rates are measured as the ratio of debt service to debt. Source: Sussman and Yafeh (2006), Figure 1B.



## Figure 1C: British Consol Yields and the Size of the British Navy

On the left axis: 3% British daily consol yields for the period 1750-1809 drawn from data provided by Larry Neal in European State Finance Database, www.le.ac.uk/hi/bon/ESFDB and, for the period 1809-1815, from the *London Times*. On the left axis: The number of enlisted men in the navy, in thousands, is from the House of Commons Papers 1868-69 (366) pp. 1150, 51, 57, 58.

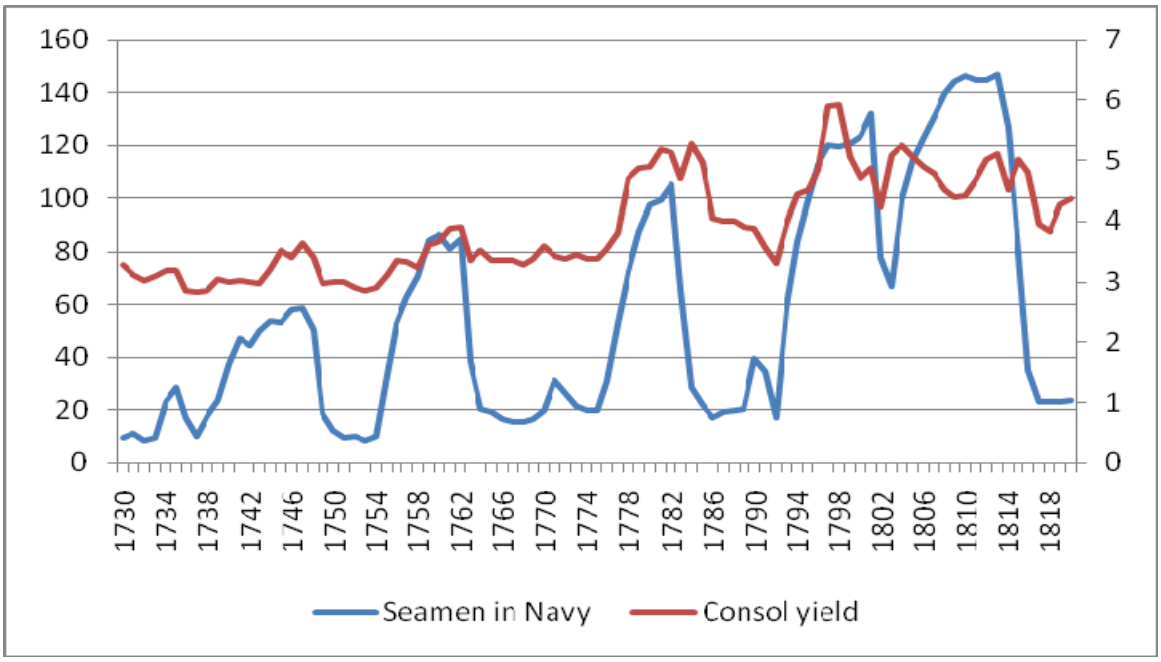


**Figure 2: Japanese Government Bond Yiels vs. British Consols, 1870-1914**
Source: Sussman and Yafeh (2000), Figure 1

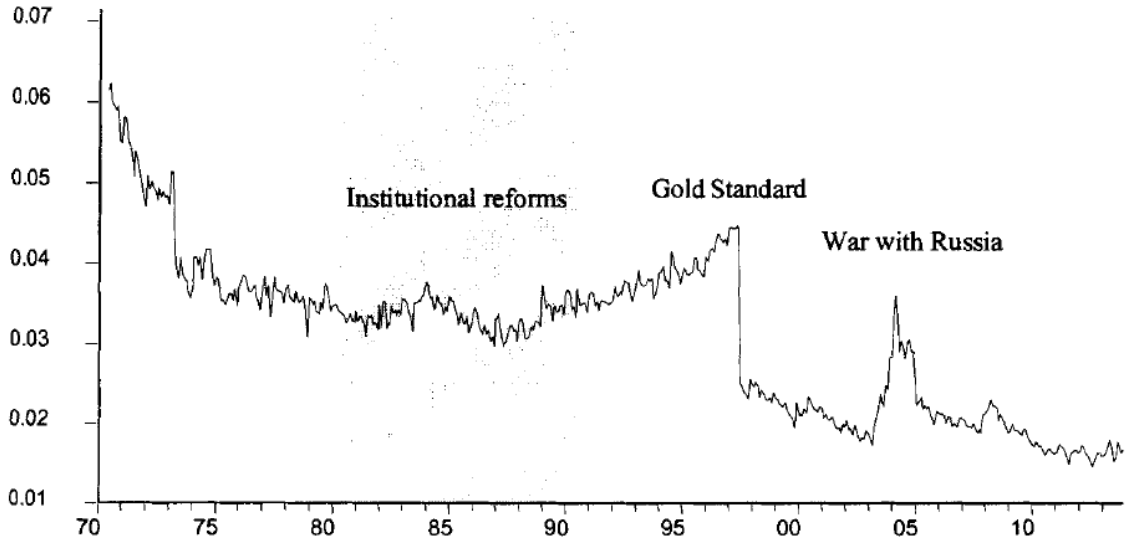


**Table 1A: The Determinants of Consol Yields, Univariate Analysis: 1730-1850**

Sources: Annual British consol yields and macroeconomic data are from Mitchell (1998). The number of enlisted men (in thousands) in the navy is from the House of Commons Papers 1868-69 (366) pp. 1150, 51, 57, 58. Military expenditures, debt, exports and GDP (extrapolated) are from Mitchell (1988) in millions of (constant) pounds.

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Military expenditure | 0.0944*** | | | | | |
| | (7.27) | | | | | |
| Debt to GDP (t-1) | | 0.00685*** | | | | |
| | | (5.42) | | | | |
| Deficit to GDP | | | 0.126*** | | | |
| | | | (8.99) | | | |
| Exports | | | | 0.0317* | | |
| | | | | (2.41) | | |
| Soldiers | | | | | 0.00573*** | |
| | | | | | (10.36) | |
| Seamen | | | | | | 0.0139*** |
| | | | | | | (11.66) |
| Constant | 3.160*** | 2.809*** | 3.494*** | 3.533*** | 3.191*** | 3.081*** |
| | (30.62) | (14.73) | (56.64) | (28.26) | (42.12) | (40.37) |
| Observations | 121 | 121 | 121 | 121 | 121 | 121 |
