

Sovereign Bond Prices and Interstate War

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Abstract: What is the effect of interstate war on sovereign bond prices? In this short article I improve upon existing analyses of wartime sovereign debt markets in two key ways. First, I causally identify the effect of war initiation on sovereign bond prices using more granular, comprehensive data than existing analyses. Using newly cleaned data on the monthly prices of the universe of sovereign debt instruments traded in London from 1869 to 1929 and dynamic panel models I replicate existing analyses that find war initiation has a small, negative effect on sovereign bond prices. Second, I expand upon existing research by causally identifying the effect of battle outcomes on sovereign bond prices. I find that battle victories have a small, positive effect on sovereign bond prices while battle defeats have a small, negative effect. These findings contribute to an understanding of how wartime access to debt markets might constrain a state's ability to conduct and continue an interstate war and incentivizes new theoretical and empirical research on the mechanisms underpinning wartime sovereign debt market behavior.

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1. Introduction

What is the effect of interstate war on sovereign bond prices? Scholars generally agree that wars should have a small, negative effect on sovereign bond prices. Interstate conflict raises the risk of inflation, re-negotiation, and non-repayment (Poast 2015, Chadeaux 2017). Since only financially secure states will select into wars in the first place, however, the overall effect on sovereign bond prices will be small (Shea and Poast 2018). Although existing empirical research on wartime sovereign bond markets confirms this theoretical expectation, it has two potential shortcomings. First, existing research only analyzes the price movements of selected bond instruments at relatively high levels of aggregation, such as annual bond yields. This approach risks an ecological fallacy since it estimates the effect of wars on aggregated price movements as opposed to individual price movements (Kramer 1983). Second, existing research focuses primarily on the effect of war initiation on bond prices in lieu of analyzing the effect of other important wartime events, such as battle outcomes. Economic historians have long argued battle outcomes affect exchange rates, the price of money (e.g. Willard et. al. 1996, Duarte et. al. 2019), so shouldn't battles also affect sovereign bond prices?

In this short article I improve upon existing analyses of wartime sovereign debt markets in two key ways. First, I replicate existing findings on the negative effect of war initiation on sovereign bond prices using more granular, comprehensive sovereign bond price data that mitigates ecological fallacy concerns. Namely, I use newly cleaned data on the monthly prices of the universe of sovereign debt instruments traded in London from 1869-1929 and dynamic panel models to causally identify the effect of war initiation on sovereign bond prices. Second, I expand upon existing research by causally identifying the effect of battle outcomes on sovereign bond prices. I find battle victories have a small, positive effect on sovereign bond prices while defeats

have a small, negative effect. These findings contribute to an understanding of how wartime access to debt markets may, or may not, constrain a state's ability to conduct and continue an interstate war, and incentivizes new theoretical and empirical research on the mechanisms underpinning wartime sovereign debt market behavior.

2. Motivation

Sovereign governments generally prefer issuing debt to fund wars rather than raising taxes since it pushes the costs of war into the future and conceals them from domestic constituencies (Cappella Zielinski 2016, Kreps 2018). Wartime shifts in the price of sovereign bonds, however, will affect the interest rates states need to offer in order to raise additional capital (Fama and French 2004). As a result, they affect a government's ability to issue new debt, and the cost they must pay to do so. This could constrain a state's options for financing—and continuing—an ongoing conflict. The specter of domestic or transnational opposition to war based on its distributive economic consequences is a second mechanism whereby sovereign debt markets might affect the conduct and continuation of wars (Caverley 2014). If interstate wars negatively affect the economic circumstances of market actors, such as bondholders, bond traders, or underwriting banks, these actors may directly pressure governments to end the war above and beyond an indirect threat to not purchase more debt (Kirshner 2007). Whether or not this opposition emerges, however, is dependent on the effect interstate wars have on sovereign bond prices.

3. Theorizing Wartime Sovereign Debt Markets

Efficient financial markets may be able to “price in” the risk of rare disasters like interstate conflicts *ex ante* (Gabaix 2012). If interstate wars are partially caused by private information (Ramsay 2017), though, war initiation still provides valuable information to financial markets about the creditworthiness and underlying financial strength of a state. Scholars therefore generally

agree that wars will have a small, negative effect on sovereign bond prices. Financially insecure states will be unlikely to “select in” to an interstate conflict (Shea and Poast 2018), but war still raises the risk of inflation, re-negotiation or non-repayment (Poast 2015, Chadeaux 2017).

