Markets under Siege:

How Political Beliefs Move Financial Markets

Saumitra Jha
Stanford GSB

Peter Koudijs
Erasmus School of Economics

Marcos Salgado*
FGV EPGE

June 18, 2024

Please click **here** for the latest version.

Abstract

Can political beliefs, particularly about benefits of war versus peace, move thick financial markets? We document that following an unlikely victory by French citizen-soldiers during the German Siege of Paris (1870), prices of the highly liquid French sovereign bond diverged substantially and persistently there versus elsewhere. While France resisted, Parisian prices were higher and responded more to war events. However after the ceasefire, price differences reversed dramatically until peace terms were revealed. Difficult to reconcile otherwise, these patterns match the predictions of a simple model with different political beliefs in Paris and elsewhere about the benefits of war versus peace.

1 Introduction

Can political beliefs move financial markets? More specifically, can beliefs about the costs and benefits of continuing war versus making peace impact equilibrium prices, even for

* *saumitra@stanford.edu; koudijs@ese.eur.nl; marcos.salgado@fgv.br.* We are grateful to Jérémy Ducros, Pierre-Cyrille Hautcoeur and Angelo Riva for sharing data from the Data for Financial History (DFIH) database. We thank Patrice Babeau, Bruno Barsanetti, Fabio Braggion, Rik Frehen, Roberto Galbiati, Sergei Guriev, Emeric Henry, Philip Hoffman, Stefan Huber, Matti Keloharju, Elisabeth Kempf, Samuli Knüpfer, Arvind Krishnamurthy, Matt Lowe, Alessandro Riboni, Jean-Laurent Rosenthal, Sarah Thompson, Oliver Vanden Enyde, Edward Watts, Chenzi Xu, Charles Zhang, Katia Zhuravskaya and seminar participants at the NBER Pol. Econ. meeting, ENS de Lyon, École Polytechnique, Sciences-Po/PSE, the CEPR Pol. Econ. of Finance conference, PUC Rio, FGV-EPGE, UNNE, the Stanford GSB, the Monetary and Fin. History Workshop, the Erasmus Fin. History Brown Bag, LACEA RIDGE, UChile FEN and Economics, and the Helsinki Finance Seminar for useful feedback. Many thanks also to Sam Asher, Long Do, Christlee Elmera, Andrew Matejka, David Rathmann-Bloch, Lucas Salgado, Simon Salgado, Haviland Sheldahl-Thomason, Roxane Somda, and Mariann Varga for excellent research assistance. We gratefully acknowledge support from the King Center on Global Development, CIRCLE, the Behavioral Lab at Stanford GSB and from Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES), Finance Code 001.

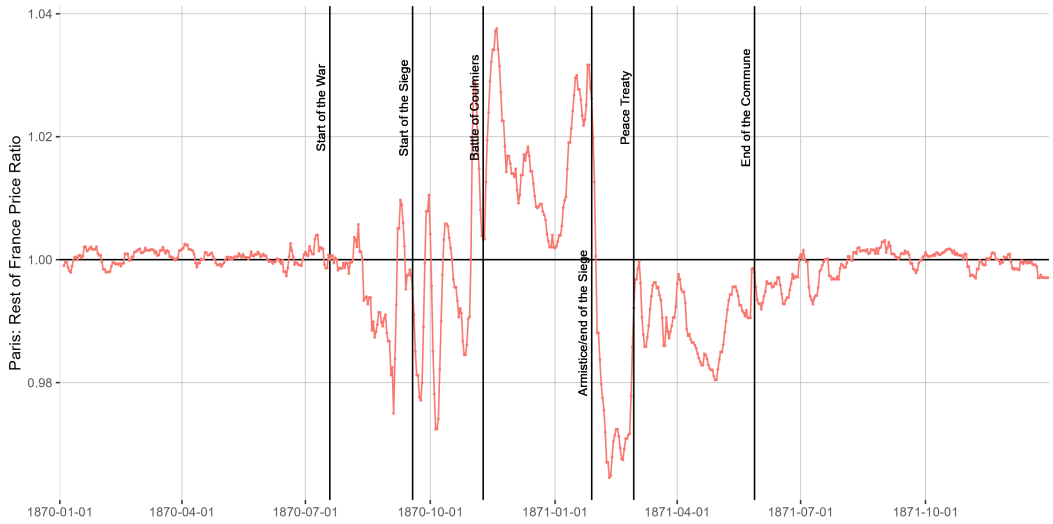
highly traded and liquid assets such as sovereign bonds? Or will the actions of politically unbiased investors drive prices back to fundamentals? Recent research establishes that political views can shape *individual* investment choices. However, much less is known about how, if at all, political beliefs can shape real-world *equilibrium prices* in thick markets.

The question of whether political beliefs can shape aggregate market outcomes has proven thus far hard to answer, arguably because we typically observe only one price for each asset. Even if we observe prices for the exact same asset in multiple markets, which might reflect the beliefs of different investors, arbitrage leads prices to converge rapidly. At least since the introduction of the telegraph, thick financial markets have been characterized by the *law of one price*.

Further, it is often difficult to attribute the actual prices that are realized by that market to *political beliefs* rather than endowments or the information that those investors may possess. Though financial asset prices often move following major political events, it is much less clear whether these shifts stem from political beliefs rather than from discount rates, anticipated changes in profitability due to new policies, or other macroeconomic changes that accompany political events. To answer the question of whether political beliefs can shape equilibrium prices, an ideal setting would involve the same asset being traded by different marginal investors with different political views and with the possibility of different equilibrium prices. In this paper, we exploit a historical episode that is a close approximation to that ideal.

In 1870, French financial markets, along with Paris itself, came under siege. The besieging Prussian army cut the telegraph lines out of the city, leaving communications entrusted to carrier pigeons and gas balloons. However, despite the Siege, both the main Bourse in beleaguered Paris and other French stock exchanges, including in Lyon and Bordeaux, continued to function. In particular, the most liquid French asset, the three percent sovereign bond—henceforth the *rente*—continued to be actively traded in each exchange. The temporary disruption of arbitrage during the Siege allows us to observe three time series of prices for the same actively traded asset. This provides a unique opportunity to document to what extent equilibrium prices diverge in response to different prevailing local political perspectives on the costs and benefits of continued conflict, and whether and how they converge as different necessary conditions for arbitrage were sequentially restored. We use voting data inside and outside Paris to document these local political differences. We further gather detailed novel data not only on prices but also on other features of the Siege, which allows us to evaluate the potential role of alternative explanations, including different information sets, discount rates, and liquidity preferences, among others. These include detailed information flows documented by 29,903 pigeon messages, 66 balloon departures, daily newspaper reports, and local food prices as recorded in the contemporary diaries of the besieged.

Figure 1: Price ratio of the 3% sovereign bond (*rente*) inside and outside Paris.



This figure shows the ratio of the price of 3% *rente* in Paris to the Lyon and Bordeaux prices for that same asset (7-day moving average). Notice: (1) the price was very similar in Paris and elsewhere (a 1:1 ratio) before the start of the war and after the Paris Commune; (2) during the Siege, the Parisian price deviated and tended to be consistently higher, particularly after the battle of Coulmiers that led to the recapture of Orléans; (3) this pattern dramatically reverses, with higher prices outside Paris between the Armistice and the peace treaty.

Figure 1 previews the main results. We first document that price differences for the *rente* between Paris and elsewhere in the early phases of the war (before the Siege) and in peacetime are close to zero and transitory. This is consistent with the law of one price and the *rente*'s status as the most widely-held financial asset in France and the most actively traded in continental Europe. However, during the Siege, the price of the *rente* differed persistently between markets in Paris and elsewhere in France. From the start of the Siege in September 1870 until the ceasefire 131 days later, the *rente* price in Paris was on average 0.93% higher than elsewhere. This overall difference mainly reflects the persistently higher price in Paris (an average premium of 1.80%) after an unlikely victory of hastily drafted French conscripts over Prussian regular troops at Coulmiers, which led to the recapture of the strategic city of Orléans.

Importantly, as the figure reveals, however, the price differences for the *rente* inside and outside Paris are not monotonic: instead, we document that as soon as the ceasefire was declared and peace negotiations began, these differences were dramatically reversed. Between the Armistice and the signing of the peace treaty (on 26 February 1871), prices in Paris were, on average, 2.59% *lower* than elsewhere.

These price differences—for the identical thickly traded asset—were not only persistent over time, they are also large in economic terms. They imply a different aggregate evaluation

of the value of French government debt equivalent to 0.30% of French GDP during the Siege overall, 0.58% in the Siege following the battle of Coulmiers, and 0.85% during the peace negotiations. In terms of yields, these differences are respectively equivalent to -6.26%, -12.01%, and 17.14% of the pre-war spread over British consols.

What explains these patterns? In this paper, we show how these large-scale differences and dramatic reversals in the value of French sovereign debt inside and outside Paris can be reconciled using a simple model that highlights a basic political disagreement that citizens often face in war-time: whether it makes more sense to seek peace today in order to avoid the destructive costs of conflict, or to remain at war in hopes of securing better peace terms tomorrow. Such disagreements find modern resonance in differing policy perspectives on whether to continue the so-called *forever* conflicts in Afghanistan and Iraq. They are even more likely to emerge as a central political cleavage when nations are mobilized for large-scale war or are facing invasion, as in contemporary Ukraine and 1870 France.[1]

While the current costs of war are more concrete and apparent to many[2], we argue that a key likely source of political disagreement that often emerges is about the continuation value: citizen-investors may disagree about the relative value of negotiating peace immediately versus staying in conflict in the hopes of changing the *facts on the ground*: i.e. securing redeeming victories that may improve the terms of a future peace settlement.[3] We model this political disagreement in a simple way: we present a dynamic asset pricing model of sovereign debt where marginal investors in different markets may have different prevailing beliefs about the sensitivity of the final peace terms to the flow of battle victories and defeats.

As we describe below, in the French context, it was uncertain how success on the battlefield would translate into better final peace terms. This was particularly the case following an initial series of disastrous defeats that led to the envelopment and surrender of most of France's professional troops. With the capture of the French Emperor himself, many thought the war was already lost and hoped that a rapid cessation of hostilities would lead to a less punitive treaty. In contrast, members of the newly constituted Republican government in Paris pushed for mass mobilization and a continuation of the war, believing that the raw citizen-soldiers of France might win redeeming victories that could yet improve the terms of

[1]The same person may disagree on these tradeoffs, depending on the context. For example, in a speech on March 22, 2022, US President Biden spoke of the war in Ukraine: "*We must commit now to be in this fight for the long haul. We must remain unified today and tomorrow, and the day after, and for the years and decades to come. It will not be easy. There will be costs. But it's a price we have to pay . . .*". However, less than seven months earlier, on August 31, 2021, Biden had remarked while withdrawing US troops from Afghanistan "*I was not going to extend this forever war, and I was not going to extend this forever exit.* " See https://www.whitehouse.gov/briefing-room.

[2]For example, by October 1870, the French newspaper *Pays* estimated that the war had already cost the French people 12 billion francs (about $ 31 billion in modern terms), due to lost battles, mobilization costs, property damage and business losses (Wawro, 2003, pg.256).

[3]Given that individual investors within a country rarely (if ever) experience multiple wars occurring in a stable environment, the convergence of beliefs through iterative processes seem much less likely than might occur with repeated experiences of phenomena in more stable environments, such as firms' dividend streams.

the peace. Of course, this disagreement would only be material if the raw citizen levees could demonstrate that they could defeat regular Prussian troops, which they were able to do at Coulmiers on 9th November 1870. We show that this basic political disagreement—about the extent to which battle events could influence the terms of the peace—can generate the large differences in the valuations of sovereign debt inside and outside Paris that we observe following that battle and that would persist for the remainder of the Siege.

The model further allows us to make a series of testable predictions that we take to the data. First, we can test our basic assumption that marginal investors in Paris believe that battle outcomes can have a greater influence on the ultimate peace terms. If true, and despite being the *thicker* market, Parisian prices should react *more* to battle outcomes: more positively to victories and more negatively to defeats. Second, the model predicts that the Parisian market should implicitly value the option of continuing the war more, as it allows the chance of future redeeming battle victories. A ceasefire that removes such an option, locking in the expected terms at a time when France has experienced multiple defeats and scarce victories, should lead the Paris price to react more negatively and hold that relatively pessimistic valuation until peace terms are announced. Lastly, when the very punishing terms of the treaty were revealed, confirming Parisian pessimism, the model predicts that the Parisian price should move less, while the rest of France should have a more dramatic negative response.

We show that each of these predictions of our simple model are confirmed in the data. The *rente* price in Paris responds 1.183pp more to the arrival of news of war events than in Lyon and Bordeaux. In particular, prices fall more in Paris in response to defeats and rise more in response to the unlikely victory of French citizen-soldiers at Coulmiers. Further, with the declaration of an Armistice leading to a ceasefire, prices outside Paris show a dramatic rise of 4.89%, compared to a 0.54% price *decrease* in Paris. The resultant large price differences are maintained despite the improving conditions for arbitrage. Finally, when the onerous terms of the peace treaty are revealed— including the loss of Alsace-Moselle and an indemnity equivalent to 25% of French GDP— prices *outside* Paris fall precipitously by 4.09%, converging to the prices inside the capital city, which decline only slightly (by 0.64%).

Naturally, one may be concerned that even though we are examining the price for the same widely-held and traded asset, differences other than political beliefs may explain the price patterns for that asset we observe inside and outside the Siege, including information sets, discount factors, market thickness, need for liquidity, among others. We draw upon a series of supplemental data sources to show that such differences are difficult to reconcile with the patterns we observe in the absence of differential political beliefs.

First, we show that different information environments cannot explain the price patterns we observe. The Siege limited communication between Paris and the rest of the world but did

not completely stop information sharing. We exploit detailed data on news flows, including pigeons messages, balloon departures, and newspaper reports to examine how the arrival of news impacted prices in these different markets. We do not find abnormal returns on days with information inflows. Further, we track when Paris prices are reported in Bordeaux and find little convergence by Bordeaux prices in response to this information. Neither do prices in Paris converge when news from outside enters the city. In fact, the price divergence is *even more pronounced* during the peace negotiations, when the exchange of information was more regular than during the Siege. Thus, the markets appear to be *agreeing to disagree* on the price.

Our results are also not explained by differences in liquidity or discount rates. We calculate price differences for four of the most liquid assets (other than the *rente*) that were dual-listed inside and outside Paris. We show that none of these assets present the same patterns as the *rente*. Since price differences are unrelated across assets, market-wide differences in liquidity or discount rates cannot explain the *rente* price differences we observe. Nor do the *rente* price differences track the ten-fold rise in staple or luxury food prices in Paris as the Siege continued.

Our results are also inconsistent with short-term fluctuations due to political beliefs moving thin markets in the regional exchanges. Paris had the deepest financial market in France, and one might expect belief shocks to have less of an effect there. However, as mentioned above, we document instead that during the Siege, the opposite was true, with Paris responding *more* strongly to war news than elsewhere.

Wealth inequality makes our results more striking. Even though the *rente* was widely held, the wealthiest held disproportionate amounts.[4] One might expect economic elites all over France to broadly share similar political beliefs and attitudes. Nonetheless, we find that the different prevailing political views of the broader Parisian public and that of others elsewhere began to translate into substantially and persistently different equilibrium prices as the Siege progressed.

To the best of our knowledge, this is the first paper to document the presence of price disparities due to differences in political beliefs. We argue that the key source of disagreement that many in France faced was a dynamic trade-off common to many decision-makers facing the prospect of defeat in war-time: between continuing fighting today to secure a better peace in the future or negotiating peace immediately to avoid the costs of continued conflict.[5] Our paper is closely related to a growing literature showing that political views affect people's investment decisions, giving rise to heterogeneous beliefs in the market. Investors of different political leanings often disagree about which policies give them the largest eco-

[4] 37% of Parisians who died with positive wealth held French government bonds, but the wealthiest 5% owned 84% of those bonds (see Appendix A.4.1).

[5] For a broader discussion of dynamic trade-offs leading to war see Fearon (1996).

nomic benefits. For example, U.S. investors from Democrat- and Republican-leading ZIP codes invest more in (risky) equities when their party is in power, suggesting investors think the market will do better when there are economic policies in place that are consistent with their own beliefs (Bonaparte et al. (2017) and Meeuwis et al. (2022)).[6] There is also a growing literature showing that political beliefs affect the actions of financial professionals, which in turn affect investor behavior (see Hong and Kostovetsky, 2012; Hutton et al., 2014; Kempf and Tsoutsoura, 2018; Goldman et al., 2020; Cassidy and Vorsatz, 2021; Kempf et al., 2023).[7]

At the same time, it has thus far remained an open question whether such differences of beliefs affect market-wide pricing—and thereby aggregate investment allocations.[8] In particular, prior research finds that the effects of beliefs on investment decisions tend to be driven by a small sub-sample of investors who actively rebalance their portfolio, are economically small on average, and can take months to materialize (Meeuwis et al. (2022)). Particularly in thick markets, one might expect cooler (less-partisan) heads to prevail and to arbitrage away any partisan impact on prices such that, in equilibrium, asset prices are unbiased.

Further, as noted above, an important body of research shows that the share prices of companies that are politically affiliated or that may benefit from the policies of a new regime often do move with political events such as elections (e.g. Fisman, 2001; Faccio, 2006; Mattozzi, 2008; Addoum and Kumar, 2016; Girardi, 2020).[9] However, it remains extremely challenging to distinguish whether such price changes result from political belief disagreement or instead reflect news that also directly influences future cash flows. Compared to this literature, by exploiting the existence of three concurrent price series for the same asset in locations with different prevailing political views, our paper provides evidence linking large and persistent equilibrium price-differences in a liquid and actively traded asset directly to differences in political beliefs.[10]

Our paper is also related to an established literature on the importance of differences of beliefs for investment decisions (see, among others, Miller, 1977; Harrison and Kreps, 1978;

[6]Relatedly, Cookson et al. (2020) use an investor social media platform to show that Republican investors were less pessimistic during the Covid-19 pandemic, Bernstein et al. (2020) show that Republican-leaning voters are more likely to own houses exposed to sea level rises, and Laudenbach et al. (2020) show that investors in former East Germany, who have grown up with a Communist ideology, invest less in the stock market than investors in West Germany.

[7]Another literature establishes this for economic forecasts, but effects on individual consumption decisions are mixed (Conover et al., 1987; Gerber and Huber, 2009; Mian et al., 2017; Gillitzer and Prasad, 2018).

[8]Two papers show price effects of different political beliefs: Dagostino et al. (2020) on loan pricing and Baldauf et al. (2020) on real estate. In contrast, our findings apply to a homogeneous and highly liquid asset.

[9]In France, in particular, Do et al. (2020) provide compelling evidence that the campaign to undo the unjust court-martial of the Jewish officer Dreyfus led to abnormal returns for other firms with Jewish board members.

[10]Further, the existing empirical evidence is predominantly based on the recent increase in U.S. political polarization. We show economically meaningful effects in a different setting in response to political disagreement related to the costs and benefits of war and peace.

Jarrow, 1980; Harris and Raviv, 1993; Kandel and Pearson, 1995; Hong et al., 2006; Hong and Stein, 2007). Recent empirical work suggests that differences in beliefs are significantly related to trading activity but that the economic effects are small (e.g., Ameriks et al. (2020), Giglio et al. (2021), and Cookson et al. (2020)). Further, the evidence that differences in beliefs have aggregate (pricing) implications is limited. There are some exceptions. There is evidence from (non-fungible) dual-listed shares that is at least consistent with differences of beliefs affecting equilibrium prices (e.g. Rosenthal and Young (1990) and Froot and Dabora (1999)).[11] Compared to this literature, our paper provides direct evidence that differences of *political* beliefs can have economically significant equilibrium pricing effects.

Our paper also relates to literature that examines how differences in beliefs emerge. There is growing evidence that personal experience is important (e.g. Bordalo et al., 2022; Vissing-Jorgensen, 2003; Greenwood and Nagel, 2009; Choi et al., 2009; Malmendier and Nagel, 2011, 2016; Koudijs and Voth, 2016). There is also evidence that social networks and peer effects matter (e.g., Hong et al. (2004, 2005), Bursztyn et al. (2014), Bailey et al. (2018, 2019)). Burnside et al. (2016) provide a theoretical model in which investors can get *infected* by others' beliefs. In our setting, negative war experiences notwithstanding, many on the Parisian *street* perceived continued French resistance as preferable for securing a better peace. Compared to this literature, our evidence suggests that these popular beliefs in Paris weighed upon the trading decisions of local (mainly elite) marginal investors as well.

Our paper also builds upon a literature that explores the relationship between war and finance (see Jha and Van Rensselaer (2021) for an overview). On the one hand, war and finance can be complements. Often seen as the *sinews of power* in international relations (Brewer, 2002), the ability of governments to access cheap finance has historically been crucial for supporting war in many settings. Financial markets can also allow individuals to potentially profit from the fortunes of war as well (Guidolin and La Ferrara, 2010; DellaVigna and La Ferrara, 2010). At the same time, financial markets, by aggregating the beliefs of investors, can provide important information to political decision-makers.[12] We contribute to this literature by demonstrating how the 'smart money' may actively and persistently disagree, and such responses can be significantly influenced by the changing beliefs of the marginal investor rather than necessarily reflecting a broader consensus. As conflict, and particular defeat and its aftermath, is economically destructive and can lead to increased

[11] For example, Baker et al. (2012) show that price differences between dual-listed shares are correlated with differences in the principal components of a number of local sentiment proxies. Jia et al. (2017) show that dual-listed shares in Hong Kong and mainland China respond differently to analyst forecasts depending on their location. Moreover, firms that more analysts cover see a lower return correlation between the two share classes. In addition, Koudijs and Voth (2016) show that different experiences of margin-lenders during the Panic of 1773 differentially affected haircuts on future margin-loans in an over-the-counter setting with search frictions. This appears to have had implications for market-wide haircuts.

[12] For example, Willard et al. (1996) and Calomiris and Pritchett (2016) examine how currency and slave prices in the US Civil War responded to war events as means to gauge public opinion of the chances of Union victory. Mitchener et al. (2015) use bond prices to predict victories in civil wars. Frey and Kucher (2000) and Ferguson (2006) look at bond prices around WWII and WWI, respectively.

risk and uncertainty (e.g. Barro, 2006; Besley and Mueller, 2012; Verdickt, 2020; Wang and Young, 2020), broad asset prices can drop substantially in the face of conflict (Rigobon and Sack, 2005; Schneider and Troeger, 2006; Zussman et al., 2008).[13] The informative aspect of financial markets can be further reinforced when decision-makers are themselves invested in broad financial assets, aligning their interests with the broader economy as well.[14] Both of these effects may lead asset price responses to moderate the political behavior of individuals and the *passions* associated with conflict (Hirschman, 2013; Jha, 2012), including those of elites. Our paper shows, however, that this potential moderating effect depends importantly on the political views of marginal investors.

Section 2 provides the essential historical background on the Franco-Prussian War and the different prevailing political beliefs inside and outside Paris. Section 3 then provides a parsimonious theoretical model to better understand price differences in and outside Paris and to derive additional empirical predictions. Section 4 presents the main empirical results testing the implications of the model. We then evaluate alternative explanations in Section 5, including the role of different information sets and liquidity shocks. We conclude by discussing our findings and avenues for future research.

The Appendix provides formal proofs (in Section A.1), further historical context on the financial markets and default risk (A.2), simulations quantifying the bounds on arbitrage during the Siege (A.3), and further supportive material on the *rente* (A.4), the political situation (A.5), war events (A.6), information flows and price responses (A.7), liquidity shocks (A.8), along with a detailed Data Appendix (A.9).

2 Historical Background

The War: The Franco-Prussian War of 1870-71 was the greatest conflict in Europe between the Battle of Waterloo and the First World War, with two million soldiers mobilized and 180,000 fatalities (Clodfelter, 2017). Though the war lasted less than half a year, it was a turning point in European history. France saw the death of an empire and the birth of a republic, Germany emerged as a unified state, and the stage was set for more global conflicts to come (Horne, 2012). In short, the Prussian premier, Otto von Bismarck, sought to provoke the French into declaring war by manipulating the language of a diplomatic communication, the so-called *Ems telegram*, into a seeming insult. He aimed to use French aggression to help unite the German lands (Chrastil, 2023).

Bismarck proved successful. With fears of a rising Germany coupled with "*war fever*" spreading on the Paris streets, all but 16 of the 260 members of the imperial legislature

[13] Jha and Van Rensselaer (2021) take a sample of all inter-state wars in which at least one participant had an active stock market with daily returns between 1900-2020. They find that, on average, there is a 2.5% fall in the three-day cumulative abnormal returns when a war begins in the countries involved.

[14] See Jha (2012, 2015); Jha and Shayo (2019); Jha et al. (2020)).

rose to acclaim 50 million francs for a punitive war against Prussia (Wawro, 2003, p.38).[15] Importantly, the French *rente* price did not reflect these passions, and the *rente* fell a dramatic 9.97% both in and outside Paris in the lead-up to the war (Figure A.2).[16]

Indeed, France was ill-prepared for war, both diplomatically and militarily. France failed to secure commitments from key potential allies before going to war. The French imperial army was made up of a cadre of highly experienced professional soldiers – *les grognards* (the grumblers). Prussia, in contrast, had universal conscription, which allowed it to access younger and more literate soldiers. This also meant that if the war endured and the reservist troops were mobilized, they would have a large numerical advantage (Wawro, 2003).

Though not inevitable *ex ante*, two strategic missteps ensured a French defeat. First, French imperial forces squandered their early numerical advantages by failing to seize the initiative, relying too much on fortified strongpoints such as at Wissenbourg that were unable to withstand the far superior Prussian artillery. Second, Emperor Napoleon III split his army, allowing the Prussians to surround them separately. Marshal Bazaine's force contested a major battle at Gravelotte before he withdrew to the fortress-city of Metz, where he was besieged. Napoleon III's own corps withdrew towards Mars-la-Tour and ultimately Sedan, where it was also surrounded. After a disastrous battle there on September 1st, 1870, leading to around 122,031 French deaths, wounded, or captured (Clodfelter, 2017), the French Emperor rode alone through the Prussian lines to surrender.

Citizen-Soldiers of the New Republic: The capture of the Emperor and the loss of almost his entire professional army delegitimized the remaining Imperial regime. Buoyed by popular Parisian sentiment, a group of pro-Republican deputies stepped out onto the balcony of the Hotel de Ville in Paris to declare the end of the Empire and the birth of the Third Republic. Again, the *rente* price tumbled (Figure A.3). Political veteran Adolphe Thiers, a former prime minister under King Louis-Philippe, declined a position in the newly-established Republican leadership, advising against any new offensives in favor of overtures for peace (Brogan, 1940, pg. 43-44). However, the Republican leadership had different views on the war. Among its leaders was Leon Gambetta, who believed that despite the defeat and capture of almost all of France's professional army, there continued to be hope for the war. He pushed for a *levee en masse* – the raising of raw but fervent citizen-soldiers like

[15] The call to arms was greeted by crowds in the streets of Paris shouting "*á Berlin!... á bas Bismarck!*[To Berlin!... Down with Bismarck!]" (Wawro, 2003, p.38). These sentiments were not confined to the streets. Summarizing the debates in the legislature, Wawro writes: "*What actually transpired revealed just how far [Napoleon's ministers] had drifted from sensible opinion in their rush to war* (pg. 38)."

[16] The six-week Austro-Prussian War four years earlier (in 1866) had culminated in the encirclement of the Austrian forces at the battle of Königgratz. Prussia's battlefield success was seen as a threat to France and was accompanied by a large fall in the French sovereign bond as well (Figure A.2). Prussia's victory removed its key rival to leadership in the German lands but also left a set of very restive south German states that did not wish to cede autonomy to Prussia.

the fabled saviors of the Great Revolution (Ferguson, 2000).[17] New forces hastily mustered around France, including the *Army of the North* around Amiens, and the *Army of the Loire* to the South, near Orléans (see map in Appendix A.6). A citizen-volunteer force of 300,000 also rallied to man the strong fortifications of the city of Paris. However, these new forces lacked both training and discipline. To put pressure on the French republican authorities to negotiate terms, Prussia laid Siege to Paris itself on September 19, 1870.

Apart from the surrender of the remaining professional forces still holding out in Metz, Strasbourg, Belfort, and other fortress towns, the critical war events during the Siege of Paris largely centered around attempts to coordinate with French forces near Orléans. With its bridge across the Loire and rail connections, Orléans could promise resupply to the capital. Importantly, in the first clear victory of French arms during the war, the *Army of the Loire*, consisting primarily of raw French levees, defeated seasoned Prussian regulars at Coulmiers on November 9, 1870, leading to the recapture of Orléans.

The news of the victory at Coulmiers arrived in Paris via pigeon on November 14, 1870. "*The city exploded into a delirium of joy ... Strangers kissed each other on the boulevard; ... 'We have passed from the lowest depths of despair to the wildest confidence', exclaimed* [English diplomat] *Henry Labouchere"*(Horne, 2012, pg. 142). *Le Figaro* reported:

> *This good news caused great and healthy emotions in Paris: enormous crowds gathered ...; readers of the dispatch were interrupted by frenetic hurrahs; it was an enthusiasm as sincere as it was perfectly justified. Since the beginning of the Siege this is the only real good news that has finally reached us* (16 November 1870).

