Markets under Siege:

How Differences in Political Beliefs Can Move Financial Markets

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Abstract

Can differences in beliefs about politics, particularly the benefits of war and peace, move markets? During the Siege of Paris by the Prussian army (1870-71) and its aftermath, we document that the price of the French 3% sovereign bond (*rente*) differed persistently between the Bourse in Paris and elsewhere, despite being one of the most widely held and actively traded financial assets in continental Europe. Further, these differences were large, reaching the equivalent of almost 1% of French GDP in overall value. We show these differences manifested themselves during the period of limited arbitrage induced by the Siege and persisted until the terms of peace were revealed.

As long as French military resistance continued, the *rente* price was higher in Paris than the outside markets, but when the parties ceased fire and started negotiating peace terms this pattern was reversed. Further, while the price responded more to war events in Paris, the price responded more to peace events elsewhere.

These specific patterns are difficult to reconcile with other potential mechanisms, including differential information sets, need for liquidity, or relative market thickness. Instead, we argue, these results are consistent with prices reflecting the updating of different prevailing political beliefs that existed in Paris and elsewhere about the benefits of war and peace.

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1 Introduction

Can differences in beliefs about politics, particularly the benefits of war and peace, move markets? More specifically, can changes in the beliefs of particular groups of investors change equilibrium prices, even for actively traded and liquid assets such as for sovereign debt in advanced economies? Or will the actions of investors whose beliefs have not changed ensure that prices stay the same? Recent research establishes that political beliefs often shape *individual* investment choices. However, much less is known about how, if at all, political beliefs can shape real-world *equilibrium* prices.

The question of whether differences in political beliefs can shape aggregate market outcomes has been thus far hard to answer arguably for the simple reason that we typically observe only one price for an asset. Even if we do observe prices in multiple markets, which might reflect the beliefs of different groups of investors, arbitrage usually leads prices to converge rapidly. At least since the introduction of the telegraph, thick financial markets have tended to be characterized by the "law of one price".

Further, with that one price determined ultimately by the marginal investors in the market, it is very difficult to attribute the actual prices that are realized by that market to *changes in political beliefs* rather than changes in endowments or the information that those investors may possess. Political events, such as close elections, are often accompanied by changes in the market price for companies that may be expected to benefit from the policies of the new regime. However, a key open question remains about the extent to which these changes reflect differing political beliefs rather than jointly-shared, even if sometimes overshooting, changes in expectations of the future stream of profits of the firm in response to government policy, or other economic changes that accompany political events. To answer the question of whether differential political beliefs can shape equilibrium prices, therefore, an ideal setting would involve the same asset being traded by different marginal investors with different political beliefs with the possibility of different equilibrium prices. In this paper, we exploit a historical episode that is a very 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 to be largely entrusted to carrier pigeons and hot air balloons.[1] Despite the Siege, both the main Bourse in beleaguered Paris and other French stock exchanges still connected to the rest of the world—particularly in Bordeaux and Lyon—continued to function. In particular, French

[1]The carrier pigeons of Paris were fêted as heroes, honored in Paris by a monument unveiled in 1906 and melted by the Germans in 1944 (Hayhurst 1970). The balloon remains a symbol of the city.

sovereign debt, the most liquid three per cent *rente*, continued to be actively traded.

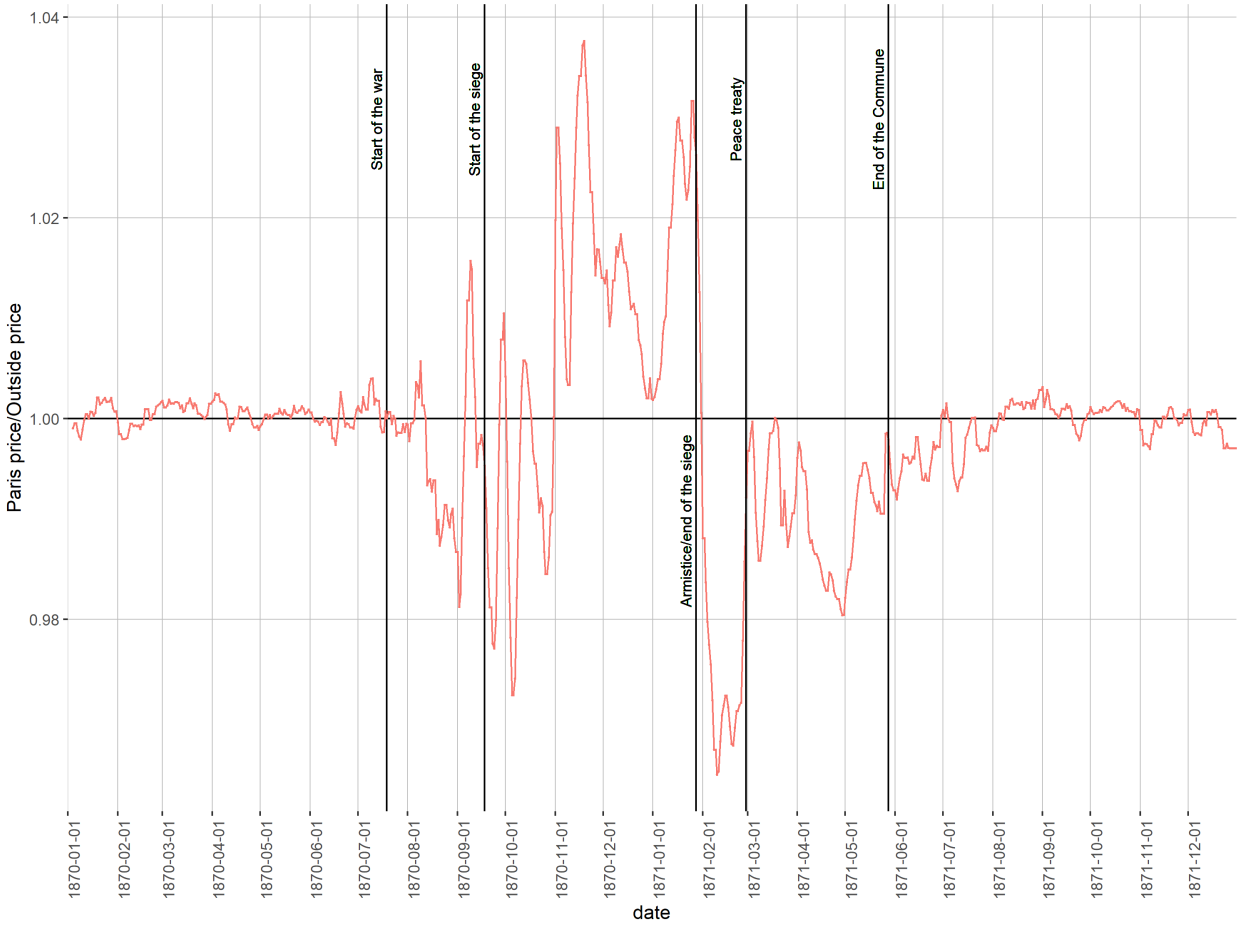
Yet, stark differences between the political views prevailing among Parisians and elsewhere in France are long-standing in French history, and political attitudes during the Franco-Prussian war were no exception. These historical facts allow us to observe three time series of equilibrium prices for the same actively traded asset, and thus a unique opportunity to document if and to what extent equilibrium prices can be shaped by differing political views about war and peace.

We first document that during the Siege of Paris, the price of the three per cent *rente* differed persistently between markets in Paris and elsewhere in France, despite being one of the most widely held and actively traded financial assets in continental Europe. Figure 1 previews this result. From the start of the Siege on 19 September 1870 until the ceasefire on 28 January 1871, the *rente* price in Paris was on average 1% higher than in Lyon and Bordeaux. In contrast, as soon as the ceasefire began, the Siege was lifted, and negotiators sought to hammer out the costs to France of securing peace, these patterns were reversed: between the Armistice and the signing of the peace treaty (on 26 February 1871), prices outside Paris were on average 2.5% higher. These differences are large, amounting to 0.3% and 0.89% of French GDP respectively.[2] In contrast, despite underlying political differences, but consistent with the law of one price, rente price differences in the early phases of the war prior to the Siege and in peacetime more generally, were almost non-existent.

We next conduct a series of event studies, examining how the arrival of news of battles as well as peace negotiations affect prices in these different markets. We show that the rente price in Paris during the Siege responded more to the arrival of news of the war and less to news about the peace than that of Bordeaux and Lyon. In particular, relative to the outside markets, the two-day return in Paris fell 1.18% more in response to news of military defeats and rose 2.2% more in response to the occasional French military victory. In contrast, the two day return in the outside exchanges rose 3.32% more than Paris in response to the main peace event, the Armistice. Finally, the revelation of the terms of the peace treaty itself, with the loss of much of Alsace-Lorraine and a 5 Billion Franc indemnity equivalent to 25% of French pre-war GDP (Dehdari and Gehring 2019; Occhino et al. 2008), again raised the spectre of violent conflict. This negative news for the prospect of enduring peace led to a

[2]To calculate these numbers, we first estimate that these differences were equal to 0.49% (during the siege) and 1.48% (during peace negotiations) of the nominal value of bonds. Second, we calculate that 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, we multiply these two numbers in order to compare the difference in prices to GDP.

Figure 1: Price ratio of the 3% sovereign bond (*rente*) between Paris and other French exchanges



This figure shows the ratio of the price of 3% rente in Paris divided by the average of the Bordeaux and Lyon prices for that same asset (7-day rolling average). Notice three patterns. First, consistent with the law of one price, the price was very similar in Paris and elsewhere (a ratio of 1) before the start of the war and after the defeat of the Paris Commune. Second, the Parisian price deviated and tended to be consistently higher throughout the Siege. Third, this pattern reversed, and the outside price was higher between the Armistice (end of the Siege and the announcement of the terms of the peace treaty.

3.39% higher fall in the outside markets relative to Paris.[3]

We interpret these differences as being consistent with the different political beliefs of the marginal investors in Paris and the two stock markets still connected to the world outside, and specifically reflecting differing views on the gains from continuing the war versus suing for peace. As we discuss below, many in Paris considered continued resistance the key means to obtain favorable peace terms.[4] Therefore, we argue, the marginal investor in Paris responded more negatively to defeats (and more positively to the occasional French victory). Outside Paris, on the other hand, many thought that a quick end to the war would encourage the Prussians to offer favorable terms. Therefore, we argue, these markets reacted positively to the surrender of French armies, only to fall when the high cost of the peace terms was revealed.

To the best of our knowledge, this is the first paper to document the presence of persistent differences in market prices 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 laying down arms to avoid the costs of continued conflict.[5]

Beyond this, our results are arguably even more striking for a number of reasons. Wealth inequality was very high in 1870[6], and though the rente was relatively widely held, market participation remained largely the preserve of the economic elite, both in Paris and elsewhere. One might expect elites all over France to broadly share the same beliefs. Yet, we find that during the Siege, different political views in Paris and elsewhere, even if not initially

[3]Devereux and Smith 2007 describes this payment as "the largest transfer in history". It is hard to overstate the size of the transfer: it was also 2.5 times the annual government budget (Devereux and Smith 2007), and around 1.67 times the size of annual French exports (Gavin 1992).

[4]Differences in political attitudes between Parisians and elsewhere in France, including major cities like Lyon and Bordeaux, are long-standing, being accentuated during the Revolution and the economic transformation and political upheaval that France experienced during the nineteenth century. The Franco-Prussian War showed continuity in these patterns. In particular, relatively more Parisians leaned to the left, were more likely to be Republican, and had greater optimism in the virtue and effectiveness of the citizen armies upon which France was forced to rely. In contrast, more of those outside Paris leaned to the right, supported the restoration of monarchical rule, and were skeptical of France's prospects on the battlefield (Wawro 2003, p. 232). We confirm these differences using roll-call votes of representatives asked to ratify the treaty. In particular, Parisian representatives voted against the ratification of the peace treaty (6 in favor and 31 against). On the other hand, apart from one abstention, every representative from Bordeaux and Lyon voted in favor. The final result was 546 in favor and 107 against.

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

[6]In 1867, the richest 10% in France owned 81% of the wealth ("World Inequality Database" 2021). See also Piketty et al. 2006.

shared by economic elites, began to be translated into substantially and persistently different equilibrium prices.

Further, we describe how these specific patterns are difficult to reconcile with other key potential mechanisms, including differential information sets, need for liquidity, or relative market thickness. First, we show that price differences cannot be explained by different information environments. The Siege limited communication between Paris and the rest of the world, but did not put a stop to the sharing of information. We track when Paris prices first appear in a business-oriented Bordeaux newspaper, *La Gironde* before and during the Siege. We find that though the Bordeaux price tended to respond to the Paris price in peacetime, Bordeaux prices did not converge when Paris prices arrived during the Siege. Neither did prices in Paris converge when news from outside entered the city, whether borne by carrier pigeon or siege-running smuggler. Interestingly, the price divergence persisted even after more regular communications were partially restored following the Armistice but prior to the peace treaty. This was a time when Paris prices were once again printed daily in Bordeaux but arbitrage was still difficult due to delays in the transmission of information.

We next describe why our results are hard to explain by differences in liquidity. First, price differences were too persistent to reflect short-term liquidity shocks. Second, during the Siege, liquidity was arguably worse in Paris but prices were higher. During the Siege, and relative to Bordeaux and Lyon, the population in Paris faced grave hunger – Parisian restaurants put zoo animals on the menu – and, later on, bombardment as well. One might expect this to lead to overall market pessimism, with investors fire-selling securities to purchase food, or increased discounting of the future. We find the opposite. Third, we calculate price differences for two other assets that were also double-listed and liquid (the bonds and stocks of the *Midi* railroad). We also find persistent price differences for these assets. If these were driven by differences in liquidity , we would expect them to line up with price differences in the three percent *rentes*. However, we find that price differences are unrelated across assets, suggesting that market-wide differences in liquidity are not at play.

Our results are also unlikely to be explained by 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. We document instead that during the Siege the opposite was true, however, with Paris responding more strongly to war news than elsewhere.

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 economic benefits. For example, U.S. investors from Democrat- and Republican-leading ZIP codes appear to 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. 2021).[7] There is also a growing literature showing that political beliefs affect the actions of financial professionals, which in turn affect investor behavior (Hong and Kostovetsky 2012, Hutton et al. 2014, Kempf and Tsoutsoura 2018, and Goldman et al. 2020).[8]

At the same time, it is an open question whether such differences of beliefs have implications for market-wide pricing (and thereby aggregate investment decisions). In particular, the effects of beliefs on investment decisions are 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. 2021). Moreover, cooler (less-partisan) heads may prevail in equilibrium and might arbitrage away any partisan impact on prices such that, in equilibrium, asset prices are unbiased. As noted above, 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, but it is less clear whether this is the result of belief disagreement or instead reflects news that also affects future cash-flows (e.g. Addoum and Kumar 2016; Faccio 2006; Fisman 2001; Girardi 2020; Mattozzi 2008). 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.[9]

Our paper is also related to an established literature on the importance of difference of beliefs for investment decisions (see, among others, Miller 1977, Harrison and Kreps 1978, Jarrow 1980, Harris and Raviv 1993, Kandel and Pearson 1995, Hong, Scheinkman, et al. 2006, and Hong and Stein 2007). Recent empirical work suggests that differences in beliefs

[7]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.

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

[9]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.

are significantly related to trading activity, but that economic effects are small (e.g. Ameriks et al. 2020, Giglio et al. 2021, and Cookson et al. 2020). Further, the evidence that differences of beliefs have aggregate (pricing) implications is limited. There are some exceptions. There is evidence from dual-listed shares that is at least consistent with differences of beliefs affecting equilibrium prices (Froot and Dabora 1999).[10] Compared to this literature, our paper provides direct evidence that differences of *political* beliefs can have economically important equilibrium pricing effects.

Our paper also relates to a literature examining from where differences in beliefs emerge. There is growing evidence that personal experience is important (E.g. Vissing-Jorgensen 2003, Greenwood and Nagel 2009, Choi et al. 2009, Malmendier and Nagel 2011, Malmendier and Nagel 2016 Koudijs and Voth 2016). There is also evidence that social networks and peer effects matter (E.g. Hong, Kubik, et al. 2004, Hong, Kubik, et al. 2005, Bursztyn et al. 2014, Bailey, Cao, et al. 2018 and Bailey, Dávila, et al. 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 even infected the local economic elite (who likely set asset prices on the margin) such that their beliefs deviated from that of economic elites elsewhere.

Our paper also builds upon a literature that explores the relationship between war and financial markets (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 (e.g. Brewer 2002), the ability for 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.[11] At the same time, financial markets, by aggregating the beliefs of investors, can provide important information to political decision-makers.[12] As conflict, and particular defeat and its aftermath, is economically destructive

[10]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 where they are located. Moreover, firms that are covered by more analysts 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.

[11]See for example DellaVigna and La Ferrara 2010; Guidolin and La Ferrara 2010.

[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

and can lead to increased 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 (Jha and Van Rensselaer 2021; Rigobon and Sack 2005; Schneider and Troeger 2006; Zussman et al. 2008).[13] The informative aspect of financial markets can be further reinforced when decisionmakers are themselves invested in broad financial assets, aligning their interests with the broader economy as well (Jha 2015; Jha, K. Mitchener, et al. 2020; Jha and Shayo 2019). Both of these effects can lead asset prices to moderate the political behavior of individuals, including elites. Our paper shows, however, that this potential moderating effect depends importantly on the political views of marginal investors. Our paper is uniquely available to show this, because we can observe the price for the same asset in two segmented markets.

We next provide some brief historical background on the Franco-Prussian war, the market microstructure for the French sovereign bond, and the politics of France useful for understanding our results. We next turn to a description of the novel data we have collected before presenting our main results. Finally, we discuss the implications of our findings and avenues for future research.

2 Historical Background

2.1 The War

The Franco-Prussian War of 1870-71 was the greatest conflict to take place in Europe between the end of the Napoleonic Wars and the First World War (Clodfelter 2017). Though the war itself lasted less than half a year, it was a turning point in European history. In that period, France would see the death of an empire and the birth of a republic, Germany would emerge as a unified state, and the stage was set for the more global conflicts to come (Horne 2012). In short, the Prussian prime minister, Otto von Bismarck, sought to provoke the

Union victory. K. J. 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. We contribute to this literature by reinforcing the point that the 'smart money' may actively disagree and such responses can be importantly influenced by the changing beliefs of the marginal investor rather than necessarily reflecting a broader consensus.

[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.

French emperor Napoleon III to declare war in order to unite Germany.[14] On July 13th, Bismarck issued press releases manipulating the language of a diplomatic communication, the so-called 'Ems telegram', omitting key phrases so that it seemed that the French had insulted the Prussian king, incensing German public opinion and seeking to provoke the French. Bismarck's attempts proved successful, and on July 16th, 1870, the French imperial parliament, the *Corps Legislatif*, declared war.

The war was initially very popular on the Paris street and among representatives of the *Corps Legislatif*– with "war fever" among some (Wawro 2003(pg.38)), combining with concerns about a rising Germany. The call to arms on July 14th was greeted by crowds in the streets of Paris shouting "*á Berlin!. . . á bas Bismarck!*[To Berlin!. . . Down with Bismarck!]"Wawro 2003(pg.38). In the *Corps Legislatif*, the call for 50 million francs ($ 150 million) to pay for a punitive war against Prussia was greeted by shouts of "*vive la France! vive l'Empereur! Bravo! Bravo"*, with all but 16 representatives in the 260 person chamber rising in acclaim.[15]

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] Importantly too, the French rente price did not reflect the war fever outside the Bourse, and the rente fell a dramatic 10% both in and outside Paris in the lead up to the war (see the time series of the rente price in Figure A.1).

And indeed, France's diplomatic and military preparations also fell short. 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 (but also relatively old) professional soldiers - *les grognards* (the grumblers)- which gave it a short-term advantage. Prussia, in

[14]For example, on July 10th, 1870, Bismarck wrote that "*politically a French attack would be very beneficial to our situation.*"(cited in Ferguson 2000,pg.191). See also Dehdari and Gehring 2019. 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. This was accompanied by a large fall (of more than 10 per cent) in the French 3 per cent rente as well (see Figure A.3). Prussia's dramatic success had removed its key rival to leadership in the German lands but had also left a set of very restive south German states that did not wish to cede autonomy to a German empire dominated by Prussia.

