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# Victory or repudiation? Predicting winners in civil wars using international financial markets

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ABSTRACT

We develop a method to estimate which side will win a civil war using data from international financial markets. The key insight we deliver is that, for typical sovereign debt contracts, the probability of debt repayment will equal the probability of victory in a civil war. We test our predictor for standard outcomes in civil wars, including when the incumbent government loses (the Chinese Nationalists), when a new government is installed by a foreign power and decides to repudiate debt (the restoration of Ferdinand VII of Spain), and when there is a secession (the U.S. Confederacy). For China, markets were predicting a Communist victory three years before it happened. For the U.S., markets never gave the South much more than a 40 percent chance of maintaining the Confederacy. For Spain, markets considered the restoration of Ferdinand VII as likely (probabilities above 50%) as soon as France declared its intention to send military forces to the area.



Civil wars can prove disruptive to growth and development. The circumstances under which civil wars break out and their demographic and economic consequences are well documented (Collier and Hoeffler, 1998; Besley and Persson, 2008; Guidolin and La Ferrara, 2007; Londregan and Poole, 1990; Campos and Nugent, 2002).[1] The economic costs also come from uncertainty about the resolution of these conflicts.[2] With a typical civil war lasting roughly six years (Fearon and Laitin, 2003), production disruptions and delays in real resource transfers from external states, aid agencies, or non-government organizations can further stall development. Given the costs arising from uncertainty over the outcome of a civil war, it follows that real-time tools developed for predicting who will win a civil war could have large potential payoffs to the policy makers and the development community.

One might rely on expert opinion, but opinions may be ideologically driven (especially during conflicts), experts often disagree, and even when they agree, their predictions are often wrong (Tetlock, 2006). Predictions markets have shown to be a reliable alternative for obtaining real-time insights that are less subjective and have more accuracy for understanding phenomena with uncertain outcomes. For example, they have been used successfully to forecast U.S. presidential, gubernatorial, and congressional races (Wolfers and Zitzewitz, 2004: Snowberg et al., 2007; Majumder et al., 2009; Arrow et al., 2008; Rhode and Strumpf, 2004; Wolfers and Zitzewitz, 2009). Market-based approaches rest on two principles. First, when people put money at risk they tend to pay close attention to events that influence the value of their

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1 For a comprehensive review of the literature, see Blattman and Miguel (2010).

2 For more on the determinants of the severity of conflicts see Lacina (2006).

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investments. Second, markets offer a mechanism for aggregating beliefs. Thus, asset prices reflect the beliefs of interested parties about future states of the world.

Most of the academic literature has focused on betting markets where participants wager on political outcomes that have a binary payoff structure. Many financial instruments can also be transformed to yield bets with equivalent payoff structures and could be used to complement information from betting markets or in place of it when such markets are illegal or have yet to emerge. Sovereign bonds are one type of asset with such a payoff structure that has the potential to yield real-time insights into regime changes, such as rebellions, coups d'état, secessions, and civil wars. Long-term government bonds have several characteristics that make them particularly attractive to studying civil conflict. First, in cases of conflict, they may become "winner take all contracts" since their issuance is often clearly identified with a party to the conflict. As a result, there is less uncertainty about attributing price movements to the changing nature of a conflict than there would be with some other types of securities. Second, sovereign bonds can (and often do) trade outside the geographical location of conflict. Indeed, they are usually traded in deep and liquid international financial markets, and have traded there for centuries.[3]

We stress, however, that the approach we outline in this article may be applied to other types of assets whose values can be driven to zero, linked to one or another party in a civil war, and trade in thick markets. For example, share prices of companies active in South Vietnam before the fall of Saigon or in Peru before the nationalizations set into place in 1968 would also allow one to make predictions about outcomes in civil wars. Other types of assets, such as fiat currency, land, or corporate stocks or bonds, are likely to be particularly useful for researchers making predictions about civil war outcomes in countries without sovereign debt. Although these other types of assets could potentially be used, our article focuses on sovereign bonds since they allow us to illustrate several different "typical" outcomes in civil wars.

Following insights from the predictions literature, we develop a market-based predictor using sovereign debt obligations to estimate which side will win a civil war. Sovereign bonds represent contingent claims with valuations that depend primarily upon the outcome of the conflict: in the case of defeat, the bonds can become worthless to investors. The debt issued by a dictator facing the threat of ouster from an opposition group, for example, can be used to predict who will win a civil war. The key insight we deliver is that the probability of debt repayment will equal the probability of victory in a civil war.