The Parisian stockbroker Jacques-Henri Paradis, commented in his journal that day:

> *The victory of Orléans changed the public mind— forever so easy to train— and today the newspapers speak no more of an armistice. That affair is finished; we now speak of battle, and the daily news sheets present campaign plans. Everyone has their own. ... Everyone wants something, but no one worries if what he dreams is achievable* (Paradis, 1872, pg. 367-369).[18]

According to the historian Denis Brogan (1940, pg. 45-46), "*at the moment, the prudence and pessimism of [Thiers] was at a discount; Gambetta and his armies must be given a chance to succeed where Thiers and his diplomacy had failed.*" Indeed, as we show, Coulmiers and the recapture of Orléans was followed by the emergence of large and persistent *rente* price

[17] The left-wing icon, Victor Hugo, newly returned to Paris from political exile in Brussels, proclaimed in September 1870 that 10 million Frenchmen were "*burning to join the fight*". As Wawro (2003, pg.257) notes, if so,'*they were burning slowly.*'

[18] Translation ours. Paradis' own view was more circumspect: "*Finally, all this shows us that we at least can believe the existence of the Army of the Loire. Now let's see in what conditions this army won the victory of Orléans. How many were we? How many were the enemy? ... M. Gambetta forgets to inform us on this subject, and this is, however, very important. If the Prussians fought one against ten, the matter loses all its importance - and does not enlighten us.*" Indeed, the French outnumbered the Bavarian regulars at Coulmiers by 3:1.

differences inside and outside Paris that would last for the rest of the Siege and beyond (see also Figure 1).

The French ability to coordinate attacks from the South with a sortie from Paris was hampered by Prussian forces who cut the telegraph lines at the beginning of the Siege in order to control the flow of information into the city. The French improvised, sending out baskets of homing pigeons in gas balloons and developing a new miniaturization technology to maximize the information a pigeon could carry (see Appendix A.2.1). Among those sent aloft to rally France in the name of the Republic was Gambetta himself, who would run a parallel administration from Tours and later Bordeaux. The balloons could be dispatched from Paris, but once aloft, their trajectories were unpredictable and determined by air currents, making it hard to return– hence the need for the homing pigeons born and raised in Paris.[19] Using the universe of balloon departures and pigeon arrivals during the Siege, Table A.1 shows that balloons landed outside Paris every 2.71 days, while from October 1870 onwards, pigeons arrived in Paris every 3.32 days on average.

Though information was shared, these delays limited arbitrage between Paris and other financial markets. Section A.3 provides evidence from about thirty thousand pigeon messages that arbitrage instructions were very uncommon (with only 22 potential mentions in the entire corpus). We also estimate modest Sharpe ratios (0.471 and 0.848, respectively) from simulated trading strategies in Bordeaux and Paris, consistent with the fact that due to price volatility and uncertainty in the information flows, risk-free arbitrage was not possible.

Coulmiers would turn out to be the only major victory by France's new citizen armies. Lacking training and discipline, they faced a series of further defeats (see also Appendix A.6.).[20] Attempts to break the Siege of Paris from the inside were also repelled. Eventually, with starvation in the offing, a breakdown of military discipline, and the threat of revolution, Parisian authorities agreed to an Armistice and the calling of elections on January 28, 1871.

Differences in Political Beliefs over War and Peace:

> "*The obstacle to peace is Paris*"' - Emilio Visconti-Venosta, Italian foreign minister, October 22, 1870.[21]

The Republican government in Paris and non-Republicans elsewhere held fundamentally different beliefs about the benefits of war and peace. Gambetta and other prominent voices

[19] The balloon carrying the critical message to coordinate a 'Great Sortie' from Paris with forces in Orléans ended up in Norway (Figure A.19). Two crews were also lost in the Atlantic Ocean. The *pigeons voyageurs* were each baptized and honored as heroes of France (Paradis, 1872).

[20] "*Even by French standards, the [Army of the Loire draftees] were breathtakingly undisciplined. They elected their own officers- having ousted their Bonapartist ones on 4 September– and frequently refused direct orders from the war ministry or regular army headquarters.*" (Wawro, 2003, pg.265), citing *Garde Mobile de la Sarthe to XV Corps, Blois, 19 Oct 1870.*

[21] He continued his dispatch arguing that the politicians there will not "*accept certain conditions that the French nation might be disposed to accept.*" Emilio Visconti-Venosta, UK Public Records Office: FO 425,98,89, Florence, 22 Oct. 1870.

in the Republican government wanted to prolong the war, hoping that continued resistance would lead Prussia to moderate their harsh proposals, despite France's devastating defeats. Further, they believed that without military victories, the French would lack any bargaining power in the negotiations (Brogan 1940, pg. 52; Wawro 2003, pg. 288, 304).[22] Even after the failure of the Great Sortie, and the Armistice itself, Gambetta wanted to resume the conflict (Brogan 1940, pg. 52; Wawro 2003, pg. 251). He was not alone – on the Parisian *street*, ardent left-wing demonstrators, many now armed as part of the defense of the city, also pressured the Republican government to continue the war.[23] On the eve of the armistice, the French negotiator Jules Favre exclaimed: "*God only knows what the Parisian populace will do to us when we are compelled to tell them the truth*" (Horne, 2012, pg. 239). Indeed, Section A.5 shows that Parisians elected representatives who voted overwhelmingly against ratifying the treaty.

In contrast, in much of the rest of France, '*from the very first, the war was markedly less popular than in Paris*" (Horne, 2012, pg. 39). According to Wawro (2003, pg. 232, 256), "*the provisional government was little more than the pre-war republican delegation from Paris, a small political faction atop a vast country that was not very republican at all*" and "*outside Paris, there was deep hostility to the Republic and the 'balloon government' at Tours, which the peasants and provincial bourgeois increasingly identified with taxes, war-mongering, and 'red revolution'*." A prevailing fear was that continuing the war would only lead the Prussians to ask for a higher indemnity to cover their war costs (Horne, 2012, pg. 91). Some also believed that the Prussians would resist the temptation to over-exploit their bargaining power and instead provide more reasonable peace terms.[24] The remaining officers of the old Empire, including Marshal Bazaine and General Bourbaki, were also unenthusiastic about the new Republican government and the war effort (Horne, 2012, pg. 207). As we return to below, after surrendering himself and the last major concentration of 179,000 French professional troops at Metz to the Prussians, Bazaine remarked to his entourage: "*This sad affair will have at least one good result: it will force Paris to cease its*

[22]According to Horne (2012, pg. 91), "*for France, with her back pinned to the wall by the rapacity of the Prussian General Staff, it now seemed there was no option but to fight tooth and nail. . . . Henceforth, warfare would no longer be a polite contest between professional armies on the eighteenth-century model, but a jungle-law 'survival of the fittest' struggle between peoples.*"

[23]They viewed the war "*as a struggle between proletarian virtue and thieving monarchy.*" Many thought that Gambetta and the Republican government were even too moderate and "*had only one thought: peace. Not a victorious peace, not even an honorable peace, but peace at any price. . . . It does not believe in resistance*" (Horne, 2012, pg. 92). There were protests in front of the Hotel de Ville or in the Place de la Concorde every day to maintain a hard line against the Prussians (Wawro, 2003, pg. 234, 253).

[24]In fact, Bismarck himself believed that onerous peace conditions would humiliate France and lead to future war. But he was overruled by the generals (Dehdari and Gehring, 2022). Similarly, the *Economist* noted that harsh peace terms "*may excite France to continue the war, and may cause her to elect an Assembly inflamed with war passion*". After the signing of the final peace treaty, independent observers were shocked by the outcome, with the *Economist* and the British prime minister respectively observing that "*to exact huge sums of money as the consequence of victory suggests a belief that money may next time be the object as well as the actual reward of battle* " and "*there is not a diplomatic tradition which has not been swept away. You have a new world, new influences at work. . . . The balance of power has been entirely destroyed.*" (Wawro, 2003, pg. 305-306).

resistance and restore peace to our country" (Wawro, 2003, pg. 251).[25]

A possible solution to this political stalemate was new elections. Bismarck realized that the French provinces were more conservative than Paris and more inclined to sue for peace. However, afraid of a "*pacifist landslide*," the Republican government postponed the elections indefinitely: "*the greater worry was that France's war-weary peasant voters would return pragmatic conservatives, or even monarchists, to make peace at any price*" (Wawro, 2003, pg. 247, 256).

After the armistice was signed, however, national elections finally took place in February 1871. The results unambiguously show the large divide between Parisian arrondissements and the rest of France (see Section A.5). Thiers, the big winner, and soon-to-become the new prime minister, headed the pro-peace list, which essentially consisted of conservatives from rural France. Gambetta headed the list for the continuation of the war, which primarily consisted of left-leaning Republicans from Paris. The former won an overwhelming majority with 500 of 676 seats in the new assembly (Wawro 2003, p. 303; Horne 2012, p. 254).

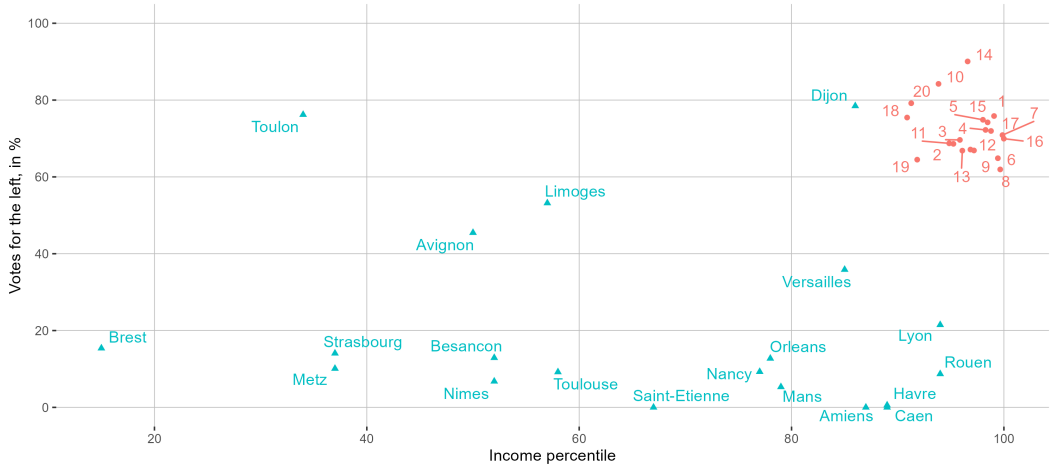
As Section A.5 details, Paris has a long and consistent history of electing more left-wing representatives, but the left-right vote gap was especially large in the war-time February 1871 election, where the key issue was whether or not to accept the terms of the peace. As Figure 2 shows, these political differences are apparent even when we only compare the voting behavior of Parisian arrondissements to other urban communes with similar levels of wealth. The differences are also particularly marked when comparing Parisian vote patterns to the city with the next thickest financial market after Paris, Lyon.[26]

The Treaty of Versailles was announced on February 28, 1871. The conditions were extremely harsh: the loss of Alsace-Moselle and payment of a five billion francs indemnity. This sum was equal to 25% of France's GDP and 2.5 times its yearly government budget, to be paid over five years. Nevertheless, on March 1, the Assembly voted to ratify the peace treaty. Table A.8 confirms that, apart from one abstention, all the representatives elected in Bordeaux (Gironde) and Lyon (Rhone) voted in favor, while a majority of the representatives elected in Paris (Seine) voted against.

[25]Similarly, Adolphe Thiers, the moderate politician favored by the provincial bourgeoisie (Brogan, 1940, pg. 55-56), "*was dedicated to concluding peace at almost any price with Germany*", drawing outrage from the then Mayor of Montmartre, Georges Clemenceau, who would devote much of his career to reversing the terms of the treaty and restoring Alsace-Moselle to France (Horne, 2012, pg. 107, 256-257). Commenting on the disagreement between Paris and the rest of France, Catholic politician Vicomte de Meaux noted that "*we provincials were unable to come to an understanding with the Parisians. It seemed as if we did not even speak the same language, and that they were prey to a kind of sickness*" (Horne, 2012, pg. 259-260).

[26]Figure A.9 shows votes for the Left in the 1871 election in each Parisian arrondissement separately, and the distribution of votes for each income percentile for the communes in the rest of France. For example, in the richest Parisian arrondissement (the 16^{th}), the left got 70% of the vote, compared to a median of 0% in the richest 1% of communes in the rest of France (if we include the center-left, those vote shares are 74% and 19% respectively).

Figure 2: Elections results in February 1871 by income percentile, in Parisian arrondissements and major urban communes in the rest of France



This graph shows the election results in each one of the 20 Parisian arrondissements (circles, numbered) and the 20 biggest urban communes in the rest of France by their income percentile (from those with available voting data, triangles). N.B. The returns for Bordeaux are not included due to missing data.

3 Model

In this section, we introduce a simple dynamic asset pricing model to understand how political beliefs about the gains of continued war can affect security price differences in different markets.[27] We include one crucial distinction: we allow investors in different markets to have different political beliefs about the benefits of battlefield victories and defeats in influencing the terms of the peace.

3.1 Setup

Individual investors i price debt securities. Each perceives the following value functions while beginning a period t in a state of war ($V^w_{i,t}$) or peace ($V^p_{i,t}$):

$$V^w_{i,t} = -\Omega + \delta\left[\pi E_t V^w_{i,t+1} + (1-\pi)\, E_t V^p_{i,t}\right], \quad (1)$$

$$V^p_{i,t} = \frac{\Gamma_{i,t}}{1-\delta}, \quad (2)$$

where Ω is the flow cost of war, $\delta < 1$ investors' discount rate, and π the probability of transitioning from a state of war to a state of peace. For simplicity, we assume that the parameters are the same in each period, and are taken as given from the perspective of each

[27] This model is inspired in part by DellaVigna and La Ferrara (2010), who provide a valuable framework for analyzing the effects of war events on financial market responses for detecting illegal arms trade.

individual investor i. We assume peace to be an absorbing state.[28]

In every period, there is a battle that can be won or lost. The probability of a win is given by Pr_t^w which is again perceived to be the same by all i. Importantly, we allow investors to disagree about how these war events affect the *peace terms* that would materialize if the war ends in t, denoted $\Gamma_{i,t}$.[29] Peace terms are a function of past wins and losses. For tractability, we assume that

$$\Gamma_{i,t} \equiv \alpha_i^{W_t - L_t}, \tag{3}$$

$$\text{with } W_t = \sum_{\tau=1}^{t} w_\tau \text{ and } L_t = \sum_{\tau=1}^{t} \ell_\tau, \tag{4}$$

where w_τ indicates a win and ℓ_τ a loss, and thus $W_t - L_t$ is the current tally of victories over defeats, or the *war score*. We assume that $\alpha_i \geqslant 1$ such that wins improve and losses worsen peace terms.[30] Therefore, α_i captures the expected sensitivity of peace terms to the war score. Crucially, we allow this parameter to differ between investors. Before fighting starts, the peace terms are normalized to $\Gamma_0 \equiv 1$. This implies that Ω can be thought of as the flow costs of war relative to the initial flow benefits of peace.

Depending on the number of wins and losses, and their impact on peace terms, $\Gamma_{i,t}$ can become bigger or smaller than 1. For example, if investor j thinks that results on the battlefield have no effect on the terms of peace, then $\alpha_j = 1$ and $\Gamma_t = \Gamma_0 = 1$. If investor $i \neq j$ believes that war events can change the peace terms, then $\alpha_i > 1$. As long as wins exceed losses (i.e. $W_t > L_t$), $\Gamma_{i,t} > 1$.

3.2 Results

We first establish predictions for price valuation levels. We then derive additional testable predictions regarding valuation changes (please see Section A.1 for formal proofs). Intuitively, as long as the probability of scoring wins is high enough (Pr_t^w is large) and there have not yet been too many losses, investors that perceive a high sensitivity of peace conditions to the war score—i.e., a high α_i—will assign a higher value to the security in the state of war. Further, this effect will flip if the end of hostilities comes after a string of losses: the accumulated losses will be expected to worsen the final peace terms and there are no more opportunities for redeeming victories. Further, in this situation, investors with the highest α_i will be most pessimistic about the value of the security.

[28] More generally, we can allow the period gain to peace to be discounted by some exogenous probability of transition back to war without changing the results substantively.

[29] Specifically, $\Gamma_{i,t}$ are the flow benefits of being at peace net of transfers or reparation payments.

[30] This can be thought of as a reduced form way of capturing a more complex bargaining process where war victories and losses accumulate in shaping peace terms.

For simplicity, we assume that losses (wins) are i.i.d.[31] Then, expectations are given by:

$$\mathbb{E}_{i,t}\Gamma_{i,t+1} = \left[Pr_t^w \alpha_i + \frac{(1 - Pr_t^w)}{\alpha_i} \right] \Gamma_{i,t} \equiv \gamma_i \Gamma_{i,t}, \tag{5}$$

where the parameter γ_i can be thought of as the expected change in peace terms from continuing to fight.

Lemma 1. *If $\alpha_j = 1$, we have $\gamma_j = 1$. If $\alpha_i > 1$ and $Pr_t^w > \frac{1}{2}$, $\gamma_i > 1$.*

Lemma 2. *As long as $Pr_t^w > \frac{1}{2}$, $\frac{\partial \gamma_i}{\partial \alpha_i} > 0$ and $\frac{\partial \gamma_i^2}{\partial \alpha_i \partial Pr_t^w} > 0$.*

Lemmas 1 and 2 establish that as long as the probability of a future battle victory is perceived to be sufficiently large, a larger α_i implies that continuing to fight will lead to better expected peace terms. Further, the sensitivity of the expected peace terms with respect to α_i increases in Pr_t^w. That is, the higher the perceived probability of a battle success, the greater the impact of α_i on the expected peace terms.

Proposition 1. *The security's value at time t while in a state of war is given by:*

$$V_{i,t}^w = \frac{-\Omega}{1 - \delta\pi} + \frac{(1 - \pi)\,\delta\gamma_i}{(1 - \delta)\,(1 - \delta\pi\gamma_i)} \alpha_i^{W_t - L_t} \tag{6}$$

The solution is well-defined as long as $\gamma_i < 1/\delta\pi$. The value after the end of hostilities in period t is given by Eqn. (2).

Proposition 2. *If markets are fully integrated and there are no short-selling constraints, the equilibrium value of the security in period t while at war or after the end of hostilities is given by:*

$$V_t^w = \sum_i \omega_i V_{i,t}^w \; ; \; V_t^p = \sum_i \omega_i V_{i,t}^p \tag{7}$$

with ω_i the weight of each investor i.

If two markets with respective investors $i \in I$ and $j \in J$ are not integrated, local prices will reflect local beliefs:

$$V_{I,t}^w = \sum_{i \in I} \omega_i V_{i,t}^w \; ; \; V_{I,t}^p = \sum_{i \in I} \omega_i V_{i,t}^p \tag{8}$$

$$V_{J,t}^w = \sum_{i \in J} \omega_j V_{j,t}^w \; ; \; V_{J,t}^p = \sum_{j \in J} \omega_j V_{j,t}^p \tag{9}$$

[31] This assumption can also be motivated by the selection of conditions under which two opposing armies will be willing to join battle, as in the canonical Priest and Klein (1984) analysis of litigation disputes: as they establish, due to selection, the outcome of cases that actually come to court should be hard to predict, with a benchmark expectation of about 50% plaintiff victories. The framework can also, in principle, incorporate a string of multiple serially correlated victories– we can redefine the duration of each period such that these are considered a single victory.

3.3 Empirical Predictions

We assume that investors in different markets can have different beliefs about how success or failure on the battlefield shaped peace conditions. For simplicity, we assume that investors in a particular market all share the same beliefs.[32] In particular, we assume $\alpha_C > \alpha_R$, where in our case, C denotes the capital (Paris) and R the Rest of France. We will test this assumption below.

Corollary 1. *As long as the count of battle victories versus losses exceeds a (negative) threshold level: $W_t - L_t > (W_t - L_t)^*$, with $(W_t - L_t)^* < 0$, the market with the largest α will have the highest valuation while in a state of war. The difference in valuations while at war increases in the probability of victories Pr_t^w.*

This corollary suggests the following interpretation of events. Initially, investors in both locations perceive the probability of a battle victory Pr_t^w to be small. As a result, price differences between the two locations are limited. After the first citizen-soldier victory at Coulmiers, there was a nationwide upward reevaluation of victories to come (i.e. $Pr_t^w \uparrow$).[33] Even though the battle itself did not dramatically change France's position in the war, this was the first time in the conflict that a citizen army had demonstrated that it could be victorious against regulars on the battlefield. Given existing differences in beliefs about the gains to future peace terms from future victories should the war continue (i.e. $\alpha_C > \alpha_R$), a substantial price difference between Paris and the Rest of France emerges.

The next corollaries establish three additional predictions from this framework for how we expect prices in Paris and the Rest of France to respond to war and peace events.

Corollary 2. *Suppose hostilities end in t. If $L_t > W_t$, the market with the highest α will have the lowest valuation. Further, it will have a more negative (less positive) response to the end of hostilities.*

Ending hostilities also removes the chance of future redeeming victories. In the model, this implies that the current count of battlefield victories over defeats pins down the peace terms. If there were more losses than wins, the market with the highest α will then have the lowest valuation, and a more negative (less positive) response to the news. Further, valuations will not immediately converge as the true value of α has not yet been revealed. Indeed, as we show below, not only do the price differences *flip* with the end of hostilities,

[32] If we allow beliefs within a given location to differ, we can apply log-linear approximations to Eqns. (2) and (6) to still arrive at a closed-form solution. This leads to qualitatively equivalent results as long as the weighted average of beliefs in Paris and the Rest of France differ in a systematic way.

[33] Though the quotes in Section 2 document the reception of the news of Coulmiers in Paris, outside observers also reevaluated Pr_t^w. In London, *The Economist* wrote "*The history of the last few weeks shows an immense recovery in the position and prospects of the French armies... the history of the maneuvers and fighting since the battle of Coulmiers has decidedly, we think, been in favor of the French*" (1870-12-03). In *Le Salut Public* (Lyon, 1870-11-12): "*RECOVERY OF ORLEANS. Will fortune, in the end, do without persecuting us?... The dawn of better days is dawning over France.*"

but the valuations remain lower inside versus outside Paris between the end of hostilities (the Armistice) and the release of the treaty terms. Importantly, this continues despite the gradual restoration of information flows and other conditions that should facilitate arbitrage, as long as the final terms of the peace remain uncertain.

Corollary 3. *The response to news about the final peace terms will be negative if battle defeats exceed victories $L_t > W_t$ and a market's perceived α is smaller than the one realized.*

With the establishment of peace terms with the ratification of the treaty, the true sensitivity of the terms to battlefield events, α, is revealed. If the marginal investors in either market had believed in a lower sensitivity than the true α, this will lead to an abrupt revaluation downward. Indeed, as we document below, markets outside Paris, which had shown a lower price responsiveness to war events (consistent with a lower sensitivity parameter α), also *over-valued* the *rente* after the Armistice. This continued until the moment the treaty terms were revealed, when their prices did indeed drop towards Parisian levels.

Corollary 4. *As long as $W_t - L_t > (W_t - L_t)^{**}$, with $(W_t - L_t)^{**} < 0$, the market with the largest α will have the strongest response to wins or losses on the battlefield.*

We can use this result to directly test our assumption that Parisians did indeed perceive a higher sensitivity of peace terms to battlefield events, α. If so, battlefield victories during wartime should elicit more positive (and defeats more negative) price responses in Paris compared to other markets.

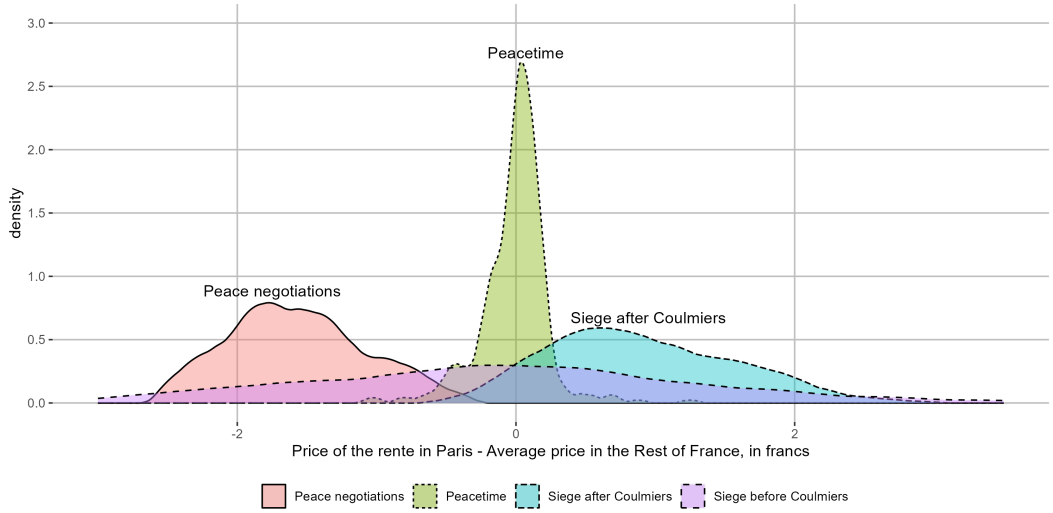
4 Empirical Results

In this section, we first document Corollary 1: that large and persistent price divergences in French sovereign debt emerge between Paris and the Rest of France during the Siege, and particularly so after the success of citizen-soldiers against Prussian regulars at Coulmiers. Next, we provide formal tests of the model's additional predictions, formalized in Corollaries 2 through 4. Finally, we explore a number of alternative explanations for our findings.

4.1 Persistent Price Differences during the Siege

We focus our analysis on the 3% *rente*: the most liquid security in France and the most actively traded asset in continental Europe (please see the Historical Appendix A.2 for more context). *Rentes* represented 7.7 million francs of the capitalization of the Paris Bourse in 1870 compared to 5 million for stocks (Viaene, 2002). Paris itself was "*the leading financial center in continental Europe throughout the nineteenth century*" (Hautcoeur and Riva, 2012, pg.7). Even though Paris came under Siege in September 1870, and the cutting of the telegraph wires limited arbitrage (see Section A.3), the Paris Bourse continued to operate,

Figure 3: Density of price differences of the 3% *rente* between Paris and other French exchanges



This graph shows the distributions of daily price differences between Paris and the average of Lyon and Bordeaux prices for four periods: the Siege prior to Coulmiers (September 18 to November 15, 1870), the Siege after Coulmiers (November 15, 1870 to January 28, 1871), the peace negotiations (January 28, 1871, to March 1, 1871), and peacetime (January 1, 1870 to July 15, 1870, and May 31, 1871 to December 31, 1871). Epanechikov kernel with Silverman rule-of-thumb bandwidth.

and incentives were such that the Bourse was often where rumors and news (both real and fake) would first be disseminated in the beleaguered city.

We hand-collected daily prices for the *rente* for 1870 and 1871 for Paris and for the second and third longest-established and thickest stock exchanges in France: Lyon and Bordeaux.[34] Our sources are the *Cours Authentique* (Paris), the *Cours Officiel* (Bordeaux), and the newspaper *La Salut Public* (Lyon) (please see details in the Data Appendix A.9.) We always use the first price of the day. All price differences are calculated as the Paris price minus the price in the other exchange on the same day.

Figure 3 establishes the basic patterns that are consistent with the model, while Table 1 provides formal non-parametric tests (Kolmogorov-Smirnov and Wilcoxon rank-sum) and parametric tests for differences in the distributions of prices (Welch t-tests of equality of means allowing unequal variances, see also Table A.7 for one-sample tests of daily price differences). As Figure 3 suggests, during peacetime, the distribution of differences between the *rente* prices inside and outside Paris was tight and centered almost perfectly around a

[34]The Lyon exchange was the first exchange outside of Paris to gain the right to establish a trading floor in 1845 (Ducros and Riva (2014),6-7). Bordeaux did so in 1846. Using commissions as a measure of transaction volumes, Ducros and Riva suggest that the Lyon stock exchange had about 1/10 of the trading volume of Paris in 1870 (Ducros and Riva (2014), p.34). Bordeaux was the thinnest market of the three.