[15]Interestingly, the 16 opposed were "irreconcilable" Republicans, led by Leon Gambetta, who would be among the most pro-war with the declaration of the Republic. Gambetta argued: "we would be the first to stand for a *national* war in the defense of our homeland. We will not stand for an aggressive *dynastic* war!" (Wawro 2003(pg.39), his italics.)

[16]In the *Corps Legislatif* too, moderate voices spoke, not against war, *per se*, but its current timing. Adolphe Thiers, who after the Prussian victory against Austria four years earlier had declared "the way to save France is to declare war on Prussia *immediately*" Wawro 2003(pg.17), remarked in the debate:"No one desires reparation for the events of 1866 more than me, but *this* occasion is detestably badly chosen." (pg.39, his italics).

contrast, had instituted universal conscription, which allowed it to access younger and more literate soldiers. This meant that if the war endured, they would have a large numerical advantage, as the reservist troops were mobilized (Wawro 2003). Further, while Prussia had inferior firearms, they enjoyed far superior artillery.[17]

However, it was not necessarily obvious *ex ante* that France would lose the war. This changed with a series of missteps. French imperial forces squandered their early numerical advantages by failing to seize the initiative (Wawro 2003).[18] Instead, French commanders preferred to wait for the Prussian forces to attack strongly defended strongpoints. This might have worked if the Prussian artillery had not effectively targeted the French emplacements. Prussian successes against the fortified emplacements in Wissenbourg and Spicheren- Wörth forced French armies to retreat, even as Prussian numerical advantages were building as reservists were called to arms. Napoleon III also split his army, allowing the Prussians to surround them separately. Marshal Bazaine's army contested a major battle at Gravelotte before he withdrew to the fortress-city of Metz, where he was besieged.[19] The other major field force, which would include Emperor Napoleon III himself, withdrew towards Mars-la-Tour and ultimately Sedan, where it too was surrounded. After a disastrous battle there on the 1st September 1870, which led to around 122,031 French killed, wounded, or captured (Clodfelter 2017), the French Emperor rode alone through the Prussian lines to seek terms of surrender.

Ironically, the capture of the Emperor at Sedan by the Prussians proved to be a liability for Bismarck, as the capture of the Emperor delegitimized the remaining Imperial regime, and thus those who might have been able to negotiate with Prussia on behalf of all France.[20] Shortly thereafter, a group of revolutionaries ascended the steps of the Hotel de Ville in Paris to declare the deposition of the emperor and the creation of the Third Republic. The birth of what would become France's longest-lived republic was however not met with universal

[17]France had developed the highly accurate *Chassepot* rifle and put its faith in a newly-developed precursor to the machine gun- the *mitrailleuse*. The Prussians deployed the Krupp gun, which greatly out-ranged their French counterparts, the *bronze Napoleons* and thus could destroy French batteries from a distance, and with impunity, before turning against the infantry. This artillery imbalance would prove militarily crucial in a series of key battles (Wawro 2003).

[18]Reminiscent of the so-called 'Phony War' seventy years later, French forces did make a small foray of several companies into the Saarland, but they quickly withdrew.

[19]Bazaine, a hero of the Mexican War and the most senior Marshal, may have felt slighted by the appointment of Imperial favorites over his head (Wawro 2003). He would be tried after the war for treason.

[20]As part of later negotiations, Prussia would repeatedly threaten to release the Emperor or set up Marshal Bazaine, then still in command at Metz, as an alternative dictator. This was potentially credible since many of the professional officer corps were Bonapartists (Wawro 2003). However, their influence would wane as the professional forces besieged at Metz began to starve and became increasingly degraded as a fighting force.

acclaim. Again, the rente price tumbled (Figure A.1).

2.2 The Siege and the Politics

"*The obstacle to peace is Paris*"- Emilio Visconti-Venosta, Italian Foreign Minister, 22 Oct 1870.[21]

The new junta in control of the newly-established Republic in Paris 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 (largely Bonapartist) professional army, continued hope both for the war and for the new Republic lay in the *levee en masse*- new conscription of citizen-soldiers like those who had saved the Great Revolution (Ferguson 2000). New conscript forces were raised around France, with clusters both in the North (around Amiens) and in the South (around Orleans). But with such limited time, both these forces lacked training and discipline. Paris itself retained an extremely strong set of fortifications, defended by a mainly- citizen force of 300,000 and rings of forts. To put pressure on the French authorities within to negotiate terms, Prussia laid siege to Paris itself on September 19th, 1870.

Apart from the surrender of the professional forces still holding out in Metz, Strasbourg, Thionville, and other fortress towns, the key war events during the Siege of Paris largely centered around attempts to coordinate with French forces near Orleans. With its bridge across the Loire and rail connections, Orleans could promise resupply to the capital (Figure A.2). Orleans itself would change hands three times during the war.

However, coordination with breakout attempts from the city was hampered by the cutting of the telegraph lines and the Prussian forces who attempted to forestall news and letters from entering the city.[22] The French improvised, sending out carrier pigeons carried by hot air balloons and developing a new miniaturizing technology to maximise the information a pigeon could carry. These balloons could be sent from Paris, but once aloft, their trajectories were unpredictable and determined by the air currents, making it hard to return. One balloon carrying the key message to coordinate a breakout attempt with the forces in Orleans ended up in Norway (see Figure A.7).[23] Those flying low were pursued by Prussian cavalry (*Uhlans*) that scoured the countryside seeking their capture. Among those sent aloft to rally France

[21]UK Public Records Office (PRO): FO 425,98,89, Florence, 22 Oct. 1870

[22]The one main exception was that the American Minister to France, Elihu Washburne, was allowed to receive a regular *Times of London* in his diplomatic pouch on condition that he did not share it. This, too was stopped when the Prussians suspected that some news had been leaked.

[23]Two crews were also lost in the Atlantic Ocean.

in the name of the Republic was Gambetta himself, who ran a parallel administration from Tours and later Bordeaux.

After the Battle of Sedan, it was clear to almost everyone that France would have to come to terms if there was to be peace. However, the nature of those terms was much less clear. For the Republicans in Paris, the hope remained that the French conscript levies, along with the emergence of partisan forces—*the franc-tireurs*— behind the lines, could keep up a slow war of attrition. This approach might make the occupation costly enough for the Prussians that they would agree to leave without costing France its territorial integrity. Some also hoped for foreign pressure and involvement, particularly from Britain, Italy, Austria, and Russia. Paris itself faced increasing hunger and, beginning in January 1871, bombardment, as the Siege continued, but not the costs of occupation. In the countryside, the costs of war were also grave. The Prussians were charging the French for the occupation, looting by both French and Prussian soldiers was common, and reprisals against civilians for *franc-tireur* activity became widespread.[24]

For many outside Paris's walls, and indeed around the world, however, a common view was that the costs of war dominated the potential gains from continued resistance, and France should seek peace as soon as possible.[25] Ironically, despite claiming to be staunch republicans, the junta in Paris was aware that their pro-war view was a minority one for French voters in general, and they consistently delayed holding elections that would return a more pacifist government.[26] 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.[27]

[24]Bismarck, whose own son was a early casualty of the war, expressed a similar sentiment to Sherman in his famous March to the sea a few years earlier. Institutional memory of the *franc-tireurs* would also shape German military attitudes towards civilian partisans in the great wars to come (Wawro 2003).

[25]For example, on his account of the siege, Horne writes: "From the very first, the war was markedly less popular in the provinces than in Paris." (Horne 2012 p. 39).

[26]The Italian foreign minister complained that 'French politicians will not "accept certain conditions that the French *nation* might be disposed to accept" [e.g., Alsace-Lorraine] (Wawro 2003 pg246, op cit. PRO FO 425,98,89, Florence 22 Oct. 1870). Similarly, Wawro 2003 pg 246 writes: "...many of the neutral powers had begun to resent the French provisional government's intransigence and its unwillingness to hold national elections that, according to Italy's foreign minister, "would return an assembly with a strong pacific current". PRO FO 425,98,89, Florence

[27]Even after months of hardship and hunger, however, the Armistice was unpopular in Paris. When Jules Favre, the minister for foreign affairs, sent a messenger to the Germans to start armistice negotiations, he asked for secrecy: "God only knows what the Parisian populace will do to us when we are compelled to tell them the truth" (Horne 2012, p. 239). Another contemporary observed: "There is a danger. And that is, one doesn't know whether, the capitulation having been signed, it will not be rejected by the virile portion of Paris." (Horne 2012, p. 241).

France elected representatives to a National Assembly on February 8th, 1871. Consistent with our interpretation and with the views of contemporaries during the Siege, the elections resulted in a overwhelmingly conservative, rural, and pro-peace majority. Paris, on the other hand, elected mostly republican, pro-war, candidates[28]. On March 1th the Assembly voted to ratify the peace treaty. Table 1 confirms that a majority of the representatives elected in Paris (Seine district) voted against ratification, while, apart from one abstention, all the representatives elected in Bordeaux (Gironde) and Lyon (Rhone) voted in favor.[29]

Table 1: Votes for the ratification of the peace treaty

	Paris	Bordeaux	Lyon	Total
Yes	6	14	12	546
No	31	0	0	107
Did not vote	6	0	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 4th, 1871. The treaty was ratified with the votes of the conservative, rural, and provincial majority. The Parisian republican left opposed it.

2.3 The Bourses

The Paris financial market was "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, that were the longest-established stock exchanges in France after Paris.[30] Unlike Paris, these exchanges, moreover, remained largely connected by telegraph with the rest of the world, and thus can be considered to provide a reflection of the world price.

[28]Included among these were the writer Victor Hugo, the Italian Giuseppe Garibaldi, and the future prime minister Georges Clemenceau, who would make the recovery of Alsace-Lorraine a career goal (finally achieved in 1918).

[29]Sources: *La Gironde*, 1871-03-03 (roll-call), and *Journal Officiel*, 1871-02-14 and 19 (representatives and their districts).

[30]The Lyon exchange was the first provincial exchange to gain the right to establish a trading floor (*parquet*) in 1845 (Ducros and Riva 2014,6-7). Bordeaux did so in 1846. Newer exchanges were founded in Marseilles, Toulouse, Lille and Nantes. See Ducros and Riva 2014. Using commissions as a measure of transactions volumes, Ducro 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)

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 the business day (e.g. buying in Lyon, selling in Paris). 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 hot air balloons, carrier pigeons (carrying micro-filmed messages) and smugglers crossing enemy lines. After the Siege ended, telegraph connections were not yet restored. Prussians did allow people in and out of the city. It would only be in May 28$^{\text{th}}$, 1871, that the telegraph lines were repaired and restored.[31]

Table 2: Information flows between Paris and the outside world, during the Siege

		Inverse frequency, in days		Delay, in days		
		Mean	Max	25 pc	Median	75 pc
Siege	Balloons	2.85	8			
	Paris price printed in Bordeaux	4.40	14	5	6	7
	Pigeons	3.20	14			
	Outside news printed in Paris	3.20	10	3	4	6
Peace negotiations	Paris price printed in Bordeaux	1.82	6	4	4	6
	Outside news printed in Paris	1.29	6	3	3	4

This table shows the (inverse) frequency and delay of information flows in and out of Paris. During the Siege, hot-air 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. The mean (inverse) frequency measures the how often news arrived through each medium. 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 Bordeaux and Paris respectively.

In table 2, we show the amount of time that prevailed between instances in which news from outside the Prussian cordon were reported in Paris (and vice versa) during the Siege and during the subsequent peace negotiations. During the Siege, hot-air balloons landed outside of Paris every 2.85 days on average. Pigeons arrived on Paris every 3.2 days on average (but they only started arriving in October). We also report how often the Bordeaux newspaper *La Gironde* printed the prices of the Paris Bourse: every 4.4 days during the

[31]Private telegraphic communication between Paris and Bordeaux was restored on June 25$^{\text{th}}$ and between Paris and Lyon on June 23$^{\text{th}}$ (La Gironde, 1871/06/23-25, Le Salut Public 1871/06/23).

siege, every 1.82 days during peace negotiations. Lastly, we report how often *Le Figaro*, a Parisian newspaper, printed news from the outside world: every 3.2 days during the Siege, falling to every 1.29 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 6.6 days old, with the 25th and 75th percentiles at 5 and 7 days. The median news from outside reported in Paris was 4 days old, with the 25th and 75th percentiles at 3 and 6 days. The delays were shorter during peace negotiations, with a median of 4 days for Paris prices in Bordeaux and 3 days for outside news in Paris.

Though Paris and the outside continued sharing information, the presence of significant information delays did limit arbitrage between Paris and the regional markets.[32] Moreover, the physical clearing of accounts was likely restricted in the absence of reliable information channels. As a result, the price of an asset in Paris and elsewhere reflected the beliefs (and other conditions) of the marginal investor in those markets specifically and prices could diverge significantly.

2.4 The Rente

> *"[T]he French rente is a security which can always find buyers"*
> - Alphonse de Rothschild, August 22, 1870, quoted in Ferguson 2000.

We focus on the French 3 per cent sovereign bond, (henceforth, the *rente*).[33] The *rente* had a nominal value of 100 francs, and its interest was 3% annually, paid quarterly. During the nineteenth century, the rente was the most liquid security in France (Méricler 1858, pp. 63-66) and indeed, the most actively traded asset in continental Europe.[34] Further, the

[32]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. During the 18th century, when information travelled by sailing boats, similar delays led to substantial price difference between cross-listed assets (Koudijs 2015; Koudijs 2016).

[33]The French government also had previously issued bonds at 4%, 4.5% and 5%, which continued to be traded. However, it could redeem these at will, and as Homer and Sylla 1996,pg221 discuss, French investors "preferred discount issues with longer probable life and a greater chance of price appreciation", favoring the 3 per cent. Since interest coupons are not paid in the three cities on exactly the same day, for each day of payment we add 0.75 francs to the price of all subsequent observations. Our sources always specify which coupons were included with the listed bond.

[34]Rentes represented Fr 7,742,001,334 of the capitalization of the Paris Bourse in 1870 compared to Fr.5,028,424,050 for stocks (Viaene 2002). For an excellent overview on the French sovereign debt, see Hautcoeur 2007 and other volumes in that series.

rente was broadly held.[35] On the eve of the Franco-Prussian War, the number of primary subscriptions to the last-prewar rente issuance (of 1868) was 832,798 (having risen from 99,224 in 1854).[36]

3 Data

We hand-collected daily prices for the 3% *rente* for the years 1870 and 1871 for three cities with longest established stock exchanges in France: Paris, Lyon and Bordeaux. Our original sources are the *Cours Authentique* (Paris), the *Cours Officiel* (Bordeaux), and the newspaper *La Salut Public* (Lyon) (please see figures A.4, A.5, and A.6 for an example.) 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.

In order to measure the reaction to events, we need to know exactly when each city found out about each news event. Our main sources are the newspapers *Le Figaro* (Paris), *La Gironde* (Bordeaux), *Le Salut Public* and *Le Journal Des Dépêches* (both Lyon).[37] We also transcribed the corpus of all 29,903 surviving private messages as well as official messages received in Paris via carrier pigeon (please see wordclouds in Figures A.10 and A.11) and used the journal of a Parisian stockbroker, Jacque-Henri Paradis 1872, who kept and published a detailed account of life in Paris and the markets during the siege.

We include the most important military events during the Siege. We base our decision on importance based upon the extent of their coverage in Wawro 2003's definitive history of the *Franco-Prussian War*.[38] For robustness, we also include a set of events that were mentioned in Clodfelter 2017 or in Parisian newspapers, even though they were ultimately not as consequential (see Appendix A.1). For each battle, we follow Wawro in determining

[35] 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– putting it out of the reach of small savers– to merely 3 Francs according the Finance Law of July 1870.

[36] Further, the number of separate registrations of rentes (inscriptions) in the General Ledger in 1870 of 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 proprietaires 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).

[37] These newspapers were chosen because they were available in a digital format for the entire period.

[38] In particular, we go through each page of Wawro's book and classify major battles as those that he treats with separate chapters or sections with the battle name listed in capital letters in his book (the one exception is the Siege and Fall of Metz, which he describes in great detail.) *Minor* battles are those that are mentioned only once or in passing.

whether they were French victories (positive news for French arms) or French defeats (negative news).[39] We end up with nine major military events (eight defeats and one victory). We add two peace events, the armistice of January 28$^{\text{th}}$ and the peace treaty of February 26$^{\text{th}}$. The Armistice marks the end of the military conflict, and contemporaries interpreted it as positive news (especially outside Paris). The peace treaty revealed the very high cost demanded by Prussia, and therefore we classify it as negative news for the prospects of enduring peace.[40] Figure A.2 provides the *rente* price time series inside and outside the Siege over these events.

We focus on two-day returns for the *rente*. Returns in day t are calculated as: $\frac{p_t - p_{t-2}}{p_{t-2}}$. We choose a two-day window because that is the smallest time frame within which one can time with certainty the arrival of a specific piece of news.[41]

Three events (the signing of the Armistice, the recapture of Orleans, and the second fall of Orleans) were first reported in Paris as rumors and later on confirmed by the government. If the marginal investor gave the rumor some positive probability of being true, we would expect the market to partially respond to the rumor and to fully adjust once it is confirmed. Therefore, we add both returns to account for the full response to the event. Our results are robust to only using the rumor or only using confirmation.

4 Results

4.1 Persistent Price Differences during the Siege

We now turn more systematically to the evidence, and to document our first result: that prices for the *rente* were higher in Paris during the war and higher elsewhere during peace negotiations. Figure 2 summarizes these basic patterns, showing the distributions of the

[39] In our main results, we omit three minor confrontations Wawro does not list as major battles (the fall of Dijon, a defeat at Nuits-St-George and a minor victory at Villersexel) and two battles classifies as 'draws' that had similar numbers of casualties for both sides (Bapaume and Hallue). Our results are robust to including these battles. We also exclude battles that were only reported in Paris after the Armistice.

[40] Bismarck predicted that seizure of large parts of Alsace and Lorraine would humiliate France and lead to future war, but in this instance the generals, particularly von Moltke, largely prevailed (see Dehdari and Gehring 2019.) Indeed, as we examine in our companion work, France itself would very soon confront a civil war, with Communards in Paris refusing to accept the terms of peace.

[41] For example, news of the fall of Orleans was printed in Le Figaro on Saturday, October 15$^{\text{th}}$. The stock market traded for a couple of hours around noon (approximately 12 A.M. to 2 P.M., Monday to Saturday), and newspapers were distributed in the early morning. By choosing the two day time frame we incorporate the possibility that Thursday's news could have arrived between the printing of the Friday newspaper and the Friday stock market or after the Friday stock market. Since the response could be incorporated into prices on either Friday or Saturday, we compare the Saturday price to the Thursday price.

differences between the rente price inside and outside Paris in three time periods in the years 1870 and 1871: during peacetime (in green), during the Siege (blue) and during the period of peace-negotiations that followed the Armistice.