| Adjusted $R^2$ | 0.302 | 0.191 | 0.399 | 0.039 | 0.470 | 0.529 |
| *AIC* | 229.1 | 246.9 | 210.9 | 267.8 | 195.9 | 181.4 |

*t* statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

**Table 1B: The Determinants of Consol Yields, Multivariate Analysis: 1730-1850**

Sources: Annual British consol yields and macroeconomic data are from Mitchell (1998). The number of enlisted men (in thousands) in the navy is from the House of Commons Papers 1868-69 (366) pp. 1150, 51, 57, 58. Gold is a dummy variable for Gold Standard periods. Military expenditures, debt, exports and GDP (extrapolated) are from Mitchell (1988) in millions of (constant) pounds.

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Gold | -0.0639*** | -0.0235 | -0.0228 | -0.0229 | -0.0242 |
| | (-5.62) | (-1.76) | (-1.80) | (-1.85) | (-1.95) |
| Military expenditure | -0.00572 | 0.0134 | | | |
| | (-0.21) | (0.92) | | | |
| Deficit to GDP | 0.122*** | | 0.0570*** | 0.0573*** | 0.0503** |
| | (3.75) | | (3.50) | (3.78) | (3.17) |
| Debt to GDP (t-1) | | 0.00528*** | 0.00510*** | 0.00507*** | 0.00528*** |
| | | (3.95) | (4.03) | (4.56) | (4.64) |
| Exports | | -0.0182 | -0.0210* | -0.0212* | |
| | | (-1.68) | (-2.11) | (-2.31) | |
| Seamen (thousands) | | 0.0149*** | 0.00886* | 0.00867*** | 0.00594*** |
| | | (4.41) | (2.49) | (5.68) | (3.47) |
| Soldiers (thousands) | | -0.00171 | -0.0000846 | | |
| | | (-1.18) | (-0.06) | | |
| Exports per seamen | | | | | -1.045* |
| | | | | | (-2.35) |
| Constant | 3.709*** | 2.573*** | 2.714*** | 2.720*** | 2.913*** |
| | (29.24) | (11.20) | (12.30) | (14.69) | (13.83) |
| Observations | 121 | 121 | 121 | 121 | 121 |
| Adjusted $R^2$ | 0.524 | 0.641 | 0.673 | 0.676 | 0.677 |
| *AIC* | 184.8 | 153.5 | 142.0 | 140.0 | 139.9 |