Table 1: 3% *Rente* Price Differences between Paris and Other Markets: Two-sample tests

	Paris - Rest of France	Paris - Lyon	Paris - Bordeaux	Lyon - Bordeaux	Average Paris price	N
Entire Siege	0.515	0.384	0.655	0.271	55.327	110
Welch SE	(0.129)	(0.156)	(0.135)	(0.173)		
Welch p-values	0.000	0.015	0.000	0.119		
K-S p-values	0.000	0.008	0.000	0.196		
Wilcoxon p-values	0.000	0.009	0.000	1.000		
Diff as % price	0.93%	0.69%	1.18%	0.49%		
Siege after Coulmiers	0.997	1.167	0.825	-0.342	55.309	64
Welch SE	(0.150)	(0.160)	(0.160)	(0.185)		
Welch p-values	0.000	0.000	0.000	0.066		
K-S p-values	0.000	0.000	0.000	0.101		
Wilcoxon p-values	0.000	0.000	0.000	0.055		
Diff as % price	1.80%	2.11%	1.49%	-0.62%		
Peace Negotiations	-1.409	-1.199	-1.676	-0.477	54.426	23
Welch SE	(0.165)	(0.159)	(0.202)	(0.213)		
Welch p-values	0.000	0.000	0.000	0.030		
K-S p-values	0.000	0.000	0.000	0.007		
Wilcoxon p-values	0.000	0.000	0.000	0.015		
Diff as % price	-2.59%	-2.20%	-3.08%	-0.88%		
Peacetime pre-war	0.054	0.071	0.027	-0.045	74.358	155
Welch SE	(0.107)	(0.113)	(0.110)	(0.118)		
Welch p-values	0.611	0.529	0.809	0.705		
K-S p-values	0.962	0.924	1.000	0.982		
Wilcoxon p-values	0.597	0.587	0.833	0.729		
Diff as % price	0.07%	0.10%	0.04%	-0.06%		
Peacetime post-war	-0.062	-0.066	-0.033	0.033	60.764	181
Welch SE	(0.190)	(0.113)	(0.196)	(0.190)		
Welch p-values	0.745	0.727	0.866	0.864		
K-S p-values	0.974	0.751	0.959	0.914		
Wilcoxon p-values	0.816	0.816	0.837	0.984		
Diff as % price	-0.10%	-0.11%	-0.05%	0.05%		

This table tests whether the prices in Paris and the Rest of France (the average between Lyon and Bordeaux) come from the same distributions. The main coefficient is a difference in means, for which we performed a Welch's t-test (SE and p-values reported), which allows for unequal variances across distributions. We also implement nonparametric tests comparing the distributions and report the p-values: the Kolmogorov-Smirnov test and the Wilcoxon rank-sum test. The last row for each period reports the average difference as a percentage of the average Paris price (in the last column). For tests of the distribution of the price differences themselves, see Table A.7.

zero mean. Further, the non-parametric tests in Table 1 fail to reject that the distributions of daily prices are the same before the war (with Kolmogorov-Smirnov p-values: 0.962 and Wilcoxon: 0.597) and afterward as well (Kolmogorov-Smirnov: 0.974. Wilcoxon: 0.816). Similarly, we fail to reject that price differences in Paris and elsewhere are zero (with p-values of 0.611 before the Siege and 0.745 after). These patterns are consistent with the presence of the telegraph and the law of one price.

Further, as Figure 3 suggests, early in the Siege, there is much greater volatility in the price differences.[35] The mean price difference, however, remains centered around zero. This changes after the Battle of Coulmiers and the resultant recapture of Orléans, when Paris begins to overvalue the *rente* by 1.80% (consistent with Corollary 1). Further, with the cessation of hostilities, between the Armistice and the declaration of the peace terms in the Versailles Treaty, the price differences *flip* (consistent with Corollary 2). During that period, Parisian traders *undervalue* the *rente* by 2.59%. The non-parametric and parametric tests of these differences are all highly statistically significant (p-values less than 0.001; see Table 1).[36]

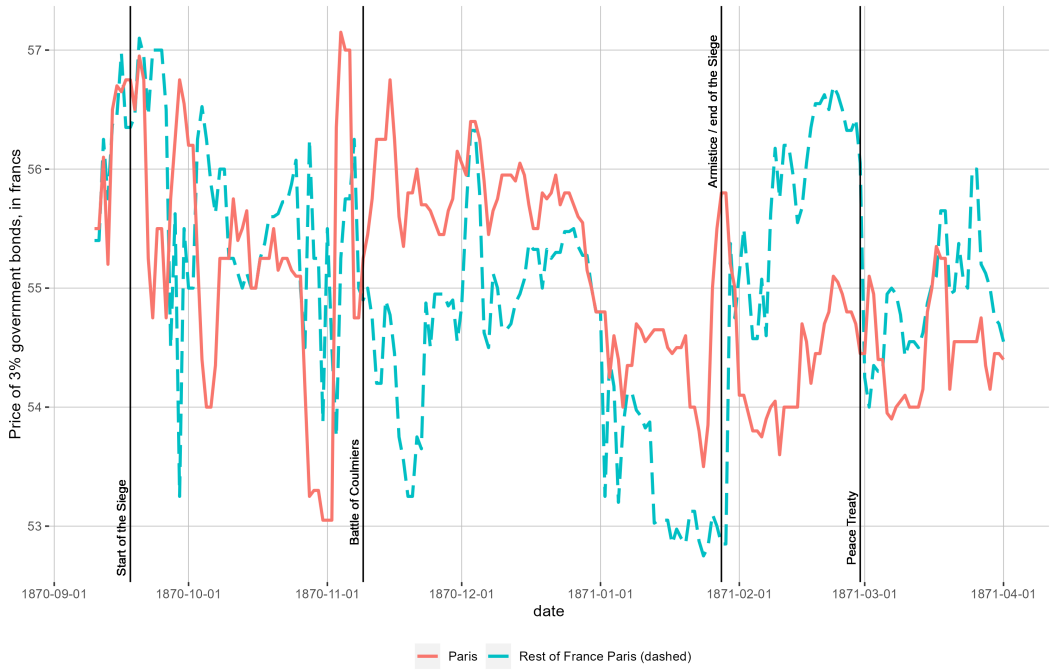
Figure 4 shows the time series of the price differences in Paris versus Lyon and Bordeaux. The figure shows that the *rente* not only had a higher price overall in Paris after Coulmiers, but these differences are *persistent* and present at almost all trading days over the nearly three months remaining of the Siege. Similarly, immediately following the cessation of hostilities with the Armistice, the markets outside Paris persistently over-value the *rente* relative to Paris. The prices then begin to converge only after the treaty terms are revealed (consistent with Corollary 3). Importantly, as we document below, this lack of convergence (in fact, increased price *divergence*) occurred despite the period of peace negotiations between the Armistice and the Treaty being one where information flows became more rapid, and the flow of goods and people into and out of Paris was gradually restored, facilitating arbitrage.

The differences are also economically meaningful. They imply a different aggregate valuation of the value of French government debt equivalent to 0.30% of French GDP during the Siege overall, 0.58% after Coulmiers and 0.85% during the peace negotiations, or differ-

[35]The periods of analysis are (1) The entire Siege, from 1870-09-18 to 1871-01-28. (2) The Siege from its start until the news was declared in Paris of the French victory at Coulmiers on 1870-11-15. (3) The Siege after the news of Coulmiers was announced in Paris (3) The peace negotiations from the announcement of the Armistice (in Paris, on 1871-01-29) until the announcement of the Peace Treaty (in Paris, on 1871-02-28). (4) Peacetime includes two periods: before the war (1870-01-01 to 1870-07-13, the date of the Ems Dispatch) and after the restoration of the telegraph (1871-05-28 to 1871-12-31).

[36]In contrast, the differences between the next thickest market, Lyon, and Bordeaux, which became home to the Republic's government in exile, are not as pronounced in both magnitude and statistical significance, despite also facing some disruptions in communications. In fact, we fail to reject that the distributions are the same during the entire Siege (Kolmogorov-Smirnov p-value 0.196, Wilcoxon p-value about 1). As we describe below, we can exploit the fact that during the Siege, the Bordeaux newspaper *La Gironde* published both Lyon and Paris prices. We show that the Bordeaux market price ceases to converge to Parisian prices during the Siege (Table 5) but does converge strongly to the prices in Lyon when the Bordeaux newspaper *La Gironde* publishes information about Lyonnais *rente* prices (Table A.13). See also Section A.7.

Figure 4: Prices of the 3% *rente* in Paris versus Lyon and Bordeaux between the Siege and Treaty.



This graph shows the prices of the 3% *rente* inside and outside Paris between September 18, 1870 (the start of the Siege) and April 1, 1871. The outside price is an average between Lyon and Bordeaux. Parisian prices were persistently higher during the Siege, particularly after Coulmiers and the recapture of Orléans, but the situation reversed with the end of hostilities. Prices converged again when the terms of the peace treaty became public.

ences in yields of French sovereign debt of 5.14 bps, 9.87bps and 14.08 bps respectively. We can also compare the difference in yields to the pre-war spread over British consols: The difference between Paris and the rest of France is equivalent to -6.26% of the pre-war spread throughout the entire Siege, -12.01% during the Siege following the battle of Coulmiers, and +17.14% during the peace negotiations (see Table A.6 and Figure A.6 in Section A.4.2).

4.2 Differential Responses to War and Peace

We have so far shown how a model with a single source of political disagreement inside and outside Paris about the gains from redeeming victories can reconcile the broad patterns of the emergence, persistence, and two reversals of large price differences for sovereign debt visible in the different markets. We now provide more precise evidence that the *timing* of the emergence and these reversals also correspond to the moments when investors became aware of the two peace events: the announcements of the Armistice on January 28 and the Versailles Peace Treaty on February 26, 1871. Importantly, we can also directly test

the key assumption of the model stated in Corollary 4. Despite being the thickest market, we would expect Parisians to react *more* strongly to war events (more positive in response to battlefield victories and more negative in response to defeats) if they indeed held the political belief that peace terms would be highly sensitive to battle victories or defeats.

This is not straightforward, since the war and the Siege meant that the different markets often learned about the news at different times. Figure A.4 shows how *rente* prices change in the immediate aftermath of war events in each market. Paris prices do respond differently, though, not surprisingly given the information flows, the responses sometimes appear with a lag. Thus, to measure the reaction to specific events, we reconstruct when each city was first documented to have received knowledge of each news event. We again do this by hand-coding daily data from contemporary newspapers from each city and the daily *Journal du Siege*, kept by the Parisian stockbroker, Jacques-Henri Paradis (1872), who also provides very valuable insight into how informed Parisian investors thought of events (see Section A.9). We classify each war event as a major and minor victory or defeat for French arms, following Wawro (2003) and Clodfelter (2017) (see Section A.9.5 for details).[37] We focus on two-day returns for the *rente*. Returns on day t are calculated as: $log(p_t) - log(p_{t-2})$. We choose a two-day window as that is the shortest period within which we can place the arrival of a specific piece of news with confidence.[38]

Figure 5 illustrates the methodology for two major war events and two peace events. Figure 5(A) shows *rente* prices respond as news arrives in the three markets after a major defeat— the surrender of Metz— and a major citizen-soldier victory—Coulmiers (both discussed above). The fall of Metz was a terrible loss, as 179,000 of France's remaining professional soldiers under Marshal Bazaine surrendered (Clodfelter, 2017). Thus in order to lower Parisian morale, the Prussians allowed reports of the event to rapidly leak into Paris. These were initially denied by the government, but were officially confirmed days later (see specific news entries in Tables A.18 and A.20). For this and other events, we therefore record both the date of the first rumor and the confirmation. We provide both the price responses to the confirmation, and in a robustness specification, effects that add up the responses after the first rumor *and* the confirmation of each event.

As Figure 5(A) illustrates, Parisian prices did tend to react more negatively to the major defeat at Metz and more positively to the major victory at Coulmiers, consistent with Corollary 4. The French surrender at Metz decreased the Paris price by a dramatic

[37] Data Appendix A.9.5 describes the data collection and event classification. Table A.17 provides descriptive statistics of the delays between the events and report date for each city. It validates our dates: battle news took much longer to reach Paris during the Siege (of course, apart from sorties to attack the besiegers from within Paris). Tables A.18 to A.20 provide the (translated) quotes of news of each event news each newspaper or source.

[38] The stock market traded from noon to 2 pm, Monday to Saturday, with newspapers distributed early in the morning. For example, the details of the Treaty of Versailles were printed in Lyon on Wednesday, March 1, 1871. Since there is uncertainty about whether the news arrived before or after Tuesday's market hours, we compare Monday's price to Wednesday's price.

3.89% (3.42% after the first mention and 0.47% after the confirmation). In contrast, the prices in Lyon and Bordeaux were less negative: in fact, they actually *rose*– by 1.90% and 0.45%, respectively– as news arrived of the French defeat at Metz. These patterns are consistent with marginal investors in these markets being more skeptical than Parisians of the gains to be had from continued war.[39]

Similarly, the lower panel shows the price responses as news arrived of the major French citizen-soldier victory at Coulmiers. Paris prices responded most positively (increasing by 0.88%) to the news confirmation (as did, to a slightly lesser extent, the prices in Bordeaux). However, in the thickest market outside Paris, Lyon, the *rente* prices actually *fell* by 0.89% in response to the French victory. Further, as discussed above, after Coulmiers, Parisian prices would remain persistently higher for the rest of the Siege.

Figure 5 (Column B) further confirms that the two price difference reversals predicted by Corollaries 2 and 3 also correspond to the specific timing of news arriving about the end of the hostilities (the Armistice) and the terms of the peace (in the Treaty). The price in Paris fell by -0.54% just as the Armistice was confirmed. Lyon and Bordeaux, in contrast, saw huge gains (4.27% and 5.51%). In contrast, when the details of the Versailles treaty became public, the price of the *rente* in Lyon and Bordeaux dropped by 4.75% and 3.43%, respectively. The Paris price, on the other hand, barely moved, with a fall of just 0.64%.

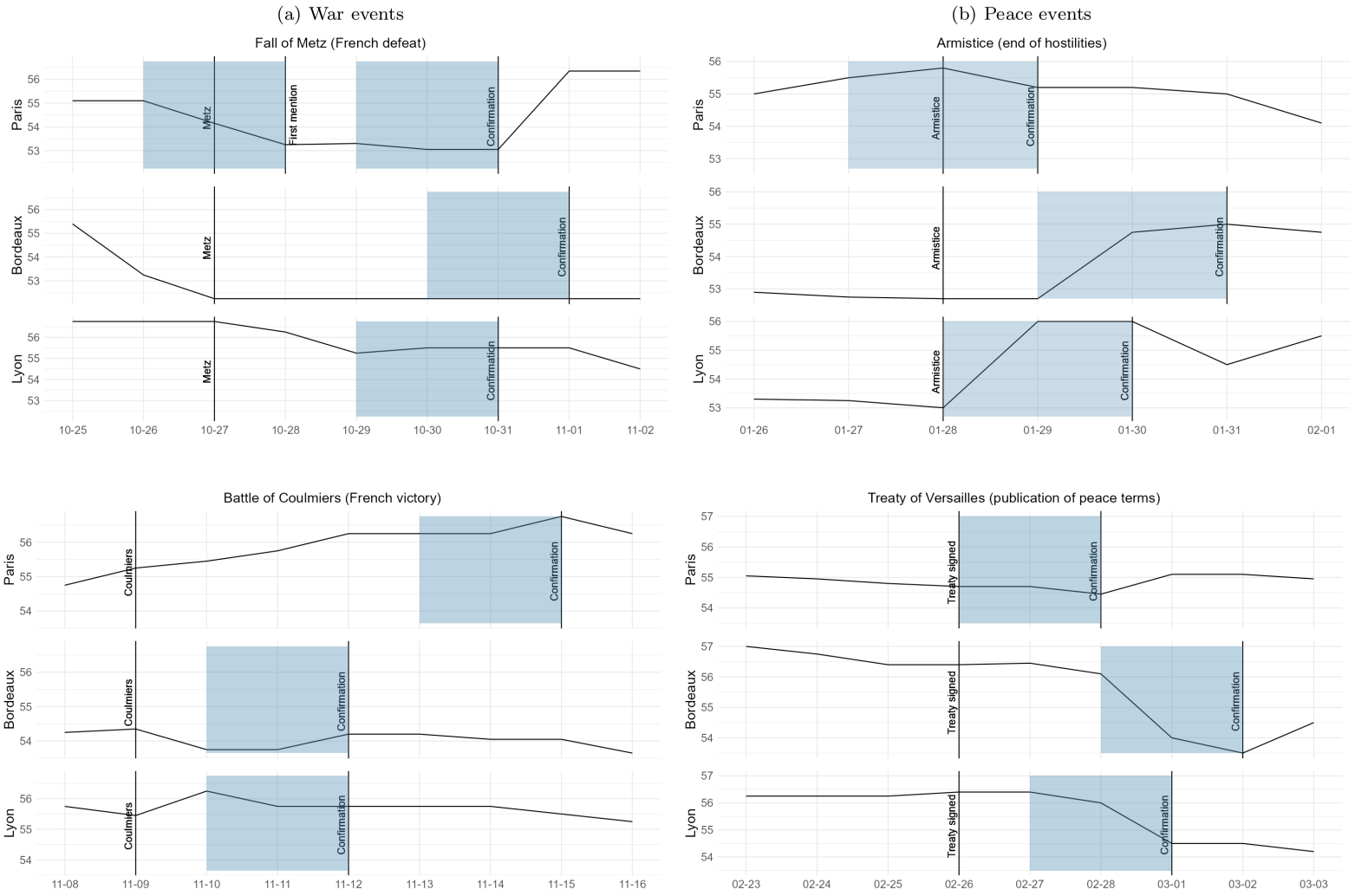
Table 2 lists price responses for all major war and peace news events during the Siege. For each event and market, it reports the two-day return for on the *rente* on the day in which news was printed in a particular city. Responses that are consistent with the model's predictions are in bold. Overall, of the 14 war events during the Siege, the model's predictions are borne out in 11 of them, including the much more positive response during the one victory at Coulmiers, and the strong differential responses to the two peace events- the Armistice and the Treaty. Further, of the eleven major defeats during the Siege, Parisian prices responded more negatively than both other markets to news confirmation in seven cases: Chevilly, First Orléans, Metz, Le Bourget, Beaune-la-Rolande, Villiers and Buzenval. In one more case–Beaugency– it is tied as the most negative, with more negative Parisian prices emerging when summing up both rumor and confirmation.[40]

Table 3 provides formal tests to document that, consistent with the model, Paris reacted more to war events on average, as well as checking for robustness. We again compute differences in the direction our hypothesis predicts, i.e. higher (lower) returns in Paris for victories (defeats). As the table suggests, the average difference in returns between Paris and the Rest of France (over 12 events) is 1.183 percentage points (se = 0.481) over all major battles during the Siege. The average differences are somewhat *larger* (1.27pp) when

[39] As noted above, the war skeptics included the commander at Metz, Marshal Bazaine himself. Bazaine would be tried for treason after the war.

[40] It is also notable that the three events where the model's predictions do not hold—the battles of Bellevue, Loigny and Le Mans—also tend to be those where the information arriving in Paris more old and arguably more stale.

Figure 5: *Rente* price changes (in francs) with news arrivals of war and peace events.



Column (a) shows the stronger (and even conflicting) responses of *rente* prices in Paris versus elsewhere around two major war events for France– the surrender of 179K professional troops at Metz and the victory of citizen levees at Coulmiers. The Prussians allowed news of Metz's fall to leak into Paris, though it was officially denied for several days. The Parisian government learned of Coulmiers by carrier pigeon and siege runner on 14 Nov 1870, and it was publicly announced on 15 Nov 1870. In contrast, Column (b) shows greater price responses *outside* Paris- rising with the Armistice and falling with the declaration of peace terms. The shaded area covers the two-day window when the published news most likely arrived.

Table 2: Two day *rente* returns for major war and peace events

			Days for news to arrive						Two-day returns to rentes, in %					
			First rumor			Confirmation			First rumor			Confirmation		
	Date	Positive news?	Paris	Lyon	Bord	Paris	Lyon	Bord	Paris	Lyon	Bord	Paris	Lyon	Bord
War events														
Chevilly	1870-09-30	No				2	4	2				**-2.33**	-0.79	1.83
Bellevue	1870-10-07	No				11	2	1				0.45	0.00	-0.89
First battle of Orléans	1870-10-11	No		0	1	4	3	3		-1.79	-0.90	**-0.90**	0.45	-0.45
Metz	1870-10-27	No	1			4	4	5	**-3.42**			**-0.47**	0.45	1.90
Le Bourget	1870-10-30	No				1	6	5				**-0.47**	5.38	3.76
Coulmiers	1870-11-09	Yes				6	3	3				**0.88**	-0.89	0.83
Beaune-la-Rolande	1870-11-28	No				19	4	2				**-0.81**	3.26	0.00
Loigny	1870-12-02	No		2		5	5	5		-0.54		-1.43	-2.27	-1.08
Villiers	1870-12-03	No				3	2	2				**-0.89**	-0.54	-1.33
Beaugency	1870-12-10	No	7	-1	0	11	4	4	**-0.81**	0.46	-0.91	**0.00**	0.00	0.91
Le Mans	1871-01-12	No				9	2	1				-0.92	-0.47	-2.14
Buzenval	1871-01-19	No				3	3	3				**-1.48**	0.38	-0.28
Average (signed)									**2.11**	0.62	0.91	**0.84**	-0.56	-0.11
Peace events														
Armistice	1871-01-28	Yes				1	2	3				-0.54	**5.51**	**4.27**
Treaty of Versailles	1871-02-26	No				2	3	4				-0.64	**-3.43**	**-4.75**
Average (signed)												0.05	**4.47**	**4.51**

This table shows the two-day returns in the three markets to war and peace events. Returns are calculated as: $\log(p_t) - \log(p_{t-2})$, for news printed on day t. Since news arrived on different days to each market, they do not necessarily correspond to the same calendar date. In bold, the events for which our hypothesis holds: stronger negative (positive) responses to French defeats (victories) in Paris, and a stronger response to both the Armistice and Peace treaty in the Rest of France. To calculate the averages we multiply the returns to defeats and the negative peace event by -1. More events, including minor and inconclusive battles are listed in Table A.11 in Online Appendix Section A.6.

we include battles deemed *minor* by Clodfelter (2017) and Wawro (2003), and when we cumulate price responses to rumors and initial (unconfirmed) mentions as well (1.44 pp). They are also robust to adding inconclusive battle events (as either victories or defeats).[41] Importantly, the price responses are specific to the arrival of war news rather than due to other events occurring close in time: in Section A.6, we report placebo specifications (Table A.9), where we arbitrarily shift the windows of the report both by 2, 4, or 6 days before or after the actual report, and we do not observe significant differences during these other windows. The results are further robust to dropping any particular major battle, one by one (Table A.10).

Table 3: Price response differences by event type

	Differences in two-day returns to rentes, in pp				Average abs return,
	Paris v Rest of France	Paris v Lyon	Paris v Bordeaux	N	in pp
Major battles	1.183	1.408	0.959	12	1.148
	(0.481)	(0.550)	(0.525)		
p-values	[0.032]	[0.027]	[0.095]		
Major battles	1.382	1.603	1.160	12	1.166
(with rumor reports)	(0.602)	(0.627)	(0.668)		
p-values	[0.042]	[0.027]	[0.110]		
Major + minor battles	1.270	1.518	1.023	14	1.123
	(0.417)	(0.486)	(0.449)		
p-values	[0.009]	[0.008]	[0.040]		
Major + minor battles	1.441	1.686	1.195	14	1.143
(with rumor reports)	(0.517)	(0.548)	(0.570)		
p-values	[0.015]	[0.009]	[0.056]		
Major + minor +	1.123	1.417	0.829	17	1.084
inconclusive (as defeats)	(0.416)	(0.473)	(0.433)		
p-values	[0.016]	[0.009]	[0.074]		
Major + minor +	0.969	1.083	0.856	17	1.084
inconclusive (as victories)	(0.440)	(0.525)	(0.430)		
p-values	[0.043]	[0.056]	[0.064]		

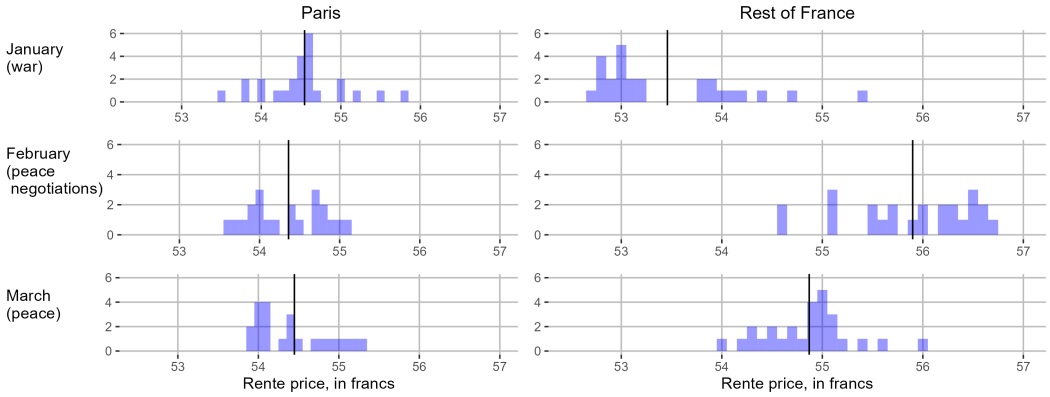
This table shows that differences in responses to reports of war events between Paris and the outside are statistically significant. Each coefficient represents a one-sample t-test. We compute returns as: $R = \log(p_t) - log(p_{t-2})$, for news printed on day t. We set up differences as $R_{Paris} - R_{outside}$ for victories and $R_{outside} - R_{Paris}$ for defeats, so positive coefficients confirm the model's predictions. To facilitate interpretation, the last column reports the average absolute returns for events of each class across the three cities.

[41] See Table A.11. One reason to classify inconclusive battles as defeats is that France was losing and needed decisive victories. Classifying them as victories however may also be justifiable since the French press tended to spin those events favorably.

4.3 Which financial market correctly priced the terms of peace?

The muted response in Paris to the details of the Versailles treaty suggests that beliefs in Paris ended up being more "correct". We further explore this in Figure 6. The Figure shows daily *rente* price frequencies for January (the last month of the war, during which, as we describe below, food prices in Paris appear to already show anticipation of an Armistice), February (the month of negotiations, as it starts with the Armistice and it ends with the peace treaty), and March 1871. The figure is consistent with Parisians more accurately pricing the terms of the peace treaty into their valuations of the *rente*. During January and February, the average Parisian market *rente* price already closely predicts post-treaty prices. The average difference between Parisian January and March prices is 0.10 francs (p-value = 0.50), and the difference between Parisian February and March prices is 0.08 francs (p-value = 0.54). Outside Paris, in contrast, investors first greatly undervalued the *rente* (the average difference between January and March outside prices was -1.41 francs, p-value = 0.00), and then greatly overvalued it relative to its post-treaty price (the average difference between February and March outside prices was 1.03 francs, p-value = 0.00).

Figure 6: Rente price frequencies in Paris and outside right before, during, and right after the peace negotiations



This figure shows *rente* price frequencies in Paris and outside for January, February, and March 1871. Therefore, it includes the month of peace negotiations (February) and the months before and after. It shows that Parisians more accurately priced the costs of peace. Outside investors, on the other hand, experienced high volatility, undervaluing the *rente* before the end of the war, and overvaluing it during peace negotiations, relative to its post-treaty price.

5 Alternative explanations

In this section, we evaluate the merits of a series of natural potential alternative explanations for our results. We first consider whether price differences inside and outside Paris were

driven by differential *information sets* induced by the Siege. In particular, we use detailed data on information flows to provide evidence that prices did not converge even on days when the different markets received news from one another. Second, we consider whether different *discount rates, liquidity shocks or demands for hedging risk* in each market could be driving the observed price differences. In particular, we provide evidence that other liquid cross-listed assets do not exhibit the same price differences, and evaluate the relationship with food prices in Paris. Finally, we consider explanations related to differential *preferences* for holding the *rente*. In sum, we find that none of these alternative explanations can explain our full set of empirical results on their own, even though they may each contribute to specific pieces of the patterns we observe when in conjunction with political beliefs.

5.1 Different information sets?

As described above, when the Siege of Paris started, the Prussians cut off information flows in and out of Paris. The telegraph lines were cut, and neither people nor goods were allowed to pass through the Siege lines.[42] However, Parisians did successfully manage to smuggle information into and out of the city by turning to the air: via balloon and carrier pigeon (see also Section A.2). These two were sometimes supplanted with runners who dared to dodge the Prussians.

Given that these means of communication were of course relatively unreliable and slow, a natural question is whether the difference in prices we observe may be explained by different information sets. In other words, Parisians or those outside its walls may have been ignorant about facts that influenced the price of the *rente*. We argue, in contrast, that price differences are explained by differences in political beliefs and not purely by differences in information. That is, that even when investors inside and outside Paris were in possession of the same facts about the world, they began to *agree to disagree*. We have three pieces of evidence to support this claim.

First, rather than being ignorant, contemporary observers in Paris and elsewhere had full knowledge that their prices were systematically different. In Bordeaux, Parisian (and Lyonnais) prices were printed often (see below). Those within the Parisian siege cordon were also well-aware of the persistent differences that had emerged.[43] Yet, there nonetheless remained large and persistent price differences.

[42]The one main exception was that, as thanks for his care of the destitute Germans caught in Paris by the war, the American ambassador, Elihu Washburne, was allowed to receive the *Times* through diplomatic pouch, on condition that he did not share information within it.

[43]For example, a financial analyst noted how much lower the prices were outside: "*The departmental stock exchanges have, moreover, been sending us, for two days, prices significantly higher than those quoted here...*" (*Le Temps*, February 15, 1871). See also the Parisian newspaper, *Le Figaro*, on November 19, 1870: "*the French Rente was: In Lyon, at 50 francs; In Bordeaux, at 51 francs; In Paris, at 53 fr.*" In London, a *Times* financial analyst also noted the difference: "*It is worth noting that during the time Paris was [surrounded], prices ruled higher than those in the principal provincial bourses... But since the capitulation the Bordeaux prices have been better that those of Paris...*" (*The Times*, February 15, 1871).

Second, the price differences were even more stable and accentuated in magnitude during the period of peace negotiations *despite* more regular information flows. After the Armistice, telegraph service was still not restored, and mail was slow and unreliable due to the accumulated backlog and continued Prussian restrictions.[44] However, Prussians allowed people to leave and enter the city. As Section A.2.1 details, Paris *rente* prices reported in Bordeaux fell from a median delay of 6 days during the Siege to 4 days during the peace negotiations. In Paris, the delay in the reporting of outside news fell from a median of 4 days during the Siege to 3 days during the peace negotiations. However, prices in these markets failed to converge (instead they *diverged* even further) during the period from the signing of the Armistice until after peace terms were announced.