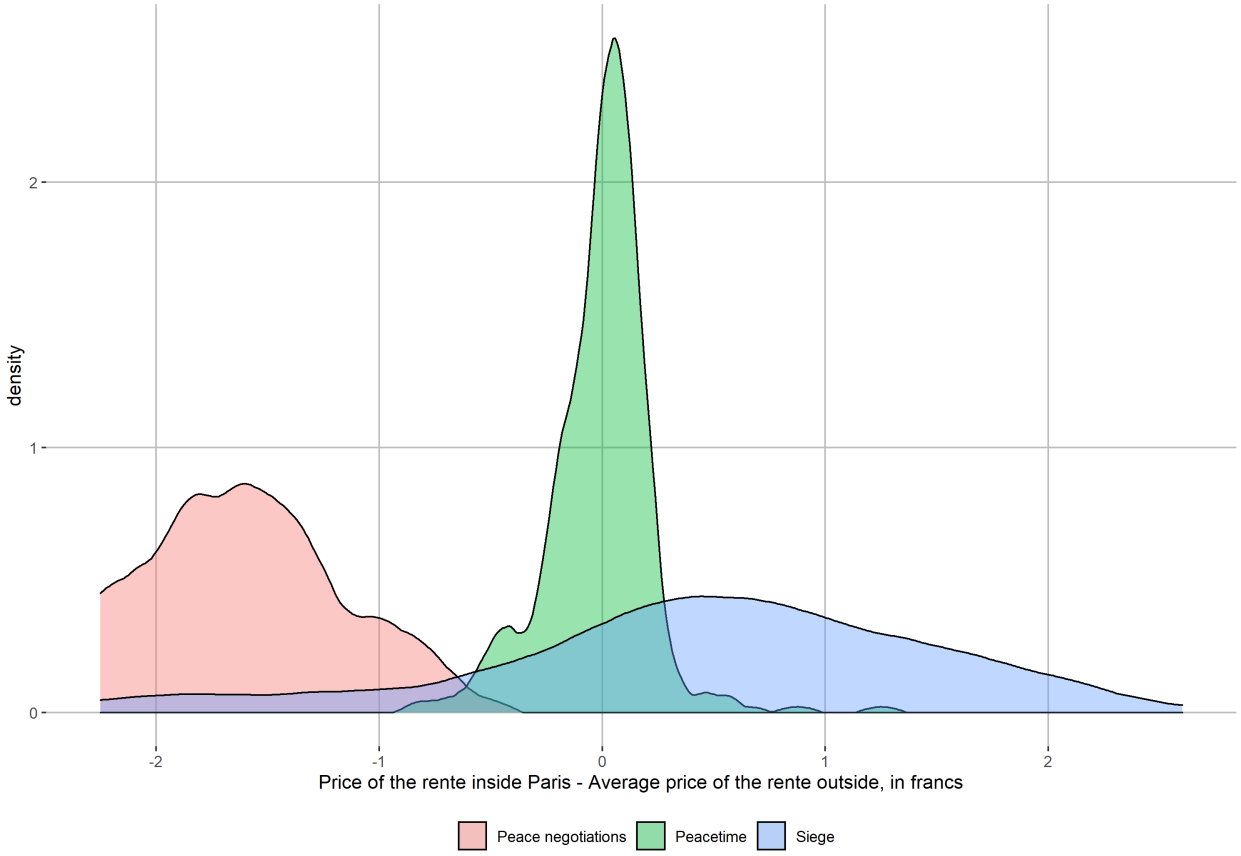
Notice first that in peace-time, the distribution of differences between the *rente* prices inside and outside Paris is tight and centered almost perfectly around a zero mean (more precisely, -0.013, se= 0.013, with an average price of 67.2 Francs). This is consistent with the law of one price. However, during the Siege, Parisian prices diverge and are higher, with a mean price difference of 0.49 Francs relative to outside Paris (se=0.12) (see Table A.2 for estimates of the the differences between Paris and Bordeaux and Lyon separately). In contrast, between the Armistice and the peace-treaty, the Parisian price falls to an average of 54.4 Francs or a mean price difference of -1.48 relative to outside Paris.

Further, as Figure 3 suggests, the distribution of the price differences in peace-time, the Siege, and the negotiations are not only systematically different on average, they are also largely persistent over time. Figure 3 provides a time series of the ratio of the rente price inside Paris and the average of the two exchanges outside during the Siege, between September 1870 to January 1871, and the subsequent peace negotiations, in February 1871. Notice that at the beginning of the Siege in September 1870, the *rente* price in and outside Paris remained quite similar, but by the beginning of November the prices diverged. From then on the *rente* had a persistently higher price in Paris than in other exchanges at almost all times over the nearly three months remaining of the Siege.

On January 28, 1871, the national government agreed to an Armistice with the Prussians, and negotiations over a peace settlement began. The price patterns however reverse: now Parisian traders undervalue the *rente* relative to those outside the Siege cordon. The difference in prices went from +1.025 on January 25$^{\text{th}}$ to -1.025 on February 1$^{\text{st}}$, and it subsequently became even more negative. During this period, the average price difference was -1.48 francs (se = 0.16). This difference is equal to 2.2% of the Paris price.

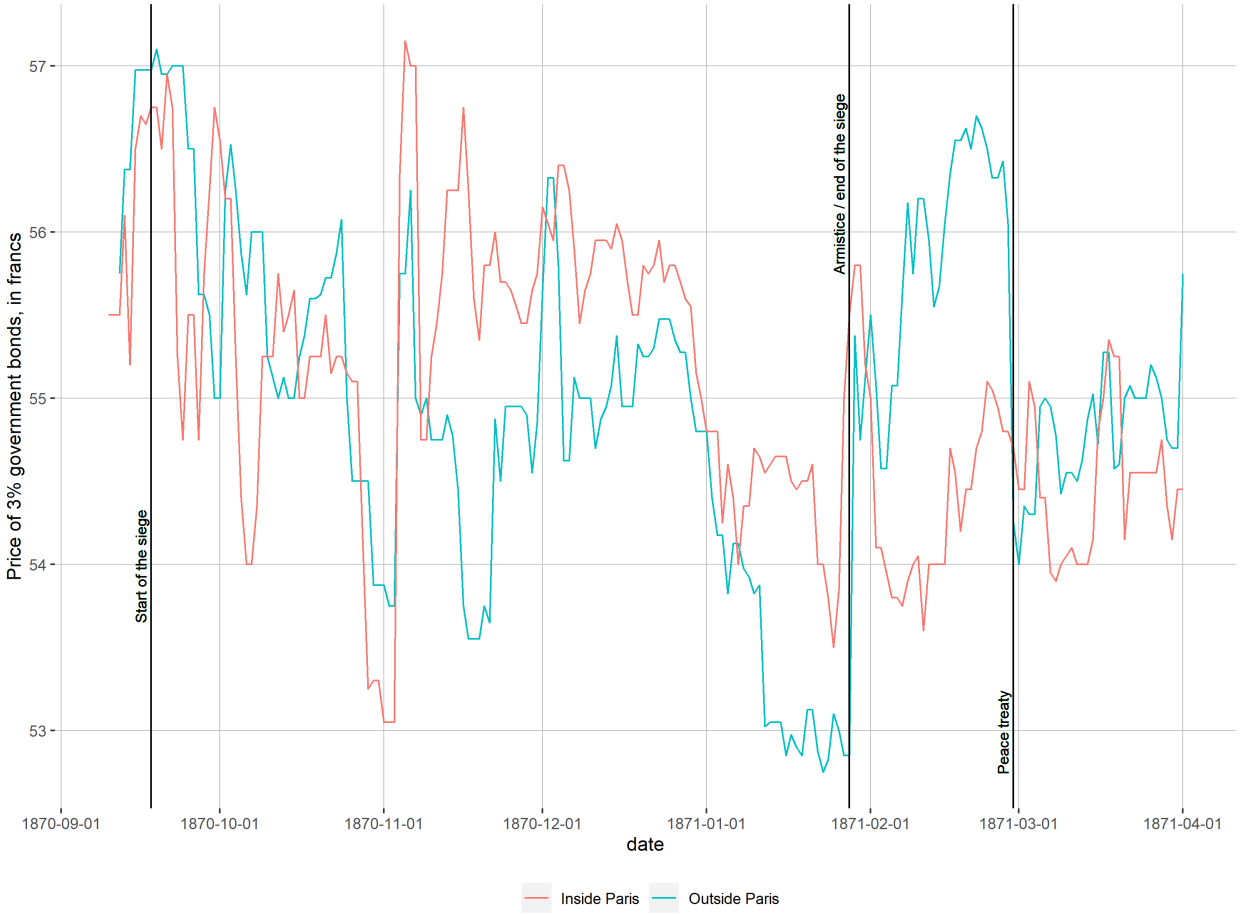
The Treaty of Versailles was announced on February 28$^{\text{th}}$. The conditions were onerous: the loss of Alsace-Lorraine and payment of a five billion francs indemnity. This sum was equal to 25% of France's GDP and 2.5 times its yearly government budget, to be paid over three years. Immediately after the conditions were known, prices dropped outside of Paris. After the news about the peace treaty were out, the price of the *rente* in Bordeaux and Lyon was down -3.87% and -5.15%, respectively. The Paris price, on the other hand, barely moved with the announcement of the treaty terms.

Figure 2: Density of price differences of the 3% *rente* between Paris and other French exchanges



This graph shows the distributions of daily price inside and outside Paris for for three periods: the Siege of Paris (September 18th, 1870 to January 28th, 1871), the peace negotiations (January 28th, 1871 to March 1st, 1871), and peacetime (January 1st, 1870 to July 15th 1870, and May 31st, 1871 to December 31st, 1871). The differences are calculated by subtracting the average between the Bordeaux and Lyon prices from the Paris price. As expected, differences are small and centered in zero during peacetime. Prices are higher outside during piece negotiations and higher in Paris during the Siege. Epanechikov kernel with Silverman rule-of-thumb bandwidth.

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



This graph shows the prices of the 3% French sovereign bond (the *rente*) inside and outside Paris between September 18th 1870 (the start of the Siege) and April 1st, 1871. The outside price is an average between Bordeaux and Lyon. The graph shows that Parisians were higher during the war, but the situation was reversed after the end of hostilities. Prices converged again when the terms of the peace treaty (and the cost of the war) became public.

4.2 Differential Responses to War and Peace

In the last section, we showed that investors inside Paris valued *rentes* more during the war, and investors outside Paris valued them more during peace negotiations. We know that the war was more popular in Paris from contemporary accounts, historical accounts, and election results (Horne 2012, Wawro 2003). We hypothesize that Parisians believed that continuing the war effort would have some degree of success and would bring favorable peace terms. The prevailing view elsewhere, on the other hand, was that a quick ceasefire and start of peace negotiations would yield better outcomes for France. We now test this hypothesis by showing how the three markets responded to war and peace events. We find that the Parisian market reacted more strongly to war news, and reacted less to news about peace.

As we have discussed, arbitrage between Paris and markets elsewhere was interrupted as early as September 19$^{\text{th}}$, 1870. After the battles of Spicheren (Wörth), Gravelotte, and Sedan in early August and early September 1870 the price of the *rente* had fallen dramatically from 66 to 52 Francs (Figure A.1). Persistent price differences between markets inside and outside Paris only appear in November 1870 however (Figure 3). With Paris under Siege and most of the professional army having surrendered, it was already clear to most that France had lost the war. As we have described above, to the extent that this reflects political disagreement, therefore, it was most likely about whether continued fighting in a war of attrition was worth the costs of war in affecting the ultimate terms of the peace.[42]

To test the hypothesis that the persistent price differences we observe are due to differences in political beliefs, we examine how these prices update in response to new information.

[42]That there were differences in political beliefs that might have driven the markets was also not alien to contemporary observers. After the ceasefire, an anonymous financial analyst for *The Times* in London wrote:

> "It is worth noting that during the time Paris was invested [surrounded], prices ruled higher in the principal provincial bourses... This was probably owing to the conviction being entertained by Parisians that armies from the provinces would relieve them, whereas outside that was known to be a delusion. But since the capitulation the Bordeaux prices have been better that those of Paris... The explanation no doubt is that at Bordeaux the armistice was considered morally certain to lead to peace, whereas in the capital that was not clear." (*The Times*, February 15, 1871).

There was also the dynamic question of laying down arms: if the French opened their fortresses and laid down their weapons as condition for the Armistice, they would be in a much weaker bargaining position than if they continued to have intact forces and territory where they could raise new levies. Without an army, they also faced the threat of civil war with the more radical National Guard conscripts. As Bismarck remarked to Favre during the Armistice negotiations: "Sooner or later you will have to bring reason to the National Guard, and you gain nothing by waiting. Provoke an uprising then, while you still have an army to suppress it with."(Horne 2012,p.240.)

Our logic is as follows. If investors in Paris had different beliefs about the potential success of the war efforts in securing a better peace, we would expect them to respond more strongly to war-related news. In the case of French military defeats, the price should fall more in Paris than elsewhere since this would lower Parisian investors' hopes for better peace terms. In contrast, if investors elsewhere were more skeptical of the gains of war and more cognizant of the costs, then they would react in a more muted way to military defeats that would both weaken France's bargaining position but could also expedite the end of the war. In the case of (the few) French military victories, we expect Parisians to update more positively as they expected more favorable peace terms as a function of French military success. Moreover, a French victory increased the probability of extending the war of attrition against Prussia.

Along the same lines, if investors outside Paris thought that a quick end to war would improve the outcome of the peace negotiations, we would expect the outside price to respond more positively to news about the ceasefire. The ceasefire was instigated by the Paris government under duress, not by the Prussians trying to end the conflict in the fear of French military success. We therefore expect Parisian investors to have been more skeptical about the final peace terms than investors outside Paris who believed that a quick surrender was the way to get better peace terms. Given that the final peace terms were very harsh for France, we expect the price elsewhere to respond more negatively to the announcement than in Paris.[43]

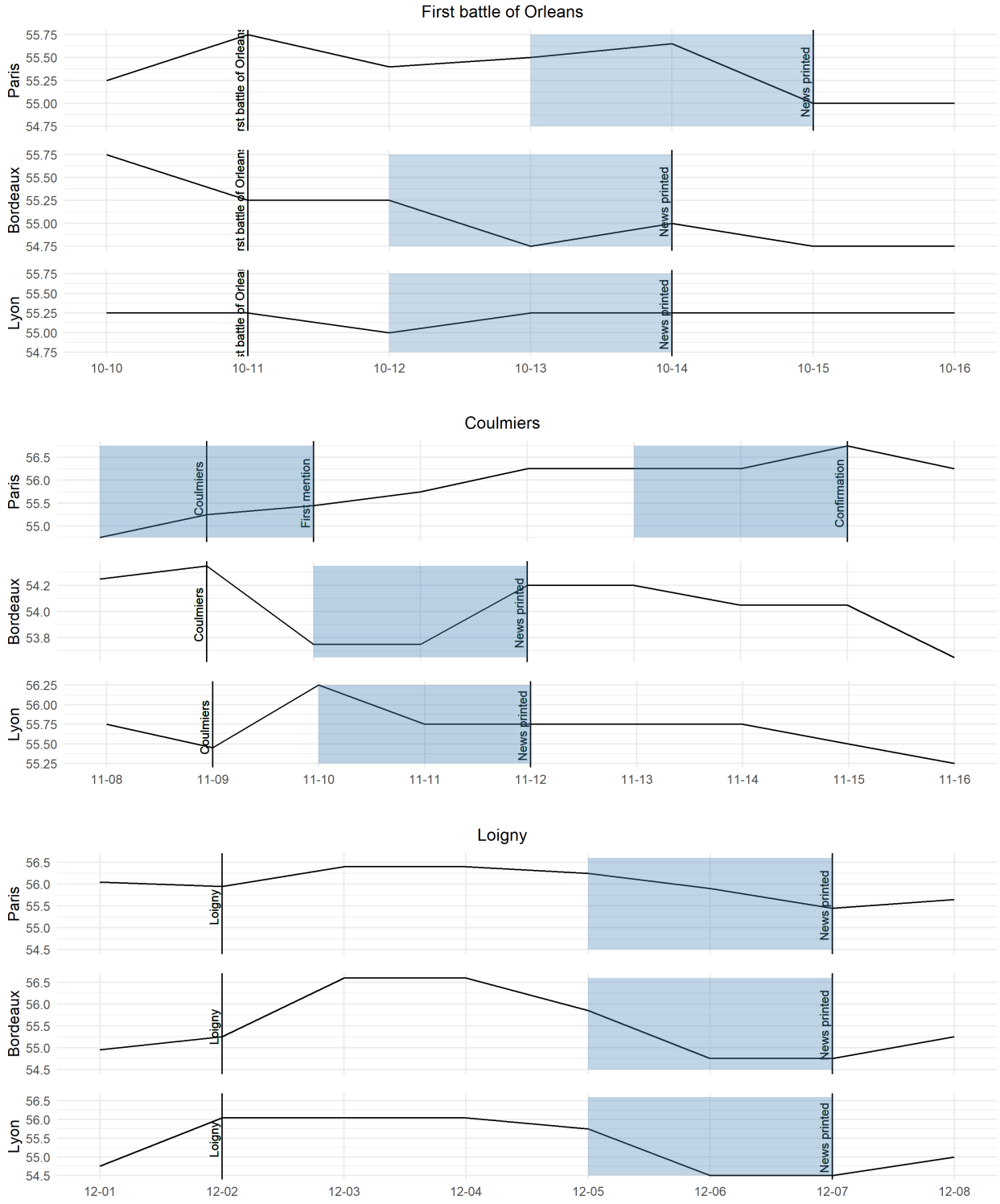
Figure 4 illustrates the steps in our methodology. It shows the *rente* prices in the three cities during developments in the crucial Orleans sector that, with its bridge and rail networks represented the French Republic's best hope of relieving Paris. Three major battles were fought there that led to the fall, recapture and subsequent fall of Orleans.[44]

For each event, we note the date of the event, but also the first date or a rumor about the event is reported in local newspapers. With Paris under Siege, rumors (often inaccurate) would arrive quickly but the confirmation of news would arrive considerably later than in Bordeaux and Lyon. As described above, we allow a two day window for news to be reflected in the reported end of day rente price.

[43]France ultimately managed to pay the enormous war indemnity ahead of schedule without defaulting its debts. However, contemporaries did not expect this. An analysis by The Economist (February 11, 1871), considered France unable to pay interest on the the debt required to cover a 2.5 billion franc indemnity (half as big as the one announced three weeks later) (cited by Gavin 1992).

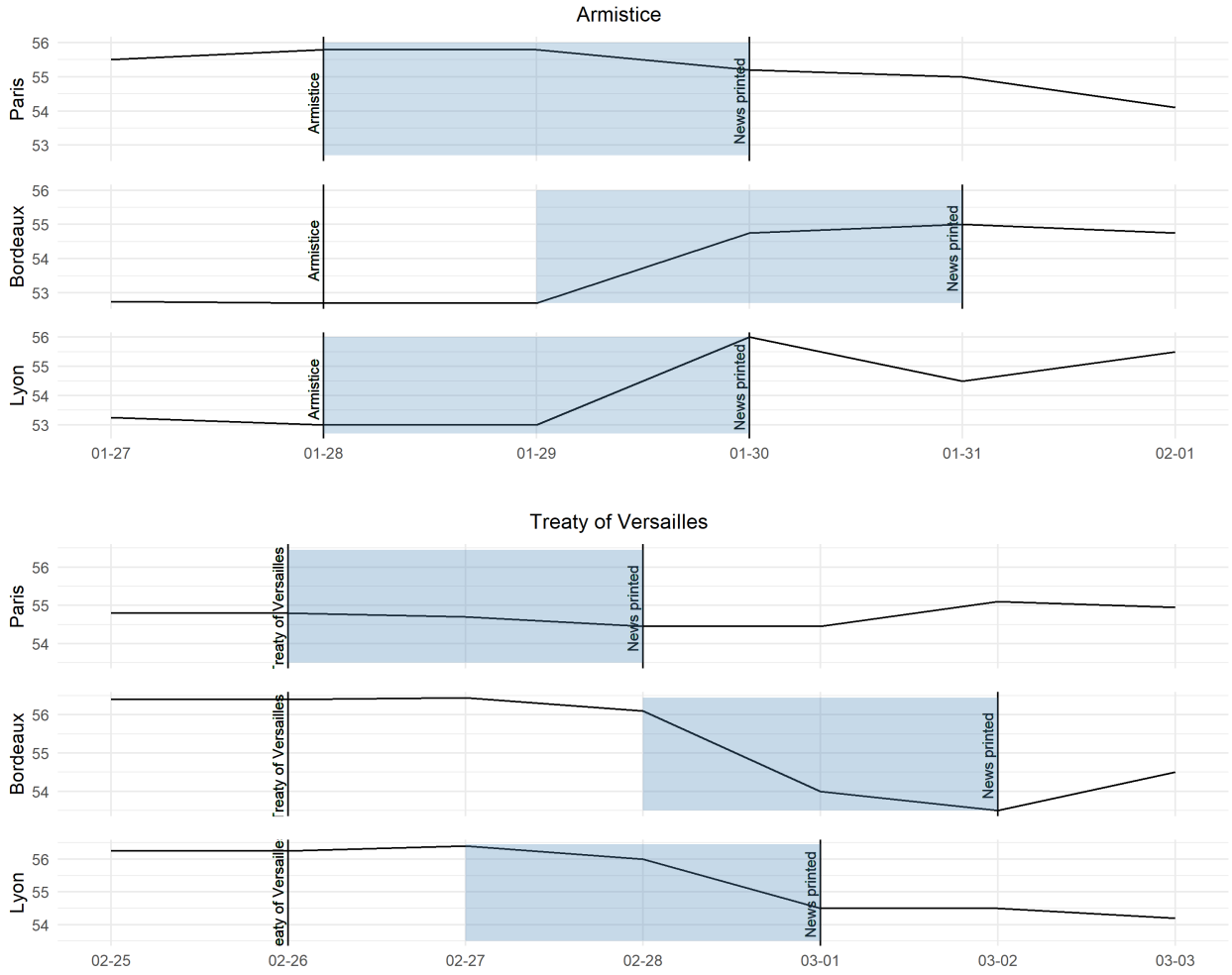
[44]Orleans was first captured by the Prussians on October 11. A month later, a rare French victory– at Coulmiers– led to the Prussian evacuation of Orleans. The French attempt to relieve Paris was however checked at Beaune-La-Roland when 80,000 French conscripts encountered 9000 German regulars along with artillery, and they were forced to retreat. The Battle of Loigny then led to the French evacuating Orleans once more.