Existing empirical research on wartime sovereign debt markets finds support for this theoretical expectation, but has potential shortcomings. Paul Poast (2015), for instance, finds that interstate wars increase the spread (difference) between the annual yield (rate of return) of sovereign bonds and a risk free asset for all country-years from 1816-1914.² Measuring bond yields, war initiation, and control variables at the annual level, however, raises the risk of ecological fallacy and inadvertent post-treatment and collider bias. An ecological fallacy occurs when researchers inappropriately draw conclusions about individual-level behavior based on aggregate data (Kramer 1983). Sovereign bond yields and prices change with daily trading, so aggregating these price movements at the annual level may obscure the effect of wars on prices. Including annual, country-level control variables like industrial production and population growth in empirical models of wartime sovereign bond prices may introduce collider and post-treatment bias if these factors are also affected by wars that occur in a given year (Elwert and Winship 2014).

Thomas Chadeaux (2017) addresses these concerns by analyzing the monthly yield on selected government bonds from 1816-2007, finding that war initiation increases monthly yields.³ Analyzing selected government bonds, however, also risks introducing bias. Namely, investors may hedge against wartime risks by purchasing different types of government bonds, such as bonds with differing maturities (i.e. time to repayment). This hedging behavior would mean wars affect both the prices of individual bonds and a sovereign’s overall yield curve, or the relative price of a

² Bond yields are inversely related to bond prices, so this implies wars have a negative effect on bond prices. For a formal discussion of calculating bond prices and yields see Chadeaux 2017.

³ In particular, Chadeaux analyzes the monthly yield on 10 year government bonds “to the extent [they] existed, and instruments with shorter maturities were used otherwise” (2017: 317).

given sovereign's bonds across differing maturities. To appropriately control for this hedging behavior we need to estimate the effect of war on the prices of all sovereign debt instruments in a market, not selected bonds.

Finally, existing research on wartime sovereign debt markets focuses primarily on the effect of war initiation on sovereign bond prices versus the effect of other wartime events. Economic historians have long descriptively analyzed the relationship between battles and exchange rates (e.g. Willard et. al. 1996, Duarte et. al. 2019), but less research analyzes sovereign bond prices. The primary exception is Bruno S. Frey and Marcel Kucher's (2000) analysis of the Swiss sovereign bond market before and during World War II. Frey and Kucher, however, don't explicitly theorize the effect of battle outcomes on sovereign bond prices, and their structural break analysis lacks causal identification. Building on the theoretical intuition behind this research, though, we can conclude that battle outcomes may affect sovereign bond prices since these intra-war outcomes are signals of a state's capabilities and resolve (Powell 2004). Specifically, since victories in battle signal a state's underlying military strength and may help belligerents reach a negotiated settlement, we would expect that victories in battle would increase the prices of a victor's sovereign bonds while a defeat would decrease the prices of a loser's sovereign bonds.

4. Research Design & Data

I test these theoretical expectations using dynamic panel models and newly cleaned data on the monthly prices of the universe of sovereign debt instruments traded in London from 1869-1929. Specifically, I predict the price of a debt instrument in a given month based on three distinct treatment variables: an indicator variable for whether the issuing state is involved in an interstate war, and the number of battles a state won or lost in a given month. I also include country, month, and debt instrument fixed effects and a lagged dependent variable in each dynamic panel model.

This approach represents a credible causal identification strategy since it correlates treatment variables and within-instrument variation in bond prices while controlling for any monthly system-wide temporal shocks, as well as time-invariant country and instrument level factors, that might also affect sovereign bond prices (Bell and Jones 2015, Wilkins 2018).⁴

I estimate my dynamic panel models using Ordinary Least Squares (OLS) regression and a newly cleaned data set comprising the monthly prices of the universe of sovereign debt instruments traded in London, the world's pre-eminent sovereign debt market at the time, from 1869-1929. These data come from *The Investors Monthly Manual*, an industry publication, as initially compiled by William Goetzmann and K. Geert Rouwenhorst (International Center for Finance, n.d.). These data are the best comprehensive market-level data on sovereign bond prices currently available, and therefore are an important source for assessing the historical baseline effect of war and battle outcomes on sovereign bond prices.

I use two primary measures of monthly bond prices as dependent variables, the opening price of a bond in a given month and highest price of a bond in a given month, and generate lagged bond price measures based on an instrument's previous month's price. I code my monthly war indicator variable (War_{it}) using the Correlates of War (COW) data set (Sarkees and Wayman 2010) and my monthly battle victory ($BattleVictories_{it}$) and defeat ($BattleDefeats_{it}$) variables using the Interstate War Battle (IWB) dataset (Min 2021). I code country and instrument fixed effects based on identifying variables in Goetzmann and Rouwenhorst's data. More information on how I cleaned the Goetzmann and Rouwenhorst data and descriptive statistics can be found in this article's supplementary appendix.

5. Results

⁴ I present auto correlation function (ACF) plots justifying the inclusion of a single lagged price variable in the supplementary appendix.