**Table 1C: The Determinants of Consol Yields, Multivariate ARMA Analysis: 1730-1850**

Sources: Annual British consol yields and macroeconomic data are from Mitchell (1998). The number of enlisted men in the navy (in thousands) is from House of Commons Papers 1868-69 (366) pp. 1150, 51, 57, 58. Military expenditures, debt, exports and GDP (extrapolated) are from Mitchell (1988) in millions of (constant) pounds.

| | (1) | (2) |
|---|---|---|
| Debt to GDP (t-1) | 0.00673*** | 0.00626*** |
| | (3.77) | (3.52) |
| Deficit to GDP | 0.0350** | |
| | (2.62) | |
| Seamen | 0.00896*** | 0.0105*** |
| | (5.64) | (6.42) |
| Exports | -0.0304** | -0.0274** |
| | (-2.66) | (-2.58) |
| Military expenditure | | 0.0105 |
| | | (0.92) |
| Constant | 2.540*** | 2.511*** |
| | (7.27) | (6.92) |
| ARMA | | |
| L.ar | 0.634*** | 0.617*** |
| | (7.76) | (7.55) |
| L.ma | 0.434*** | 0.517*** |
| | (3.50) | (4.76) |
| sigma | | |
| Constant | 0.250*** | 0.253*** |
| | (17.35) | (16.65) |
| Observations | 121 | 121 |
| *AIC* | 25.03 | 28.56 |

*t* statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

## Table 1D: The Determinants of Consol Yields, Difference Equations: 1730-1850

Sources: Annual British consol yields and macroeconomic data are from Mitchell (1998). The number of enlisted men in the navy is from the House of Commons Papers 1868-69 (366) pp. 1150, 51, 57, 58. Military expenditures, debt, exports and GDP (extrapolated) are from Mitchell (1988) in millions of (constant) pounds.

| | (1) | (2) | (3) |
|---|---|---|---|
| ΔMilitary expenditure | -0.00230 | 0.0252 | |
| | (-0.11) | (1.83) | |
| ΔDeficit to GDP | 0.0577* | | 0.0484** |
| | (2.60) | | (3.08) |
| ΔDebt to GDP | | 0.00518 | 0.00572 |
| | | (1.40) | (1.59) |
| ΔExports | | -0.0302* | -0.0358** |
| | | (-2.29) | (-2.74) |
| ΔSeamen | | 0.00717*** | 0.00571** |
| | | (3.44) | (2.72) |
| Constant | -0.00134 | 0.000369 | 0.000791 |
| | (-0.05) | (0.01) | (0.03) |
| Observations | 121 | 121 | 121 |
| Adjusted $R^2$ | 0.101 | 0.163 | 0.204 |
| *AIC* | 46.57 | 39.79 | 33.73 |

## Table 2: The Determinants of Consol Yields, 1790-1815

Sources: 3% British consol daily prices for the period 1750-1809 are from data provided by Larry Neal in: European State Finance Database, www.le.ac.uk/hi/bon/ESFDB and for the period 1809-1815 from the *London Times.* The figures on enlisted men in the navy and in the army (in thousands) are from the House of Commons Papers 1868-69 (366) pp. 1150, 51, 57, 58. All other variables are dummy variables which take the value one on a day in which the event takes place or is reported in the *London Times*. Because of the large number of dummy variables, we take natural logs of the number of enlisted men. Single asterisks indicate significance at the 5 percent level; double asterisks indicate significance at the 1 percent level. Robust t-statistics are in brackets.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Naval battle | 0.00400* | 0.00221 | 0.00214 | |
| | (2.31) | (1.66) | (1.62) | |
| Naval news reported | 0.00472** | 0.00302* | 0.00294* | |
| | (2.73) | (2.28) | (2.22) | |
| Land battle | 0.00272* | 0.000861 | 0.000904 | |
| | (2.27) | (0.94) | (0.98) | |
| Land battle reported | 0.00281* | 0.000605 | 0.000658 | |
| | (2.09) | (0.59) | (0.64) | |
| War declaration | 0.00468 | 0.00424 | 0.00440 | |
| | (1.03) | (1.21) | (1.26) | |
| Truce | -0.00152 | -0.00421 | -0.00428 | |
| | (-0.24) | (-0.85) | (-0.87) | |
| Day with coupon payment | -0.000666* | -0.000473* | -0.000487* | -0.000399 |
| | (-2.34) | (-2.16) | (-2.23) | (-1.25) |
| Log (number of seamen) | | 0.00806*** | 0.00835*** | 0.00823*** |
| | | (70.46) | (57.53) | (52.40) |
| Log (number of soldiers) | | | -0.000366*** | |
| | | | (-3.30) | |
| Naval battle (t-6) | | | | 0.00790*** |
| | | | | (3.56) |
| Naval news reported (t-3) | | | | 0.00471** |
| | | | | (2.68) |
| War declaration (t-6) | | | | 0.00479 |
| | | | | (1.36) |
| Truce (t-3) | | | | -0.00554 |
| | | | | (-1.12) |
| Constant | 0.0470*** | -0.0453*** | -0.0446*** | -0.0473*** |
| | (585.88) | (-34.57) | (-33.53) | (-26.22) |
| *N* | 7084 | 7083 | 7083 | 3901 |
| adj. $R^2$ | 0.003 | 0.414 | 0.415 | 0.416 |
| *AIC* | -51359.7 | -55115.4 | -55124.3 | -30317.5 |