Figure 4: Price of *rentes* (in francs) around the Struggle for Orleans



This figure shows *rente* prices in three markets around the Struggle for Orleans that was the main hope for the relief of Paris. As expected, prices fall more in Paris in defeat (graphs 1 and 3) and rise in victory (graph 2). The shaded area covers the two-day period when news may have arrived. Therefore, response to the event happened within the shaded area.

Figure 5: Price of *rentes* (in francs) around peace events



This figure shows *rente* prices in three markets around peace events. As expected, prices rise more outside Paris after the armistice (graph 1) and fall more when the terms of the peace treaty are revealed. The shaded area covers the period when news may have arrived. Therefore, response to the event happened within the shaded area.

Notice that during the period that the news was reported in each city, the responses in Paris versus Bordeaux and Lyon tended to differ. In Paris the news of the first fall of Orleans to the Prussians was met by a fall in the rente price of 0.9%, where as in Bordeaux the response was a more muted 0.45% fall, and Lyon the price actually increased by 0.45%. The French victory at Coulmiers raised the Paris price by 0.89%, whereas the price in Bordeaux rose by 0.84% and the price in Lyon actually fell by 0.90%.[45] The arrival of news of the final time Orleans exchanged hands, however, led to falls in all stock exchanges, with the fall in Paris being smaller than in Lyon (1.42% vs. 2.24%), but bigger than in Bordeaux (1.07%).

Figure 5 does the same exercise for the two main peace negotiation events- the Armistice, and disclosure of the terms of the peace treaty. The response in Paris rose with rumors of the Armistice before falling when the rumors were confirmed, leaving a 1.73% overall gain (our measure adds up the returns of both days, though as we show below our main estimates are not sensitive to this.) The gains in Bordeaux and Lyon, in contrast, were much higher (4.36% and 5.74%). When the onerous terms of the treaty were revealed, the marginal Parisian investor did not seem terribly surprised, and the price fell only slightly (by 0.64%) compared to dramatic falls elsewhere (of 4.63% in Bordeaux and 3.41% in Lyon).

Table A.1 displays these comparisons for all major war and peace news events during the Siege. For each event and market, it reports the two-day return for *rentes* on the day in which news were printed in the city. In bold it presents effect patterns which are consistent with our hypotheses: that Paris should experience larger absolute returns for war events (positive for victories and negative for defeats), and that outside markets should react more strongly to news about peace. Notice that the patterns hold for 7 out of the 9 major news events.

Table 4 reports the results of two-tailed t-tests on the average difference in price responses. The null hypothesis is that the differences are equal to zero on average. We show comparisons between Paris and Bordeaux, Paris and Lyon, and Paris and the outside (i.e., the average between Bordeaux and Lyon). We always compute differences in the direction our hypothesis predicts.[46] For our baseline model, we obtain that the average difference between Paris and the provinces (over 9 events) was 1.73 percentage points. We also report the same result

[45]The difference between Paris and Bordeaux is starker if we take into account that the news were first reported as a rumor and later confirmed, see graph 4

[46]For example, we expect prices to decrease more in Paris when news of Chateaudun (a French defeat) arrive. Therefore, we predict $R_{outside} > R_{paris}$. We calculate that $R_{outside} - R_{paris}$ is in fact bigger than zero (3.76 percentage points). On the other hand, we expect prices in Paris to increase more when news about the French recapture of Orleans arrives. Therefore, we predict $R_{paris} > R_{outside}$. We likewise calculate that $R_{paris} - R_{outside}$ is in fact bigger than zero (0.9 percentage points).

Table 3: Events and *rente* returns in three cities

	Two-day returns to rentes		
War events	Paris	Bordeaux	Lyon
First battle of Orleans	**-0.90%**	-0.45%	0.45%
Chateaudun	**-3.36%**	-0.80%	0.00%
Metz	**-0.47%**	1.91%	0.45%
Coulmiers	**0.89%**	0.84%	-0.89%
Beaune-la-Rolande	**-0.80%**	0.00%	-0.54%
Loigny	-1.42%	-1.07%	-2.24%
Le Mans	-0.92%	-2.57%	-0.47%
Average (signed)	**1.25%**	0.55%	0.21%
Peace events	Paris	Bordeaux	Lyon
Armistice	-1.08%	**4.36%**	**5.66%**
Treaty of Versailles	-0.64%	**-4.63%**	**-3.37%**
Average (signed)	0.86%	**4.49%**	**4.51%**

This table shows the two-day returns in the three markets to war and peace events in three markets. Returns are calculated as: $\frac{p_t - p_{t-2}}{p_{t-2}}$, 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: bigger responses for war events in Paris, and bigger responses for peace events outside Paris. To calculate the averages we multiply the returns to defeats and the negative peace event by -1.

including only including war events, and we find a positive (but somewhat smaller) significant result (0.875 pp.) These results are also robust to including minor battles and draws (we classify the later as French defeats, since they came late in the war when the French were desperate for a victory).

Table 4: Differences between Paris and the outside in responses to events

	Differences in two-day returns to rentes, in percentage points			
	Paris v Outside	Paris v Bordeaux	Paris v Lyon	N
Baseline	1.73**	1.597*	1.864**	9
	(0.7)	(0.731)	(0.742)	
Only war events	0.875*	0.705	1.044*	7
	(0.449)	(0.544)	(0.498)	
Baseline + minor battles	1.135**	0.854	1.417***	18
	(0.468)	(0.529)	(0.48)	
Baseline + minor battles and draws	0.96**	0.673	1.248**	20
	(0.437)	(0.491)	(0.448)	
Placebo (pre-siege battles)	-0.676	-0.744	-0.609	8
	(0.496)	(0.664)	(0.483)	

This table shows that differences in responses to events between Paris and the outside are statistically significant. Each coefficient represents a one-sample t-test. We set up differences in the direction our hypothesis predicts, so positive differences are evidence in our favor (in bold). We compute returns as: $R = \frac{p_t - p_{t-2}}{p_{t-2}}$, for news printed on day t. We show the robustness of our estimates to restricting the sample to only war events.
*p<0.1; **p<0.05; ***p<0.01.

4.3 Robustness and Alternative Mechanisms

So far we have argued that these patterns are consistent with the different political beliefs between Paris and elsewhere on the trade-offs between continuing the war or suing for peace. We now turn consider the robustness of our findings and alternative explanations for the patterns we observe.

4.3.1 Rejecting null hypothesis 1: markets are responding to different, unrelated events

What if each market is actually responding to something else, not included in our event list? In this case, prices changes in each market would be unrelated to price changes in the other two. In this section, we explicitly model this possibility, and test it as a null hypothesis we need to reject.

Out of our nine events, seven are objectively negative and two are objectively positive. That is, we expect negative returns after seven of them (six defeats and the peace treaty) and positive returns after two of them (one victory and the Armistice). Therefore, in order to reject this null, we compare the average differences reported in Table 4 to average differences of nine random "negative news days" and two "positive news days", during war and the peace negotiations: September 18$^{\text{th}}$, 1870 to March 15$^{\text{th}}$, 1871. We implement this comparison with a Monte Carlo procedure, drawing 10,000 samples of eleven prices per city. More specifically, we do the following in each iteration of the Monte Carlo: First, we draw two observations with price increases and seven with price decreases for each city (note that they may be on different dates). Second, we designate seven of these events to be war events and two to be peace events. Third, for each event, we compute $R_{paris} - R_{outside}$ for positive war events and for negative peace events, and $R_{outside} - R_{paris}$ for negative war events and positive peace events. Lastly, we compute the mean difference for the nine placebo events.

The first row of Table 5 displays the mean differences in our event sample (already reported in Table 4, first row). The second row shows the average over the 10,000 Monte Carlo iterations of the computed mean differences. The numbers are close to zero, far from the large return differential we found. The third row shows the 95% percentile of mean differences in the placebo samples. They are all smaller than the mean difference in our event sample (1.73 pp.). The last row further shows that the value of the cumulative distribution function at 1.73 is close to a 100%. In other words, almost none of the iterations yield a higher average. In summary, it is extremely unlikely to observe the price patterns we observe if each city was reacting to different events.

4.3.2 Rejecting null hypothesis 2: markets have the same reaction, but differences in magnitude are due to noise

Our second null hypothesis is the opposite of the first one: markets are reacting to the same event, but the differences in the magnitude of their responses are purely due to random noise. If this were true, the fact that we usually observe Paris on the predicted side of the

Table 5: Comparison to placebo samples where markets react to different events

	R_{paris} v R_{bord}	R_{paris} v R_{lyon}	R_{paris} v $R_{outside}$
Mean difference for 9 events	1.597 pp.	1.864 pp.	1.73 pp.
Average over 10,000 samples of mean differences for 9 placebo events	-0.042 pp.	-0.102 pp	-0.072 pp.
95% percentile of mean differences in placebo samples	0.784 pp.	0.689 pp.	0.642 pp.
P(placebo mean difference $<$ mean difference for 9 events)	99.89%	99.99%	99.98%

This table shows that the differences in responses we observe that we observe to the 9 events are very unlikely to occur due to pure chance. The first row reports the mean (directed) return difference ($R_{paris}-R_{outside}$ for military victories and negative peace events, and $R_{outside}-R_{paris}$ for military defeats and positive peace events). For each sample of placebo events, we draw 7 days with negative returns and 2 days with positive returns (different days for each city). Row 2 reports the average of the mean of (directed) return differences in the placebo samples. Row 3 reports the 95% of the mean (directed) return differences. Row 4 reports the probability that a placebo mean difference is higher than 1.6 (the number in row 1).

inequality is purely due to chance. We explicitly model this possibility taking advantage of the fact that, during the period without limits arbitrage, the three markets reacted to the same set of events on each day.

In particular, we compare responses to our nine events to random sets of nine days chosen from the period before September 15$^{\text{th}}$, 1870 and after May 31$^{\text{st}}$, 1871. For each iteration of the Monte Carlo procedure we do the following: Since we have seven negative events and two positive events, we first select seven trading days when Paris had a price decrease and three days when Paris had a price decrease. Second, we designate nine of these events to be war events and two to be peace events. Third, for each event, we compute $R_{paris} - R_{outside}$ for positive war events and for negative peace events, and $R_{outside} - R_{paris}$ for negative war events and positive peace events. Lastly, we compute the mean difference for the eleven placebo events.

Table 6: Comparison to placebo samples where markets react to the same event but the magnitude is noise

	$R_{paris} - R_{bord}$	$R_{paris} - R_{lyon}$	$R_{paris} - R_{outside}$
Mean difference for 9 events	1.597 pp.	1.864 pp.	1.73 pp.
Average over 10,000 samples of mean differences for 9 placebo events	0.01 pp.	0.03 pp.	0.02 pp.
95% percentile of mean differences in placebo samples	0.41 pp.	0.56 pp.	0.39 pp.
P(placebo mean difference $<$ mean difference for 9 events)	100%	100%	100%

This table shows that the difference we observe in responses to the 9 events is very unlikely to occur due to pure chance. The first row reports the mean (directed) return difference ($R_{paris} - R_{outside}$ for military victories and bad peace events, and $R_{outside} - R_{paris}$ for military defeats and good peace events). For each sample of placebo events, we draw prices from the three cities for 9 days during the period with arbitrage (same day for all three cities). Row 2 reports the average of the mean of (directed) return differences in the placebo samples. Row 3 reports the 95% of the mean (directed) return differences. Row 4 reports the probability that a placebo mean difference is higher than 1.6 (the number in row 1).

The first row of Table 6 displays the mean differences in our event sample (already

reported in Table 4). The second row shows the average over the 10,000 Monte Carlo iterations of the computed mean differences. The numbers are close to zero, far from the large return differential we found. The third row shows the 95% percentile of mean differences in the placebo samples. They are all smaller than the mean difference in our event sample (1.73 pp.). The last row shows that the value of the CDF at 1.73 is 100%. In other words, none of the iterations yield a higher average.

4.4 Different information sets

When the Siege of Paris started, the Germans cut off information flows in and out of Paris. The telegraph lines were cut, and neither people nor goods were allowed to pass through siege lines. However, Parisians successfully managed to smuggle information into and out of the city. The principal way to get news out of the city was hot air balloons, and the main way to get them in were carrier pigeons (Horne 2012, ch. 8). These two were sometimes supplanted with runners who dared to dodge the Prussians, and diplomatic mail. Given that these means of communications are unreliable and slow, a remaining concern is that the difference in prices we observe is due to different information sets. In other words, Parisians or those outside its walls may have been ignorant about facts that influenced the price of the *rentes*.

We argue that price differences are explained by political beliefs and not purely by information. That is, even when investors inside and outside Paris were in possession of the same facts about the world, they agreed to disagree. We have three pieces of evidence to support this claim.

First, Parisians and those elsewhere had full knowledge that their prices were systematically different. In Bordeaux, Paris prices were printed often (see below). In Paris too, a financial analyst noted with worry how much lower the prices were in Bordeaux and Lyon (*Le Figaro*, November 6 1870).[47]

Second, the differences are even more stable in 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 backlog and Prussian restrictions (*Le Figaro, 1871-02*). However, Prussians allowed people to leave and enter the city (and more importantly for Parisians, they allowed food in). During this period, four day old Paris prices were printed daily in Bordeaux, but prices failed to converge until peace terms were announced.

[47] An analyst from the *The Times* (quoted above) also noted the difference.

Third, we show below that information flows between Paris and the outside did not drive prices closer to each other. Bordeaux prices did not converge to Paris prices when the latter were printed in *La Gironde*. In turn, Paris prices did not converge to external prices when news from the outside were printed in *Le Figaro*. Also, Paris did not experience abnormal returns on days with incoming news– as measured by pigeon arrivals or news from outside reported by *Le Figaro*.[48]

4.4.1 The External Exchanges do not converge to the Paris price

In this section, we show that even when a Bordeaux newspaper printed the price of the *rente* in Paris, the price did not converge. Before the siege, the Bordeaux newspaper *La Gironde* printed daily prices of a few securities in the Paris and Bordeaux markets. During the siege, Paris prices were printed less regularly. Between September 19$^{\text{th}}$, 1870, and January 28$^{\text{th}}$, 1871, Paris prices were printed 30 times (an average of one every 4.4 days). The information was also lagged, the median Paris price during the Siege was reported 6 days later (see Table 2 for more details about information transmission).

We measure the Bordeaux market response to these printed prices. We focus on two-day changes in prices for the same reason we worked with two-day returns in section 4. 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 $t-2$. We calculate the changes in price difference for each instance of a printed price as:

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

Were 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 (but it was on average five days old). The first term captures the difference before after the price was reported, and the first term the difference before. If Bordeaux moved closer to the reported Paris price after receiving news, the change in price difference should be negative, since price would be moving closer to each other. We find 48 instances of Paris prices printed in Bordeaux during the siege and the peace negotiations.

Panel a of table 7 reports the results. The average $\Delta\text{price difference}_t$ equals is -0.028 francs, a very slight convergence. However, it is not statistically significant (p-value = 0.76).

[48] We analyze the pigeon messages themselves: as Figure A.11 shows, the word *rente* appears only 28 times in 29,903 messages.

The lower bound of the 95% CI (an upper bound for convergence) is -0.215 francs, which is only 18% of the average distance between the Bordeaux and Paris prices during the siege. Table 7 also reports separate results for the siege and peace negotiations periods, in neither of which we find convergence.

Table 7: Absence of price convergence after incoming information to 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
Mean absolute price difference	1.05	1.73	1.18	1.06	1.70	1.17
Δprice difference	-0.113	0.114	-0.028	0.084	-0.107	0.033
	(0.129)	(0.120)	(0.093)	(0.099)	(0.115)	(0.079)
Lower bound 95% CI	-0.377	-0.139	-0.215	-0.118	-0.356	-0.127
Observations	30	18	48	38	14	52
Median delay	6 days	4 days	5 days	4 days	3 days	4.5 days

This table shows the absence of 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.

4.4.2 The Paris price does not converge to the external exchanges

We were not able to find outside prices printed in Paris. However, we can show more indirect evidence that suggests that Paris prices were not significantly affected by outside prices either. In this section, we show that when Paris got news from the outside world, prices did not converge. To compile this information, we collected every piece of news of the outside printed in *Le Figaro* during the siege and the peace negotiations. 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 find that 53 days had information more recent than anything previously reported. We measure the Paris market response to the incoming news. In particular, we test whether prices converged to the average price between Bordeaux and Lyon. We perform the same test as in the previous

section.

Panel b of table 7 reports the results. The average Δprice difference$_t$ equals is 0.033 francs, meaning that on average prices slightly *diverged*. However, it is not statistically significant (p-value = 0.68). The lower bound of the 95% CI is -0.13 francs, which is only 11% of the average distance between inside and outside Paris. Table 7 also reports separate results for the siege and peace negotiations periods, in neither of which we find convergence.

4.4.3 There are no abnormal returns on days with incoming information flows

We also show that the *rente* did not experience abnormal returns on days with incoming news. In Paris, the absolute value of the two-day *rente* return was not higher on days when a carrier pigeon arrived, nor when *Le Figaro* printed news from the outside. In Bordeaux, there were no abnormal returns on days when the Paris *rente* price was printed in *La Gironde*, or when a hot-air balloon with Paris mail landed.

Table 8 shows the effect of different measures of incoming information on abnormal *rente* returns. As in the rest of the paper, we calculate two-day rent returns, but since we are interested in a measure of volatility, without an expectation of direction, we take the absolute value. Therefore, returns on day t are calculated as $|\frac{p_t - p_{t-2}}{p_{t-2}}|$, where p_t is the Paris or Bordeaux price on day t. In table 8 we present four measures of incoming information. First, we use a dummy that equals one if *Le Figaro* reported a pigeon arrival on that day. Second, a dummy that equals one if news from the the outside were printed in *Le Figaro* (using the same definition as in the previous section). Third, a dummy that equals one if the Paris price was printed in *La Gironde*. Fourth, a dummy that equals one if there was a balloon landing on that day.[49]

We account for the fact that information flows are not necessarily random by adding week and month fixed effects. For example, the early days of the siege were a period of high price volatility, but there are no pigeon arrivals because the service had not been yet established. We do not find any evidence of increased volatility. The coefficients are largely indistinguishable from zero, except for pigeon arrivals with month fixed effects, which are negative (the opposite of what we may expect if pigeons were bringing useful information).

In summary, we do not find that the *rente* had increased volatility when news arrived. Therefore, we can rule out the possibility that the differences in prices were fully explained by some investors knowing facts that others ignore. As figures 4, 5, A.8, and A.9 show,

[49] Our results are robust to using a dummy that equals one if there was a pigeon arrival documented by a historian (Hayhurst 1970) instead of *Le Figaro*, and to use the number of news reported by *Le Figaro* instead of the dummy (table A.5).