Third, we use the universe of balloon departures and pigeon arrivals, as well as the timing of news reports in each market, to show that information flows between Paris and the other markets do not significantly drive prices closer to each other. The Bordeaux *rente* prices do not converge to those of Paris when balloons are dispatched or Parisian *rente* prices are printed in their local newspaper, *La Gironde*. In turn, Paris *rente* prices do not converge to external prices when news from the outside are printed in *Le Figaro*. Further, Paris does not experience abnormal returns on days with incoming news– either from pigeon arrivals or news from outside reported by *Le Figaro*.

Lack of convergence of external exchanges to Paris: Because of data restrictions, we focus on Bordeaux. When a newspaper there printed the price of the *rente* in Paris, we show that the *rente* price in Bordeaux did not converge. Before the Siege, the Bordeaux newspaper *La Gironde* printed daily prices of the most liquid securities in the Paris and Bordeaux markets. During the war, Paris prices were printed less regularly: 32 times during the Siege and 18 during the negotiations. The longest spell without printed prices was 14 days during the Siege and 6 days during the negotiations (see Table A.1).

We measure the Bordeaux market response to these printed prices. We once again focus on two-day changes in prices.[45] We calculate the changes in price difference for each instance of a printed price as:

$$\Delta\text{price difference}_t = |p_t^B - p_{print,t}^P| - |p_{t-2}^B - p_{print,t}^P|$$

where p denotes the *rente* price, the superscripts P and B denote Paris and Bordeaux, and the subscript $print, t$ denotes that the Paris price was *printed* in Bordeaux on day t. The first term captures the difference after the price was reported, and the second term the difference before. Thus, if the price in Bordeaux converges to the reported Paris price after receiving news, the change in price difference should be negative since the prices would be

[44] *Le Figaro:* 1871-01-31, p. 4; 1871-02-07, p. 4; 1871-02-13, p.4; 1871-02-18, p.5, among others.

[45] For a price printed on a newspaper in day t, we know that it arrived before the market opened in t, since trading hours started at noon. However, we do not know whether it arrived before or after trading on $t-1$. Therefore, we compare prices in t to prices in $t-2$.

moving closer to each other.

Table 4(A) shows that the average change in the price difference$_t$ in Bordeaux during the Siege and the peace negotiations equals -0.026 francs in response to Parisian prices, a very slight and statistically insignificant convergence effect (p-value: 0.772). In fact, the lower bound of the 95% CI (an upper bound for convergence) is -0.205 francs, which is only 14% of the average price difference between the Bordeaux and Paris during the Siege. Further, as the table reveals, there is even less convergence (in fact the prices *diverge* by 0.114 francs on average) during the peace negotiations, despite the more rapid flows of information.

Table 4: Lack of price convergence after incoming information in Paris and Bordeaux

	Panel A			Panel B		
	Bordeaux prices after receiving the Paris price			Paris prices after receiving news from outside		
	Siege	Peace negotiations	All	Siege	Peace negotiations	All
Δprice difference	-0.105	0.114	-0.026	-0.035	-0.336	-0.113
	(0.121)	(0.120)	(0.089)	(0.087)	(0.129)	(0.074)
p-values	[0.393]	[0.355]	[0.772]	[0.689]	[0.022]	[0.134]
Lower bound 95% CI	-0.351	-0.139	-0.205	-0.211	-0.615	-0.262
Mean absolute price difference	0.977	2.261	1.439	0.957	1.716	1.154
Δprice difference as % of abs price diff	-10.72%	5.04%	-1.81%	-3.65%	-19.56%	-9.79%
Observations	32	18	50	40	14	54
Median delay	6 days	4 days	5 days	4 days	3 days	4 days

This table shows the absence of significant price convergence after incoming news. In Panel A, we study whether the price difference between Bordeaux and Paris decreased after the Bordeaux newspaper *La Gironde* printed Paris prices. In Panel B, we study whether the price difference between markets inside and outside Paris decreased after the Parisian newspaper *Le Figaro* printed news from the outside. Standard errors are calculated from a t-test that compares the sample of changes in price differences to zero. We also report the lower bound of the 95% CI (an upper bound for convergence). The upper bound for convergence is never more than 36% of the mean absolute price difference.

Lack of convergence of Paris to the external exchanges: Similarly, we show that when Paris received news from the outside world, prices do not converge. Unlike in Bordeaux, the major Parisian newspapers did not systematically report outside prices for the *rente*, likely reflecting the fact that *rente* price discovery tended to happen in its thickest market: Paris itself. Instead, we collected every piece of news from outside the Siege cordon printed in *Le Figaro* during the Siege and the peace negotiations (see Section A.9.4). We classify a *day with news* as one in which events outside the Siege cordon reported by *Le Figaro* were more recent than any event reported before. We find 54 days with news. We then measure the Paris market response to the incoming news. In particular, we test whether

prices converge to the external price (i.e. the average of Lyon and Bordeaux). We perform the same test as above.

As Table 4(B) reveals, during the Siege, the average change in the price difference$_t$ in Paris in response to outside news is a very slight and statistically insignificant -0.035 francs, or 3.65% of the mean absolute price difference inside and outside Paris (p-value = 0.689). We do, however, detect more meaningful (but still very far from complete) convergence during the peace negotiations. On days with news from the outside, the Paris price moves 0.336 francs closer to the average outside price (p-value: 0.022). However, this represents only 19.56% of the mean absolute difference, which had itself *increased* by 80% (from 0.957 to 1.716 francs) during the peace negotiations relative to the time of Siege.

Lack of abnormal returns on days with incoming information: Finally, we show that the *rente* did not experience abnormal returns on days with incoming news. In Section A.7, we illustrate how the time series of the *rente* price difference does not appear to respond to arrivals of balloons, pigeons or other information flows. Table 5 tests whether such incoming information generates *abnormal rente* returns. To do so, we construct indicators for whether *Le Figaro* reported a pigeon arrival on that day, whether *Le Figaro* printed news from outside the Siege cordon, whether there was a balloon landing on that day, and indicators for whether *La Gironde* printed Parisian or Lyonnais prices. We account for the fact that information flows were not necessarily uniform during the Siege by adding week fixed effects.[46] We again calculate two-day returns, but since we are specifically interested in abnormal volatility (without expectation of direction), we take the absolute value.[47]

Table 5 reveals that for each type of information flow between Paris and Bordeaux, there are no meaningful abnormal returns. For example, in Paris (Panel A), the increase in the absolute value of the two-day *rente* return is close to zero (0.02pp, p-value: 0.923) on days when a carrier pigeon arrived. This is consistent with our text analysis of the 29,903 incoming pigeon messages themselves, which reveal that though they often provided both personal and general news, there were only 22 with speculative trading instructions, and even these yielded only modest returns (see Section A.3.) Furthermore, as the table reveals, even when *Le Figaro* printed fresh news from outside, whether derived from pigeons or other sources, the volatility of two-day returns was not greater – in fact, if anything, it was slightly *lower* than other trading days in that same week (-0.203pp, p-value: 0.242).

The response of *rente* price volatility in Bordeaux to information flows from Paris paints the same picture (Panel B). There are no abnormal returns on days when the Paris *rente* price was printed in *La Gironde* or when a balloon with Paris mail landed (if anything, again, the volatility is slightly lower). Thus in both Paris and Bordeaux, we do not find

[46] For example, the early days of the Siege were a period of high price volatility, but there were no pigeon arrivals because the service had not yet been established.

[47] Therefore, returns on day t are calculated as $|\log(p_t) - \log(p_{t-2})|$, where p_t is the Paris or Bordeaux price on day t.

that the volatility of the *rente* price increased when news arrived from the other side of the Siege cordon, whether regarding prices or more generally. Therefore, we can rule out the possibility that the differences in prices were fully explained by some investors knowing more than others.

In contrast to flows across the Siege cordon, however, we find a different pattern when information flowed *between* the external exchanges (Panel B, bottom right). When Lyonnais prices are printed in Bordeaux, *rente* prices in the latter have higher average absolute returns (of 0.517 pp, p-value 0.09). Further, in Section A.7, Table A.13 documents that, particularly during the Siege, the Bordeaux *rente* price does converge significantly to the Lyonnais price when the latter was reported in Bordeaux. Together, these two results suggest that unlike the persistent price differences with Paris, the smaller and more transitory price differences between the two external exchanges of Lyon and Bordeaux may indeed reflect temporary differences in information sets.[48] And unlike in peace-time, the Siege saw Bordelais traders begin to disregard the price signals originating with Parisian marginal investors, while placing greater trust in those sent from Lyon.

5.2 Different discount rates, liquidity shocks or hedging demand?

Another set of natural alternative explanations focuses on the possibility that investors in Paris and the outside had different needs for liquidity or may have developed different discount rates during the Siege, particularly as food became scarce and individuals focused on the needs of the present. Further, money could not move freely between Paris and the outside in this period and the demand and supply of money (francs) could have affected the demand and supply of traded securities. Relatedly, there may be differences in demand for liquid assets as a hedge against risks to physical property inside and outside Paris, perhaps in anticipation of Prussian bombardment or civil unrest within Paris.[49]

Dual-listed financial assets: If the *rente* price differences were driven by different market-wide discount rates, liquidity shocks or demand for hedging physical property risks, we should see that the price differences of other liquid publicly traded assets display similar behavior inside and outside Paris. We therefore examine the price differences between Paris and Lyon/Bordeaux for four assets that are the most liquid during our period of interest, as reflected in having the most days with prices reported in Paris and either Lyon or Bordeaux after the *rente* itself. Dual-listed prices inside and outside Paris for the *rente* itself were reported on 133 days out of 140 possible business days. The top four assets after the *rente* include two private domestic assets and two foreign assets (see Table A.16 in Section A.8 for

[48] In Section A.7, we show that the results in Table 4 are robust to using an alternative coding of pigeon arrivals documented by a historian (Hayhurst (1970)) instead of *Le Figaro*, and to use the number of external news reports featured by *Le Figaro* instead of an indicator variable (Table A.12).

[49] Indeed, Prussian shells began to fall on Paris in January 1871, the last month of the Siege. The Paris Commune saw extensive arson as well. The Commune is a focus of our ongoing research.

Table 5: Incoming information and abnormal returns in Paris and Bordeaux

	Absolute value of two-day *rente* returns, in percentage points				
	Panel A: Paris		Panel B: Bordeaux		
	(1)	(2)	(3)	(4)	(5)
Pigeon arrival in Paris	0.020				
	(0.209)				
p-values	[0.923]				
Outside news printed in Paris		−0.203			
		(0.172)			
p-values		[0.242]			
Paris prices printed in Bordeaux			−0.166		−0.304
			(0.209)		(0.224)
p-values			[0.429]		[0.178]
Balloon landing				0.016	
				(0.189)	
p-values				[0.933]	
Lyon prices printed in Bordeaux					0.517
					(0.302)
p-values					[0.090]
Fixed effects	Week	Week	Week	Week	Week
Mean DV	1.003	0.954	1.000	0.937	0.937
Observations	133	164	164	133	133
Sample	Siege	Siege and negotiations	Siege and negotiations	Siege	Siege

This table shows the relationship between incoming information and abnormal returns in Paris and Bordeaux. The dependent variable is the absolute value of the two-day *rente* return in Paris/Bordeaux: $|\log(p_t) - log(p_{t-2})|$. The independent variables are dummies that equal one if: *Le Figaro* reported a pigeon arrival, *Le Figaro* printed recent news from the outside, *La Gironde* printed Paris or Lyon prices, there was a balloon landing. For more specifications, see Table A.12 in Online Appendix Section A.7.

the full list). The domestic assets include the bond for the *Midi* railroad, which connected the Atlantic to the Mediterranean through Bordeaux in the Southwest (116 dual-listed days, quoted in Paris and Bordeaux) and shares in the *Lyon et Mediterranee* railroad that connected Paris to Lyon and the South (108 dual-listed days, quoted regularly in Paris and Lyon along with 48 days in Bordeaux). The foreign assets include shares in an Austrian railroad (the *Societe Autrichienne*, which linked Vienna to Trieste: 115 days of dual prices again quoted regularly in Paris and Lyon, with 38 days in Bordeaux) and the 5% Italian sovereign bond (56 days, quoted in Paris and Bordeaux).[50]

The price differences for the liquid foreign assets are particularly valuable for testing the importance of market-wide differences in discount rates and liquidity shocks etc. in explaining our findings, since those factors should also affect their price differences inside and outside Paris even while their fundamental values are considerably less likely to be affected by the fortunes of the war itself (see Figure 7). In contrast, the French private railroads were of course also exposed to the war, both through the destruction of capital, the challenges of operating in a war zone and through their relationships with the French government (see Figure A.15 in Section A.8). Different beliefs about war and peace could also lead to disagreements inside and outside Paris about their profitability. Regardless, if market-wide differences in discount rates or liquidity shocks were first order explanations of our results, the patterns of price differences of all four assets should both mimic each other and be similar to the *rente* itself.

Table 6 shows the results of comparing the price differences inside and outside Paris for the four assets using specifications analogous to Tables 1 and A.7. As the table shows, none of the price series differences of each of these four liquid assets match the patterns displayed by the *rente*. Among the foreign assets, the 5% Italian bond does not reveal a consistent (or significant) overall price difference during the Siege, and it has a higher price in Paris during the peace negotiations (a pattern *opposite* to the *rente*). The Austrian railroad has a lower price in Paris during the Siege (again, an *opposite* pattern to the *rente*) as well as no significant price difference during the peace negotiations.

Neither do we find the same patterns as the *rente* for either of the domestic railroads we analyze as well. The Lyon railroad stock matches the *rente* in that the prices are higher in Paris during the Siege, but, unlike the *rente* they reveal no significant differences inside and outside Paris during the peace negotiations. Similarly, Midi bond prices match the *rente* in being lower in Paris during the peace negotiations, but, unlike the *rente*, Midi bond prices are also *lower* in Paris during the Siege.

In summary, the price dynamics of both liquid foreign and private domestic assets are

[50]The next most liquid shares, as measured by their dual-listing in Paris and elsewhere had considerably fewer trading days. These include the *Orléans* railroad (equity: 42 days), *Midi* railroad (equity: 38 days), Suez Canal (equity: 38 days), *Credit Mobilier Espagnol* (equity: 16 days). *Est* railroad (equity: 15 days) and *Credit Mobilier* (equity: 10 days): see Table A.16.

Figure 7: Price differences of liquid foreign assets do not match the rente

These graphs show the prices in side and outside Paris for two liquid foreign assets: the Italian 5% bond and the *Societe Autrichienne* (Austrian railroad) stock. For the Italian bond, we use prices in Bordeaux. For the Austrian railroad, we use the average of Lyon and Bordeaux.

Table 6: Price differences inside and outside Paris for the four most liquid dual-listed assets after the *rente*

	Italian bond	Lyon et Med RR	Midi RR bond	Austrian RR
Entire Siege	0.183	**9.822**	-1.238	-57.271
	(0.238)	(3.737)	(0.534)	(2.480)
p-values	[0.447]	[0.010]	[0.023]	[0.000]
as % of price	0.34%	1.19%	-0.43%	-8.16%
N	46	85	94	94
Siege after	0.240	9.422	-2.485	-52.059
Coulmiers	(0.308)	(5.6550)	(0.744)	(3.135)
p-values	[0.442]	[0.102]	[0.002]	[0.000]
as % of price	0.44%	1.16%	-0.86%	-7.39%
N	30	47	55	59
Peace	1.695	6.772	**-7.447**	-2.22
Negotiations	(0.190)	(4.060)	(0.768)	(1.653)
p-values	[0.000]	[0.110]	[0.000]	[0.194]
as % of price	2.97%	0.83%	-2.61%	-0.29%
N	10	23	22	21
Peacetime	0.207	-1.311	0.014	-1.042
	(0.123)	(0.336)	(0.107)	(0.504)
p-values	[0.142]	[0.000]	[0.897]	[0.040]
as % of price	0.35%	-0.14%	0.004%	-0.13%
N	7	306	317	209

This table shows the average daily price difference (in francs) between Paris and the rest of France (the average between the Lyon and Bordeaux price when both are available). The standard errors (in parentheses) are the result of a one-sample t-test comparing the sample of daily differences to zero, p-values in brackets. The last row for each period reports the average difference as a percentage of the average Paris price. In bold, assets-periods for which the differences are statistically significant and in the same direction as the differences in *rente* prices.

very different from that of the *rente*. This is inconsistent with market-wide discount rates, liquidity shocks or demand for liquid assets as hedges against risks to physical property driving our results, which should cause the changes in the different price series to coincide instead.

Staple and luxury food prices in besieged Paris: Another approach is to see whether factors that should lead individuals to discount the future relative to immediate needs, or generate a specific need for liquidity, explain the *rente* price differences. Of course, with Paris under Siege, a proximate concern for many was the availability of food, including both staples like butter, potatoes and eggs, and luxuries in the beleaguered city, such as rabbits and fowl. The prices of many of these items rose by *tenfold* during the course of the Siege (Figure 8).[51] If the *rente* price differences we document are explained by such discounting of the future or the resultant demands for liquidity, we should also expect these differences to correlate with the dramatic rises in Parisian food prices. However, as Figure 8 suggests and Table A.14 in Section A.8 confirms, the differences in *rente* price between Paris and elsewhere are not strongly correlated with food prices in Paris, whether it be for staples, luxuries or the introduction of markets for particularly exclusive (e.g. elephant trunk) or otherwise unusual (and likely inferior) meats, like cat. Thus, the *rente* price differences do not seem to reflect arguably the most direct reason Parisians might have for liquidity or to discount the future relative to the present: fear of starvation and the need for food.

Interestingly, food prices in Figure 8 arguably do tell us something about beliefs about the war in Paris. In particular, as mentioned above, prices started to decrease around mid-January, as Parisians began to anticipate the Armistice and hoarders released their supply (Sheppard (1874), pg. 229). Around the same time, *rente* prices decreased in Paris, with prices converging towards their ultimate post-treaty levels (see Section 4.3.) These patterns are consistent with Parisian pessimism about the peace terms in light of the relative absence of battlefield successes (Corollary 3).

5.3 Patriotic fervor and different preferences?

A final set of likely alternative explanations for the patterns we observe stems from the possibility that there might be different *preferences* for holding *rentes* in Paris relative to elsewhere. The simplest form of this is that there might have been basic differences in innate preferences for holding the *rente* inside and outside Paris (as in Hong and Kacperczyk (2009)). However, since we observe the price differences switching signs in large and persistent ways, this cannot explain our results.

Nevertheless, a more nuanced variant of this that could explain the switch in sign is that some Parisians invested in the *rente* in order to signal patriotic fervor or to influence policy

[51] Importantly, Paris never ran out of wine (Horne, 2012). Tastes also mattered. Unlike most Parisians, Elihu Washburne, the American ambassador, had an abundant stockpile of canned food, allowing him to support others until relatively late in the Siege (McCullough, 2011).

Figure 8: *Rente* price differences do not correlate with the dramatic food price rises for staples and luxuries in Paris during the Siege

Prices rose close to tenfold for for both food staples (top) and luxuries (below) in Paris. However, *rente* price differences do not correlate strongly with these food price rises in Paris, whether it be staples (butter: $\rho = 0.277$, potatoes: -0.135, eggs: 0.123) luxuries in besieged Paris (rabbit: $\rho = 0.073$, fowl: 0.355) or the introduction of unusual (cats) and extra rare meats (e.g. zoo elephant trunk). See also Section A.8.

in favor of continuing the war by reducing the cost of borrowing, and this raised the *rente* price in a persistent way. They then divested after the Armistice as they had a preference for the *rente* only during the war.

Notice that this explanation also involves a form of differences in political beliefs (though somewhat different to the specific disagreement we incorporate in our model). Yet, even this is an unlikely explanation for the persistent price differences we observe. First, recall that the *rente* was the most liquid and widely held asset in continental Europe: this explanation would require individuals to bear potentially very high costs for a public aim, knowing that other Parisians would have incentives to profit by trading against them. Second, there was no concerted attempt by the French government to lower yields on existing debt with patriotic appeals – instead, the French government issued new *sterling*-denominated debt in *London*, not Paris.[52] Finally, as discussed above and documented in Section 4.3, the basic timing of *rente* price convergence is inconsistent with this explanation: Parisian prices converge towards their post-treaty prices weeks *before* the Armistice, rather than thereafter.

In sum, we examine alternative explanations for the patterns we observe based upon differential information sets, discount rates, needs for liquidity, or preferences between investors in the *rente* inside and outside Paris. We provide evidence that none of these alternative explanations can explain our full set of empirical results on their own, though each could contribute to specific pieces of the patterns we observe in conjunction with differences in political beliefs.

6 Discussion

To the best of our knowledge, this is the first paper to document that the presence of persistent differences in equilibrium market prices can arise due to differences in political beliefs and can do so even in thick markets. With increasing political polarization and the emergence of echo chambers in news provision and social interactions (e.g., Flaxman et al. (2016); Gentzkow and Shapiro (2010)), market prices have the potential to provide much-needed non-partisan metrics of the effects of political decisions on the economy. Our results point to both the possibilities but also the limitations of this approach. When the French declared war on Prussia, there was much support, both on the street and among political elites. Nevertheless, the price of the French *rente* plummeted, consistent with the *smart*

[52] Further even if such patriotic appeals had existed, there are good reasons to doubt they would have had such an effect. Even during World War I, when the United States government employed massive bond rallies, widespread advertising and celebrity endorsements, their efforts had little effect on lowering yields (Kang and Rockoff, 2015).

money, both in Paris and around the world, providing a corrective to "*war fever*".[53]

Yet, our results suggest that, as Paris and other markets were separated by the Siege, the marginal trader began to see war news through the political perspective of those around her. For example, traders in Bordeaux could read Parisian prices printed in their newspapers, but these prices were largely ignored in favor of differing political beliefs, leading to misperceptions and misalignment with respect to the outcome of the peace. This suggests an under-explored but potentially important social value to the dual listing of financial assets across borders. As conduits of information themselves, these assets may be particularly relevant for aligning expectations among economic and political decision-makers in countries perceived to be in emergent great power competition.[54] Though it caused the deaths of more than 180,000 soldiers, contributed to the deaths of more than 250,000 civilians, and created lasting animosities that would make the great conflicts of the twentieth century more likely, the Franco-Prussian War may still have lessons to teach us that might help support peace.

[53]Such patterns can exist even in a highly-controlled information environment. For example, following Russia's invasion of Ukraine, on March 18, 2022, Vladimir Putin held a choreographed rally with bussed-in crowds of employees at Moscow's Luzhniki stadium, proclaiming: "*We know what we should do now and how we should do it and we will implement all our plans.*" (The Independent, March 19, 2022). In contrast, however, investors in Russian sovereign debt appear to have had a different perspective of the war than that espoused by state propaganda: Russian 10 year bond yields immediately doubled (from 9.75% to close to 20%) with news of the invasion (investing.com: RU:10YT).

[54]Indeed, much like many in France viewed a rising Germany with grave concern in the 1860s, a focal contemporary example of the so-called *Thucydides trap* is that of the United States, where concerns exist about a rising China. Such a *trap* is seen as commonplace in international relations, where incumbent powers see advantages in economic decoupling and even pre-emptive war to check the rise of other states perceived to pose future threats.

Bibliography

Addoum, Jawad M and Alok Kumar, "Political Sentiment and Predictable Returns," *The Review of Financial Studies*, 2016, *29* (12), 3471–3518.

Ameriks, John, Gábor Kézdi, Minjoon Lee, and Matthew D Shapiro, "Heterogeneity in Expectations, Risk Tolerance, and Household Stock Shares: The Attenuation Puzzle," *Journal of Business & Economic Statistics*, 2020, *38* (3), 633–646.

Bailey, Michael, Eduardo Dávila, Theresa Kuchler, and Johannes Stroebel, "House Price Beliefs and Mortgage Leverage Choice," *The Review of Economic Studies*, 2019, *86* (6), 2403–2452.

_ , Rachel Cao, Theresa Kuchler, Johannes Stroebel, and Arlene Wong, "Social Connectedness: Measurement, Determinants, and Effects," *Journal of Economic Perspectives*, 2018, *32* (3), 259–80.

Baker, Malcolm, Jeffrey Wurgler, and Yu Yuan, "Global, Local, and Contagious Investor Sentiment," *Journal of Financial Economics*, 2012, *104* (2), 272–287.

Baldauf, Markus, Lorenzo Garlappi, and Constantine Yannelis, "Does Climate Change Affect Real Estate Prices? Only if You Believe in It," *The Review of Financial Studies*, 2020, *33* (3), 1256–1295.

Bank of England, "Consol (Long-term Bond) Yields in the United Kingdom," 2023. Retrieved April 17, 2023, from FRED, Federal Reserve Bank of St. Louis.

Barro, Robert J., "Rare Disasters and Asset Markets in the Twentieth Century," *Quarterly Journal of Economics*, 2006, *121* (3), 823—-866.

Bernstein, Asaf, Stephen B Billings, Matthew Gustafson, and Ryan Lewis, "Voting with their Sandals: Partisan Residential Sorting on Climate Change Risk," Technical Report, National Bureau of Economic Research 2020.

Besley, Timothy and Hannes Mueller, "Estimating the Peace Dividend: The Impact of Violence on House Prices in Northern Ireland," *American Economic Review*, 2012, *102* (2), 810–833.

Bonaparte, Yosef, Alok Kumar, and Jeremy K Page, "Political Climate, Optimism, and Investment Decisions," *Journal of Financial Markets*, 2017, *34*, 69–94.

Bordalo, Pedro, Giovanni Burro, Katherine B Coffman, Nicola Gennaioli, and Andrei Shleifer, "Imagining the future: memory, simulation and beliefs about COVID," Technical Report, National Bureau of Economic Research 2022.

Brewer, John, *The Sinews of Power: War, Money and the English State 1688-1783*, Routledge, 2002.

Brogan, D.W., *France Under the Republic: The Development of Modern France (1870-1939)*, Harper & Brothers, 1940.

Burnside, Craig, Martin Eichenbaum, and Sergio Rebelo, "Understanding Booms and Busts in Housing Markets," *Journal of Political Economy*, 2016, *124* (4), 1088–1147.

Bursztyn, Leonardo, Florian Ederer, Bruno Ferman, and Noam Yuchtman, "Understanding Mechanisms Underlying Peer Effects: Evidence from a Field Experiment on Financial Decisions," *Econometrica*, 2014, *82* (4), 1273–1301.

Cagé, Julia and Thomas Piketty, *Une histoire du conflit politique: Elections et inégalités sociales en France, 1789-2022*, Seuil, 2023.

Calomiris, Charles W and Jonathan Pritchett, "Betting on Secession: Quantifying Political Events Surrounding Slavery and the Civil War," *American Economic Review*, 2016, *106* (1), 1–23.

Cassidy, Will and Blair Vorsatz, "Partisanship and Portfolio Choice: Evidence from Mutual Funds," *Available at SSRN 3977887*, 2021.

Choi, James J, David Laibson, Brigitte C Madrian, and Andrew Metrick, "Reinforcement Learn-

ing and Savings Behavior," *Journal of Finance*, 2009, *64* (6), 2515–2534.

Chrastil, Rachel, *Bismarck's War: The Franco-Prussian War and the Making of Modern Europe*, Hachette UK, 2023.

Clodfelter, Micheal, *Warfare and Armed Conflicts: A Statistical Encyclopedia of Casualty and Other Figures, 1492-2015*, McFarland, 2017.

Coates, John M and Lionel Page, "A Note on Trader Sharpe Ratios," *PloS One*, 2009, *4* (11), e8036.

Conover, Pamela Johnston, Stanley Feldman, and Kathleen Knight, "The Personal and Political Underpinnings of Economic Forecasts," *American Journal of Political Science*, 1987, pp. 559–583.

Cookson, J Anthony, Joseph E Engelberg, and William Mullins, "Does Partisanship Shape Investor Beliefs? Evidence from the COVID-19 Pandemic," *The Review of Asset Pricing Studies*, 2020, *10* (4), 863–893.

Dagostino, Ramona, Janet Gao, and Pengfei Ma, "Partisanship in Loan Pricing," *Available at SSRN 3701230*, 2020.

Dehdari, Sirus H and Kai Gehring, "The Origins of Common Identity: Evidence from Alsace-Lorraine," *American Economic Journal: Applied Economics*, 2022, *14* (1), 261–92.

DellaVigna, Stefano and Eliana La Ferrara, "Detecting Illegal Arms Trade," *American Economic Journal: Economic Policy*, 2010, *2* (4), 26–57.

Devereux, Michael B and Gregor W Smith, "Transfer Problem Dynamics: Macroeconomics of the Franco-Prussian War Indemnity," *Journal of Monetary Economics*, 2007, *54* (8), 2375–2398.

Do, Quoc-Anh, Roberto Galbiati, Benjamin Marx, and Miguel Ortiz Serrano, "J'Accuse! Antisemitism and Financial Markets in the time of the Dreyfus Affair," discussion paper 14826, CEPR May 2020.

Ducros, Jérémy and Angelo Riva, "The Lyon Stock Exchange: A Struggle for Survival (1866-1914)," 2014.

Faccio, Mara, "Politically Connected Firms," *American Economic Review*, 2006, *96* (1), 369–386.

Fearon, James D, "Bargaining over Objects hat Influence Future Bargaining Power," 1996.

Ferguson, Niall, *The House of Rothschild: The World's Banker, 1849-1999*, Penguin, 2000.