**Table 3: The Most Significant Structural Break Points**
**British Consol Yields, 1790-1815**

Sources: 3% British consol daily prices for the period 1750-1809 are from data provided by Larry Neal in: European State Finance Database, www.le.ac.uk/hi/bon/ESFDB and for the period 1809-1815 from the *London Times*. Dates of major naval and land battles are from Cook and Stevenson (1980).

| Date | Change in Consol Yield (basis points) | Event |
|---|---|---|
| October 2, 1801 | -50 | Truce of Amiens |
| July 8, 1812 | +50 | US Declares war on Britain |
| March 9, 1803 | +30 | King informs Parliament of French war preparations |
| March 14, 1803 | +30 | British Ambassador leaves France (end of the Truce of Amiens) |
| April 8, 1814 | -30 | Napoleon abdicates |
| July 23, 1805 | +15 | Rumors of combined French squadrons not far from Britain |
| March 31, 1815 | +20 | Reports of Napoleon in France, fear of another war |

## Table 4: Yields on United States Bonds, 1792-1820

Sources: Prices of U.S 6% consols traded in New York are from the data set Early US Securities Prices, compiled by Richard Sylla, Jack Wilson and Robert Wright, http://eh.net/databases/early-us-securities-prices. Annual data on outstanding debt (in dollars) is from Treasury Direct: htttp://www.treasurydirect.gov/govt/reports/pd/histdebt/histdebt_histo1.htm. Government deficit is from: www.usgovernmentspending.com . Single asterisks indicate significance at the 5 percent level; double asterisks indicate significance at the 1 percent level. Robust t-statistics are in brackets.

| | (1) | (2) | (3) |
|---|---|---|---|
| | **Yield_US** | **Yield_US** | **Yield_US minus Consol Yield** |
| **US Debt per Capita** | 0.942 | 0.959 | 0.967 |
| | (3.24)** | (5.71)** | (5.27)** |
| **US Gov Deficit per Capita** | 2.903 | 2.709 | 2.616 |
| | (4.59)** | (4.85)** | (4.13)** |
| **Consol Yield** | | 0.675 | |
| | | (6.18)** | |
| **Constant** | 0.049 | 0.017 | 0.001 |
| | (15.06)** | (3.52)** | -0.7 |
| **Observations** | 28 | 28 | 28 |
| **R-squared** | 0.44 | 0.79 | 0.59 |