Parisians often knew about the most important events at the same time or a few days later than people outside. Maybe the most clear example are the "peace events" in Figure 5: everyone learned about them at (approximately) the same time, but the reactions are wildly different. Moreover, figures A.12, A.13, A.14, and A.15 show graphically that there is no correlation between periods with more information flows and the price difference.

Table 8: Incoming information and abnormal returns in Paris and Bordeaux

	Absolute value of two-day *rente* return, in percentage points							
	Panel (a): Paris				Panel (b): Bordeaux			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Pigeon arrival in Paris	0.022	−0.562**						
	(0.211)	(0.243)						
Outside news printed in Paris			−0.188	−0.113				
			(0.184)	(0.198)				
Paris prices printed in Bordeaux					−0.269	−0.010		
					(0.216)	(0.256)		
Balloon landing							−0.181	−0.176
							(0.173)	(0.207)
Fixed effects	Week	Month	Week	Month	Week	Month	Week	Month
Mean DV	1.006	1.006	1.006	1.006	1.006	1.006	1.006	1.006
Observations	133	133	165	165	133	133	165	165

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: $|\frac{p_t - p_{t-2}}{p_{t-2}}|$ The independent variables are: a dummy that equals one if *Le Figaro* reported a pigeon arrival, a dummy that equals one if *Le Figaro* printed news from the outside, and the number of outside news reported by *Le Figaro*. Robust standard errors in parenthesis. *p<0.1; **p<0.05; ***p<0.01.

4.5 Liquidity shocks

The purpose of this section is to show that price differences between Paris and the outside were not driven by liquidity shocks. During the period we study, money could not move freely between Paris and the outside. The demand and supply of money (francs) could have affected the demand and supply of traded securities. If the patterns we described for *rentes* in section 3 were driven by liquidity shocks, other publicly traded assets should display the same behavior.

In this section we study the price dynamics of two assets: the stock of the *Midi* railroad,

and a bond issued by the same company. These two assets were the only two that complied with the following requirements: 1. they were double listed in Paris and Bordeaux[50], 2. they were liquid enough (that is, we observe a price in both markets), and 3. they were not French government debt.[51]

We replicate the method we used to analyze the *rente*, but find very different price responses for the two Midi assets. As a reminder, we showed that the *rente* was overvalued in Paris during the siege and overvalued in the outside during peace negotiations. Figure 6 replicates Figure 1. We can see *Midi* stock was also overvalued in Paris during the siege. The average difference was +14 francs (se = 2.36), equivalent to 2.56% of the average Paris price. Unlike the *rente*, however, it was also overvalued in Paris during the peace negotiations. The average difference was +23 francs (se = 3.61), equivalent to 4% of the average Paris price.

The *Midi* bond, on the other hand, was slightly undervalued in Paris. The average difference during the siege was -1.32 francs (se = 0.51), equivalent to 0.45% of the average Paris price. This difference was concentrated in the last month of the siege since during the first three months, it was volatile but centered at zero. During peace negotiations, this bond was undervalued in Paris. The average difference was -7.83 francs (se = 0.69), equivalent to 2.75% of the Paris average price.

In summary, the price dynamics of the *Midi* railroad's stock and bond are different from each other's and from the *rente's*, ruling out the possibility that liquidity shocks are driving our results.

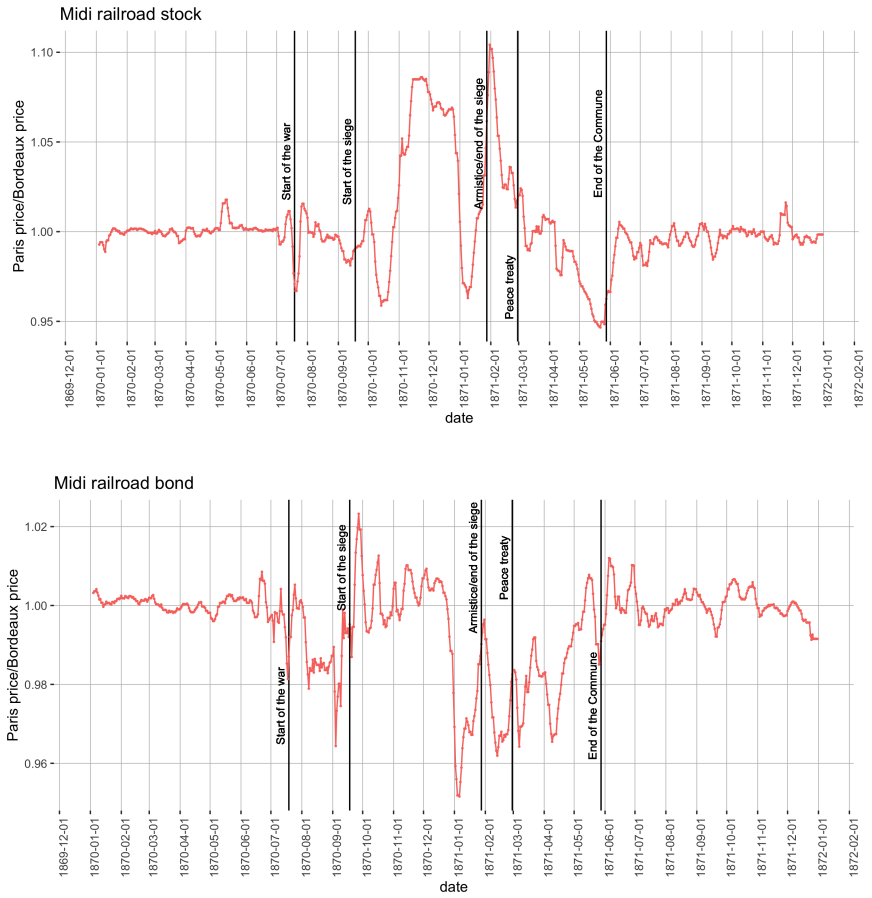
5 Discussion

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 for one of the most actively traded assets in history. 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

[50] We only include Bordeaux because we only have data on *rente* prices for Lyon.

[51] Only two assets comply with the requirements because very few assets were traded daily in Bordeaux and because most of those are either government debt or not listed in Paris (mostly local government debt). The *Midi* railroad ran from Bordeaux to the Mediterranean coast.

Figure 6: Price ratio of *Midi* railroad bonds and stock between Paris and Bordeaux



These graphs show the price ratio of two assets: *Midi* railroad stock and bond in Paris and Bordeaux. We divide the price in Paris by the price in Bordeaux. These graphs suggest that the patterns discovered for *rentes* were not common to every security. The stock was overvalued in Paris during most of the war and during peace negotiations. The bond ratio was volatile around one during most of the war. During the last month of the war and during peace negotiations, it was overvalued in Bordeaux. In summary, the patterns we observe on *rente* prices are not present for these two assets.

on the street and among political elites. Nevertheless, the price of the French *rente* fell, consistent with the *smart money*, both in Paris and around the world, providing a corrective to "war fever".[52]

Yet, our results suggest that, as Paris was isolated by the Siege, the marginal trader began to see war news through the political perspective of those around her. Thus the corrective effect of the market price on potentially biased political perceptions seems to have weakened with their separation from world markets. This suggests an under-explored but potentially important social value to the dual listing of financial assets for companies across borders. This may be particularly relevant for aligning expectations among economic and political decisionmakers in countries perceived to be in great power competition. A focal contemporary example is that of the United States, where like, France and Germany in 1870, many are concerned about a rising China.[53] As contemporary political pressure is mounting to de-list one another's financial assets, there is a risk of a further decoupling of beliefs, especially regarding the costs and benefits of military conflict. 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.[54]

References

Addoum, J. M., & Kumar, A. (2016). Political sentiment and predictable returns. *The Review of Financial Studies*, *29*(12), 3471–3518.

[52]On how social diversity may make asset markets less prone to bubbles in on-line lab experiments, see also Levine et al. 2014.

[53]The 'trap' where incumbent powers may engage in pre-emptive war to check the rise of others perceived be in competition is a common phenomenon in international relations, noted as least as early as Thucydides (431), who argued the Peloponnesian War resulted from the fears of Sparta in the face of a rising Athens.

[54]Both stock prices and bond prices in France fell by around 30 per cent in real terms as a result of the Franco-Prussian War and the terms of the treaty (Le Bris 2012). The new French Republic would also face a vicious civil war in the streets of Paris, a topic of our companion research. But the recovery was rapid, and increasing integration of financial markets that followed in France also was accompanied by educational and other reforms that, in the classic words of Eugen Weber, made "Peasants into Frenchmen". At the same time, the Franco-Prussian War and the Commune gave impetus to both extreme left and nationalist forces in France and Germany that would shape conflict on a global scale in the twentieth century.

Ameriks, J., Kézdi, G., Lee, M., & Shapiro, M. D. (2020). Heterogeneity in expectations, risk tolerance, and household stock shares: The attenuation puzzle. *Journal of Business & Economic Statistics*, *38*(3), 633–646.

Bailey, M., Cao, R., Kuchler, T., Stroebel, J., & Wong, A. (2018). Social connectedness: Measurement, determinants, and effects. *Journal of Economic Perspectives*, *32*(3), 259–80.

Bailey, M., Dávila, E., Kuchler, T., & Stroebel, J. (2019). House price beliefs and mortgage leverage choice. *The Review of Economic Studies*, *86*(6), 2403–2452.

Baker, M., Wurgler, J., & Yuan, Y. (2012). Global, local, and contagious investor sentiment. *Journal of financial economics*, *104*(2), 272–287.

Barro, R. J. (2006). Rare disasters and asset markets in the twentieth century. *Quarterly Journal of Economics*, *121*(3), 823–866.

Bernstein, A., Billings, S. B., Gustafson, M., & Lewis, R. (2020). *Voting with their sandals: Partisan residential sorting on climate change risk* (tech. rep.). National Bureau of Economic Research.

Besley, T., & Mueller, H. (2012). Estimating the peace dividend: The impact of violence on house prices in northern ireland. *American Economic Review*, *102*(2), 810–833.

Bonaparte, Y., Kumar, A., & Page, J. K. (2017). Political climate, optimism, and investment decisions. *Journal of Financial Markets*, *34*, 69–94.

Brewer, J. (2002). *The sinews of power: War, money and the english state 1688-1783*. Routledge.

Burnside, C., Eichenbaum, M., & Rebelo, S. (2016). Understanding booms and busts in housing markets. *Journal of Political Economy*, *124*(4), 1088–1147.

Bursztyn, L., Ederer, F., Ferman, B., & Yuchtman, N. (2014). Understanding mechanisms underlying peer effects: Evidence from a field experiment on financial decisions. *Econometrica*, *82*(4), 1273–1301.

Calomiris, C. W., & Pritchett, J. (2016). Betting on secession: Quantifying political events surrounding slavery and the civil war. *American Economic Review*, *106*(1), 1–23.

Choi, J. J., Laibson, D., Madrian, B. C., & Metrick, A. (2009). Reinforcement learning and savings behavior. *The Journal of finance*, *64*(6), 2515–2534.

Clodfelter, M. (2017). *Warfare and armed conflicts: A statistical encyclopedia of casualty and other figures, 1492-2015*. McFarland.

Conover, P. J., Feldman, S., & Knight, K. (1987). The personal and political underpinnings of economic forecasts. *American Journal of Political Science*, 559–583.

Cookson, J. A., Engelberg, J. E., & Mullins, W. (2020). Does partisanship shape investor beliefs? evidence from the covid-19 pandemic. *The Review of Asset Pricing Studies*, *10*(4), 863–893.

Dehdari, S. H., & Gehring, K. (2019). The origins of common identity: Evidence from alsace-lorraine.

DellaVigna, S., & La Ferrara, E. (2010). Detecting illegal arms trade. *American Economic Journal: Economic Policy*, *2*(4), 26–57.

Devereux, M. B., & Smith, G. W. (2007). Transfer problem dynamics: Macroeconomics of the franco-prussian war indemnity. *Journal of Monetary Economics*, *54*(8), 2375–2398.

Ducros, J., & Riva, A. (2014). The lyon stock exchange: A struggle for survival (1866-1914).

Faccio, M. (2006). Politically connected firms. *American economic review*, *96*(1), 369–386.

Fearon, J. D. (1996). Bargaining over objects that influence future bargaining power.

Ferguson, N. (2000). *The house of rothschild: The world's banker, 1849-1999*. Penguin.

Ferguson, N. (2006). Political risk and the international bond market between the 1848 revolution and the outbreak of the first world war 1. *The Economic History Review*, *59*(1), 70–112.

Fisman, R. (2001). Estimating the value of political connections. *American economic review*, *91*(4), 1095–1102.

Flaxman, S., Goel, S., & Rao, J. M. (2016). Filter Bubbles, Echo Chambers, and Online News Consumption. *Public Opinion Quarterly*, *80*(S1), 298–320. https://doi.org/10.1093/poq/nfw006

Frey, B. S., & Kucher, M. (2000). History as reflected in capital markets: The case of world war ii. *The Journal of Economic History*, *60*(2), 468–496.

Froot, K. A., & Dabora, E. M. (1999). How are stock prices affected by the location of trade? *Journal of financial economics*, *53*(2), 189–216.

Gavin, M. (1992). Intertemporal dimensions of international economic adjustment: Evidence from the franco-prussian war indemnity. *The American Economic Review*, *82*(2), 174–179.

Gentzkow, M., & Shapiro, J. M. (2010). What drives media slant? evidence from us daily newspapers. *Econometrica*, *78*(1), 35–71.

Gerber, A. S., & Huber, G. A. (2009). Partisanship and economic behavior: Do partisan differences in economic forecasts predict real economic behavior? *American Political Science Review*, *103*(3), 407–426.

Giglio, S., Maggiori, M., Stroebel, J., & Utkus, S. (2021). Five facts about beliefs and portfolios. *American Economic Review*, *111*(5), 1481–1522.

Gillitzer, C., & Prasad, N. (2018). The effect of consumer sentiment on consumption: Cross-sectional evidence from elections. *American Economic Journal: Macroeconomics*, *10*(4), 234–69.

Girardi, D. (2020). Partisan shocks and financial markets: Evidence from close national elections. *American Economic Journal: Applied Economics*, *12*(4), 224–52.

Goldman, E., Gupta, N., & Israelsen, R. D. (2020). Political polarization in financial news. *Available at SSRN 3537841*.

Greenwood, R., & Nagel, S. (2009). Inexperienced investors and bubbles. *Journal of Financial Economics*, *93*(2), 239–258.

Guidolin, M., & La Ferrara, E. (2010). The economic effects of violent conflict: Evidence from asset market reactions. *The Journal of Peace Research*, *47*(6), 671–684.

Harris, M., & Raviv, A. (1993). Differences of opinion make a horse race. *The Review of Financial Studies*, *6*(3), 473–506.

Harrison, J. M., & Kreps, D. M. (1978). Speculative investor behavior in a stock market with heterogeneous expectations. *The Quarterly Journal of Economics*, *92*(2), 323–336.

Hautcoeur, P.-C. (2007). *Le marché financier français au xixe siècle: Récit* (Vol. 1). Publications de la Sorbonne.

Hautcoeur, P.-C., & Riva, A. (2012). The paris financial market in the nineteenth century: Complementarities and competition in microstructures 1. *The Economic History Review*, *65*(4), 1326–1353.

Hayhurst, J. D. (1970). The pigeon post into paris 1870-1871. *https://www.cix.co.uk/ mhayhurst/jdhayhurst/pigeon/pigeon.html*.

Homer, S., & Sylla, R. E. (1996). *A history of interest rates*. Rutgers University Press.

Hong, H., & Kostovetsky, L. (2012). Red and blue investing: Values and finance. *Journal of Financial Economics*, *103*(1), 1–19.

Hong, H., Kubik, J. D., & Stein, J. C. (2004). Social interaction and stock-market participation. *The journal of finance*, *59*(1), 137–163.

Hong, H., Kubik, J. D., & Stein, J. C. (2005). Thy neighbor's portfolio: Word-of-mouth effects in the holdings and trades of money managers. *The Journal of Finance*, *60*(6), 2801–2824.

Hong, H., Scheinkman, J., & Xiong, W. (2006). Asset float and speculative bubbles. *The journal of finance*, *61*(3), 1073–1117.

Hong, H., & Stein, J. C. (2007). Disagreement and the stock market. *Journal of Economic perspectives*, *21*(2), 109–128.

Horne, A. (2012). *The fall of paris: The siege and the commune 1870-71*. Pan Macmillan.

Hutton, I., Jiang, D., & Kumar, A. (2014). Corporate policies of republican managers. *Journal of Financial and Quantitative Analysis*, *49*(5-6), 1279–1310.

Jarrow, R. (1980). Heterogeneous expectations, restrictions on short sales, and equilibrium asset prices. *The Journal of Finance*, *35*(5), 1105–1113.

Jha, S. (2015). Financial asset holdings and political attitudes: Evidence from revolutionary england. *Quarterly Journal of Economics*, *103*(3), 1485–1545.

Jha, S., Mitchener, K., & Takashima, M. (2020). *Swords into bank shares: Finance, conflict and political reform in meiji japan* [mimeo].

Jha, S., & Shayo, M. (2019). Valuing peace: The effects of financial market exposure on votes and political attitudes. *Econometrica*, *87*(5), 1561–1588.

Jha, S., & Van Rensselaer, K. (2021). *Profiteers or peacemakers: Financial market responses to war* [mimeo, Stanford].

Jia, C., Wang, Y., & Xiong, W. (2017). Market segmentation and differential reactions of local and foreign investors to analyst recommendations. *The Review of Financial Studies*, *30*(9), 2972–3008.

Kandel, E., & Pearson, N. D. (1995). Differential interpretation of public signals and trade in speculative markets. *Journal of Political Economy*, *103*(4), 831–872.

Kempf, E., & Tsoutsoura, M. (2018). *Partisan professionals: Evidence from credit rating analysts* (tech. rep.). National Bureau of Economic Research.

Koudijs, P. (2015). Those who know most: Insider trading in eighteenth-century amsterdam. *Journal of Political Economy*, *123*(6), 1356–1409.

Koudijs, P. (2016). The boats that did not sail: Asset price volatility in a natural experiment. *The Journal of Finance*, *71*(3), 1185–1226.

Koudijs, P., & Voth, H.-J. (2016). Leverage and beliefs: Personal experience and risk-taking in margin lending. *American Economic Review*, *106*(11), 3367–3400.

Laudenbach, C., Malmendier, U., & Niessen-Ruenzi, A. (2020). The long-lasting effects of experiencing communism on attitudes towards financial markets.

Le Bris, D. (2012). Wars, inflation, and stock market returns in france, 1870-1945. *Financial History Review*, *19*(3), 337–361.

Levine, S. S., Apfelbaum, E. P., Bernard, M., Bartelt, V. L., Zajac, E. J., & Stark, D. (2014). Ethnic diversity deflates price bubbles. *Proceedings of the National Academy of Sciences*, *111*(52), 18524–18529.

Lévy-Leboyer, M., & Bourguignon, F. (1990). *The french economy in the nineteenth century: An essay in econometric analysis*. Cambridge University Press.

Malmendier, U., & Nagel, S. (2011). Depression babies: Do macroeconomic experiences affect risk taking? *The quarterly journal of economics*, *126*(1), 373–416.

Malmendier, U., & Nagel, S. (2016). Learning from inflation experiences. *The Quarterly Journal of Economics*, *131*(1), 53–87.

Mattozzi, A. (2008). Can we insure against political uncertainty? evidence from the us stock market. *Public Choice*, *137*(1-2), 43–55.

Meeuwis, M., Parker, J. A., Schoar, A., & Simester, D. I. (2021). *Belief disagreement and portfolio choice* (tech. rep.).

Mériclet, A. G. (1858). Nouveau tableau de la bourse de paris. conseils aux spéculateurs.

Mian, A., Sufi, A., & Khoshkhou, N. (2017). Partisan bias, economic expectations, and household spending. *The Review of Economics and Statistics*, 1–46.

Miller, E. M. (1977). Risk, uncertainty, and divergence of opinion. *The Journal of finance*, *32*(4), 1151–1168.

Mitchener, K. J., Oosterlinck, K., Weidenmier, M. D., & Haber, S. (2015). Victory or repudiation? predicting winners in civil wars using international financial markets. *Journal of Banking & Finance*, *60*, 310–319.