We recognize that the nature of victory and the extent of debt repayment may vary across civil wars, so we develop a predictor that can account for outcomes that vary across time and space. For example, some civil wars start as secessions. Others end in a negotiated settlement. In some cases, investors might expect "a haircut" in payment once the conflict ends because the war has reduced the winning side's ability to pay, and in other conflicts, the debt holders might have missed coupon payments during the course of the war they ended up winning.[4] Our cash flow price model allows us to go beyond simply inferring the probability of victory from the ratio of market to par prices, as is commonly done in electoral prediction markets, and permits repayment streams to be modified in order to take these kinds of contingencies into account.

Our predictor has a number of attractive general properties. First, it provides an ex ante judgment about the outcome of a civil war. Second, because it relies on high-frequency, time-series data, it can take into account daily or weekly changes in factors that may influence the outcome (e.g., battlefield victories, technological changes, and shifts in alliances). Third, it mitigates problems of subjectivity: bondholders are not interpreting a question put to them by a researcher; instead, researchers can simply observe bondholder's self-interested behavior.

The ultimate utility of a predictor rests on its performance. We therefore compare the predictions of our model against historical civil wars when the outcome is known ex post and is not bound to change further. We test the predictor's external validity by examining three different types of outcomes – where the incumbent government lost the civil war (the Chinese Nationalists), when, following a civil war, a new government repudiated the debts issued by its predecessor (the restoration of Ferdinand VII of Spain), and a case of failed secession (the U.S. Confederacy). We find that our predictor correctly picked the winner in each of these civil wars years before each conflict ended. In the case of China, our model predicted that the Communists would defeat the Nationalists by March 1946—a full three years before it actually happened. In fact, our model shows that the markets heavily discounted the Nationalist victory in March 1947, in which they drove the Communists from their capital of Yenan. We know, ex post, that this event made little difference to the ultimate outcome of the war. At the time, however, the fall of Yenan was much heralded in the West as evidence that the communists would be defeated.[5] Importantly, our model got it right: the fall of Yenan did not change the way that markets priced Chinese sovereign debt. In the Spanish case, the Verona Congress, which opened the way for France to invade Spain to restore the throne to Ferdinand VII, led to a change in markets expectations. After October 1822, markets gave less than a 50 percent chance to the constitutional regime. For the U.S. Civil War, our model never gave the South much more than a 40 percent chance of maintaining the Confederacy. With each battlefield setback, our model predicted an even lower likelihood of a Confederate victory.

## 1. A baseline model for estimating victory

A standard way of calculating the value of a bond at a point in time is to discount the cash flows using the risk free rate so that risk gets embedded into the risk-neutral probability of repayment (Bierman and Haas, 1975; Yawitz, 1977). The probability of reimbursement of the principal is conditional on no earlier default. Merrick (2001) uses a cash flow model to derive an equation that can be used to extract the probability of repayment of a bond. Following his formulation, the price of a bond at time 0, $V_0$, depends on: the coupon payment on date $t$, $C_t$; the principal repayment at maturity $F_T$, (where $T$ is the maturity date); the recovery value of the debt obligation, $R$, in the case of default; the adjusted probability of a timely payment of cash flows on date $t$, $D_t$; the adjusted default probability between date $t-1$ and date $t$, $d_t$ (where $d_t = d_{t-1} - d_t$); and the risk-free present value factor, $f_{rt}$ (often formulated in practice as the risk-free bond). We can express this as:

$$V_0 = \underbrace{\sum_{t=1}^{T}(D_t \times C_t \times f_{rt})}_{\text{Term } l} + \underbrace{D_T \times F_T \times f_{rT}}_{\text{Term 2}} + \underbrace{\sum_{t=1}^{T}(d_t \times R \times f_{rt})}_{\text{Term 3}} \tag{1}$$

[3] It is well known, for example, that emerging market borrowers issue currency with foreign-currency clauses, and often do so in New York, London, and other international financial centers (Eichengreen et al., 2004)

[4] For conditions under which civil wars end in negotiated settlements, see Walter (1997) and Mason et al. (1999).

[5] See, for example, the description of the fall of Yenan in *Life*, April 7, 1947, p. 43.