_ , "Political Risk and the International Bond Market between the 1848 Revolution and the Outbreak of the First World War," *The Economic History Review*, 2006, *59* (1), 70–112.

Fisman, Raymond, "Estimating the Value of Political Connections," *American Economic Review*, 2001, *91* (4), 1095–1102.

Flaxman, Seth, Sharad Goel, and Justin M. Rao, "Filter Bubbles, Echo Chambers, and Online News Consumption," *Public Opinion Quarterly*, 03 2016, *80* (S1), 298–320.

Frey, Bruno S. and Marcel Kucher, "History as Reflected in Capital Markets: The Case of World War II," *The Journal of Economic History*, 2000, *60* (2), 468–496.

Froot, Kenneth A and Emil M Dabora, "How are Stock Prices Affected by the Location of Trade?," *Journal of Financial Economics*, 1999, *53* (2), 189–216.

Gentzkow, Matthew and Jesse M Shapiro, "What Drives Media Slant? Evidence from US Daily Newspapers," *Econometrica*, 2010, *78* (1), 35–71.

Gerber, Alan S and Gregory A Huber, "Partisanship and Economic Behavior: Do Partisan Differences in Economic Forecasts Predict Real Economic Behavior?," *American Political Science Review*, 2009, *103* (3), 407–426.

Giglio, Stefano, Matteo Maggiori, Johannes Stroebel, and Stephen Utkus, "Five Facts about Beliefs and Portfolios," *American Economic Review*, 2021, *111* (5), 1481–1522.

Gillitzer, Christian and Nalini Prasad, "The Effect of Consumer Sentiment on Consumption: Cross-Sectional Evidence from Elections," *American Economic Journal: Macroeconomics*, 2018, *10* (4), 234–69.

Girardi, Daniele, "Partisan Shocks and Financial Markets: Evidence from Close National Elections," *American Economic Journal: Applied Economics*, 2020, *12* (4), 224–52.

Goldman, Eitan, Nandini Gupta, and Ryan D Israelsen, "Political Polarization in Financial News," *Available at SSRN 3537841*, 2020.

Greenwood, Robin and Stefan Nagel, "Inexperienced Investors and Bubbles," *Journal of Financial Economics*, 2009, *93* (2), 239–258.

Guidolin, Massimo and Eliana La Ferrara, "The Economic Effects of Violent Conflict: Evidence from Asset Market Reactions," *The Journal of Peace Research*, 2010, *47* (6), 671–684.

Harris, Milton and Artur Raviv, "Differences of Opinion make a Horse Race," *The Review of Financial Studies*, 1993, *6* (3), 473–506.

Harrison, J Michael and David M Kreps, "Speculative Investor Behavior in a Stock Market with Heterogeneous Expectations," *The Quarterly Journal of Economics*, 1978, *92* (2), 323–336.

Hautcoeur, Pierre-Cyrille, *Le Marché Financier Français au XIXe siècle: Récit*, Vol. 1, Publications de la Sorbonne, 2007.

__ and Angelo Riva, "The Paris Financial Market in the Nineteenth Century: Complementarities and Competition in Microstructures," *The Economic History Review*, 2012, *65* (4), 1326–1353.

Hayhurst, John D., "The Pigeon Post into Paris 1870-1871," 1970.

Hirschman, Albert O, *The passions and the interests: Political arguments for capitalism before its triumph*, Vol. 2, Princeton university press, 2013.

Hong, Harrison and Jeremy C Stein, "Disagreement and the Stock Market," *Journal of Economic Perspectives*, 2007, *21* (2), 109–128.

__ and Leonard Kostovetsky, "Red and Blue investing: Values and Finance," *Journal of Financial Economics*, 2012, *103* (1), 1–19.

__ and Marcin Kacperczyk, "The Price of Sin: The Effects of Social Norms on Markets," *Journal of Financial Economics*, 2009, *93* (1), 15–36.

__ , Jeffrey D Kubik, and Jeremy C Stein, "Social Interaction and Stock-Market Participation," *The Journal of Finance*, 2004, *59* (1), 137–163.

__ , __ , and __ , "Thy Neighbor's Portfolio: Word-of-Mouth Effects in the Holdings and Trades of Money Managers," *The Journal of Finance*, 2005, *60* (6), 2801–2824.

__ , Jose Scheinkman, and Wei Xiong, "Asset Float and Speculative Bubbles," *The Journal of Finance*, 2006, *61* (3), 1073–1117.

Horne, Alistair, *The Fall of Paris: The Siege and the Commune 1870-71*, Pan Macmillan, 2012.

Hutton, Irena, Danling Jiang, and Alok Kumar, "Corporate Policies of Republican Managers," *Journal of Financial and Quantitative Analysis*, 2014, *49* (5-6), 1279–1310.

Jarrow, Robert, "Heterogeneous Expectations, Restrictions on Short Sales, and Equilibrium Asset Prices," *The Journal of Finance*, 1980, *35* (5), 1105–1113.

Jha, Saumitra, "Sharing the Future: Financial Innovation and Innovators in Solving the Political Economy Challenges of Development," in "Institutions and Comparative Economic Development," Springer, 2012, pp. 131–151.

_ , "Financial Asset Holdings and Political Attitudes: Evidence from Revolutionary England," *Quarterly Journal of Economics*, August 2015, *103* (3), 1485–1545.

_ **and Kyle Van Rensselaer**, "Profiteers or Peacemakers: Financial Market Responses to War," 2021. mimeo, Stanford.

_ **and Moses Shayo**, "Valuing Peace: The Effects of Financial Market Exposure on Votes and Political Attitudes," *Econometrica*, 2019, *87* (5), 1561–1588.

_ **, Kris Mitchener, and Masanori Takashima**, "Swords into Bank Shares: Finance, Conflict and Political Reform in Meiji Japan," 2020. mimeo.

Jia, Chunxin, Yaping Wang, and Wei Xiong, "Market Segmentation and Differential Reactions of Local and Foreign Investors to Analyst Recommendations," *The Review of Financial Studies*, 2017, *30* (9), 2972–3008.

Kandel, Eugene and Neil D Pearson, "Differential Interpretation of Public Signals and Trade in Speculative Markets," *Journal of Political Economy*, 1995, *103* (4), 831–872.

Kang, Sung Won and Hugh Rockoff, "Capitalizing Patriotism: the Liberty Loans of World War I," *Financial History Review*, 2015, *22* (1), 45–78.

Kempf, Elisabeth and Margarita Tsoutsoura, "Partisan Professionals: Evidence from Credit Rating Analysts," Technical Report, National Bureau of Economic Research 2018.

_ **, Mancy Luo, Larissa Schäfer, and Margarita Tsoutsoura**, "Political Ideology and International Capital Allocation," *Journal of Financial Economics*, 2023, *148* (2), 150–173.

Koudijs, Peter, "Those Who Know Most: Insider Trading in Eighteenth-Century Amsterdam," *Journal of Political Economy*, 2015, *123* (6), 1356–1409.

_ , "The Boats that did not Sail: Asset Price Volatility in a Natural Experiment," *The Journal of Finance*, 2016, *71* (3), 1185–1226.

_ **and Hans-Joachim Voth**, "Leverage and Beliefs: Personal Experience and Risk-Taking in Margin Lending," *American Economic Review*, 2016, *106* (11), 3367–3400.

la Follye, De, *Recueil des dépêches télégraphiques reproduites par la photographie et adressées à Paris au moyen de pigeons voyageurs pendant l'investissement de la capitale*, L'inspecteur des Télégraphes, 1871.

Laudenbach, Christine, Ulrike Malmendier, and Alexandra Niessen-Ruenzi, "The Long-Lasting Effects of Experiencing Communism on Attitudes Towards Financial Markets," 2020.

Lévy-Leboyer, M. and F. Bourguignon, *The French Economy in the Nineteenth Century: An Essay in Econometric Analysis*, Cambridge University Press, 1990.

Malmendier, Ulrike and Stefan Nagel, "Depression Babies: do Macroeconomic Experiences Affect Risk Taking?," *The Quarterly Journal of Economics*, 2011, *126* (1), 373–416.

_ **and** _ , "Learning from Inflation Experiences," *The Quarterly Journal of Economics*, 2016, *131* (1), 53–87.

Mattozzi, Andrea, "Can we Insure against Political Uncertainty? Evidence from the US Stock Market," *Public Choice*, 2008, *137* (1-2), 43–55.

McCullough, David, *The Greater Journey: Americans in Paris*, Simon and Schuster, 2011.

Meeuwis, Maarten, Jonathan A Parker, Antoinette Schoar, and Duncan Simester, "Belief disagreement and portfolio choice," *The Journal of Finance*, 2022, *77* (6), 3191–3247.

Mian, Atif, Amir Sufi, and Nasim Khoshkhou, "Partisan Bias, Economic Expectations, and Household Spending," *The Review of Economics and Statistics*, 2017, pp. 1–46.

Miller, Edward M, "Risk, Uncertainty, and Divergence of Opinion," *The Journal of Finance*, 1977, *32*

(4), 1151–1168.

Mitchener, Kris James, Kim Oosterlinck, Marc D Weidenmier, and Stephen Haber, "Victory or Repudiation? Predicting Winners in Civil Wars Using International Financial Markets," *Journal of Banking & Finance*, 2015, *60*, 310–319.

Morlaix, *Recueil des dépêches télégraphiques officielles publiées pendant la durée de la guerre 1870-1871* 1871.

Officer, Lawrence H, "Gold-point Arbitrage and Uncovered Interest Arbitrage under the 1925-1931 Dollar-Sterling Gold Standard," *Explorations in Economic History*, 1993, *30* (1), 98–127.

Paradis, Jacques-Henry, *Journal du Siège, 1870 -1871, par un Bourgeois de Paris* 1872.

Piketty, Thomas, Gilles Postel-Vinay, and Jean-Laurent Rosenthal, "Inherited vs Self-made Wealth: Theory & Evidence from a Rentier Society (Paris 1872–1927)," *Explorations in Economic History*, 2014, *51*, 21–40.

Priest, George L and Benjamin Klein, "The selection of disputes for litigation," *The journal of legal studies*, 1984, *13* (1), 1–55.

Reinhart, Carmen M and Kenneth S Rogoff, *This Time Is Different*, Princeton University Press, 2009.

Rigobon, Roberto and Brian Sack, "The Effects of War Risk on U.S. Financial Markets," *The Journal of Banking and Finance*, 2005, *29*, 1769–1789.

Rosenthal, Leonard and Colin Young, "The seemingly anomalous price behavior of Royal Dutch/Shell and Unilever NV/PLC," *Journal of Financial Economics*, 1990, *26* (1), 123–141.

Schneider, Gerald and Vera E. Troeger, "War and the World Economy: Stock Market Reactions to International Conflicts," *The Journal of Conflict Resolution*, 2006, *50* (5), 623–645.

Sheppard, Nathan, *Shut up in Paris*, Vol. 1175, B. Tauchnitz, 1874.

Verdickt, Gertjan, "The Effect of War Risk on Managerial and Investor Behavior: Evidence from the Brussels Stock Exchange in the Pre-1914 Era," *The Journal of Economic History*, 2020, *80* (3).

Viaene, Alex, "L'Efficience de la Bourse de Paris au 19ème siècle: une Confrontation Théorique Face aux Données Empiriques des Marchés à Terme et à Prime." PhD dissertation, Orléans 2002.

Vissing-Jorgensen, Annette, "Perspectives on Behavioral Finance: Does "Irrationality" Disappear with Wealth? Evidence from Expectations and Actions," *NBER macroeconomics annual*, 2003, *18*, 139–194.

Wang, Albert Y and Michael Young, "Terrorist Attacks and Investor Risk Preference: Evidence from Mutual Fund Flows," *Journal of Financial Economics*, 2020, *137* (2), 491–514.

Wawro, Geoffrey, *The Franco-Prussian War: The German Conquest of France in 1870-1871*, Cambridge University Press, 2003.

Willard, Kristen L., Timothy W. Guinnane, and Harvey S. Rosen, "Turning Points in the Civil War: Views from the Greenback Market," *American Economic Review*, 1996, *86* (4), 1001–1018.

Zussman, Asaf, Noam Zussman, and Morten Ørregaard Nielsen, "Asset Market Perspectives on the Israeli–Palestinian Conflict," *Economica*, 2008, *75*, 84–115.

A Supplemental Appendix: Markets under Siege

For Online Publication

A.1 Formal Proofs . . . 49
A.2 Historical Context . . . 50
A.2.1 French Financial Markets and Information Flows during the Siege. . . . 51
A.2.2 War and default in the nineteenth century . . . 53
A.3 Quantifying Arbitrage . . . 54
A.3.1 Was there arbitrage? Evidence from pigeon messages . . . 54
A.3.2 Why was there no arbitrage? Simulation exercises . . . 58
A.4 The *rente* . . . 60
A.4.1 *Rente* ownership . . . 60
A.4.2 Price differences . . . 61
A.5 The political situation . . . 66
A.6 War events . . . 68
A.7 Information flows and price responses . . . 72
A.8 Liquidity shocks . . . 76
A.9 Data Appendix . . . 78
A.9.1 Price data . . . 78
A.9.2 Who owned the rente? . . . 79
A.9.3 Episodes of default . . . 80
A.9.4 Data on information flows during the Siege . . . 80
A.9.5 Events related to war and peace . . . 82
A.9.6 Election results and income . . . 83
A.9.7 Legislators . . . 87
A.9.8 Ratification of the peace treaty . . . 87
A.9.9 Food prices in the besieged city . . . 88

A.1 Formal Proofs

Proof of Lemma 1. If $\alpha_j = 1$, it directly follows from Eqn. (5) that $\gamma_j = 1$. Further, Eqn. (5) indicates that $\gamma_i > 1$ if

$$Pr_t^w > \frac{1}{1-\alpha}.$$

Therefore, $\alpha_i > 1$ and $Pr_t^w > 1/2$ guarantee that $\gamma_i > 1$. □

Proof of Lemma 2. The derivative and cross-derivative are given by

$$\frac{\partial \gamma_i}{\partial \alpha_i} = Pr_t^w - \frac{1}{\alpha_i^2}\left(1 - Pr_t^w\right) \tag{10}$$

$$\frac{\partial \gamma_i^2}{\partial \alpha_i \partial Pr_t^w} = 1 + \frac{1}{\alpha_i^2} > 0 \tag{11}$$

As long as $Pr_t^w > 1/\left(1+\alpha_i^2\right)$, $\partial\gamma_i/\partial\alpha_i > 0$. Given that $Pr_t^w > 1/2$, this holds for the smallest possible value of $\alpha_i = 1$ and therefore for all α_i. □

Proof of Proposition 1. Equation (6) follows directly from iterating forward Eqns. (1) and (2). □

Proof of Proposition 2. This follows directly from market clearing. At the equilibrium price an equal weight of investors should be willing to sell or buy the security. If markets are integrated, this should hold globally. Otherwise, this will hold locally. □

Proof of Corollary 1 . We first transform the valuation expressions, adding a constant:

$$\widehat{V}_{C/R,t}^w = V_{C/R,t}^w + \frac{\Omega}{1-\delta\pi},$$

from where we can write

$$\frac{\widehat{V}_{C,t}^w}{\widehat{V}_{R,t}^w} = \frac{\gamma_C}{\gamma_R}\frac{1-\delta\pi\gamma_R}{1-\delta\pi\gamma_C}\left(\frac{\alpha_C}{\alpha_R}\right)^{W_t - L_t} \tag{12}$$

Lemma 2 implies that $\gamma_C > \gamma_R$ if $\alpha_C > \alpha_R$. Therefore, we also have that $1-\delta\pi\gamma_R > 1-\delta\pi\gamma_C$. That means that there exists some $(W_t - L_t)^* < 0$ at which $\widehat{V}_{C,t}^w = \widehat{V}_{R,t}^w$. For any $W_t - L_t > (W_t - L_t)^*$, $\widehat{V}_{C,t}^w > \widehat{V}_{R,t}^w$.

The fact that difference in valuations while at war increases in Pr_t^w follows directly from Lemma 2 which indicates that γ is more sensitive to α for larger values of Pr_t^w.

□

Proof of Corollary 2. This follows directly from Eqns. (2) and (4). Formally,

$$\frac{V_{C,t}^p}{V_{R,t}^p} = \left(\frac{\alpha_C}{\alpha_R}\right)^{W_t - L_t} < 1.$$

After the end of hostilities, valuations are given by

$$V_t^p = \frac{\alpha^{W_t - L_t}}{1-\delta}$$

If $L_t > W_t$, this expression is decreasing in α.

□

Proof of Corollary 3. This follows directly from Proposition 1. Formally, the return to news about an Armistice (end of hostilities; realization of $W_t - L_t$) is given by:

$$V_{t+1}^p - V_t^w = \frac{\Omega}{1-\delta\pi} - \frac{\delta\gamma - 1}{(1-\delta)(1-\delta\pi\gamma)}\Gamma_t. \tag{13}$$

The first element is positive: the Armistice means that further costs of war are avoided. As long as $\delta\gamma > 1$ (the expected payoff from a win γ is larger than $1/\delta$), the second element is negative. This element captures the lost benefits of war, which, in expectation, should lead to more wins than losses as long as $\alpha > 1$. This second element is increasing in γ and therefore in α. □

Proof of Corollary 4 . The change in valuation after a win, conditional on remaining in war, is given by:

$$V_{t+1}^w | w_t - V_t^w = \underbrace{(\alpha - 1)}_{A} \underbrace{\frac{(1-\pi)\gamma\delta}{(1-\delta)(1-\delta\pi\gamma)}}_{B} \underbrace{\Gamma_{i,t}}_{C}. \tag{14}$$

Parts A and B are both strictly increasing in γ and therefore in α. Part C is increasing in α if $W_t \geq L_t$. Therefore, there exists some $(W_t - L_t)^{**} < 0$ at which $\partial\left(V_{t+1}^w | w_t - V_t^w\right)/\partial\alpha = 0$. For any $W_t - L_t > (W_t - L_t)^{**}$, $\partial\left(V_{t+1}^w | w_t - V_t^w\right)/\partial\alpha > 0$. Results for losses are symmetric. □

A.2 Historical Context

> *Twenty years ago a war might have been proclaimed without causing any great perturbation. Hardly anybody but the bankers held stock exchange or commercial securities, but today everybody has his railway coupons or his three per cents [rentes]. The Emperor was right when he said "The Empire meant peace," but what he does not know is that the Empire is done for if we have a war.* — James de Rothschild, 1859 (quoted in Ferguson (2000, pg.91))

A.2.1 French Financial Markets and Information Flows during the Siege.

During the nineteenth century, the 3% *rente* was the most liquid security in France and the most actively traded asset in continental Europe.[55] *Rentes* represented 7.7 million francs of the capitalization of the Paris Bourse in 1870 compared to 5 million for stocks (Viaene (2002)). Further, the *rente* was broadly held.[56] In 1872, 37% of all Parisians who died with positive wealth held French government debt (comprising 10% of all Parisians who died that year). The total value of those bonds was equivalent to 12% of all inherited wealth. However, ownership was concentrated among richer individuals. The richest 5% held 84% of French public bonds. For more details, please see Section A.4.[57]

The Bourses and information flows The Paris financial market was itself "*the leading financial center in continental Europe throughout the nineteenth century*" (Hautcoeur and Riva, 2012, pg. 3). We compare asset prices in Paris to that of two regional exchanges, Lyon and Bordeaux, which were the longest-established stock exchanges in France after Paris.[58]

During normal times, there was real-time information sharing and active arbitrage via telegraph between Paris and the regional exchanges. Information delays were minimal, and arbitrageurs could take opposite positions in different markets that would clear within minutes. This was further facilitated by the presence of futures markets that obviated the need for arbitrageurs to take expensive spot positions. However, with the start of the Siege and the cutting of telegraph connections between Paris and the rest of the world, real-time information sharing disappeared. Instead, news now depended upon balloons, carrier pigeons (carrying micro-filmed messages), and smugglers crossing enemy lines.[59] After the Siege ended, telegraph connections were not reintroduced, though the Prussians did allow people in and out of the city. It would only be on May 28, 1871, that the telegraph lines

[55] The *rente* had a nominal value of 100 francs, and its interest was 3% annually, paid quarterly. For an excellent overview of French sovereign debt, see Hautcoeur (2007) and other volumes in that series.

[56] Hautcoeur (2007) points to the "*democratization of the rente*" over the 19th century (p.331), as successive governments reduced the minimum denomination that could be registered from 50 Francs in 1831 to merely 3 Francs according to the Finance Law of July 1870.

[57] Another way to approximate the rente's popularity is by looking at subscriptions. The number of primary subscriptions to the last-prewar *rente* issuance (1868) was 832,798 (having risen from 99,224 in 1854). Further, the number of separate registrations of rentes (inscriptions) in the General Ledger in 1870 was 1,254,040, reflecting a sum of 358,087,510 Francs (Hautcoeur (2007) p.333-34). Naturally, both these figures could, to some extent, reflect large investors making multiple subscriptions and registrations, and as Hautcoeur argues, the actual number of individual proprietaries is hard to know for sure. However, Leroy-Beaulieu suggests a ballpark of 550,000 or 600,000 individual investors before 1870. (Hautcoeur (2007), p.335).

[58] The Lyon exchange was the first exchange outside of Paris to gain the right to establish a trading floor in 1845 (Ducros and Riva (2014),6-7). Bordeaux did so in 1846. Using commissions as a measure of transaction volumes, Ducros and Riva suggest that the Lyon stock exchange had about 1/10 of the volume of trading of the exchange of Paris in 1870 (Ducros and Riva (2014), p.34)

[59] Even for the Rothschilds besieged in Paris, communications were extremely difficult, and they depended on the balloons as well, with significant delays. For example, on December 10, Alphonse de Rothschild received a letter dated October 21 (Ferguson (2000), pg 203). The Rothschilds were only able to restore regular letter correspondence even between their constituent banking households from February 3, 1871 onward (Ferguson (2000), pg 203).

were repaired and restored.[60]

Table A.1: Information flows between Paris and the outside world, during the Siege

		Spells without news, in days			Delay, in days	
		Mean	Max	25 pc	Median	75 pc
Siege	Balloons	2.71	6			
	Paris price printed in Bordeaux	4.15	14	5	6	7
	Pigeons	3.32	14			
	Outside news printed in Paris	3.32	13	3	4	6
Peace negotiations	Paris price printed in Bordeaux	1.72	6	4	4	6
	Outside news printed in Paris	1.57	5	3	3	4

This table shows the (inverse) frequency and delay of information flows in and out of Paris. During the Siege, gas-filled balloons left Paris with mail, official communications, and homing pigeons. Those pigeons were sent back to Paris with private mail and official communications. Both during the Siege and subsequent peace negotiations, a Bordeaux newspaper printed Paris prices, and a Parisian newspaper printed news from the outside. Spell without news measures the average amount of days between incoming information. The maximum is the largest time interval without news from that source. 'Delay' measures how old were the prices and news observed at the time they arrived in Bordeaux and Paris, respectively.

In Table A.1, we show the amount of time between instances in which news from outside the Prussian cordon was reported in Paris (and vice versa) during the Siege and the subsequent peace negotiations. During the Siege, on average, balloons landed outside Paris every 2.71 days. Starting in October, pigeons arrived in Paris every 3.32 days on average. We also report how often the Bordeaux newspaper *La Gironde* printed the prices of the Paris Bourse: every 4.15 days during the Siege and every 1.72 days during peace negotiations. Lastly, we report how often *Le Figaro*, a Parisian newspaper, printed news from the outside world: also every 3.32 days during the Siege, falling to every 1.57 days during peace negotiations.

More importantly, we can establish the average delay in information transmission from the Bordeaux and Paris newspapers. During the Siege, the median price printed in Bordeaux was six days old, with the 25th and 75th percentiles at five and seven days. The median news from outside reported in Paris was four days old, with the 25th and 75th percentiles at three and six days. The delays were shorter during peace negotiations, with a median of four days for Paris prices in Bordeaux and three days for outside news in Paris.

Though Paris and the outside world continued sharing information, significant information delays did limit arbitrage between Paris and the regional markets.[61] Moreover, the

[60] Private telegraphic communication between Paris and Bordeaux was restored on June 25 and between Paris and Lyon on June 23 (La Gironde, 1871/06/23-25, Le Salut Public 1871/06/23).

[61] For example, take a symmetric information delay of five days. An arbitrageur would have to use five-day-old information from the other market to take a position that he could only offload five days into the future. Such a "round-trip" of ten days was risky, especially during the Siege and its aftermath as prices were volatile. Indeed, during the 18th century, when information traveled by sailing boats, similar delays led to substantial price differences between cross-listed assets (Koudijs (2015, 2016)).

physical clearing of accounts was likely restricted in the absence of reliable information channels. These limits to arbitrage implied an upper and lower bound in cross-market price differences.[62] Within these bounds, prices in Paris and elsewhere could differ to reflect the beliefs (and other conditions) of the marginal investor in those markets specifically.

In Section A.3, we provide more evidence and a deeper analysis of the possibilities for and limits of arbitrage during the Siege. In particular, Section A.3.1 provides a detailed analysis of the micro-filmed messages transported by carrier pigeons into Paris. We provide evidence that though some agents do appear to attempt to arbitrage, this activity was minimal. This suggests that there was little pressure in Paris and the regional markets to push prices even further away from one another and that belief disagreement largely remained within the arbitrage bounds.

Further, in Section A.3.2, we simulate a trading strategy that aims to exploit price differences. Due to price volatility and uncertainty in the information flows, risk-free arbitrage was not possible. Even with assumptions very favorable to traders, they only obtain moderate Sharpe ratios, between 0.47 and 0.85 (today's traders in the city of London get a Sharpe ratio of 0.7 on average (Coates and Page (2009)). This suggests that arbitrageurs could have acted to bring prices closer together but stopped when risk and uncertainty started to dominate arbitrage opportunities.

A.2.2 War and default in the nineteenth century

In this paper, we show that after four months of persistent price differences between Paris and the rest of France, prices mostly converged when the peace terms were announced. We argue that peace conditions (and, in particular, the size of the indemnity) were a key source of disagreement. The sheer size of the indemnity supports this view: the payment was equivalent to 25% of French GDP, and Devereux and Smith (2007) called it "*the biggest transfer in history.*" The most famous case of defeat, reparations, and default is Germany after World War I. However, this example was unavailable to contemporaries.

Table A.2 lists the cases of European defaults between 1800 and 1870 in Reinhart and Rogoff (2009) dataset. With the exception of Greece, Portugal, and Spain, they are all associated with international wars. Most of them date to the Napoleonic wars. There are two relevant and more recent examples. Prussia defaulted on its debt in 1850 following its defeat in the First Schleswig War. The Peace of Prague stipulated that Prussia had to pay reparations worth 20 million thalers. Austria defaulted on its debt in 1868 following its defeat in the Austro-Prussian War. Austria suspended debt amortization, wrote down its debt by 5%, and further imposed a permanent tax on coupon payments of 16% (Dinger 1870, p. 89). Not listed by Reinhart and Rogoff (2009) is Italy in 1868, when a permanent

[62] This is similar to the so-called "gold points" during the Classical Gold Standard period, see Officer (1993) for example.

tax of 8.8% was levied on coupon payments, which constitutes default (Dinger 1870, p. 122). This was in response to financial difficulties brought about by the war with Austria in 1866 (Houghton 1889).

In sum, it must have been well known to investors at the time that military defeat could lead to problems with debt repayment and subsequent writedowns on sovereign bonds, even by relatively developed countries.

Table A.2: List of European default episodes between 1800 and 1870

Country	Start	End	International war?
Austria	1802	1816	Napoleonic Wars
Netherlands	1802	1814	Napoleonic Wars
Germany	1807	1807	Napoleonic Wars
France	1812	1812	Napoleonic Wars
Germany	1812	1814	Napoleonic Wars
Sweden	1812	1812	Napoleonic Wars
Spain	1820	1820	
Spain	1824	1834	
Greece	1826	1874	
Portugal	1828	1828	
Portugal	1837	1841	
Spain	1837	1867	
Russia	1839	1839	
Germany	1850	1850	Defeat in the First Schleswig War
Portugal	1850	1856	
Austria	1868	1870	Defeat in the Austro-Prussian War

This table lists every episode of sovereign default by a European nation between 1800 and 1870 in the Reinhart and Rogoff (2009) dataset.

A.3 Quantifying Arbitrage

A.3.1 Was there arbitrage? Evidence from pigeon messages

To study the prevalence of arbitrage, we take advantage of the fact that pigeon messages were photographed and their text is known today (Hayhurst (1970)). In order to look for messages that may include either trading instructions or confirmations, we digitized the messages included in a published collection of messages[63] We searched the messages for seventeen words that were likely to be included in trading messages.[64] Out of a total of almost thirty thousand digitized messages, we found 902 that included one of our keywords. We read those 902 messages and found that only 22 were speculative trading instructions

[63] *Recueil des dépêches télégraphiques reproduites par la photographie et adressées à Paris au moyen de pigeons voyageurs pendant l'investissement de la capitale*, available at `https://gallica.bnf.fr/ark:/12148/bpt6k5499951n.texteImage`.

[64] The seventeen words are: *action, obligations, intérêt, marché, échange, vend, impot, paiement, banque, offre, credit, Rothschild, compagnie, rente, achet, terme et comptant.* In English: stock, obligation, interest, market, exchange, sell, tax, payment, bank, offer, credit, Rothschild, company, rente, buy, term, and spot.

or confirmations.[65] Of those 22 messages, 14 concerned French government bonds.