Occhino, F., Oosterlinck, K., & White, E. N. (2008). How much can a victor force the vanquished to pay? france under the nazi boot. *The Journal of Economic History*, *68*(1), 1–45.

Paradis, J.-H. (1872). *Journal du siège, 1870 -1871, par un bourgeois de paris*.

Piketty, T., Postel-Vinay, G., & Rosenthal, J.-L. (2006). Wealth concentration in a developing economy: Paris and france, 1807-1994. *American Economic Review*, *96*(1), 236–256.

Rigobon, R., & Sack, B. (2005). The effects of war risk on u.s. financial markets. *The Journal of Banking and Finance*, *29*, 1769–1789.

Schneider, G., & Troeger, V. E. (2006). War and the world economy: Stock market reactions to international conflicts. *The Journal of Conflict Resolution*, *50*(5), 623–645.

Verdickt, G. (2020). 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*, *80*(3).

Viaene, A. (2002). *L'efficience de la bourse de paris au 19ème siècle: Une confrontation théorique face aux données empiriques des marchés à terme et à prime* (Doctoral dissertation). Orléans.

Vissing-Jorgensen, A. (2003). Perspectives on behavioral finance: Does" irrationality" disappear with wealth? evidence from expectations and actions. *NBER macroeconomics annual*, *18*, 139–194.

Wang, A. Y., & Young, M. (2020). Terrorist attacks and investor risk preference: Evidence from mutual fund flows. *Journal of Financial Economics*, *137*(2), 491–514.

Wawro, G. (2003). *The franco-prussian war: The german conquest of france in 1870-1871*. Cambridge University Press.

Willard, K. L., Guinnane, T. W., & Rosen, H. S. (1996). Turning points in the civil war: Views from the greenback market. *American Economic Review*, *86*(4), 1001–1018.

World inequality database. (2021). *https://wid.world/country/france/*.

Zussman, A., Zussman, N., & Nielsen, M. Ø. (2008). Asset market perspectives on the israeli–palestinian conflict. *Economica*, *75*, 84–115.

A Appendix

Table A.1: Events and *rente* returns in three cities

	Two-day returns to rentes		
Minor war events	Paris	Bordeaux	Lyon
Strasbourg	**-2.30%**	-0.94%	0.88%
Chevilly	**-2.30%**	1.84%	0.88%
Bellevue	**2.31%**	-0.89%	1.35%
Buzenval	0%	-1.34%	1.81%
Thionville	**-1.42%**	0%	-0.27%
Amiens	0.54%	0%	3.32%
Le Bourget	0.54%	1.09%	-0.54%
Villiers	0.54%	-1.33%	-0.54%
Beaugency	0.45%	0.91%	0.18%
Draws	Paris	Bordeaux	Lyon
Hallue River	0.64%	-0.27%	-0.18%
Bapaume	-0.27%	-1.27%	0%
Pre-siege battles	Paris	Bordeaux	Lyon
Saarbrucken	0%	0.70%	0%
Weissenburg	-2.55%	-0.15%	-0.51%
Froschwiller/Worth/Spicheren	-2.68%	-3.65%	-2.78%
Borny (Colombey)	-2.11%	-1.79%	-3.89%
Vionville-Mars-la-Tour	-0.31%	0.84%	2.25%
Gravelotte-St. Privat	-3.14%	-4.30%	-3.71%
Noisseville	1.81%	1.46%	0.81%
Sedan/Beaumont	-7.24%	-11.60%	-8.15%

This table shows the two-day returns in the three markets to war and peace events in three markets. Returns are calculated as: $\frac{p_t - p_{t-2}}{p_{t-2}}$, 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: bigger responses for war events in Paris, and bigger responses for peace events outside Paris. To calculate the averages we multiply the returns to defeats and the negative peace event by -1.

Table A.2: 3% *Rente* Price Differences in Paris and Elsewhere, during the Siege and in Peace

	Paris - Bordeaux	Paris - Lyon	Paris - Elsewhere	Average Paris price
Siege	0.68***	0.339**	0.490***	55.3
	(0.12)	(0.136)	(0.111)	
Peace negotiations	-1.72***	-1.23***	-1.48***	54.4
	(0.23)	(0.115)	(0.157)	
Peacetime	-0.01	-0.01	-0.01	67.2
	(0.02)	(0.02)	(0.01)	

This table shows the average daily price difference between Paris, Bordeaux, and Lyon prices for three different periods. Elsewhere is calculated as the average between the Bordeaux and Lyon price. The standard errors are the result of a one-sample t-test comparing the sample of daily differences to zero.

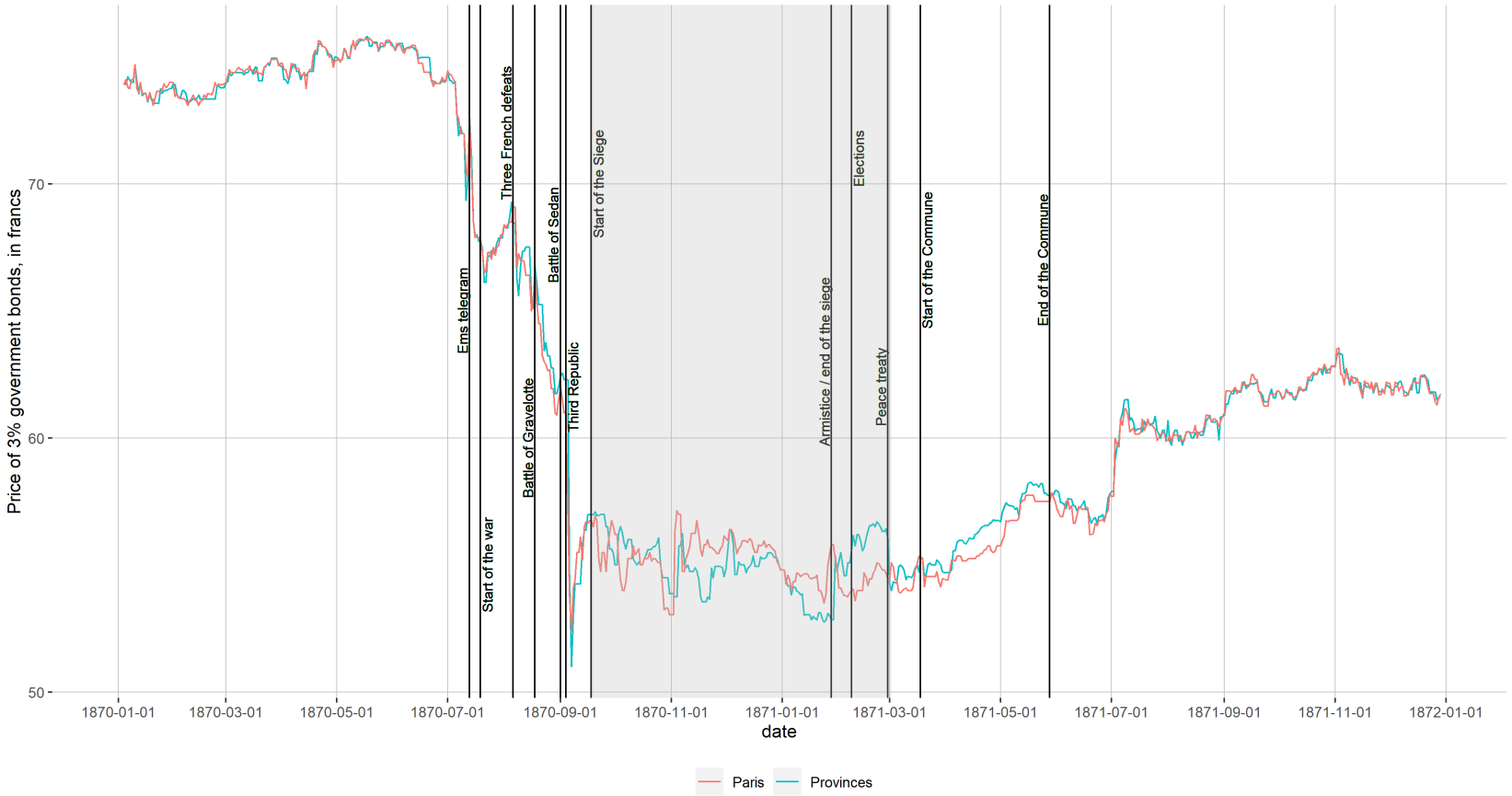
Table A.3: Main events, date, and delay for news to reach each city

Event	Date	How many days later news arrived at... Paris	Bordeaux	Lyon
Defeat at Strasbourg	1870/09/28	4	3	3
1st defeat at Orleans	1870/10/11	4	3	3
Defeat at Metz	1870/10/27	1	5	4
Victory at Orleans (rumor)	1870/11/09	1		
Victory at Orleans	1870/11/09	6	3	3
Defeat at Thionville	1870/11/24	13	6	4
Defeat at Amiens	1870/11/27	7	3	5
Defeat at Beaune La Roland	1870/11/28	19	2	6
Defeat at Villiers	1870/12/03	1	2	2
2nd defeat at Orleans/Loigny (rumor)	1870/12/04	3		
2nd defeat at Orleans/Loigny	1870/12/04	13	3	3
Armistice (rumor)	1871/01/28	-2		
Armistice	1871/01/28	2	3	2
Treaty of Versailles	1871/02/26	2	4	3

Table A.4: Secondary events, date, and delay for news to reach each city

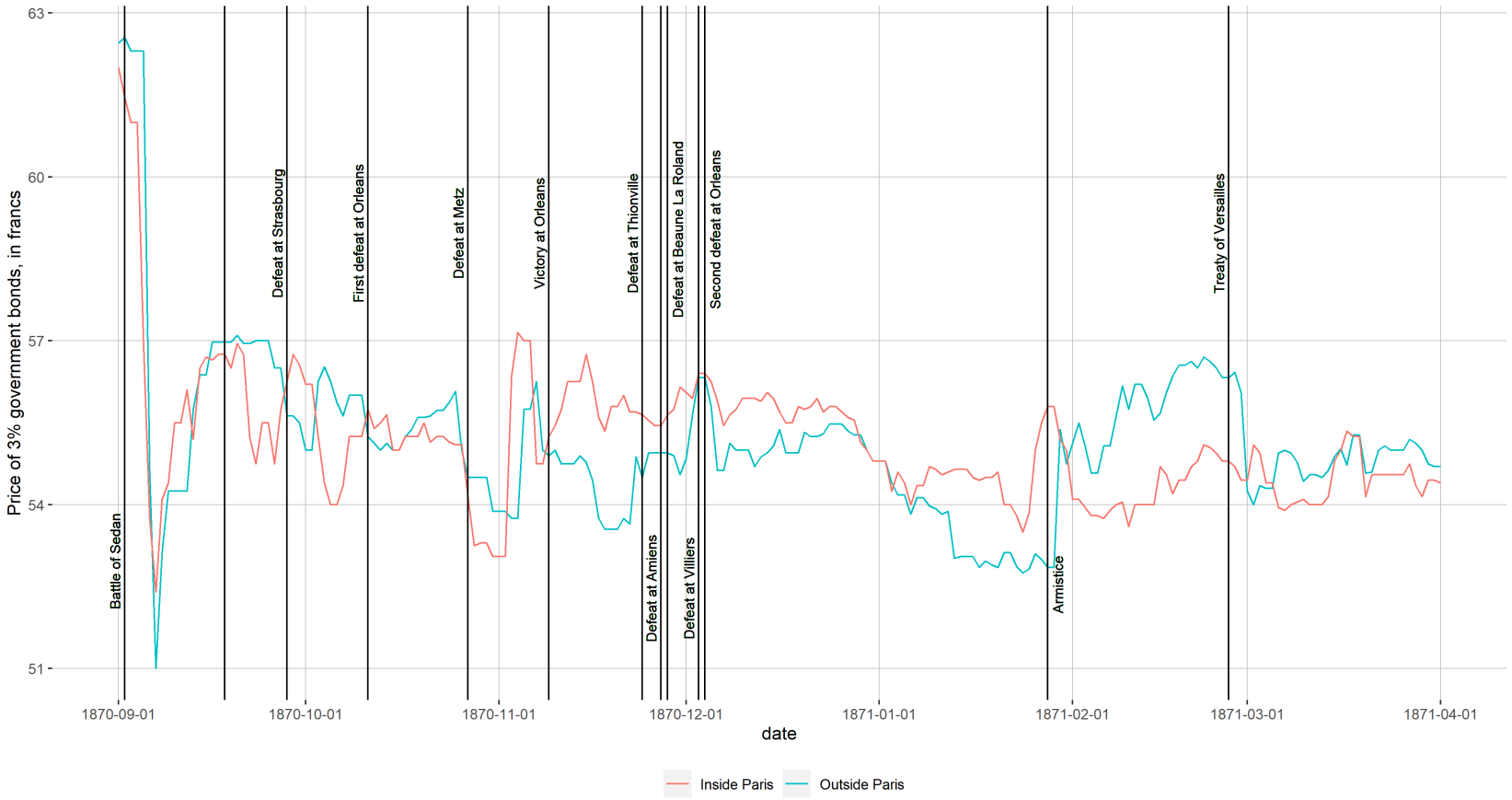
Event	Date	How many days later news arrived at... Paris	Bordeaux	Lyon	Reason for exclusion
Defeat at Dijon	1870/10/30	18	4	3	minor
Defeat at Nuits	1870/12/18	29	3	4	minor
Draw at Hallue	1870/12/24		2	3	draw
Draw at Bapaume	1871/01/03		3	3	draw
Victory at Villersexel	1871/01/10	12	6	3	minor
Defeat at Le Mans	1871/01/12	14	2	2	news arrived to
Defeat at Lisaine	1871/01/15	11	5	5	Paris after
Defeat at St. Quentin	1871/01/19	7	2	6	the armistice

Figure A.1: Prices of 3% government bonds in Bordeaux, Lyon, and Paris



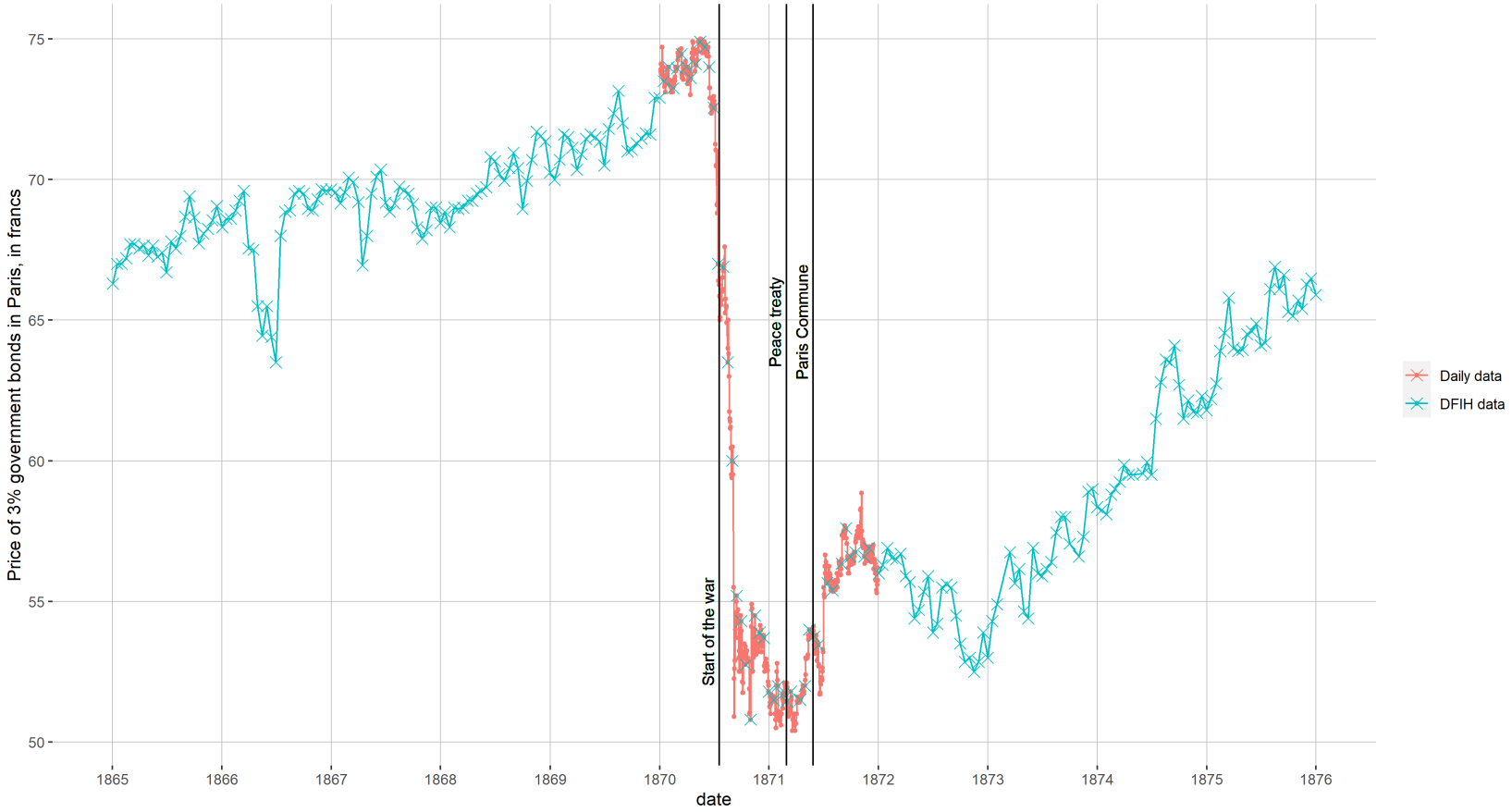
This graph shows the prices of 3% French government bonds inside and outside Paris between 1870-01-01 and 1871-12-31. The outside prices are an average between Lyon and Bordeaux. The shaded area corresponds to the period we analyze (zoomed in in Figure A.2). The events depicted are, on chronological 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.2: Prices of 3% government bonds in Bordeaux, Lyon, and Paris



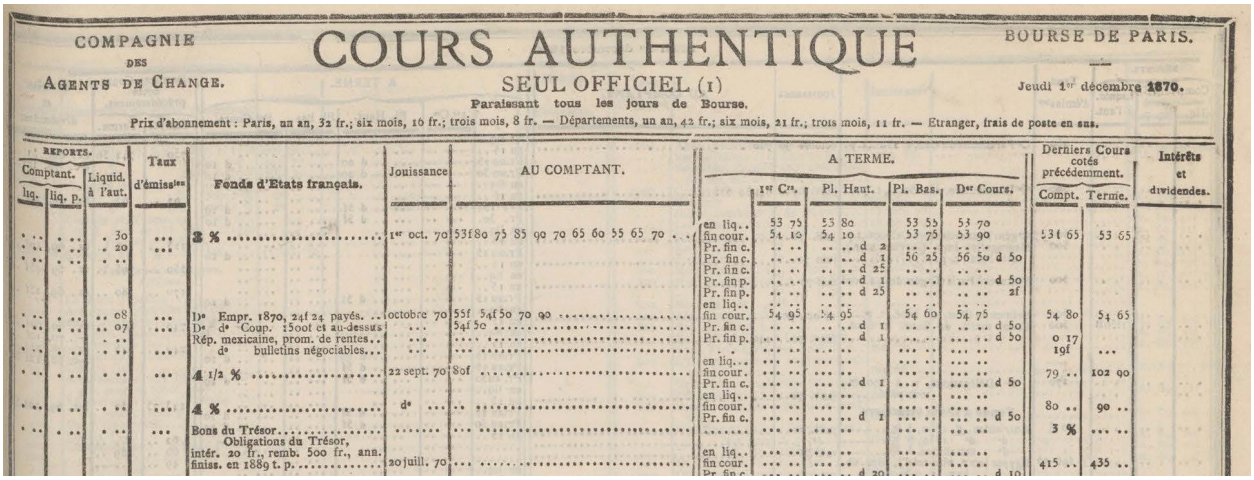
This graph shows the prices of 3% French government bonds inside and outside Paris between 1870-09-01 and 1871-12-31. Outside prices are an average between Lyon and Bordeaux. All the events we use in we use in section 4 are depicted here.