**Table 5: Events Associated with Structural Breaks in the Spreads of Nineteenth Century Emerging Markets**

Source: Mauro, Sussman and Yafeh (2002), Table V

| Country | Date | Sign | Event |
|---|---|---|---|
| **Argentina** | March 1876 | Increase | Period of revolution and crisis |
| | June 1890 | Increase | Baring Crisis |
| | July 1891 | Increase | Failure of national bank |
| | April 1879 | Decrease | Success against rebellion |
| | April 1896 | Decrease | Improvement in the fiscal position |
| **Brazil** | April 1898 | Increase | Following the crushing of Canuda rebellion |
| | October 1890 | Increase | Going off the gold standard, Baring crisis |
| | September 1895 | Increase | Between revolt of military school and dissolution of congress |
| **Canada** | February 1912 | Decrease | Pro-British Conservatives win important elections |
| **Chile** | November 1896 | Decrease | Establishment of a financial inquiry commission? |
| | September 1891 | Decrease | End of Civil war |
| | March 1886 | Decrease | New regime |
| | November 1879 | Decrease | Doing well in a war with Bolivia and Peru |
| | July 1876 | Decrease | New information provided to market about financial position |
| **China** | June 1885 | Decrease | ? |
| | May 1896 | Decrease | End of war with Japan |
| | July 1900 | Increase | Boxer rebellion |
| **Egypt** | May 1879 | Decrease | July, Ismail pasha deposed |
| | September 1881 | Increase | Armed uprising |
| | April 1885 | Increase | War against Sudan |
| **Greece** | July 1893 | Increase | Financial crisis |
| | April 1897 | Decrease | End of war with Turkey |
| **Hungary** | May 1877 | Decrease | Hungary to be neutral in Balkan conflict between Turkey and Russia |

| | | | |
|---|---|---|---|
| **Japan** | August 1897 | Decrease | Going onto the gold standard |
| | March 1904 | Increase | War with Russia |
| **Mexico** | March 1879 | Decrease | ? |
| | August 1886 | Decrease | Ease of tensions with the US? |
| | July 1894 | Decrease | ? |
| **Portugal** | July 1902 | Decrease | Renegotiation of debt |
| | March 1891 | Increase | Going off the gold standard; bank moratorium |
| | September 1907 | Increase | Franco dictatorship; end of monarchy |
| **Queensland** | January 1891 | Increase | Banking Crisis |
| | April 1893 | Increase | Banking Crisis |
| **Russia** | April 1877 | Increase | War with Turkey |
| | February 1903 | Increase | Tensions with Japan? |
| **Sweden** | June 1881 | Decrease | ? |
| **Turkey** | July 1875 | Increase | Trouble in Bosnia |
| | May 1878 | Decrease | End of war with Russia, introduction of the gold standard |
| | September 1895 | Increase | War against Greece |
| | October 1912 | Increase | War in the Balkans |
| **Uruguay** | March 1892 | Decrease | End of a financial crisis |
| | April 1877 | Increase | Beginning of military rule |
| | February 1895 | Increase | Instability leading to war |
| | January 1905 | Decrease | End of civil war |

Data Sources: *The Economist's Investor's Monthly Manual.* The breaks are listed in the order in which they are obtained; see Mauro, Sussman and Yafeh (2002) for details.

## Table 6: Spreads and News, Panel Regressions, 1870–1913

Source: Mauro, Sussman and Yafeh (2006), Table 5.2.

The dependent variable is the yield differential ("spread") relative to British consol yields, and the sample consists of 627 country/year observations for eighteen contemporary emerging markets. Explanatory variables include news categories, which are calculated using all articles on each borrowing country in the *London Times* during the sample period. Single asterisks indicate significance at the 5 percent level; double asterisks indicate significance at the 1 percent level. Standard errors are in brackets.

| | News In logarithms | | | | | | News in fractions | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No fixed effects | | | With fixed effects | | | No fixed effects | | | With fixed effects | | |
| Wars | 0.114 [0.021]* | 0.109 [0.020]** | 0.095 [0.018]** | 0.052 [0.017]** | 0.044 [0.014]** | 0.044 [0.014]** | 0.640 [0.115]* | 0.540 [0.106]** | 0.509 [0.096]** | 0.359 [0.084]** | 0.232 [0.065]** | 0.234 [0.065]** |
| Good/Neutral economic | −0.165 [0.027]* | −0.098 [0.026]** | −0.049 [0.024]* | −0.147 [0.023]** | −0.033 [0.019] | −0.034 [0.020] | −0.302 [0.078]* | −0.108 [0.073] | −0.055 [0.067] | −0.314 [0.058]** | −0.088 [0.046] | −0.091 [0.047] |
| Bad economic | 0.069 [0.032]* | 0.066 [0.030]* | 0.056 [0.027]* | 0.041 [0.023] | 0.052 [0.018]** | 0.051 [0.018]** | 0.834 [0.241]* | 0.910 [0.221]** | 0.783 [0.200]** | 0.163 [0.175] | 0.260 [0.136] | 0.254 [0.137] |
| Reform | 0.010 [0.034] | −0.006 [0.031] | 0.020 [0.028] | −0.008 [0.026] | −0.017 [0.021] | −0.018 [0.021] | 0.160 [0.293] | 0.003 [0.269] | 0.248 [0.245] | 0.241 [0.211] | 0.123 [0.164] | 0.119 [0.165] |
| Political | −0.119 [0.023]* | −0.126 [0.021]** | −0.162 [0.019]** | −0.014 [0.023] | 0.014 [0.018] | 0.014 [0.018] | −0.346 [0.160] | −0.273 [0.147] | −0.280 [0.133]* | 0.164 [0.124] | 0.262 [0.097]** | 0.261 [0.097]** |
| Foreign | 0.071 [0.022]* | 0.042 [0.021]* | 0.019 [0.018] | 0.007 [0.021] | −0.008 [0.017] | −0.007 [0.017] | 0.360 [0.121]* | 0.329 [0.111]** | 0.249 [0.101]* | 0.087 [0.108] | 0.041 [0.084] | 0.041 [0.085] |
| Default history | | | 0.522 [0.041]** | | | 0.027 [0.083] | | | 0.488 [0.042]** | | | 0.045 [0.082] |
| Portfolio spreads | | 0.453 [0.044]** | 0.517 [0.040]** | | 0.561 [0.029]** | 0.563 [0.030]** | | 0.498 [0.046]** | 0.545 [0.042]** | | 0.555 [0.028]** | 0.559 [0.029]** |