We only found 10 messages that both concerned French government bonds and were specific enough as to allow us to evaluate the profitability of trades.[66] The trading profits were modest: only half of them had a positive return, with an average return of 0.13%.

We cannot rule out speculative trading messages that were cryptic enough to hide from our analysis. After all, investors had an incentive to keep their trades secret. However, it is clear that trading was not a common topic and that arbitrage attempts were rare. The word cloud of private messages in Figure A.1 shows that messages were chiefly concerned with reassuring family or inquiring about the health of loved ones.

[65] A typical example of a message that we did not classify as speculative trading was: "*send news olivier take care of your cash if you need money could sell part of the loan annuities*" (our translation).

[66] Two examples of specific trading instructions/confirmations were: "*buy rents with all available funds*", and "*just bought an annuity to the value of fifty thousand francs at fifty-three and three-quarters*".

Figure A.1: Word Clouds of Pigeon Correspondence

(a) Private messages

(b) Public messages

These two word clouds feature the most common words in private (panel a) and public (panel b) correspondence during the Siege. All the private messages were sent by carrier pigeons. Notice that private communications by carrier pigeon chiefly concerned reassuring family or inquiring about the health of loved ones (*bien* [N=14733], *sante* [N=4580]), acknowledging receipt of previous messages (e.g., *reçu*, *recevons*, *lettre(s)*) and other basic questions. Though *argent* (money) appears 1134 times, *rente* only appears 28 times in the private corpus. The *rente* was not mentioned in government-to-government Pigeon communications during the Siege.

Table A.3: All messages with identified arbitrage orders or reports (out of 29,903)

Date	Keyword	Message	Message (translated)	Type of transaction
1870-12-02	comptant	crédit aux premières maisons seulement, autres comptant acheter des rentes a cinquante quatre pour tout argent disponible	credit to first houses only, others cash to buy annuities at fifty four for all available money	Rente bought outside (report)
1871-01-27	rente	envoyer mandat ballon, deux mille francs valoir rente 30, jean, niort, (deux-sevres)	Send Mandate Ballon, two thousand francs to value rent 30, Jean, Niort, (Deux-Sresvres)	Rente bought outside (report)
1870-12-20	achet	nous avons vos lettres, été payé cinquante mille francs, nous acheterons de la rente, ete a roubaix	we have your letters, been paid fifty thousand francs, we will buy rente, been to roubaix	Rente bought outside (report)
1870-12-27	rente	viens d'acheter de rente au valeur de cinquante mille francs à cinquante-trois et trois quarts	just bought a rent at the value of fifty thousand francs at fifty-three and three quarters	Rente bought outside (report)
1871-01-29	achet	41 les sonssignes désirent que leur argent libre soit employé en achetant de la rente française a 3 010	41 the sonssigns desire that their free money be used by purchasing French annuity at 3,010	Buy rente in Paris (order)
1870-12-30	rente	acheter trois cent mille rente française dernier emprunt, deux cent forges mediterranee, reponse 9 mably	Buy three hundred thousand French rents Last loan, two hundred forges mediterranee, response 9 mably	Buy rente in Paris (order)
1870-12-22	rente	achetez rente à mesure fonds disponibles	buy rente based on available funds	Buy rente in Paris (order)
1870-12-29	achet	gouverneur dit qu'il ne faut pas acheter la rente, tout monde bien,	governor says that we should not buy the annuity, everyone well,	Sell rente in Paris (order)
1871-01-31	rente	tous bien fouiller casiers infirmerie, cabinet, trouverez valeurs vendez si nécessaire rente obligations, pleins pouvoirs	All search for infirmary lockers, cabinet, will find values sell if necessary rent obligations, full powers	Sell rente in Paris (order)
1871-01-16	terme	voyez henri si propriétaire fait commandement, payez un terme, vendez rente, rendrai au relour, amities	See Henri if owner does command, pay a term, sell rent, go to the reour, friendships	Sell rente in Paris (order)
1871-01-29	achet	colombe, nous, sante parfaite reçu cinquante lettres vendu espagnols trente faut-il acheter emprunt francais souscrit quarante? com- bien	Colombe, we, perfect health received fifty letters sold Spanish thirty should we buy French loan subscribed forty? How much	Can't compute rente trade
1871-01-31	achet	eviter detournements, centralise fonds bordeaux achete rente nominative informés, conseils sinistres connus mauvaise moyenne	avoid embezzlement, centralize Bordeaux funds buy registered annuity informed, known claims advice poor average	Can't compute rente trade
1871-01-27	obligations	payez le plus possible emprunt 1870 demandez argent picard semestre obligations	pay as much as possible loan 1870 ask for money picard semester bonds	Can't compute rente trade
1871-01-05	rente	rachetez douze mille rente morenn contre rente douze mille emprunt avec trente sous ecart, livrez emprunt	redeem twelve thousand morenn rente against twelve thousand loan annuity with thirty cents difference, deliver loan	Can't compute rente trade
	compagnie	acheter argent actions compagnie parisienne gaz, reponse, 22, castillon, bordeaux	buy money shares Parisian gas company, response, 22, castillon, Bordeaux	Not concerning the rente
1870-11-29	achet	lettres 14 18 recues, achetez seulement obligations dépôts rouen, marseille, bordeaux envoi prêt au havre	letters 14 18 received, buy only bonds deposits Rouen, Marseille, Bordeaux ready sending to Le Havre	Not concerning the rente
1870-12-27	achet	na famille bien, marseille tranquille, famille gavot bien, pavente rien, lettres recues, obligations achetees	my family is good, marseille is quiet, the gavot family is good, nothing is paved, letters received, bonds purchased	Not concerning the rente
1870-12-26	credit	ordonnez envoyer immédiatement bordeaux ou espagne credit deux cent mille francs avisez vallarino	Order send Bordeaux or Spain immediately, credit two hundred thousand francs advise Vallarino	Not concerning the rente
1871-01-11	achet	portons bien donner 300 francs alfred vendre dollars acheter obligations orleans nominatives elisabeth, marie, gabrielle	Let's be fine to give 300 francs alfred to sell dollars buy orleans nominative obligations Elisabeth, Marie, Gabrielle	Not concerning the rente
1870-12-23	vend	position assez bonne, vendons moitie, 55, confiance renait, ferons 10,000, ecrivez	Quite good position, let's sell half, 55, confidence will rebuild, will be 10,000, write	Not concerning the rente
1870-12-27	credit	rue taitbout, paris ordonnez envoyer immédiatement bordeaux ou espagne credit 200,000 fr , avisez valarino	Rue Taitbout, Paris Order immediately send Bordeaux or Spain Credit 200,000 FR, Avise Valarino	Not concerning the rente
1870-12-01	vend	suite borie dhier, vendu depuis 5,000 obligations a 55, ex-coupon ; six, rien	Suite Borie Dhier, sold for 5,000 obligations at 55, ex-coupon; Six, nothing	Not concerning the rente

From a total of 29,903 messages, we selected the 902 that contained one of our keywords. This table shows every message with trading instructions or reports we were able to find among those 902. The first ten concern the *rente* and have enough information so we could calculate returns. The next four concern the *rente* but we could not compute the trade. The last eight do not concern the rente.

A.3.2 Why was there no arbitrage? Simulation exercises

In this section, we ask why the price differences remained despite the fact that they were known both within and outside Paris. We simulate a trading strategy that aims to exploit price differences. We compute two strategies: that of a trader residing in Paris, who receives Bordeaux prices via pigeon and sends trading orders via balloon, and that of a trader residing in Bordeaux, who reads Paris prices in the local newspaper and sends trading orders via pigeon.

Simulation of arbitrage from Bordeaux:

1. We randomly draw one of the 38 Paris prices printed in the Bordeaux newspaper *La Gironde*. This price is n_1 days old.
2. If $Price_{Paris} - Price_{Bord} > t$, the investor buys rentes in Bordeaux and sends a pigeon message to Paris ordering to sell an equal amount of bonds there.
3. If $Price_{Bord} - Price_{Paris} > t$, the investor sells rentes in Bordeaux and sends a pigeon message to Paris ordering to buy an equal amount of bonds there.
4. We randomly draw a pigeon travel time to capture uncertainty in how long it would take, n_2 days.
5. To capture the ex-ante uncertainty associated with returns, we draw returns from a random $n_1 + n_2$ days period.

The investor faces three sources of uncertainty: What happened to the Paris price in the n_1 until reported, how long would it take to reach Paris n_2, and the return over n_1 + n_2 days. We assume investors form beliefs from past returns, so we draw returns from the past for each iteration of the simulation. After repeating this procedure 10,000 times, we calculate the average return and its standard deviation to calculate the Sharpe ratio as $E(return)/sd(return)$, as a measure of the performance of the investment.

Simulation of arbitrage from Paris:

1. We randomly draw one of the 41 pigeon arrivals in Paris. Despite scant evidence of arbitrage in these messages, we assume that they contain Bordeaux prices. This price is n_1' days old.
2. If $Price_{Paris} - Price_{Bord} > t$, the investor sells rentes in Paris and sends a message via balloon to Bordeaux ordering to sell an equal amount of bonds there.
3. If $Price_{Bord} - Price_{Paris} > t$, the investor buys rentes in Paris and sends a pigeon message to Bordeaux ordering to buy an equal amount of bonds there.

4. We randomly draw a balloon travel time to capture uncertainty in how long it would take, n_2' days.

5. To capture the ex-ante uncertainty associated with returns, we draw returns from a random $n_1' + n_2'$ days period.

Investors in Paris face the same three sources of uncertainty as investors in Bordeaux, and we run the same simulation to get a Sharpe ratio. In our simulation, it seems safer to trade from Paris than from Bordeaux since balloons are much more reliable than pigeons. However, it should be noted that the first exercise is grounded on actual Paris prices printed in a Bordeaux newspaper, while in the second one, we are only assuming that pigeons carried prices. We were not able to find a systematic report of outside prices in Paris.

Table A.4 reports results from our simulation exercise. Taking all possible trades, investors in Bordeaux and Paris get Sharpe ratios of 0.471 and 0.848, respectively. The ratios become higher if investors only trade when price differences are sufficiently high, 1.066 and 1.368 from Bordeaux and Paris, respectively. These numbers do not take into account transaction costs (such as brokerage or pigeon fees) and assume that investors had a complete understanding of the pigeon and balloon systems (including expected travel times) from the start.

For comparison, today's traders in the city of London get a Sharpe ratio of 0.7 on average (Coates and Page (2009)), and experienced traders get 1.02. In summary, our simulation shows that risk-free arbitrage was not possible, and investors would have taken a considerable risk to make a profit out of it. We cannot rule out all trades, and it is possible that inter-city trade made the price differences smaller.

Table A.4: Simulation of a trading strategy that exploits price differences

Min price diff to make a trade (in francs)	From Bordeaux Sharpe ratio	From Bordeaux Number of days with trades	From Paris Sharpe ratio	From Paris Number of days with trades
0	0.471	38	0.848	41
0.25	0.599	31	1.057	35
0.5	0.685	27	1.111	34
0.75	0.991	20	1.240	30
1	1.066	19	1.368	24

This table shows the results of a simulation of an arbitrage strategy. For example, if a Parisian investor receives news of lower prices in Bordeaux, she can sell rentes in Paris and send a balloon message to Bordeaux to buy rentes there. The simulation randomly draws news from the outside (either a pigeon in Paris or a Paris price printed in Bordeaux, n_1 days old), a travel time for the trading order (n_2 days), and returns from a random $n_1 + n_2$ day period, for 10,000 iterations. We then compute the Sharpe ratio as $E(return)/sd(return)$. If investors only make trades for bigger price differences, Sharpe ratios are higher, but they also have fewer opportunities to make trades.

A.4 The *rente*

In this subsection, we provide more information about the French *rente*. We first provide more information about who held the rente, we then provide various ways to quantify or visualize the price differences between different markets.

A.4.1 *Rente* ownership

Table A.5: The ownership of the French *rente* and other assets

	French gov bonds	Equity	Real Estate	Foreign gov bonds	French priv bonds
% of Parisians who owned...	**10**	10	5	3	8
% of Parisians with positive wealth who owned...	**37**	36	17	10	29
... as % of total wealth	**12**	17	34	3.1	10
% of ... owned by richest 5%	**84**	88	92	88	85
% of ... owned by richest 10%	**95**	97	99	97	96
% of ... owned by women	**41**	38	44	31	45

This table reports basic descriptive statistics about French *rente* and other assets. It uses a stratified sample of wills of people who died in 1872. Data source: Piketty et al. (2014).

A.4.2 Price differences

Table A.6: Four ways to quantify the price differences

	Price differences between Paris and the rest of France		
	Entire Siege	Second half of the Siege	Peace negotiations
As a % of price	0.92%	1.77%	-2.63%
As a % of GDP	0.30%	0.58%	-0.85%
Difference in yields (in bps)	-5.14	-9.87	14.08
As a % of the pre-war spread over British consols	-6.26%	-12.01%	17.14%

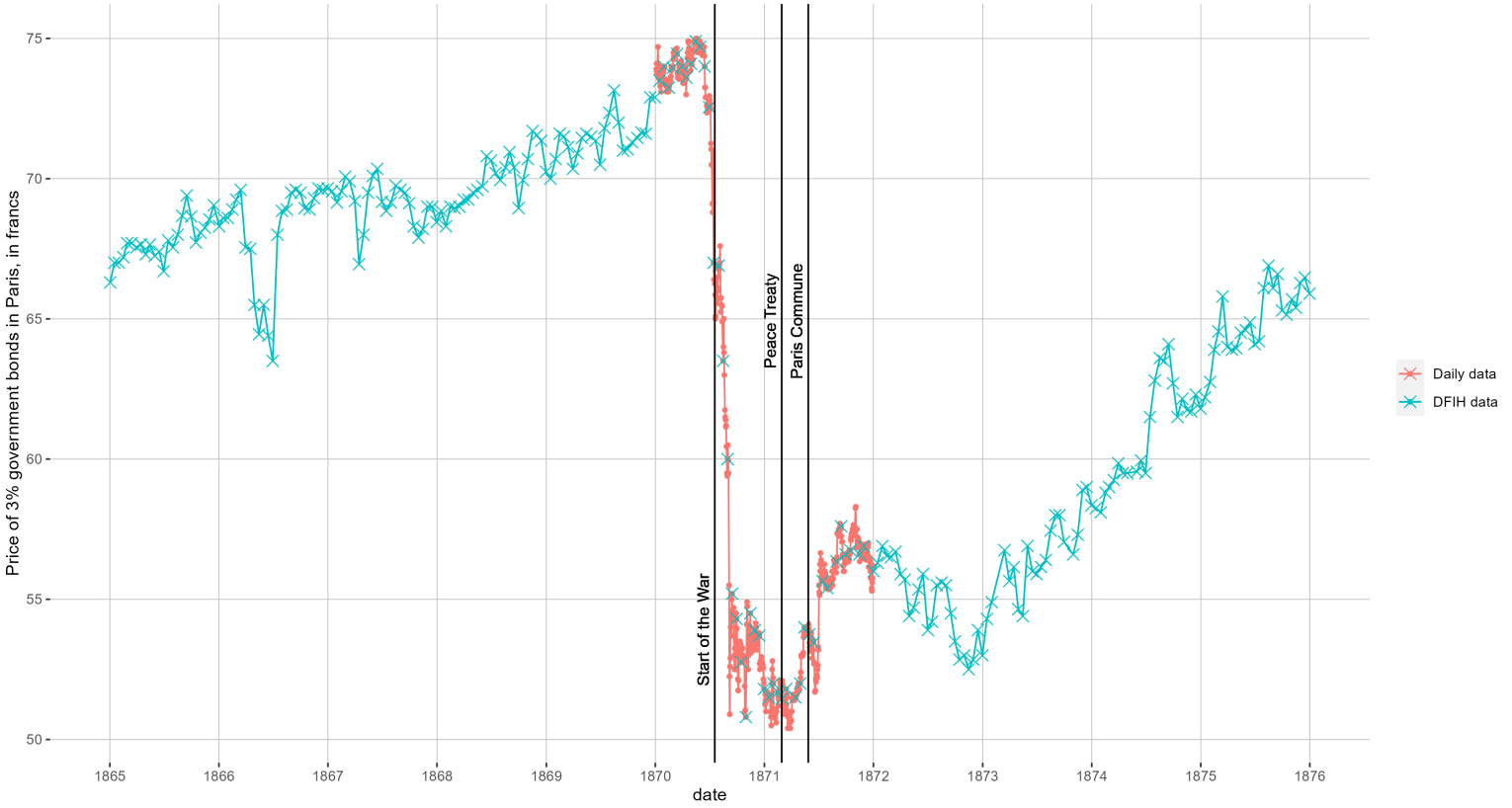
This table shows three ways to quantify the price differences between the rest of France and Paris (always as Paris minus the rest of France). First, as a percentage of the price. Second, as a percentage of GDP, we calculate that the French debt-to-GDP ratio in 1870 was 59.63% (Source for debt: Annuaire Statistique de la France 1966, source for GDP: Lévy-Leboyer and Bourguignon (1990)). Third, the difference in yields as a percentage of the pre-war spread over British consols. We calculate this spread as the difference in yields between French and British debt on June 30$^{\text{th}}$, 1870 (82.1 bps).

Table A.7: 3% *Rente* Price Differences between Paris and Other Markets

	Paris - Rest of France	Paris - Lyon	Paris - Bordeaux	Lyon - Bordeaux	Average Paris price	N
Entire Siege	0.511	0.325	0.679	0.326	55.327	110
	(0.111)	(0.135)	(0.118)	(0.135)		
p-values	[0.000]	[0.018]	[0.000]	[0.017]		
as % of price	0.92%	0.58%	1.22%	0.59%		
Siege after	0.981	1.137	0.803	-0.328	55.309	64
Coulmiers	(0.088)	(0.082)	(0.119)	(0.092)		
p-values	[0.000]	[0.000]	[0.000]	[0.001]		
as % of price	1.77%	2.05%	1.45%	-0.59%		
Peace	-1.430	-1.213	-1.691	-0.436	54.426	23
Negotiations	(0.133)	(0.108)	(0.200)	(0.162)		
p-values	[0.000]	[0.000]	[0.000]	[0.013]		
as % of price	-2.62%	-2.22%	-3.10%	-0.80%		
Peacetime	-0.008	-0.017	-0.005	0.013	67.142	336
	(0.013)	(0.017)	(0.015)	(0.019)		
p-values	[0.528]	[0.319]	[0.733]	[0.478]		
as % of price	-0.01%	-0.02%	-0.00%	0.02%		

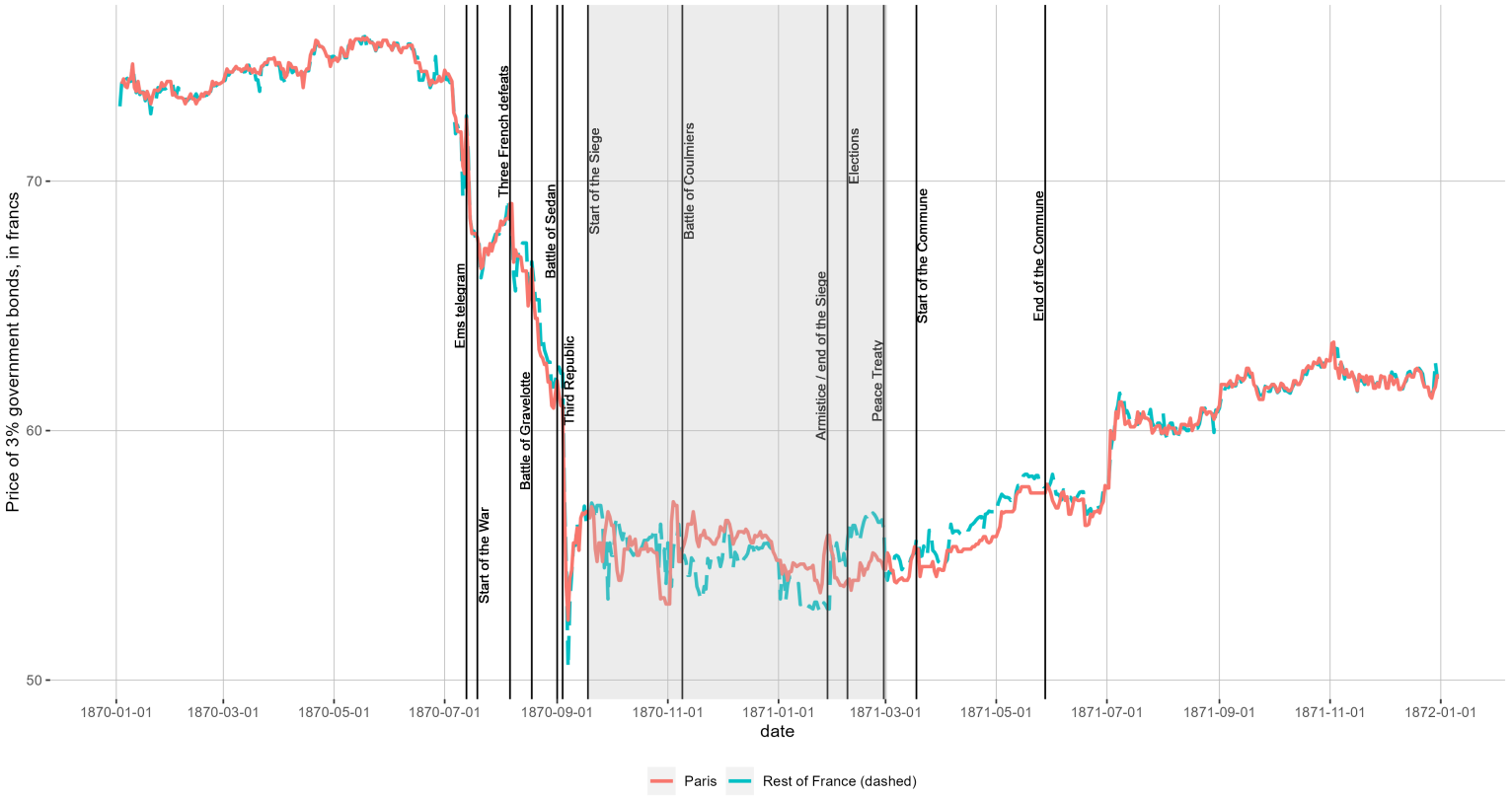
As a robustness check on Table 1, this table shows the average *daily* price difference between Paris, Bordeaux, and Lyon prices. *Rest of France* is calculated as the average between Lyon and Bordeaux. The standard errors (in parentheses) are the result of a one-sample t-test comparing the sample of daily differences to zero, p-values in brackets. The last row for each period reports the average difference as a percentage of the average Paris price (in the last column).

Figure A.2: Prices of the 3% *rente* in Paris, 1865-1875



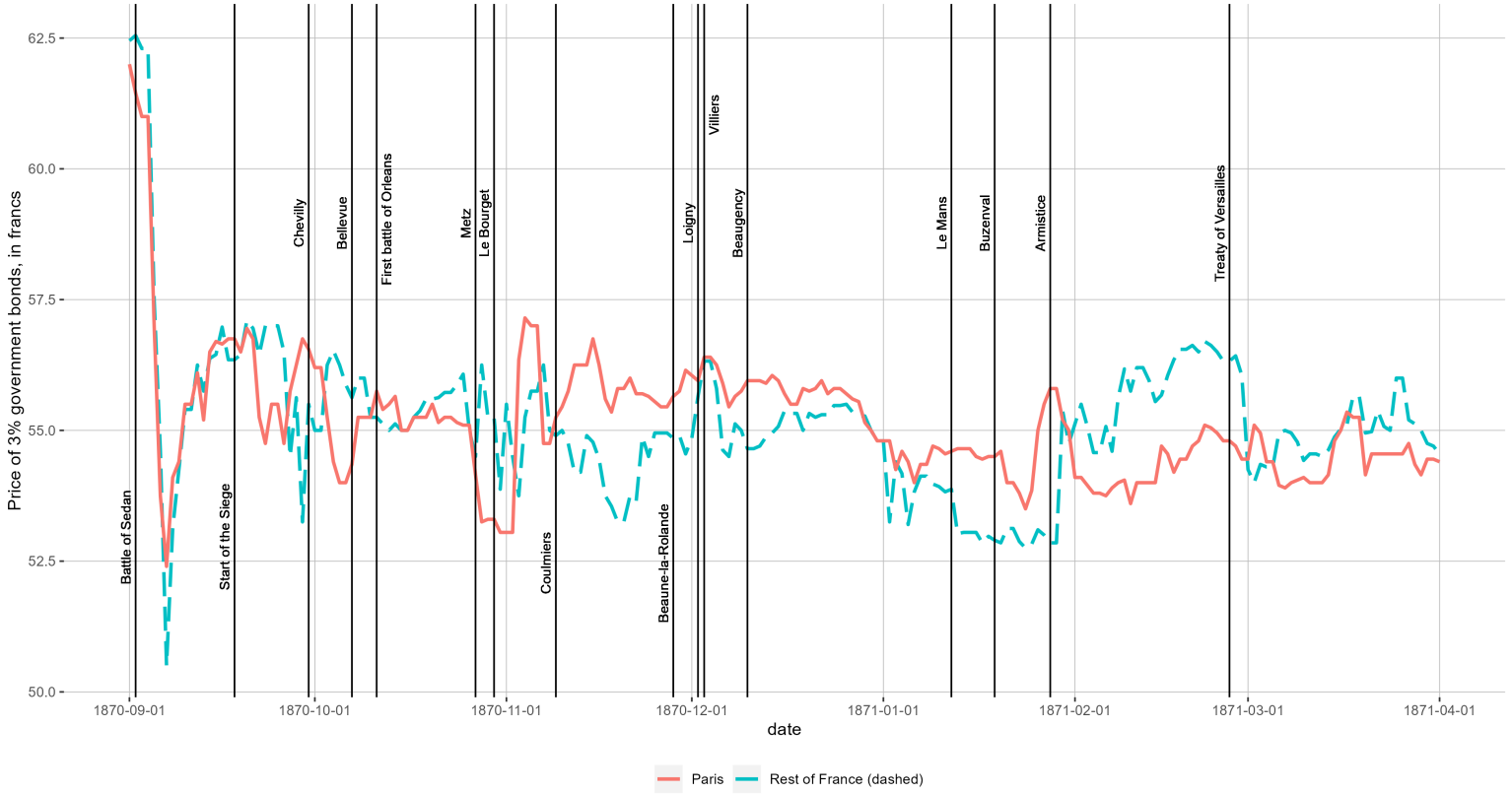
This graph shows the prices of the 3% French *rente* in Paris between 1865 and 1876. In blue, bimonthly prices from DFIH. In red, daily prices collected by us (for 1870 and 1871). Notice (1) the 10% dip in the French *rente* during the Prussian victory in the Austro-Prussian war in 1866. (2) the dramatic fall during the Franco-Prussian war, (3) the post-war recovery as France pays off its reparation debts in 1874.

Figure A.3: Prices of the 3% *rente* in Bordeaux, Lyon, and Paris, 1870-1872



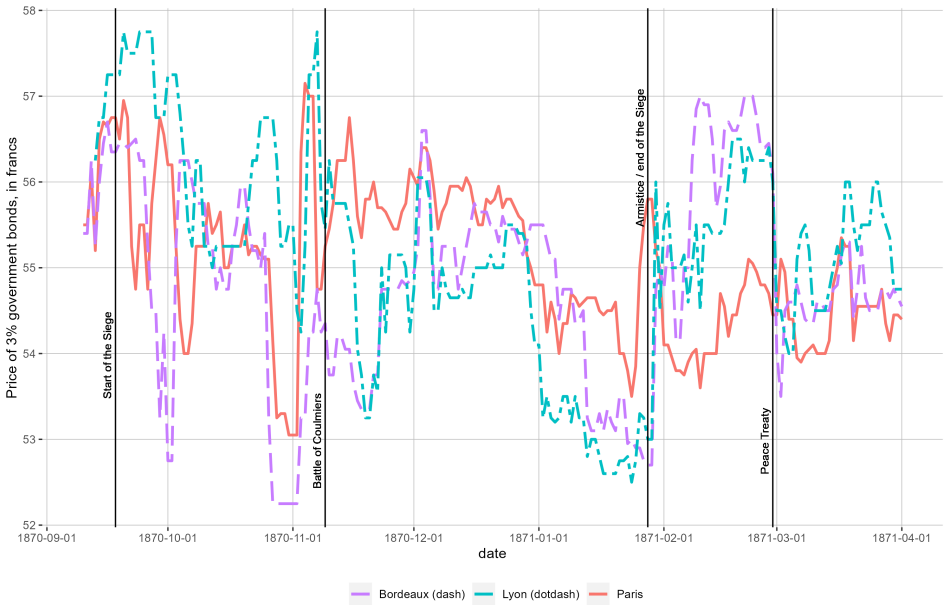
This graph shows the prices of the 3% French rente inside and outside Paris between 1870-01-01 and 1871-12-31. The outside prices are an average between Lyon and Bordeaux. The shaded area corresponds to the period we analyze (zoomed in in Figure A.4). The events depicted are, in chronological order: the Ems telegram (a diplomatic incident), the start of the war (the French declaration of war), three French defeats that happened within three days (Wörth, Spicheren, and Wissembourg), the inconclusive Battle of Gravelotte, the Battle of Sedan (where Napoleon III got captured), the declaration of the Third Republic in Paris (and the accession of the Government of National Defense), the start of the Siege of Paris, the French surrender with the signature of the Armistice (and end of the Siege), the February elections to the National Assembly, the signature of the Treaty of Versailles (which was ratified four days later), and the beginning and end of the Paris Commune.