Figure A.3: Prices of 3% government bonds in Paris over 10 years



This graph shows the prices of 3% French government bonds in Paris between 1865 and 1876. In blue, bimonthly prices from DFIH. In red, daily prices collected by us (for 1870 and 1871). The purpose of this graph is to display *rente* prices over a longer time period, and to show that our independently collected data matches DFIH's.

Figure A.4: 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.

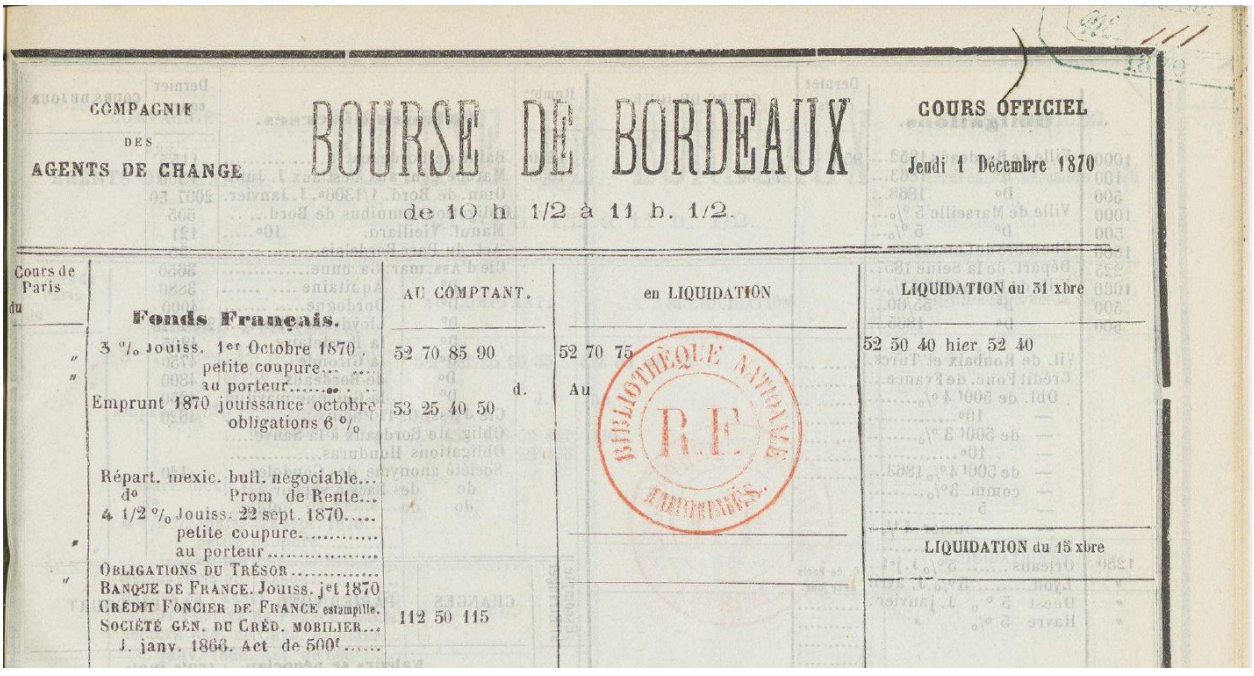
Jeudi 1er décembre 1870.

Prix d'abonnement : Paris, un an, 32 fr.; six mois, 16 fr.; trois mois, 8 fr. — Départements, un an, 42 fr.; six mois, 21 fr.; trois mois, 11 fr. — Etranger, frais de poste en sus.

REPORTS. Comptant. liq. | Liquid. liq. p. | Liquid. à l'aut. | Taux d'émiss.es | Fonds d'Etats français. | Jouissance | AU COMPTANT. | A TERME. 1er Cs. | Pl. Haut. | Pl. Bas. | Dr Cours. | Derniers Cours cotés précédemment. Compt. | Termc. | Intérêts et dividendes.

		30	...	3 %	1er oct. 70	53f 80 75 85 90 70 65 60 55 65 70	en liq..	53 75	53 80	53 55	53 70		
		20	...				fin cour.	54 10	54 10	53 75	53 90	53f 65	53 65
							Pr. fin c.		d 2				
							Pr. fin c.		d 1	56 25	56 50 d 50		
							Pr. fin c.		d 25				
							Pr. fin p.		d 1		d 50		
							Pr. fin p.		d 25		2f		
							en liq..						
		08	...	Dc Empr. 1870, 24f 24 payés.	octobre 70	55f 54f 50 70 90	fin cour.	54 95	54 95	54 60	54 75	54 80	54 65
		07	...	Dc dc Coup. 1500f et au-dessus	...	54f 50	Pr. fin c.		d 1		d 50		
				Rép. mexicaine, prom. de rentes	...		Pr. fin p.		d 1		d 50	0 17	
			...	dc bulletins négociables	...							19f	...
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			...	4 1/2 %	22 sept. 70	80f	fin cour.					79 ..	102 90
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							en liq..						
			...	4 %	dc ...		fin cour.					80 ..	90 ..
							Pr. fin c.		d 1		d 50		
				Bons du Trésor								3 %	... ..
				Obligations du Trésor, intér. 20 fr., remb. 500 fr., ann. finiss. en 1889 t. p.	20 juill. 70		en liq..					415 ..	435 ..
							fin cour.						
							Pr. fin c.		d 20		d 10		

Figure A.5: 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	52 70 85 90	52 70 75	52 50 40 hier 52 40
"	petite coupure			
	au porteur		d.	
	Emprunt 1870 jouissance octobre	53 25 40 50	Au	
	obligations 6 %			
	Répart. mexic. bull. négociable			
	dc Prom de Rente			
	4 1/2 % Jouiss. 22 sept. 1870			
"	petite coupure			LIQUIDATION du 15 xbre
	au porteur			
"	OBLIGATIONS DU TRÉSOR			
	BANQUE DE FRANCE. Jouiss. 1er 1870			
	CRÉDIT FONCIER DE FRANCE estampille.			
	SOCIÉTÉ GÉN. DU CRÉD. MOBILIER	112 50 115		
	J. janv. 1866. Act de 500f			

BIBLIOTHÈQUE NATIONALE R.F.

Figure A.6: Original Source: the published Paris *rente* price in the daily newspaper *Le Salut Public*, Dec 1st, 1870.

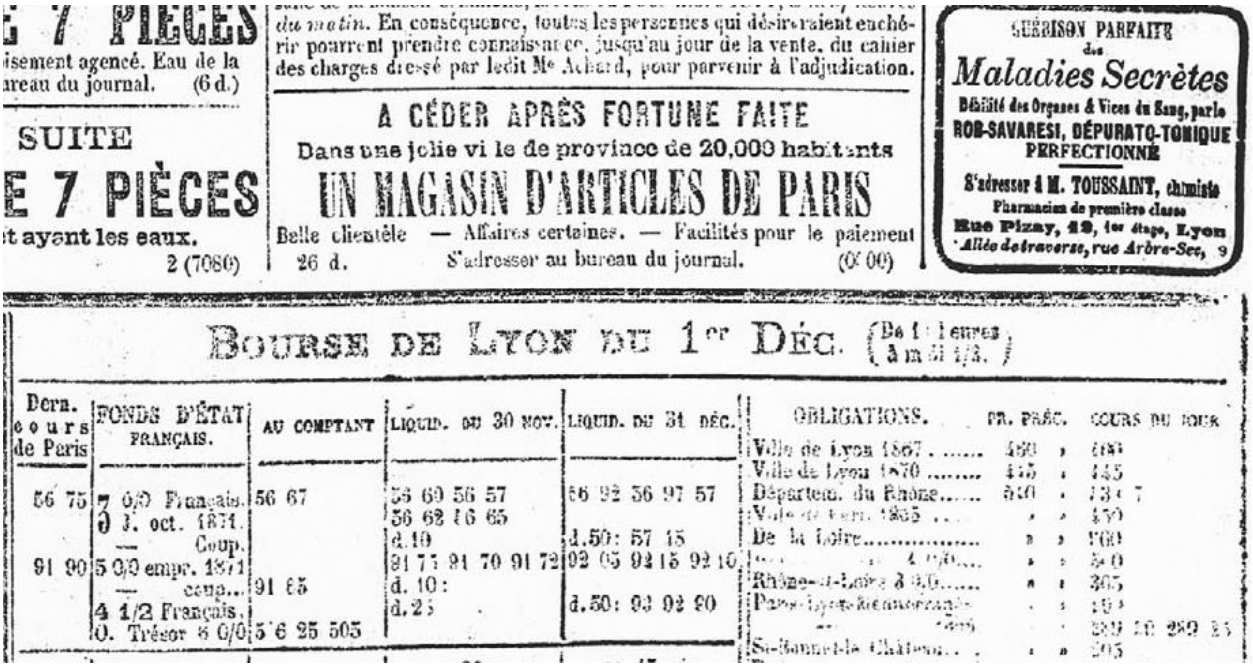
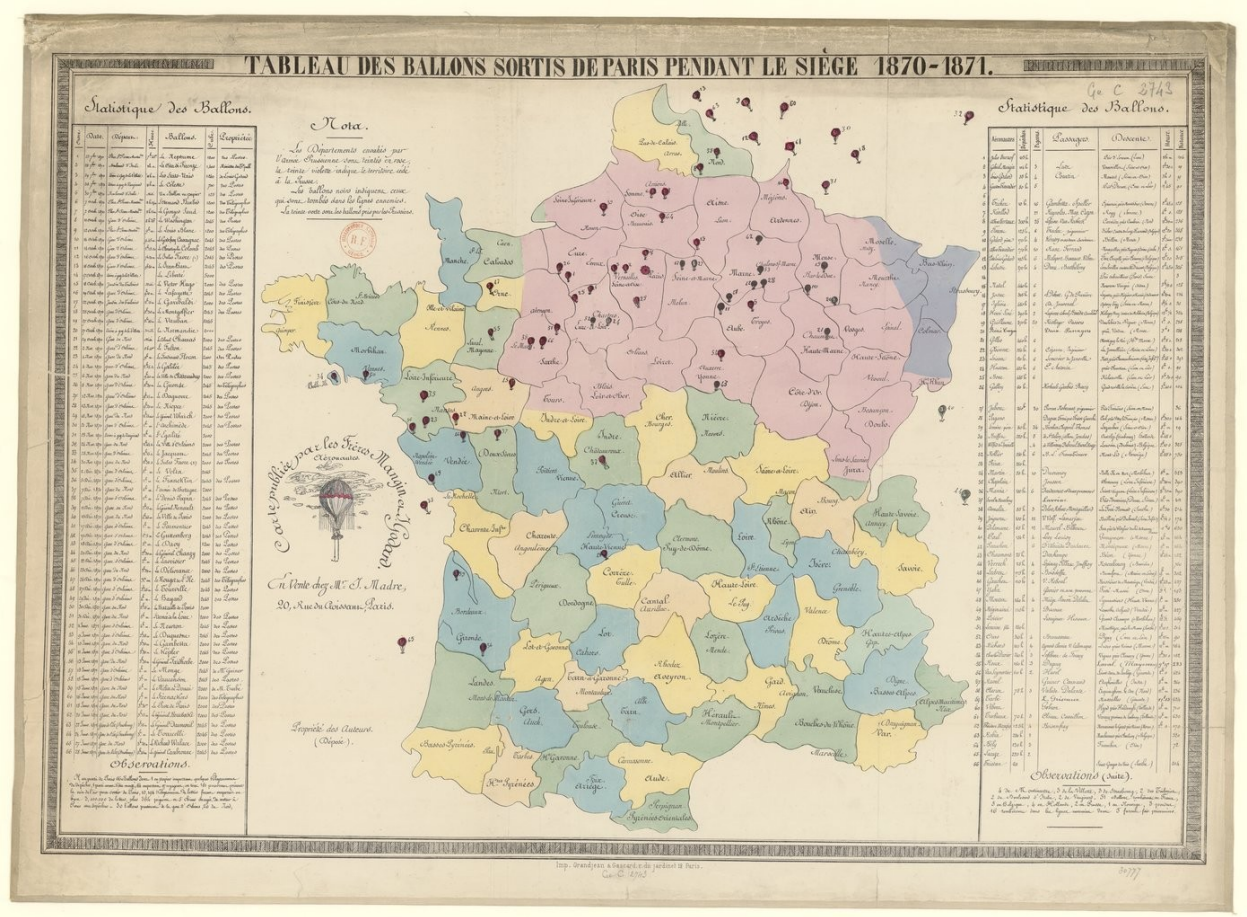


Table A.5: Incoming information and abnormal returns in Paris

	Absolute value of two day rente return			
	(1)	(2)	(3)	(4)
Pigeon arrival in historical source	−0.028	−0.831***		
	(0.257)	(0.263)		
Number of outside news			0.005	−0.008
			(0.016)	(0.017)
Fixed effects	Week	Month	Week	Month
Mean DV	1.006	1.006	1.006	1.006
Observations	133	133	165	165

This table shows the relationship between incoming information and abnormal returns in Paris, as a robustness check of table 8. The dependent variable is the absolute value of the two-day *rente* return in Paris: $|\frac{p_t - p_{t-2}}{p_{t-2}}|$ The independent variables are: a dummy that equal one if a historical source documented a pigeon arrival (from Hayhurst 1970) and the number of outside news reported by *Le Figaro*. Robust standard errors in parenthesis. Models 3 and 4 include both the siege and the peace negotiations. Models 1 and 2 only include the siege (because there were no pigeon arrivals after the siege ended). *p<0.1; **p<0.05; ***p<0.01.

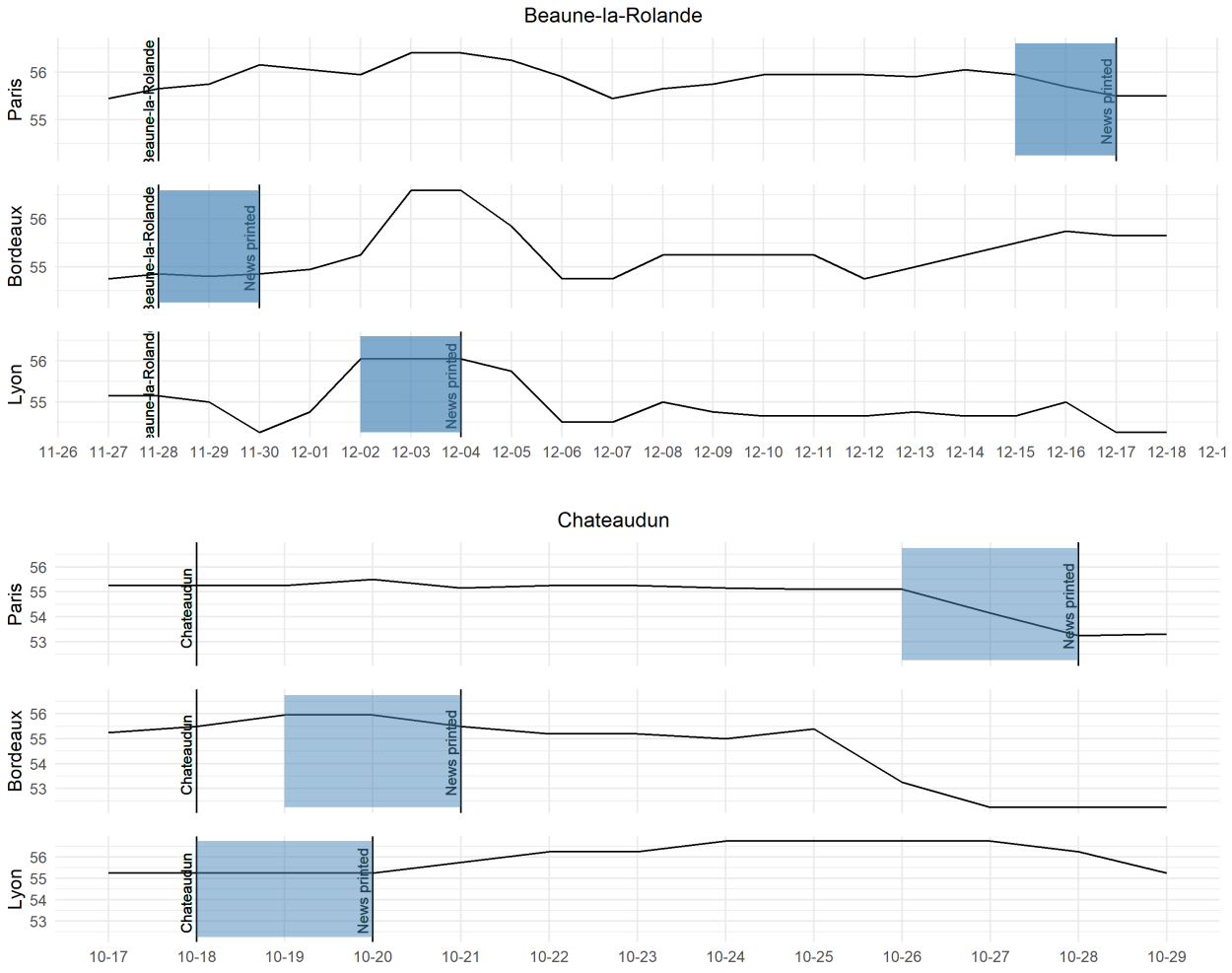
Figure A.7: Original Source: "Table of Balloons Leaving Paris during the Siege, 1870-1871"



Source gallica.bnf.fr / Bibliothèque nationale de France

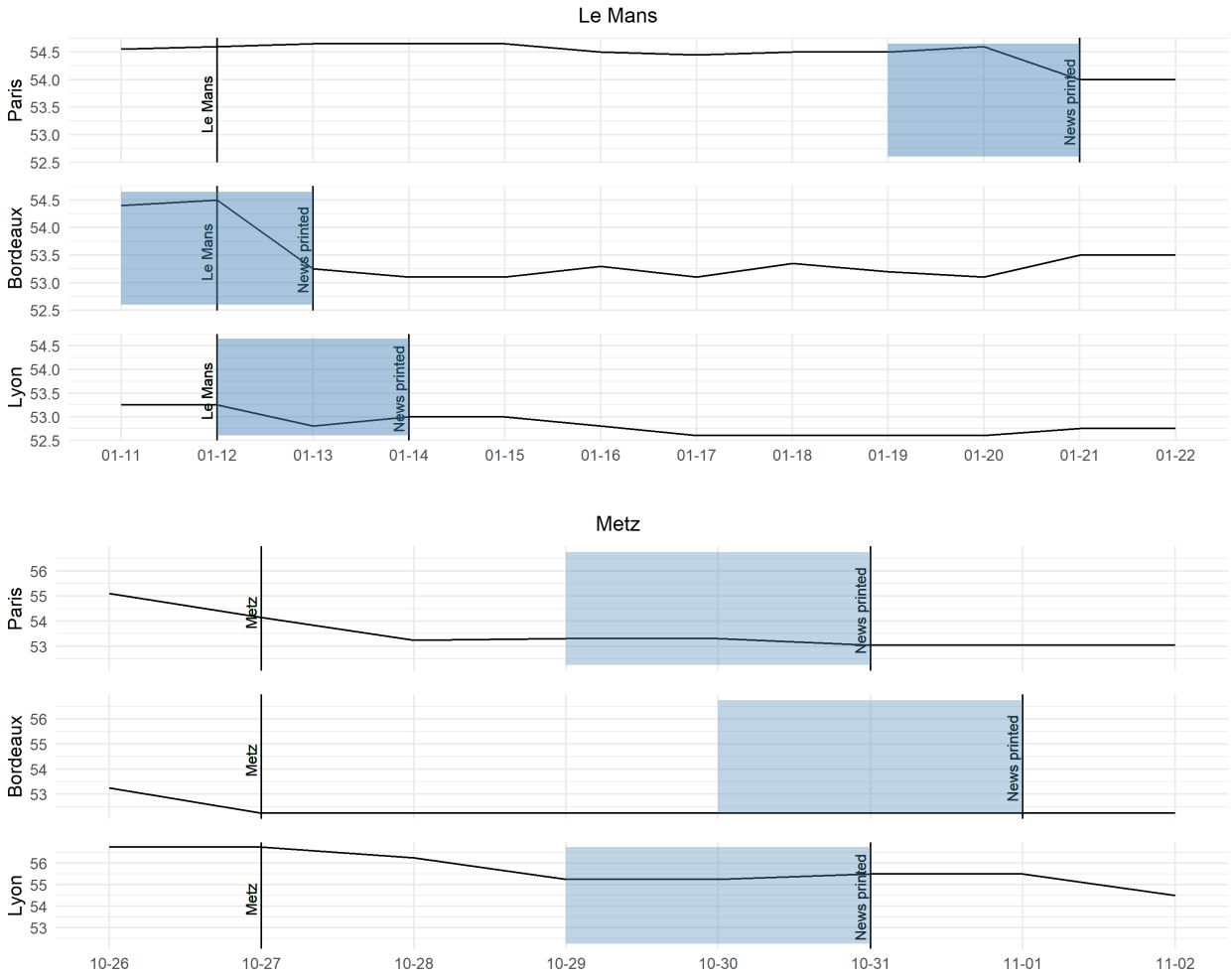
Source: Freres Mangin et Goddard, *Bibliothéque nationale de France*: Ge C 2743.