**Table 7: Spreads and News, 1994–2002**
Source: Mauro, Sussman and Yafeh (2006), Table 5.5

The dependent variable is the yield differential ("spread") relative to US Treasury Bonds for a sample of eight emerging markets. News indicators are based on articles in the *Financial Times* on each borrowing country during the sample period and refer to the number of news or to the fraction of all news for the category indicated. F.E. denotes regressions with country fixed effects; single asterisks indicate significance at the 5 percent level; double asterisks indicate significance at the 1 percent level. Standard errors are in brackets.

| | Annual data | | | | | | Quarterly data | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Logs | | | | Fractions | | Logs | | Fractions | |
| | No F.E. | | With F.E. | | No F.E. | With F.E. | No F.E. | With F.E. | No F.E. | With F.E. |
| Wars/Instability | 0.166 (0.079)* | 0.183 (0.074)* | 0.033 (0.086) | 0.063 (0.074) | 2.641 (0.699)* | 1.683 (0.767)* | 0.165 (0.056)* | 0.041 (0.041) | 1.155 (0.239)* | 0.471 (0.177)* |
| Good/Neutral economic | 0.397 (−0.108)* | 0.366 (0.101)* | 0.262 (0.102)* | 0.208 (0.089)* | 2.665 (0.503)** | 1.316 (0.496)* | 0.251 (0.047)** | 0.121 (0.033)* | 1.481 (0.206)** | 0.542 (0.148)* |
| Bad economic | 0.235 (0.089)* | 0.217 (0.083)* | 0.089 (0.086) | 0.055 (0.074) | 3.381 (0.684)* | 1.722 (0.732)* | 0.218 (0.051)* | 0.071 (0.035)* | 1.527 (0.234)** | 0.514 (0.166)* |
| Reform | −0.331 (0.109)* | −0.294 (0.103)* | −0.125 (0.105) | −0.095 (0.091) | −1.282 (0.814) | −0.147 (0.681) | −0.217 (0.061)* | −0.103 (0.041)* | −0.013 (0.264) | −0.016 (0.174) |
| Political | −0.118 (−0.087) | −0.107 (0.081) | 0.024 (0.082) | 0.038 (0.071) | 0.922 (0.539) | 0.578 (0.476) | −0.031 (0.045) | 0.098 (0.032)* | 0.755 (0.200)* | 0.463 (0.138)* |
| Foreign | −0.27 (0.087)* | −0.291 (0.082)* | −0.033 (0.103) | −0.079 (0.089) | | | −0.317 (0.053)** | −0.103 (0.039)* | | |
| Portfolio spreads | | 0.798 (0.241)* | | 0.849 (0.184)* | 0.799 (0.240)* | 0.876 (0.184)* | 0.869 (0.104)** | 0.885 (0.068)** | 0.878 (0.111)** | 0.918 (0.071)** |
| Constant | 1.653 (0.229)** | 0.011 (0.540) | 1.376 (0.290)* | −0.276 (0.437) | −1.221 (0.648) | −0.763 (0.554) | 0.017 (0.222) | −0.054 (0.146) | −0.748 (0.274)* | −0.318 (0.182) |
| Number of observations | 72 | 72 | 72 | 72 | 72 | 72 | 282 | 282 | 263 | 263 |