Figure A.4: Prices of the 3% *rente* in Bordeaux, Lyon, and Paris with major war events



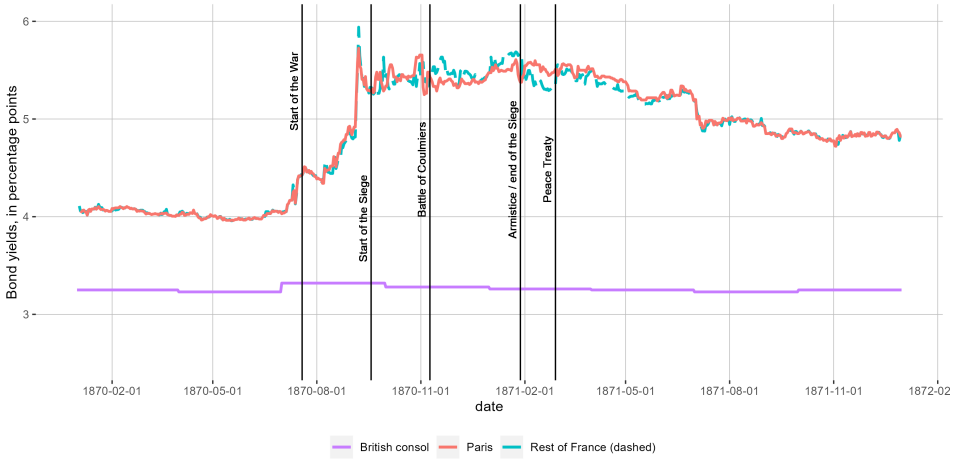
This graph shows the prices of the 3% French *rente* inside and outside Paris between 1870-09-01 and 1871-12-31. Outside prices are an average between Lyon and Bordeaux. All the events we use in section 4 are depicted here.

Figure A.5: Prices of the 3% *rente* in Bordeaux, Lyon, and Paris



This graph shows the prices of the 3% French *rente* in Paris, Bordeaux, and Lyon between 1870-09-10 and 1871-04-01. The differences between Lyon, the thickest market after Paris, and Bordeaux, which became the seat of the Republican government in exile, are smaller and not as persistent as the differences with Paris.

Figure A.6: Bond yields in France and Great Britain

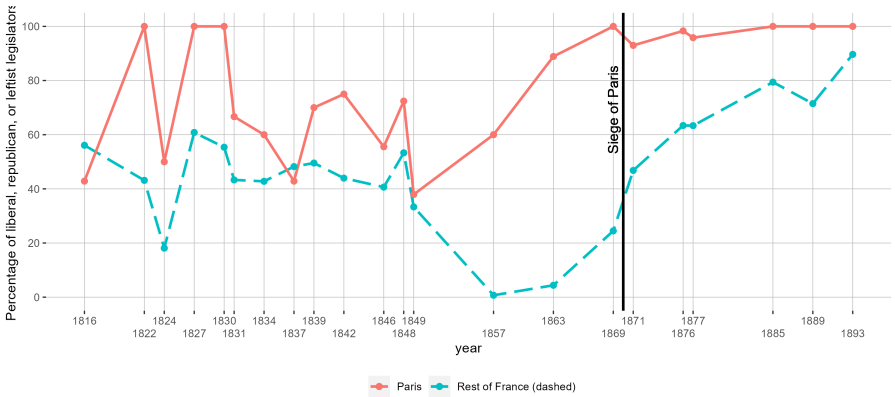


This graph shows the yields for the 3% French government bond in Paris (green) and in the rest of France (blue, average of Lyon and Bordeaux). It also shows the yields for the British 3% consol (red). The British consol, on the other hand, was only minimally impacted by the war. Source for British consol yields: Bank of England (2023).

A.5 The political situation

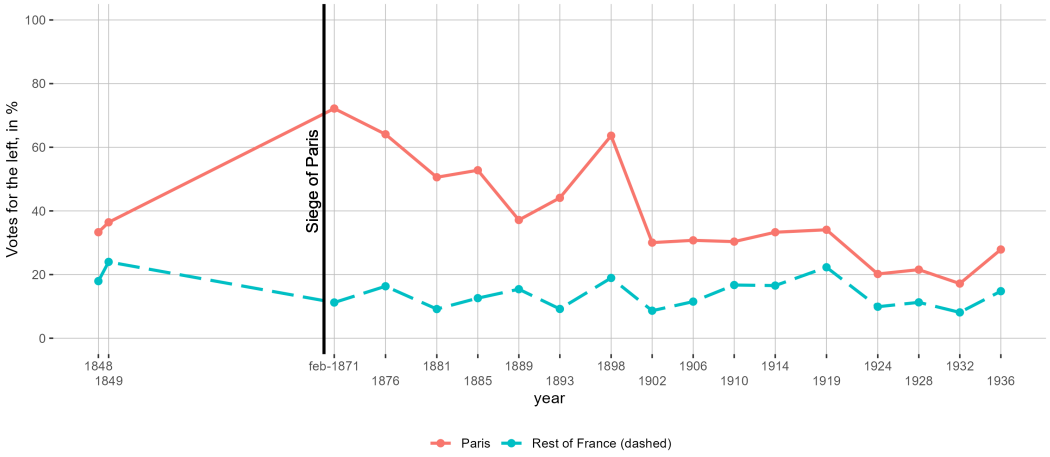
Here we look more closely at the political differences between Paris and the rest of France. We first show long-term trends in voting behavior, then additional figures from the February 1871 election, and finally, detailed outcomes of the vote ratifying the Versailles treaty.

Figure A.7: Proportion of republican, liberal, or leftist deputies in the National Assembly from Paris and the rest of France.



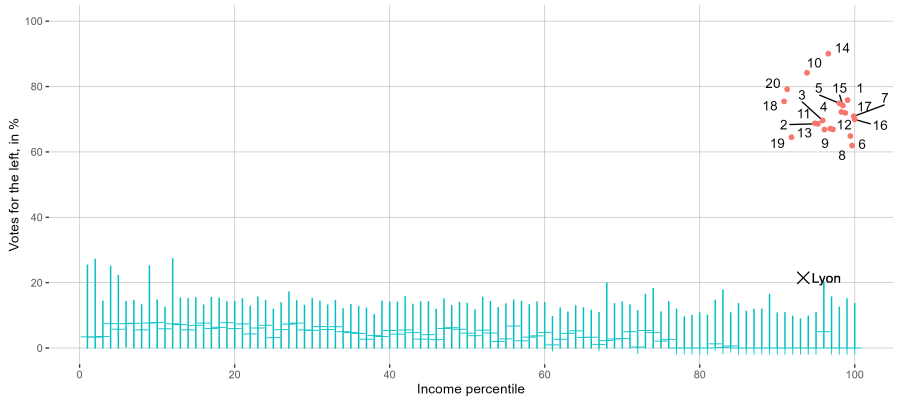
Paris consistently elected more leftist deputies than the rest of France. Each observation corresponds to an election year (every post-Napoleonic election of the 19th century is included).

Figure A.8: Votes for the left in all communes and arrondisements



This graph shows the percentage of votes that left parties obtained in each (free) election.

Figure A.9: Elections results in February 1871, in Paris and the rest of France



This graph shows election results in each Parisian arrondissement (circles) and the distribution for each income percentile for communes in the rest of France (horizontal lines).

Table A.8: Votes for the Ratification of the Peace Treaty

	Paris			Lyon			Bordeaux			France
	Left	Center-Left	Right	Left	Center-Left	Right	Left	Center-Left	Right	
Yes	1	5		3	3	6		3	11	546
No	31									107
Did not vote	4	1	1	1						23

This table shows the number of deputies in the National Assembly voting for and against the ratification of the peace treaty on March 4, 1871. The treaty was supported by the conservative, rural and provincial majority. The Parisian Republican left opposed.

A.6 War events

Here we provide additional placebo and robustness tests documenting that Paris responded more to war events (see Section 4.2). Table A.9 provides placebo tests, arbitrarily shifting the news reports by 2,4 or 6 days before or after the actual event, and finds no significant returns in these placebo windows. Table A.10 show the results are robust to dropping major battles one by one. Table A.11 shows responses for all war events, including minor and inconclusive battles as well as pre-Siege events. We also provide a map of the major battles (Figure A.10).

Table A.9: Placebos: Price response differences, arbitrarily shifting news windows

	Differences in two-day returns to rentes, in pp						
	Real date	Placebos, date of report changed by:					
	(Table 3)	-6	-4	-2	2	4	6
Major battles	1.183	0.032	0.311	-0.367	-0.746	-1.393	0.324
	(0.481)	(0.278)	(0.498)	(0.317)	(0.802)	(0.913)	(0.850)
	[0.032]	[0.910]	[0.544]	[0.271]	[0.372]	[0.155]	[0.711]
Major battles	1.382	0.074	-0.007	-0.301	-0.941	-1.754	-0.104
(with rumor reports)	(0.602)	(0.316)	(0.568)	(0.396)	(0.766)	(1.206)	(0.621)
	[0.042]	[0.819]	[0.990]	[0.463]	[0.245]	[0.174]	[0.870]
Major + minor battles	1.270	-0.071	-0.099	-0.234	-0.313	-1.011	-0.097
	(0.417)	(0.315)	(0.576)	(0.285)	(0.819)	(0.822)	(0.782)
	[0.009]	[0.825]	[0.866]	[0.426]	[0.708]	[0.241]	[0.903]
Major + minor battles	1.441	-0.035	-0.373	-0.178	-0.480	-1.302	-0.464
(with rumor reports)	(0.517)	(0.341)	(0.608)	(0.348)	(0.801)	(1.070)	(0.588
	[0.015]	[0.919]	[0.550]	[0.618]	[0.559]	[0.239]	[0.444]
Major + minor +	1.123	0.060	-0.118	-0.107	-0.238	-1.314	-0.625
inconclusive (as defeats)	(0.416)	(0.279)	(0.482)	(0.245)	(0.672)	(0.753)	(0.817)
	[0.016]	[0.833]	[0.809]	[0.669]	[0.728]	[0.100]	[0.456]
Major + minor +	0.969	-0.178	-0.045	-0.279	-0.278	-0.351	0.464
inconclusive (as victories)	(0.440)	(0.276)	(0.483)	(0.236)	(0.671)	(0.817)	(0.824)
	[0.043]	[0.530]	[0.926]	[0.255]	[0.684]	[0.674]	[0.581]

This table reports placebo specifications of Table 3 (Column 1, Paris - Rest of France). The differences in responses to reports of war events are not statistically significant if we arbitrarily shift the windows in which the events were reported in each city, by -6 to +6 days. Each coefficient represents a one-sample t-test. We compute returns as: $R = \log(p_t) - log(p_{t-2})$, for news printed on day t. We set up differences as $R_{Paris} - R_{outside}$ for victories and $R_{outside} - R_{Paris}$ for defeats, so positive coefficients confirm the model's predictions.

Table A.10: Robustness to dropping individual battles, one-by-one

Event dropped	Major battles	Major battles (with rumor reports)
All	1.183	1.382
(Table 3)	(0.481)	(0.602)
	[0.032]	0.042
First battle of Orléans	1.208	1.547
	(0.526)	(0.634)
	[0.045]	[0.035]
Loigny	1.313	1.554
	(0.508)	(0.632)
	[0.027]	[0.034]
Beaugency	1.249	1.413
	(0.522)	(0.658)
	[0.038]	[0.057]
Metz	1.141	1.047
	(0.525)	(0.548)
	[0.055]	[0.085]
Coulmiers	1.208	1.424
	(0.526)	(0.657)
	[0.045]	[0.056]
Villiers	1.295	1.511
	(0.513)	(0.644)
	[0.030]	[0.041]
Bellevue	1.372	1.589
	(0.484)	(0.619)
	[0.018]	[0.028]
Chevilly	1.032	1.249
	(0.500)	(0.643)
	[0.066]	[0.081]
Le Bourget	0.833	1.049
	(0.361)	(0.549)
	[0.044]	[0.085]
Beaune-la-Rolande	1.069	1.285
	(0.512	(0.651)
	[0.063]	[0.076]
Le Mans	1.325	1.542
	(0.503)	(0.635)
	[0.025]	[0.036]
Buzenval	1.152	1.369
	(0.526)	(0.659)
	[0.053]	[0.065]

This table reports placebo specifications of Table 3 (Column 1, Paris - Rest of France). The differences in responses to reports of war events remain statistically significant if we drop any major event. Each coefficient represents a one-sample t-test. We compute returns as: $R = \log(p_t) - log(p_{t-2})$, for news printed on day t. We set up differences as $R_{Paris} - R_{outside}$ for victories and $R_{outside} - R_{Paris}$ for defeats, so positive coefficients confirm the model's predictions.

Table A.11: All war events and *rente* returns in three cities

	Positive news?		Days for news to arrive						Two-day returns to events, in %					
			First rumor			Confirmation			First rumor			Confirmation		
Pre-siege battles		Date	Paris	Lyon	Bord	Paris	Lyon	Bord	Paris	Lyon	Bord	Paris	Lyon	Bord
Weissenburg	1870-08-04	No				3	2	4				-2.59	-0.51	-3.72
Froeschwiller/Worth	1870-08-06	No				3	2	2				-2.71	-2.82	-3.72
Spicheren	1870-08-06	No				3	2	2				-2.71	-2.82	-3.72
Borny (Colombey)	1870-08-14	No				2	2	2				-2.13	-3.97	-1.81
Vionville-Mars-la-Tour	1870-08-16	Yes				3	3	3				-0.31	2.22	0.83
Gravelotte-St. Privat	1870-08-18	No				3	3	6				-3.19	-3.79	-2.72
Beaumont	1870-08-30	No				5	5	5				-7.52	-8.5	-12.33
Noisseville	1870-08-31	No				5	1	6				-6.78	0.8	-11.85
Sedan	1870-09-01	No	1			3	3	5	0.16			-7.52	-8.5	-11.85
Minor battles														
Strasbourg	1870-09-28	No				4	3	3				-2.33	0.88	-0.94
Thionville	1870-11-24	No				13	4	6				-1.43	-0.27	0
Inconclusive battles														
Chateaudun	1870-10-18	Inconclusive				10	7	3				-3.42	0.88	-0.81
Hallue River	1870-12-24	Inconclusive				16	3	2				0.64	-0.18	-0.27
Bapaume	1871-01-03	Inconclusive				6	3	3				0.64	0	-1.28
Battles reported after the Armistice														
Lisaine River	1871-01-17	No				9	3	3				2.77	0	-0.47
St Quentin	1871-01-19	No				7	6	2				2.77	-0.09	0.56
Belfort	1871-02-15	No				5	3	2				0.46	1.79	1.33

This table shows the two-day returns in the three markets to pre-siege and minor and inconclusive battles, and battles that were not known in Paris before the end of the war (it is an extension of Table 2). Returns are calculated as: $\log(p_t) - \log(p_{t-2})$, for news printed on day t. Since news arrived on different days to each market, they do not necessarily correspond to the same calendar date.

Figure A.10: *Carte d'invasion allemande en France* by Charles de Mazade, Plon 1875.

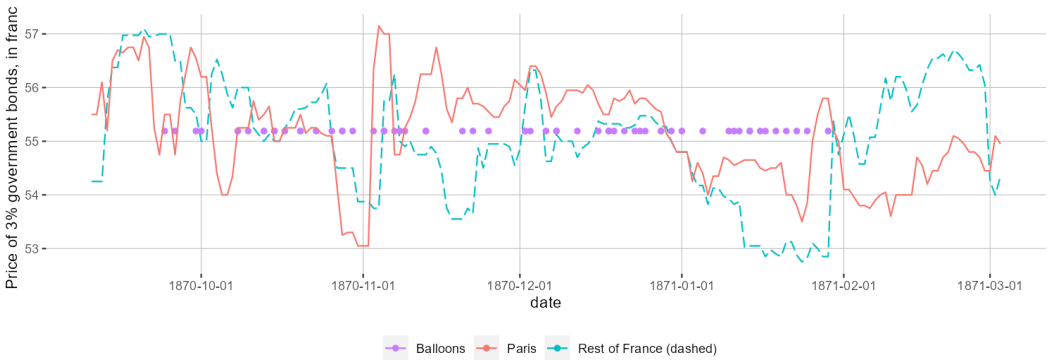
Source gallica.bnf.fr / Bibliothèque nationale de France

This map shows the major battles (as crossed swords), as well as the path of the German advance in France. source: *Bibliotheque nationale de France: Ge C 9319*

A.7 Information flows and price responses

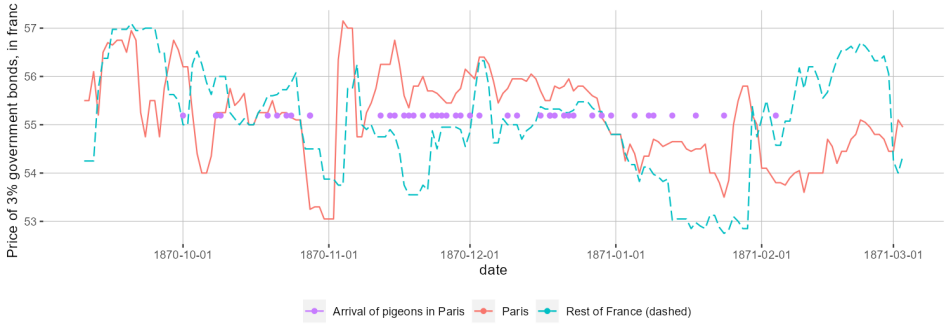
In this subsection, we provide further information about how prices responded to the arrival of information. We first show that there are no (large) price changes after the arrival of balloons, carrier pigeons, or other news reports. We then look at return volatility in response to news traveling between Paris and Bordeaux. Finally, we investigate to what degree prices converged in Bordeaux after receiving information from Lyon.

Figure A.11: Balloon arrival dates and Prices



This figure shows the price of the *rente* inside and outside Paris during the Siege. Gas-filled balloons traveled from Paris to the rest of France, the dots represent days with balloon landings.

Figure A.12: Pigeon arrival dates and Prices



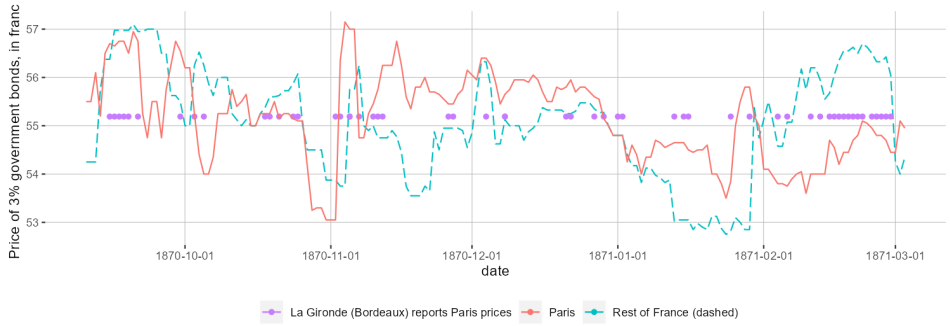
This figure shows the price of the *rente* inside and outside Paris during the Siege. Carrier pigeons traveled from the outside to Paris with both official correspondence and private mail, the dots represent days with pigeon landings.

Table A.12: Incoming information and abnormal returns in Paris

	Absolute value of two-day *rente* returns, in percentage points				
	Panel (a): Paris			Panel (b): Bordeaux	
	(1)	(2)	(3)	(4)	(5)
Pigeon arrival reported in historical source	−0.033				
	(0.254)				
	[0.897]				
Any outside news printed in Paris		−0.192			
		(0.182)			
		[0.297]			
Number of outside news printed in Paris			0.005		
			(0.016)		
			[0.727]		
Paris price printed in Bordeaux				−0.166	−0.277
				(0.209)	(0.218)
				[0.429]	[0.218]
Lyon price printed in Bordeaux					0.376
					(0.271)
					[0.168]
Fixed effects	Week	Week	Week	Week	Week
Mean DV	1.003	1.003	1.003	0.956	0.956
Observations	133	164	164	164	164
Sample	Siege	Siege and peace negotiations			

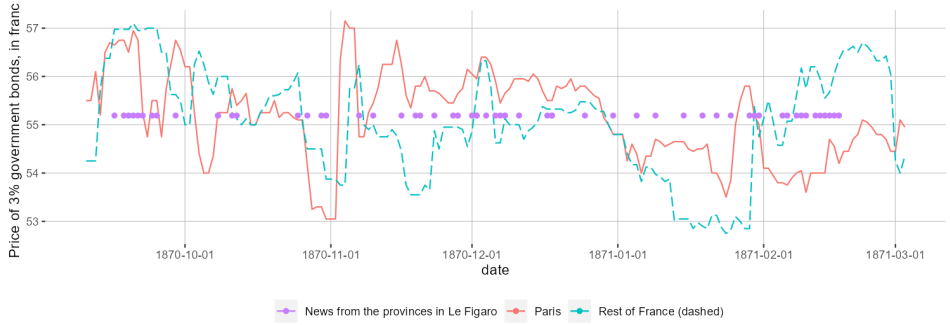
This table shows the relationship between incoming information and abnormal returns in Paris, as a robustness check of Table 5. The dependent variable is the absolute value of the two-day *rente* return in Paris/Bordeaux: $|\log(p_t) - log(p_{t-2})|$. The independent variables are: a dummy that equal one if a historical source documented a pigeon arrival (from Hayhurst (1970)), a dummy that equals one if Le Figaro reported news from the outside (regardless of how old), the number of outside news reported by *Le Figaro*, and dummies that equal one if La Gironde printed Paris and Lyon prices. Robust standard errors in parenthesis.

Figure A.13: Days with Paris prices printed in Bordeaux and Prices



This figure shows the price of the *rente* inside and outside Paris during the Siege. The dots denote the days when the Bordeaux newspaper *La Gironde* printed the Paris prices.

Figure A.14: Days with news from the outside in Paris and Prices



This figure shows the price of the *rente* inside and outside Paris during the Siege. The Parisian newspaper *Le Figaro* often printed news from outside. The dots represent the "day with news", i.e. days when the events reported by *Le Figaro* were more recent than any event reported before.

Table A.13: Price convergence after Lyon prices are printed in Bordeaux

	Bordeaux prices after receiving the Lyon price		
	Siege	Peace negotiations	All
Δprice difference	-0.200	-0.002	-0.137
	(0.100)	(0.143)	(0.082)
p-values	[0.050]	[0.988]	[0.098]
Lower bound 95% CI	-0.400	-0.230	-0.301
Mean absolute price difference	0.897	0.935	0.909
Δprice difference as % of mean diff	-22.29%	-0.22%	-15.12%
Observations	55	24	79
Median delay	4 days	4 days	4 days

In this table we study whether the price difference between Lyon and Bordeaux decreased after the Bordeaux newspaper *La Gironde* printed Lyon prices. Standard errors are calculated from a t-test that compares the sample of changes in price differences to zero. We also report the lower bound of the 95% CI (an upper bound for convergence).

A.8 Liquidity shocks

Here we supplement Section 5 by providing additional information comparing drivers of demand for liquidity (particularly food prices in the besieged city of Paris– see Table A.14) and the price differences for other liquid domestic assets with the *rente* price differences between Paris and the rest of France (see Figure A.15.)

As described in Section A.9, the food prices come from the weekly diaries of Nathan Shepphard, who was present within the Siege. They include both staples (butter, potatoes, eggs) and luxuries in the besieged city (rabbit and fowl). He also records three weekly prices for cat meat that appeared on the market later in the Siege as well as intermittent unusual luxuries such as elephant trunks (see Figure 8.)

Table A.14: Lack of consistent correlations between food price rises in Paris under Siege and *rente* price differences

	Butter	Potatoes	Eggs	Rabbit	Fowl	Cat
Correlation between	0.277	-0.135	0.123	0.073	0.355	0.554
rente price	(0.248)	(0.330)	(0.299)	(0.332)	(0.331)	(0.832)
difference and ...	[0.282]	[0.693]	[0.688]	[0.830]	[0.315]	[0.626]

This table shows the absence of a strong correlation between food prices for staples, luxuries and unusual meats in Paris and the difference between *rente* prices in Paris and outside. Coefficients are correlation coefficients. Standard errors in parentheses and p-values in brackets.

Figure A.15: Prices of non-governmental French financial assets in Paris and Elsewhere

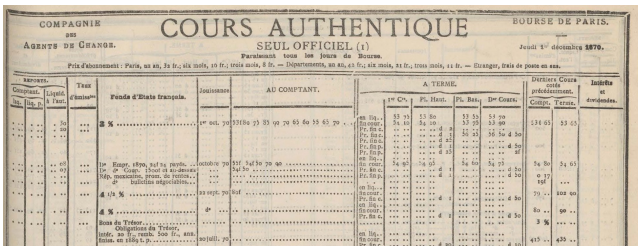
These graphs show the price series for two other liquid assets: the *Lyon et Mediterranee railroad* stock and the *Midi* railroad bond. For the Midi bond, we use prices in Bordeaux (as it was only reported there and in Paris), for the Lyon et Mediterranee stock, we use the average of Lyon and Bordeaux, similar to our main comparison of the *rente*.

A.9 Data Appendix

A.9.1 Price data

We hand-collected daily prices for the 3% *rente* for 1870 and 1871 in three cities: Paris, Lyon, and Bordeaux. Our sources are the *Cours Authentique* (Paris), the *Cours Officiel* (Bordeaux), and the newspaper *La Salut Public* (Lyon) (see Figures A.16, A.17, and A.18 for examples of the original sources).We always use the first price of the day.

Figure A.16: Original Source: the published Paris *rente* price in the daily *Cours Authentique*, Dec 1st, 1870.


COMPAGNIE DES AGENTS DE CHANGE.

COURS AUTHENTIQUE

SEUL OFFICIEL (1)

Paraissant tous les jours de Bourse.

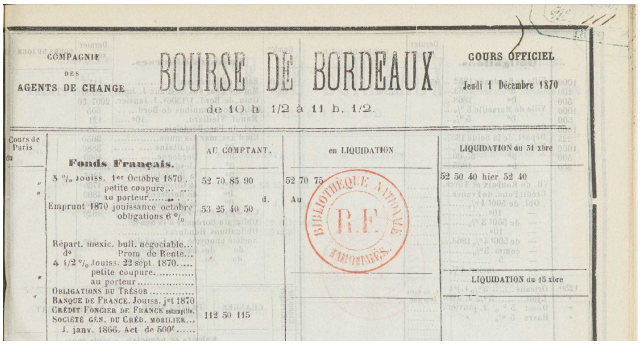
BOURSE DE PARIS.

Jeudi 1er décembre 1870.

Prix d'abonnement : Paris, un an, 24 fr.; six mois, 12 fr.; trois mois, 6 fr. — Départements, un an, 45 fr.; six mois, 23 fr.; trois mois, 11 fr. — Etranger, frais de poste en sus.

Fonds d'Etats français.	Jouissance	AU COMPTANT.	A TERME. 1er Cours	Plus Haut.	Plus Bas.	Dernier Cours.	Dernier Cours constatant précédemment. Compt.	Terme.	Intérêts et dividendes.
3 %	1er oct. 70	53 80 53 75 53 90 53 85 53 90 53 85 53 90 53 85 53 90					134 65	53 65	
4 1/2 %	22 sept. 70	80f					79	102 50	
4 %	4e						80	90	
Bons du Trésor							3 %		
Obligations du Trésor, intér. au 1er, remb. 500 fr., ann.	mi-juill. 70						427	430	

Figure A.17: Original Source: the published Bordeaux *rente* price in the daily *Cours Officiel*, Dec 1st, 1870.


COMPAGNIE DES AGENTS DE CHANGE

BOURSE DE BORDEAUX

de 10 h. 1/2 à 11 h. 1/2.

COURS OFFICIEL

Jeudi 1 Décembre 1870

Cours de Paris du	Fonds Français.	AU COMPTANT.	en LIQUIDATION	LIQUIDATION du 31 xbre
	3 % Jouiss. 1er Octobre 1870 petite coupure	52 70 85 90	52 70 75	52 50 40 hier 52 40
	au porteur		Au	
	Emprunt 1870 jouissance octobre obligations 6 %	53 25 40 50	d.	
	Répart. mexic. bull. négociable			
	d° Prom de Rente			
	4 1/2 % Jouiss. 22 sept. 1870 petite coupure			
	au porteur			LIQUIDATION du 15 xbre
	OBLIGATIONS DU TRÉSOR			
	BANQUE DE FRANCE. Jouiss. jvl 1870			
	CRÉDIT FONCIER DE FRANCE remplt.			
	SOCIÉTÉ GÉN. DU CRÉD. MOBILIER	112 50 115		
	J. janv. 1866. Act de 500f			

Figure A.18: Original Source: the published Paris *rente* price in the daily newspaper *Le Salut Public*, Dec 1st, 1870.


7 PIÈCES

isement agencé. Eau de la areau du journal. (6 d.)

SUITE

E 7 PIÈCES

t ayant les eaux.

2 (7080)

du matin. En conséquence, toutes les personnes qui désireraient enchérir pourront prendre connaissance, jusqu'au jour de la vente, du cahier des charges dressé par ledit Me Achard, pour parvenir à l'adjudication.