Figure A.8: Price of *rentes* (in francs) around other major war events



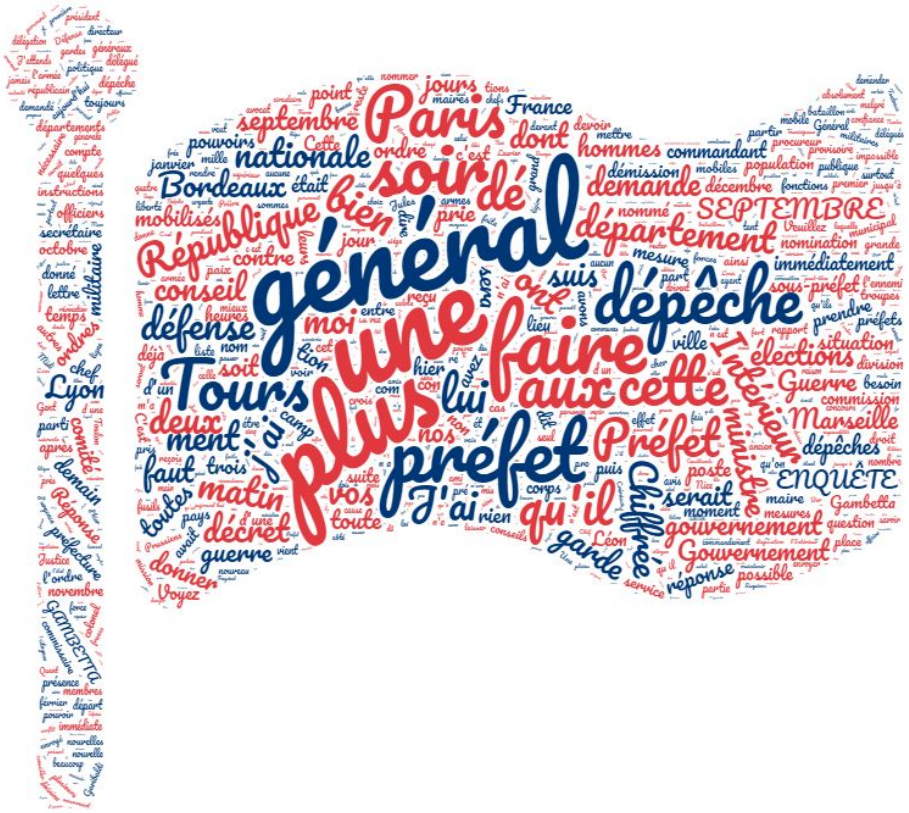
This figure shows *rente* prices in three markets around war events. The shaded area covers the two-day period when news may have arrived. Therefore, response to the event happened within the shaded area.

Figure A.9: Price of *rentes* (in francs) around other major war events (cont.d)



This figure shows *rente* prices in three markets around war events. The shaded area covers the two-day period when news may have arrived. Therefore, response to the event happened within the shaded area.

Figure A.10: Word Cloud Based upon Official Pigeon Correspondence



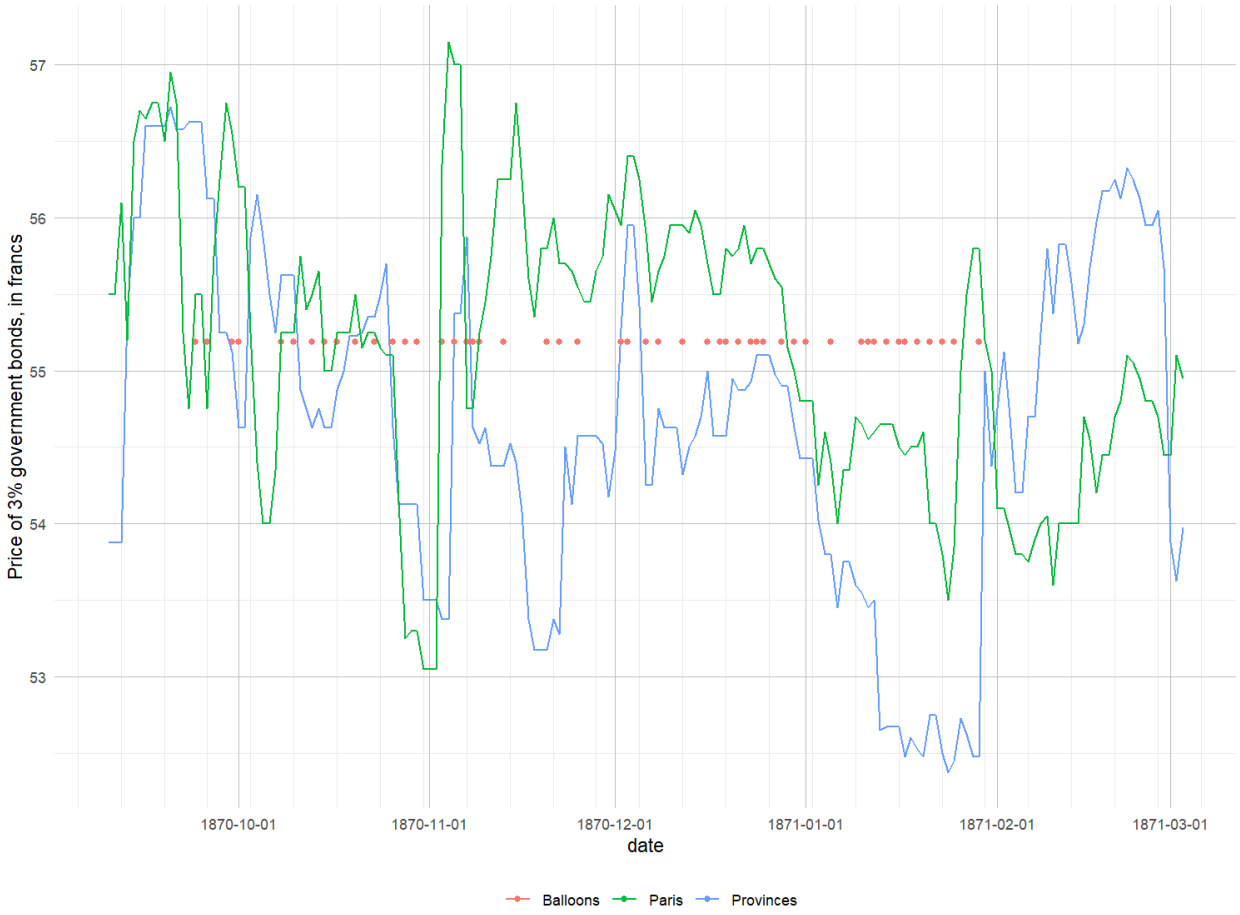
The *rente* was not mentioned in government to government Pigeon communications during the Siege.

Figure A.11: Word Cloud Based upon 29,903 Private Pigeon messages during the Siege.



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.

Figure A.12: Balloon arrival dates and Prices



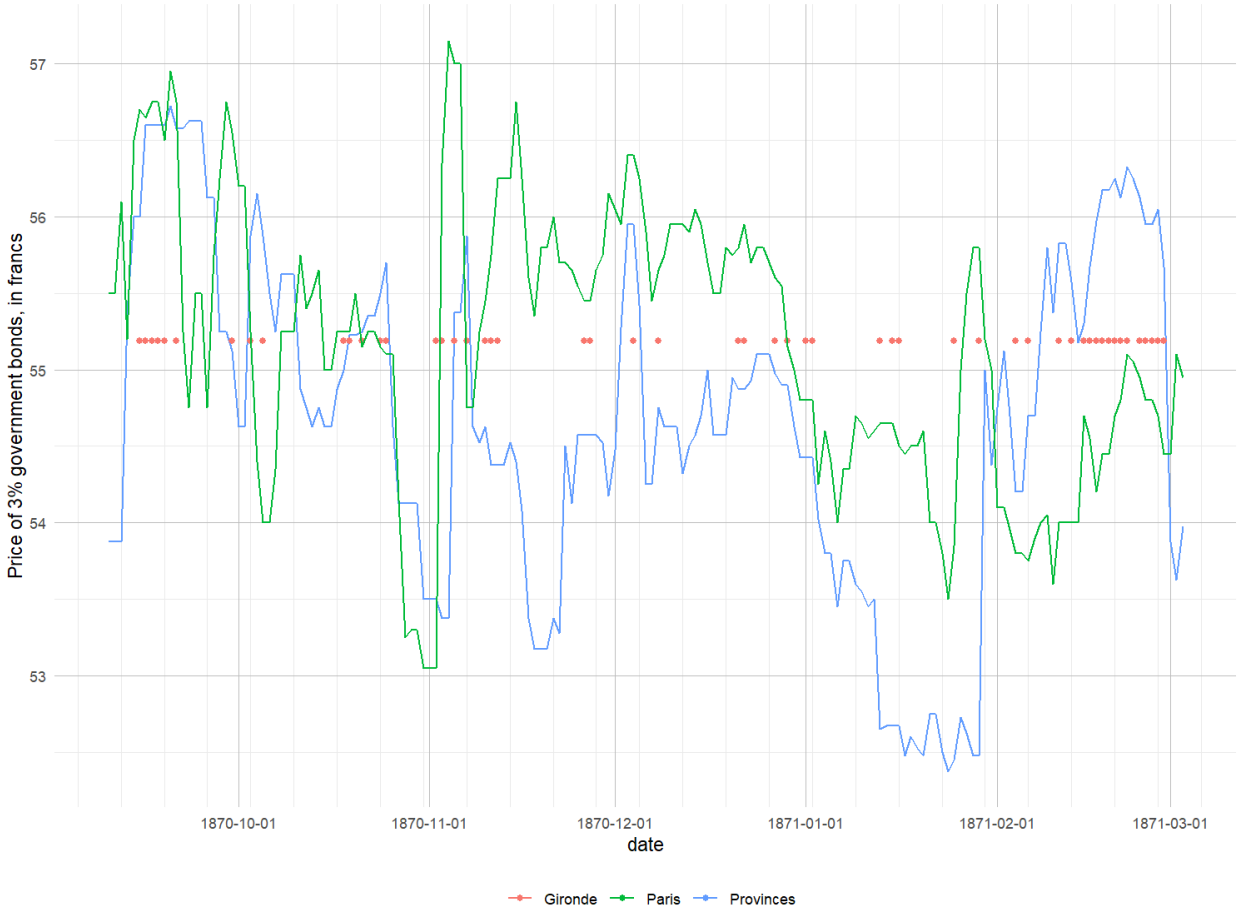
This figure shows the price of the *rente* inside and outside Paris during the Siege. Hot-air balloons travelled from Paris to the outside with official correspondence and private mail, the dots represent days with balloon landings.

Figure A.13: Pigeon arrival dates and Prices



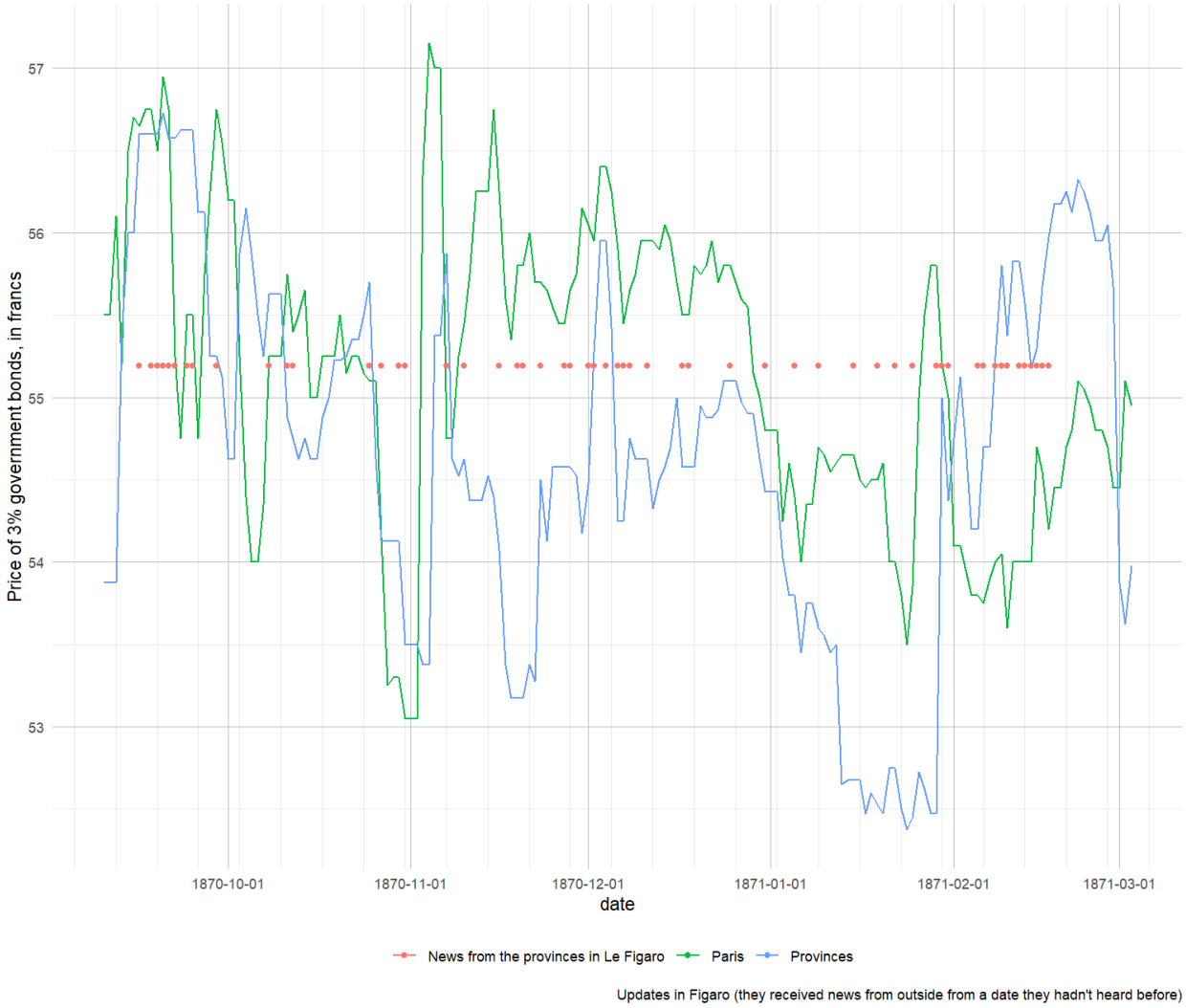
This figure shows the price of the *rente* inside and outside Paris during the Siege. Carrier pigeons travelled from the outside to Paris with both with official correspondence and private mail, the dots represent days with pigeon landings.

Figure A.14: Days with Paris prices printed in Bordeaux and Prices



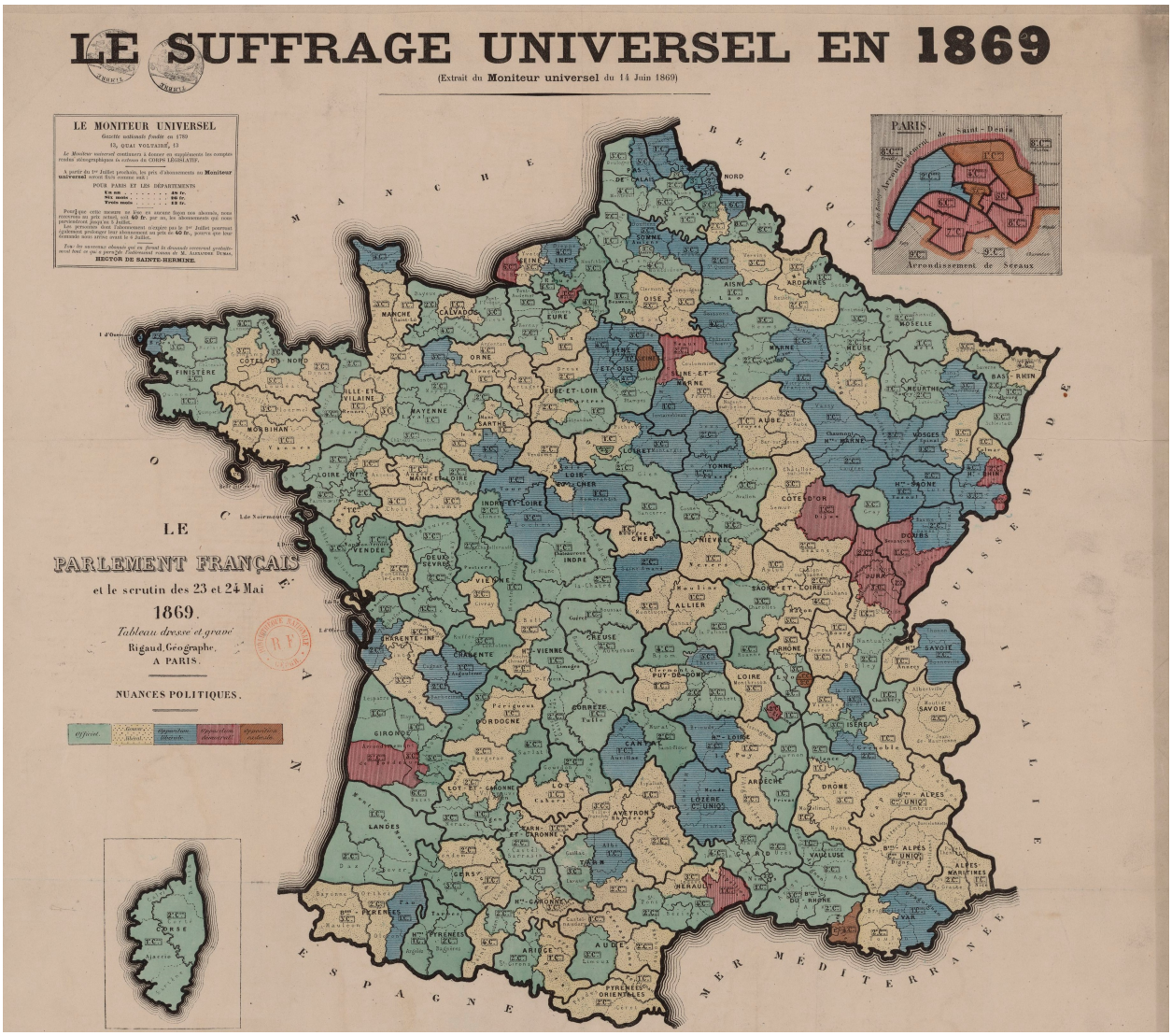
This figure shows the price of the *rente* inside and outside Paris during the Siege. The dots denote the days when the Bordeaux newspaper *La Gironde* printed the Paris prices.

Figure A.15: 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.

Figure A.16: Elections results in the 1869 national elections



The colors denote the party or faction of the majority of deputies elected by each department. From more to less bonapartist (or from right to left): Green - government, white with dots - government liberal, blue with horizontal stripes - liberal opposition, red with vertical stripes - democratic opposition, orange with diagonal stripes - radical opposition. Parisians (zoomed in in the upper left) were way more likely to vote for the left.