Table 1 presents the results of estimating my dynamic panel models. In models 1 and 2 the coefficient on War_{it} is negative and statistically significant, indicating that interstate wars have a negative effect on sovereign bond prices. The start of an interstate war causes a £0.314 decrease in the opening monthly price and £0.227 decrease in the high monthly price. The positive, statistically significant coefficients for ($BattleVictories_{it}$) in models 3 and 4, and negative, statistically significant coefficients for ($BattleDefeats_{it}$) in models 5 and 6 indicate that battle victories have a positive effect on sovereign bond prices while battle defeats have a negative effect on sovereign bond prices. Each additional monthly battle victory causes a £0.218 increase in the opening monthly price and £0.218 increase in the monthly high price, while each additional monthly battle defeat causes a £0.181 decrease in the opening monthly price and £0.162 decrease in the monthly high price.

Table 1: Results

	Opening Price (1)	High Price (2)	Opening Price (3)	High Price (4)	Opening Price (5)	High Price (6)
War	-0.314*** (-0.393, -0.234)	-0.227*** (-0.318, -0.136)				
Victories			0.218*** (0.067, 0.369)	0.218*** (0.058, 0.377)		
Defeats					-0.181*** (-0.282, -0.080)	-0.162*** (-0.270, -0.053)
Lagged Opening Price	0.988*** (0.987, 0.989)		0.972*** (0.969, 0.975)		0.972*** (0.969, 0.975)	
Lagged High Price		0.977*** (0.976, 0.978)		0.966*** (0.963, 0.969)		0.966*** (0.963, 0.969)
Instrument FE	Y	Y	Y	Y	Y	Y
Country FE	Y	Y	Y	Y	Y	Y
Month FE	Y	Y	Y	Y	Y	Y
Observations	74,858	87,436	25,000	25,584	25,000	25,584
R-squared	0.995	0.992	0.995	0.994	0.995	0.994
Adjusted R-squared	0.995	0.992	0.995	0.994	0.995	0.994
Residual standard error	2.044 (df = 73825)	2.546 (df = 86189)	2.029 (df = 24447)	2.209 (df = 24939)	2.029 (df = 24447)	2.209 (df = 24939)

Notes: ***p < .01; **p < .05; *p < .1

Unobserved time-varying confounders that are correlated with war initiation, battle outcomes, and sovereign bond prices are the key threat to my causal identification strategy (Blackwell and Glynn 2018). Although it is impossible to prove the non-existence of these confounders, I mitigate concerns that they are driving my results through a series of sensitivity, robustness and placebo tests. I present the results of these tests in the supplementary appendix.

Sensitivity tests proposed by Emily Oster (2019) indicate that potential unobserved confounders would generally need to have between a 2 and 25 times larger causal effect on sovereign bond prices than the estimated effect of war initiation and battle outcomes in order to render these estimated effects statistically insignificant. I further demonstrate that my findings are robust to including no, two, and three lagged dependent variables, controlling for both victories and defeats in the same model specification, and alternate coding of the treatment variable that captures whether a state has experienced any battle victory or defeat in a given month. As placebo tests I demonstrate that—in line with theoretical expectations—conflict outcomes and the number of monthly battles don't predict sovereign bond prices.

6. Conclusion

This short article has causally identified that both the start of interstate wars and battle outcomes affect sovereign bond prices. These findings have at least three important implications for our understanding of war finance. First, it implies that states won't find it particularly difficult to raise money through debt markets after war has begun versus before the start of hostilities. Wartime events don't lead to a widespread sell-off of government bonds, meaning that governments should be able to raise revenue to conduct and continue an interstate war at reasonable borrowing costs. Second, these findings imply that the financial industry may be less likely to oppose interstate wars than existing theories predict (e.g. Kirshner 2007). If domestic and transnational financial actors don't face investment losses as a result of interstate conflicts they have little economic reason to oppose wars.

Finally, these findings incentivize additional theoretical and empirical research on the mechanisms driving wartime sovereign bond market behavior. Specifically, future research should work to identify why wartime sovereign bond markets react so lightly to wartime events. This is

particularly important given that recent anthropological and sociological research on financial markets has questioned markets' ability to efficiently "price in" low-probability, high-consequence risks like interstate wars (Leins 2018). Scholars have yet to apply these theoretical insights to the study of wartime sovereign debt markets, and they may help explain the relatively small effects of wartime events on sovereign bond prices. Empirical research on market actors' interpretations of wartime events can provide evidence on which mechanisms—rational, psychological, and/or social—are operative. This empirical research can also help interrogate the potential constraining influence sovereign debt market actors and bankers may or may not have on governments' wartime conduct.

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