A CÉDER APRÈS FORTUNE FAITE

Dans une jolie ville de province de 20,000 habitants

UN MAGASIN D'ARTICLES DE PARIS

Belle clientèle — Affaires certaines. — Facilités pour le paiement

26 d. S'adresser au bureau du journal. (0 00)

GUÉRISON PARFAITE

des

Maladies Secrètes

Débilité des Organes & Vices du Sang, par le

ROB-SAVARESI, DÉPURATO-TONIQUE

PERFECTIONNÉ

S'adresser à M. TOUSSAINT, chimiste

Pharmacien de première classe

Rue Pizay, 29, 1er étage, Lyon

Aller de travers, rue Arbre-Sec, 9

BOURSE DE LYON DU 1er DÉC. (De 1 heures à 3 h. 1/2.)

Derniers cours de Paris	FONDS D'ÉTAT FRANÇAIS.	AU COMPTANT	LIQUID. DU 30 NOV.	LIQUID. DU 31 DÉC.
56 75	3 0/0 Français.	56 67	56 60 56 57	56 92 56 97 57
	0 1. oct. 1871		56 62 16 65	
	— Coup.		d. 10	d. 50: 57 15
91 90	5 0/0 empr. 1871		91 77 91 70 91 72	92 05 92 15 92 10
	— coup.	91 65	d. 10:	
	4 1/2 Français.		d. 2 :	d. 50: 93 02 90
	0. Trésor 6 0/0	5'6 95 505		

OBLIGATIONS.	FR. PRÉC.	COURS DU JOUR
Ville de Lyon 1867	490 »	495
Ville de Lyon 1870	445 »	445
Départem. du Rhône	840 »	734 ?
Ville de Lyon 1865	» »	450
De la Loire	» »	460
[illegible]	» »	500
Rhône-et-Loire à 5 0/0	» »	365
Prêts hypothécaires	» »	490
[illegible]	» »	329 50 329 75
Saint-André-le-Château	» »	505

Accounting for coupon payments: The *rente* was an annuity that paid three percent annually. The nominal value of the bond was 100 francs, and coupons were paid quarterly on April 1st, July 1st, October 1st, and January 2nd (0.75 francs each time). They were "considered detached" for listing purposes two weeks before. The sources were always explicit about the last attached coupon. In Paris, they were always detached on the 16th. In the rest of France, it was slightly later (on average 1.6 days later in Bordeaux and 3.1 days later in Lyon).In Table A.15 we confirm that the markets expected the detached coupons to be paid by calculating the price drops on coupon detachment days.

Table A.15: Average *rente* price change on coupon detachment days

	Paris	Bordeaux	Lyon	Number of coupons
Entire Sample	-0.719	-0.612	-0.687	8
	(0.196)	(0.570)	(0.392)	
Siege and Negotiations	-0.783	-0.733	-0.817	3
	(0.225)	(0.321)	(0.115)	

This table shows that raw *rente* prices fell by (approximately) 0.75 francs on the days coupons were considered detached.

Table A.16 lists a subset of the most liquid assets and the number of days in which their prices are reported in both Paris and Bordeaux, Paris and Lyon, or either. The sample goes from the start of the Siege to the end of the peace negotiations. The "Either" column is always close to the maximum of Lyon and Bordeaux, which indicates that Paris almost always has prices. The table shows that the 3% *rente* was by far the most liquid asset. There were 133 trading days in Paris during this period, all with *rente* prices (out of 140 business days). Therefore, we can conclude that the hardships of the Siege did not prevent business as (almost) usual. We used this table to choose the four assets for section 5.4.

Yields: Since the *rente* is an annuity that pays three percent per year, we calculate the yield as $\frac{3}{price}$. We obtained yields for UK consols from FRED.[67] We calculated the country risk as the difference between the *rente* yield and the consol yield.

A.9.2 Who owned the rente?

Table A.5 uses Piketty et al. (2014)'s replication data to report basic descriptive statistics about French government bonds and other assets. It uses a stratified sample of wills of people who died in 1872. Their data includes the amount in francs in each will for each asset category (French and foreign, equity and bonds, public and private, and all their

[67] Available at https://fred.stlouisfed.org/series/LTCYUK

Table A.16: Number of days with prices both in Paris and another city

Asset	Type	Number of days with Paris price and... Bordeaux	Lyon	Either
3% Rente	French gov bond	121	126	133
Midi Railroad	French private bond	116	0	116
Soc Autrichienne Railroad	Foreign equity	38	112	115
Lyon et Mediterranee Railroad	French equity	41	104	108
Italian 5%	Foreign gov bond	56	0	56
Orléans Railroad	French equity	42	0	42
Midi Railroad	French equity	38	0	38
Suez Canal	French equity	1	37	38
Credit Mobilier Espagnol	Foreign equity	0	16	16
Est Railroad	French equity	15	0	15
Credit Mobilier	French equity	12	0	12
Ouest Railroad	French equity	10	0	10
Espagne 3%	Foreign gov bond	9	0	9

This table shows the number of days when we observe a price in Paris and a price in either Bordeaux or Lyon. We focus on the period from the start of the Siege on September 18th, 1870 to the announcement of the peace treaty on February 28th, 1871. The assets in this list were pre-selected based on their apparent liquidity.

combinations, plus real estate).[68]

A.9.3 Episodes of default

In section A.5 ("War and Default in the Nineteenth Century") we use episodes of default mainly drawn from Reinhart and Rogoff (2009).[69] Not listed by them, we also include an entry for Italy in 1868, when a permanent tax of 8.8% was levied on coupon payments, which constitutes default (Dinger 1870, p. 122). This was in response to financial difficulties brought about by the war with Austria in 1866 (Houghton 1889).

A.9.4 Data on information flows during the Siege

In the paper, we use five sources of data to account for information flows: balloons, pigeons, prices printed in *La Gironde* (Bordeaux), news from the outside printed in *Le Figaro* (Paris), and news about war and peace events in *Le Figaro, La Gironde*[70], and *Le Salut Public* (Lyon).

Balloons: Our source for balloon departures and arrivals is the map in Figure A.19.[71] We always assume that news arrived at Bordeaux or Lyon at least twenty-four hours after

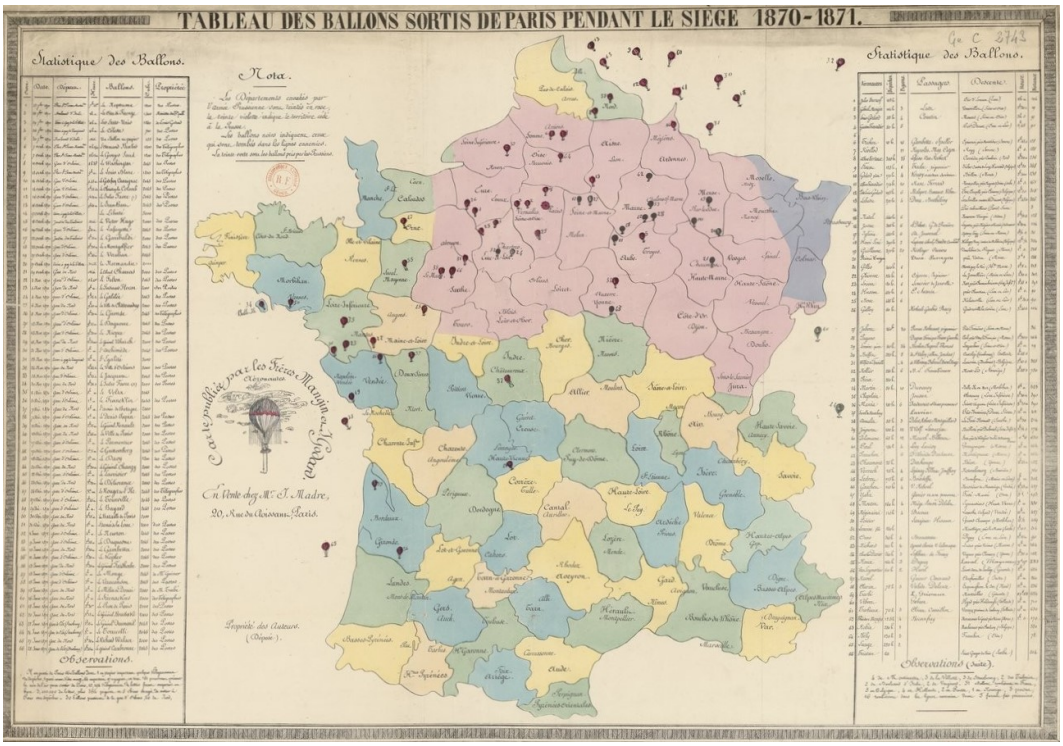
[68] Their anonymized data does not include the top 1%. Therefore, we approximate the portfolio composition of those in the 99th percentile with those in the 98th percentile.

[69] Available at: https://carmenreinhart.com/this-time-is-different/

[70] Available at https://gallica.bnf.fr/ark:/12148/cb32782567n

[71] Map published by the Freres Mangin et Goddard, *Bibliotheque nationale de France*: Ge C 2743. Available at https://gallica.bnf.fr/ark:/12148/btv1b53029817h

Figure A.19: Original Source: *Tableau des Ballons Sortis de Paris Pendant le Siege, 1870-1871*



Source: Freres Mangin et Goddard, *Bibliothéque nationale de France*: Ge C 2743.

the balloon landed. Therefore if a balloon landed in the afternoon of day t, we assume it arrived in Bordeaux or Lyon before trading day $t+2$ (trading hours were a couple of hours around noon). If it landed in the morning, we assume it arrived before trading day $t+1$. We discard three balloons that were lost at sea, five that were captured by the Prussians, and one that landed in Norway.

Carrier Pigeons: We have two sources. First, we looked for all mentions of pigeons in *Le Figaro* and recorded their arrival dates in Paris. The second source for pigeon data is Hayhurst (1970), who reports arrival and departure dates separately, but does not link them.

We also digitized the text of pigeon communications starting on November 30th, 1870, from an official report of the Direction of Mail and Telegraphs (la Follye (1871)).[72]. Then, after applying both optical character recognition and human inspection, we performed the analysis described in A.3.1 ("Was there arbitrage? Reading pigeon messages"). We also used these messages for the word cloud A.1. The second world cloud uses official messages,

[72]Available at https://gallica.bnf.fr/ark:/12148/bpt6k5499951n

also from an official report (Morlaix (1871)) [73].

Newspapers: The Bordeaux newspaper, *La Gironde*, reports Parisian and Lyonnais prices, which comprise our most direct measure of information flows. We checked that prices printed in Bordeaux coincide with those originally reported in Paris and Lyon. We also added coupon payments to these prices.

Similarly, we collected news from the outside reported by Le Figaro with the help of a team of research assistants.[74] The city and the date were often stated in the byline. We needed to rule out stories that debated or analyzed events long past (for example, the blame for the defeats in August or for the surrender of Metz was debated for our entire period). In order to identify the days with new information, we classify a day as a "day with news" if the events reported by *Le Figaro* were more recent than any event reported before. We used these data in Section 5.1.

Further, for a pre-defined list of war and peace events, we searched local newspapers (*Le Figaro* in Paris, *La Gironde* in Bordeaux, and *Le Salut Public* in Lyon for the first mention and the confirmation, which we used in section 4.2.

A.9.5 Events related to war and peace

In Section 4.2 ("Different Responses to War and Peace") we study price reactions to events. To achieve this, we first needed a list of relevant events and when the news of each event arrived in each city.

To compile the list, we start with the two peace events: the Armistice and the announcement of the Treaty of Versailles. Our list of main battle includes those listed as "major" by Clodfelter (2017) or with their own chapter or section in Wawro (2003). We exclude from the main list of major battles those that were inconclusive, lacking a clear winner (but we include them in robustness checks).[75] In some specifications, we also include two "minor battles", Strasbourg (mentioned by both sources) and Thionville (only mentioned by Wawro). These events, despite not involving significant casualties, consisted in the surrender of two strategic French fortresses under siege, freeing up large numbers of German troops.

From all specifications, we exclude battles that happened before the start of the Siege and the cutting of the telegraph lines (this includes Sedan and Gravelotte). We also exclude battles whose outcomes were not known in Paris by the date of the Armistice. We ended up with two peace events, twelve major battles, two minor battles, three inconclusive battles

[73] Available at https://gallica.bnf.fr/ark:/12148/bpt6k54385608

[74] All issues available at https://gallica.bnf.fr/ark:/12148/cb34355551z/date

[75] These include the battles of Bapaume and Hallue River, both referred to by Clodfelter (2017, pg 186) as 'draws'. We also include the battle of Chateaudun, which led to the reduction of the city into "*smoking ashes*" (Wawro, 2003, pg.265) by the Prussians and did not stop their offensive but was seen as a heroic stand that temporarily slowed the Prussian advance by some French observers.

(draws), nine pre-siege battles, and three battles reported after the Armistice (see Tables 2 and A.11).

To measure the reaction to events, we need to know when each city found out about each news event. Our sources are the newspapers *Le Figaro* (Paris), *La Gironde* (Bordeaux), and *Le Salut Public* (Lyon).[76] We also used the journal of a Parisian stockbroker, Jacques-Henri Paradis (1872), who kept and published a detailed account of life in Paris and the markets during the Siege.

Table A.17: Delay for war events to be reported in newspapers

	Paris	Lyon	Bordeaux	N
All Siege battles	9.077	3.615	3.154	13
	(1.347)	(0.368)	(0.421)	
Main Siege battles	8.625	3.375	3.000	8
	(1.802	(0.375)	(0.567)	
Siege breakout attempts	2.25	3.750	3.000	4
	(0.479)	(0.854)	(0.707)	
Presiege battles	3.333	2.556	3.889	9
	(0.333)	(0.377)	(0.564)	

This table shows the average time (in days) it took for news about the war to be reported in each city. Standard deviation in parentheses. It shows that news about battles fought in the provinces took longer to arrive in Paris. Siege breakout attempts were reported in Paris first. Also, pre-Siege battles were reported first in Lyon, then in Paris, and lastly in Bordeaux (consistent with the fact that they were fought in Eastern France).

A.9.6 Election results and income

We obtain election results and income from Cagé and Piketty (2023).[77] We assemble results for every election they have during the Second and Third Republics (eighteen elections between 1848 and 1936). We used their classification of parties, and in the figures, we report the percentage of votes that go to the left (Figure A.8). We obtain similar results when we also include votes going to the center-left. We also use Cagé and Piketty (2023)'s income percentiles of each commune in graphs of the 1871 election (Figures 2 and A.9).

[76] These newspapers were chosen because they were available in a digital format for the entire period. A few editions of *Le Figaro* are missing in early March, and Paradis' journal ends with the Armistice, so we obtain the date for the report of the Treaty in Paris from a different newspaper, *Le Temps*.

[77] Available at unehistoireduconflitpolitique.fr.

Table A.18: Quotes from newspapers reporting major battles

Event	Quote in Le Figaro Paris	Quote in Le Salut Public Lyon	Quote in La Gironde Bordeaux
		Main battles	
Chevilly (1870-09-30)	The battles of... Chevilly, ... murderous for the enemy, cost us dearly!... in short, a sad result, since it is always paid for with tears. (1870-10-02)	... two different sorties from the besieged. (1870-10-04)	At the engagement which took place on Saturday evening, in the very village of Créteil, between the troops of General Vinoy and the enemy... (1870-10-02)
Bellevue (1870-10-07)	... the entire Metz garrison... marched out... They were repulsed in their attack on the entrenched positions of the German troops, and returned to their fortress with a loss of approximately 2,500 men. (1870-10-18)	The situation of Metz- narrative looking at Bazaine's movements (1870-10-09)	As Bazaine has retreated today [...] (1870-10-08)
First battle of Orleans (1870-10-11)	Orleans. The Prussian monitor would have announced, it is said, that a corps attacked the army of the Loire and occupied Orleans (1870-10-15)	After a vigorous battle, honorable for our troops, I evacuated Orleans and retreated to the left bank of the Loire (1870-10-14)	Orléans has been occupied by the enemy since yesterday (1870-10-14)
Metz (1870-10-27)	Our unfortunate country has not yet exhausted the series of cruel misfortunes that strike it. This morning was the news of the capitulation of Metz. (1870-10-31)	The capitulation of Metz to Versailles, [...] (1870-10-31)	The capitulation of Metz brutally adds to the series of shame and disasters that have been unleashed on us since the beginning (1870-11-01)
Le Bourget (1870-10-30)	Le Bourget, [...], was bombarded throughout the day yesterday without success (1870-10-31)	The bulk of our troops remained in the village of Le Bourget which they put in a state of defense (1870-11-05)	Prussian dispatches teach us the retaking of Le Bourget positions by German troops (1870-11-04)
Coulmiers (1870-11-09)	At five o'clock in the evening, the Government posted...: The army of the Loire... captured Orléans yesterday, after a two-day struggle. (Paradis journal,1870-11-14)	RECOVERY OF ORLEANS. 'Will fortune, in the end, do without persecuting us? (1870-11-12)	We fought yesterday all day around Coulmiers. The operation of the French army has fully succeeded (1870-11-12)
Beaune-la-Rolande (1870-11-28)	Pigeons arrived, in fact, carrying the following dispatches... A French account gives the following details on the combat at Beaune-la-Rolande... (Paradis journal, 1870-12-16)	He pushed not far from Beaune La Rolande, where the enemy was in strength, and there we experienced a defeat (1870-12-02)	We must add that if Beaune-la-Rolande was able to put up such a heroic defense... and who, today, have retreated into the surrounding woods. (1870-11-30)
Loigny (1870-12-02)	...the defeat of our army of the Loire and the capture by German troops. To the capture of Orléans, we must add the capture of Thionville (Paradis journal, 1870-12-07).	Mr. Gambetta said that Orleans had been abandoned ... (1870-12-07)	During the night of December 3 to 4... General d'Aurelles spoke of the necessity which was necessary, according to him, to evacuate Orléans (1870-12-07)
Villiers (1870-12-03)	General Ducrot's proclamation... explains to us ... We left the positions we had captured to direct our efforts to a point where the enemy's forces seemed less formidable to us. (1870-12-06)	THE SORTIE FROM PARIS ... It is much less considerable progress ... (1870-12-05)	The corps of General Ducrot [...], occupied the banks of the Marne (1870-12-05)
Beaugency (1870-12-10)	That General Chanzy's retreat was well designed, well executed, that it could be repaired... We do not blame the general, we blame the editor of the dispatch who begins by being pleased that the line of the Loire is being defended and then is pleased that it is being abandoned (1870-12-21)	The last important affair of General Chanzy's army ... on our side the losses are sensitive. (1870-12-14)	The last important affair of General Chanzy's army was on December 10, and lasted from 8 a.m. to 5:30 p.m... On our side, the losses are significant. (1870-12-14)
Le Mans (1871-01-12)	As for Chanzy's defeats [...] (1871-01-21)	The losses on both sides, poorly known, are serious (1871-01-14)	Today we had the Battle of Le Mans. The enemy attacked us all along the line. (1871-01-13)
Buzenval (1871-01-19)	If the battle of January 19, did not give the results that Paris could expect, it is one of the most considerable events in the siege... (1871-01-22)	It is clear that this is not yet the big sortie, which has been overdue for so long and which now cannot be delayed any longer. The military situation therefore varied very little. (1871-01-22)	...relating to the sortie of General Trochu on January 19. (1871-01-22)

The sources are *Le Figaro*, *La Gironde*, and *Le Salut Public* for Paris, Bordeaux, and Lyon respectively, unless otherwise specified.

Table A.19: Quotes from newspapers reporting peace events as well as minor and inconclusive battles

Event	Quote in Paris	Quote in Lyon	Quote in Bordeaux
		Peace events	
Armistice (1871-01-28)	The government posted the following proclamation today: Citizens, The convention which puts an end to the resistance in Paris has not yet been signed, but it is only a delay of a few hours. (1871-01-29)	We learned last night that the armistice was signed on 28 at Versailles (1871-01-30)	Word is sent from Versailles, January 28: Mr. de Bismarck has signed with Mr. Jules Favre the capitulation of all the forts of Paris, and an armistice of twenty-one days... (1871-01-31)
Treaty of Versailles (1871-02-26)	The war indemnity amounts to 5 billion... We lose Alsace and Metz... (Le Temps, 1871-02-28)	2nd. France will pay five billion francs, including one billion in 1871. The rest over the space of three years. (1871-03-	Art. 2. France will pay H.M. the Emperor of Germany the sum of five billion francs. (1871-03-02)
		Minor battles	
Strasbourg (1870-09-28)	There is some information, which has reached from Strasbourg to us, that the total figure of the dead and wounded... (1870-10-02)	Rendition of Strasbourg and taking possession of this place by German troops (1870-10-01)	French dispatches on September 29, from Colmar and Belfort, confirm the capitulation of Strasbourg. (1870-10-01)
Thionville (1870-11-24)	...the defeat of our army of the Loire and the capture by German troops. To the capture of Orléans, we must add the capture of Thionville (Paradis journal, 1870-12-07)	Thionville's bombing has started yesterday; There are eighteen strokes per minute. (1870-11-28)	Thionville, well supplied and well defended, has been on fire since Sunday. (1870-11-30)
		Inconclusive	
Chateaudun (1870-10-18)	And Châteaudun is only a ruin! (1870-10-28)	Châteaudun, a small, open and defenseless town! (1870-10-25)	Châteaudun was taken last night (1870-10-21)
Hallue River (1870-12-24)	The Prussians even abandoned Rouen [...] to block the passage to the troops of Faidherbe (1871-01-09)	Our success was assured at five o'clock (1870-12-27)	Our success was full at five pm (1870-12-26)
Bapaume (1871-01-03)	Today, January 3, battle under Bapaume... — We have driven the Prussians from all positions, from all villages. They suffered enormous losses, and we suffered serious losses. (1871-01-09)	The enemy, fully beaten, has been pushed back to Bapaume (1871-01-06)	They experienced huge losses, and we serious losses (1871-01-06)

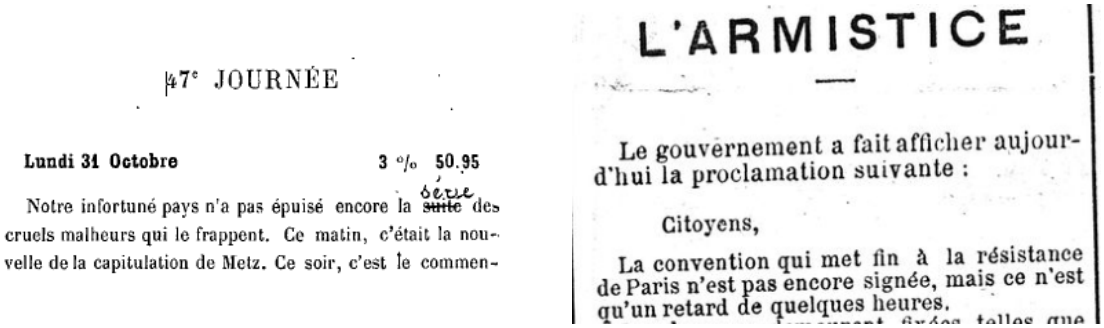
The sources are *Le Figaro*, *La Gironde*, and *Le Salut Public* for Paris, Bordeaux, and Lyon respectively, unless otherwise specified.

Table A.20: Quotes from newspapers: rumors and first mentions of war events

Event	Quote in Le Figaro Paris	Quote in Le Salut Public Lyon	Quote in La Gironde Bordeaux
First mention of events (corroborated or confirmed later)			
Spicheren (1870-08-06)	From Metz it is announced that there is a commitment on the side of General Frossard (1870-08-08)		
Sedan (1870-09-01)		Our private correspondence tells us that a dispatch, which arrived yesterday morning at the Tuileries, announced that the great battle had begun. (1870-09-02)	
Chevilly (1870-09-30)			The action began the day before yesterday, [...], between Chevilly and Artenay (1870-10-01)
Bellevue (1870-10-07)		Bazaine and his generals would be able to reject the besiegers to the north (1870-10-08)	
First battle of Orleans (1870-10-11)		The enemy was superior in infantry, cavalry and especially in artillery (1870-10-11)	General Reyers [...] had to fall back on the forest of Orleans (1870-10-12)
Chateaudun (1870-10-18)			Upon arrival of the franc tireurs sent from Châteaudun, they fled (1870-10-20)
Metz (1870-10-27)	The rumor of the capitulation of Metz had already circulated in Paris yesterday. (1870-10-29)		
Loigny (1870-12-02)		The enemy withdrew in the direction of Loigny and Château-Cambray (1870-12-04)	
Beaugency (1870-12-10)	the army of the Loire was divided into two parts... held out with indomitable courage and tenacity... between Josnes and Beaugency. (1870-12-17)	The main effort of the enemy focused on Beaugency (1870-12-09)	The report of General Chanzy, from the 7th, says: We were attacked today along the entire line (1870-12-10)
Le Mans (1871-01-12)			Le Mans, January 10. General Chanzy at war... (1871-01-12)
Buzenval (1871-01-19)	...and it was within these lines that our brave defenders fell, while they climbed the ravine slopes and crossed the trenches of Buzenval and La Bergerie.		

The sources are *Le Figaro*, *La Gironde*, and *Le Salut Public* for Paris, Bordeaux, and Lyon respectively, unless otherwise specified.

Figure A.20: Examples of the sources for two events



47e JOURNÉE

Lundi 31 Octobre 3 % 50.95

Notre infortuné pays n'a pas épuisé encore la ~~suite~~ série des cruels malheurs qui le frappent. Ce matin, c'était la nouvelle de la capitulation de Metz. Ce soir, c'est le commen-

L'ARMISTICE

Le gouvernement a fait afficher aujourd'hui la proclamation suivante :

Citoyens,

La convention qui met fin à la résistance de Paris n'est pas encore signée, mais ce n'est qu'un retard de quelques heures.

To the left is the report of the Fall of Metz in Paradis' journal. Note that every day he wrote down the price of the *rente*, which underscores the importance of the asset. To the right is the news of the Armistice, printed in *Le Figaro* on January 29, 1871.

A.9.7 Legislators

We further collect the political affiliation and department of each representative to the National Assembly from 1816 to 1893. The source is the *Assemblée nationale*.[78] It should be noted that this period encompasses many different regimes, with and without free elections, and with different extensions of the franchise. Also, even though the electoral rule allowed for candidates to run in more than one district, the database only lists one per candidate, which we use. The legislators classified as Parisians are those from the Seine departments. For party affiliation, we classified "leftists" and "conservatives", and discarded those who we could not classify. We calculated the ratio in Figure A.7 as the number of leftists over the sum of leftists and conservatives. The left affiliations are: leftist, republican, socialist, liberal, Mountain, Danton, and opposition (to Napoleon III). The conservative affiliations are: right, monarchist, Bonapartist, legitimist, and conservative. Therefore, the graph shows the ratio of leftists to conservatives, excluding moderates. The graph looks very similar if we depict leftists as a percentage of the total.

A.9.8 Ratification of the peace treaty

Votes for ratification of the peace treaty (table A.8). We assemble data on votes and votaries for the following three departments: Seine (Paris), Gironde (Bordeaux) and Rhone (Lyon). Our sources are *La Gironde*, 1871-03-03 (roll-call), and *Journal Officiel*, 1871-02-14 and 19th (representatives and their districts). Table A.21 lists every deputy from those departments and their votes. The political affiliations are from the *Assemblée nationale*[79].

[78] Available at https://www2.assemblee-nationale.fr/sycomore/recherche
[79] Available at https://www2.assemblee-nationale.fr/sycomore/recherche

Table A.21: Votes for ratification of the Peace Treaty

	Seine (Paris)	Gironde (Bordeaux)	Rhone (Lyon)
Yes	Frebault, Leon Say, Pothuau, Saisset, **Thiers**, Vacherot	Adrien Bonnet, Adrien Leon, Changarnier, Aurelle de Paladines, Martin des Palieres, J. Princeteau, Jos De Caeayon-La-tour, Jules Dufaure, Le Duc Decazes, Marquis de Lur-Saluces, Nath. Johnston, Paul Journu, Richier, **Thiers**	Berenger, De Laprade, De Mortemart, De Saint-Victor, Ducarre, Flotard, Glas, Leroyer, Mangini, Morel, Perret, **Trochu**
No	Arnaud, **Clemenceau**, Cournet, Delescluze, Dorian, Edmond Adam, Farcy, Felix Pyat, Floquet, **Gambetta**, Gambon, Greppo, Henri Brisson, Henri Martin, Joigneaux, Langlois, Lockroy, Louis Blanc, Malon, Mar Dufraisse, Martin Benard, Milliere, Peyrat, Quinet, Ranc, Razoua, Rochefort, Schoelcher, Tirard, Tolain, **Victor Hugo**		
Did not vote	**Garibaldi**, Jean Brunet, **Favre**, Ledru-Rollin, Littre, Sauvage		**Favre**

Source of deputies by department: *Journel Officiel* 1871-02-14 for Gironde and Rhone, and 1871-02-19 for Seine (some representatives were elected in more than one department). Source of votes: *La Gironde* 1871-03-02. Notable representatives in bold (Favre was in favor, but not present. Garibaldi was against, but not allowed to vote).

A.9.9 Food prices in the besieged city

We obtain food prices from the besieged city of Paris from the contemporary journal of an American, Nathan Sheppard: *Shut up in Paris*, published in 1874. Sheppard recorded prices of food items with a weekly frequency. We used the items with the most observations for both staples (butter, potatoes, and eggs), luxuries (fowl and rabbit), and, for illustration two unusual meats: elephant (which appeared when fodder for the zoo animals ran out at the *Jardin des Plantes*, at Christmas 1870) and cat, for which a market developed only late in the Siege (3 observations). We use these data in Section 5.