Fiscal Sustainability and the Value of Money:
Lessons from the British Paper Pound, 1797-1821 *

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Preliminary

Abstract

This article explores the determinants of price level fluctuations in Britain during the first suspension of the gold standard over the 1797-1821 period. I find that the contemporary price level was determined by world gold prices and expectations regarding the resumption of the gold standard at the pre-war parity. As the latter hinged on market participants' expectations concerning the financial burden of the Napoleonic Wars, my contribution establishes the importance of fiscal factors for the determination of the price level.

Keywords: Fiscal Theory of the Price Level, debt monetization, structural breaks.

JEL: N13, N23, N43, C22.

1 Introduction

The first suspension of the gold standard in Britain from 1797 to 1821 - an episode known as the Restriction Period - is at the origin of monetary economics. Over the 1797-1821 Restriction Period, Britain under George III suspended the convertibility of Bank of England notes into gold in order to finance the Napoleonic Wars. The ensuing inflationary outburst gave birth to the Bullion Report, among the first formal expressions of the quantity theory of money.[1] In the following, I will argue that the same events also underline the impact of fiscal determinants on the evolution of the price level. In particular, I will show that expectations regarding fiscal sustainability shaped the observed evolution of the price level.

The argument that inflation is always and everywhere a monetary phenomenon relies on the implicit assumption that the fiscal authority will adjust the primary surplus in order to stabilize debt. However, the existence of a threshold beyond which a government's possibilities of financing its expenditures are constrained for political or economic reasons, is equivalent to relaxing this postulate (Sargent and Wallace, 1981; Leeper, 2013).

In addition, rather than being a fixed point, the upper bound on a government's taxing power - call it the fiscal limit - is a distribution that can be affected by various factors, including those beyond a government's domain of influence (Bi, 2012; Trabandt and Uhlig, 2011). A factor of particular importance in that respect is war: it is a costly endeavor and, if lost, can strip a country of its tax base, rendering otherwise solid public finances unsustainable. As the outcome of a war can be assumed to be exogenous to the government's will, a credible commitment to contingently sustainable public finances becomes even more difficult.

Therefore, I assume that the public - and notably agents who have bound their financial fate to government bond holdings - constantly assess the probability of an unfavorable outcome of war and its implications for the sustainability of public finances. In other words, agents are expected to incorporate all available information into their expecta-

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[1]Sargent and Velde (2002) place the origins of the quantity theory in the early 17th century, expressed among others in the writings of Juan de Mariana and Henri Poullain.

tions regarding the future state of public finances. This assessment will then affect their spending, investment, and pricing decisions, which in turn shape asset prices and the general price level.

I demonstrate this nexus by identifying structural breaks in the price level. These break dates reflect the historical events that shaped market sentiments. I find that significant changes in prices coincide with events that command a reassessment of Britain's expected military fate. In particular, unfavorable news - concerning a battle lost by the British, for example - has an inflationary impact, as it potentially makes a British victory less probable and, hence, public finances less sustainable. On the contrary, favorable news causes inflation to recede.

Thus, my findings complement the Bullionist position by showing that other factors than the contemporaneous money supply affected price level fluctuations over the Restriction Period. These results are relevant in that they corroborate the effects of mounting fiscal pressure on prices in a fiat currency regime with flexible exchange rates, the mode of economic organization chosen by most industrialized economies.

The remainder of the article is organized as follows. Section 2 outlines links to the relevant literature, after which section 3 briefly recalls the events that led to the suspension and resumption of the gold standard in 1797 and 1821 respectively. Section 4 then details the econometric procedure used to detect the structural breaks identified as events shaping fiscal anticipations and, hence, asset prices. The following section 5 comments on the results. Section 6 offers a discussion on how to embed the results in the broader literature and section 7 concludes briefly.

2 Related literature

The importance of fiscal factors for price level determination goes back to Sargent and Wallace (1981). In their framework, fiscal profligacy may imply future money supply growth and, therefore, inflation through seignorage. More recently, the Fiscal Theory of the Price Level (FTPL henceforth) explains price movements by changes in government

debt sustainability. Governments issue nominal bonds that are claims to nominal payoffs. Whenever the government cannot or does not want to raise the necessary real backing against its debt, changes in the price level adjust the real value of outstanding debt depending on the discounted sum of future expected government surpluses (see Leeper, 1991 and Woodford, 2001). Hence, current and future fiscal deficits affect inflation.

Both frameworks rely on the existence of a fiscal limit, i.e. a point beyond which a government's possibilities of financing its expenditures are constrained. A restriction on government's taxing power is equivalent to relaxing the postulate that the fiscal authority accommodates the central bank's policies by adjusting its primary surplus in order to keep debt on a sustainable path. This entails the central bank's incapacity to control inflation, as fiscal policy now directly affects prices.

In addition, fiscal limits entail the existence of a threshold beyond which agents cannot be convinced that a return to the virtuous regime is feasible without some type of default - soft by means of inflation or hard as a tax on the capital of certain agents. Thus, the current behavior of policy makers influences agents' beliefs about how debt will be stabilized in the future. Beyond a government's initial commitment, agents will, hence, try to incorporate all available information that can help anticipate the future state of public finances.

The above does not necessarily entail that governments or central banks are not credible in their policy commitments. The soundness of British institutions at the time is broadly established (see Bordo and Kydland, 1995 for monetary policies; North and Weingast, 1987, Stasavage, 2007, and Sussman and Yafeh, 2006 for public finances).[2] However, fiscal sustainability also depends on exogenous factors - such as war related costs - that governments simply cannot commit to. Severe territorial losses and their impact on an economy's tax base or imminent reparation payments (Oosterlinck, 2012) can become prohibitive and render default inevitable.

Other authors have treated the impact of war fare on capital markets and inflationary

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[2]Britain's superior institutional settings facilitated war finance, eventually leading to Britain's victory over Napoleon (Bordo and White, 1991; Dickson, 1967; Chamley, 2011)

outcomes over the Restriction Period. The channel that Barro (1987), Barsky and Summers (1988) or Benjamin and Kochin (1984) highlight, relies on the eviction of private investment and consumption by public expenditures. As war time spending crowds out private expenditures, adjustments in the interest rate have to match the rising marginal product of capital during war times.

Over the period under consideration, the credit marked did, however, rarely reach equilibrium through changes in interest rates alone, but balanced rather through quantities (Ashton, 1959; Temin and Voth 2005). Usury laws, only abandoned in 1833, set a maximum interest rate of 5%; a market clearing mechanism based on a price signal does, therefore, not seem applicable to the Restriction Period.

Moreover, the above contributions analyze the part of the nominal interest rate that reflects the real expected interest rate. Although Bordo and Kydland (1995) demonstrate why long-term inflationary expectations could have been stable over the period, there is no available series that could definitely corroborate this finding.

In the absence of such evidence, movements in interest rates may also reflect changes in anticipated inflation or in the default premium on British bonds (Barro, 1987). This is my underlying hypothesis for what follows, as it has been the case for Frey and Kucher (2000), Webb (1986), Calomiris (1988) and Guinnane et al. (1996) in their analyses of 20th century Europe and the United States during the Civil War.

3 Course of events

The onset of convertibility suspension: changing money demand

The Reign of Terror in France in early 1793 had produced a sharp outflow of capital, inducing silver and gold to leave France for Britain (Sargent and Velde, 1995). This had provided ample liquidity for the British banking system. When the assignats collapsed in France in 1795, money for ordinary payments became short and those with claims or credit in Britain drew on them to fill the gap. The ensuing outflow of capital put

deflationary pressure on Britain (Kindleberger, 1984).

Gold outflows induced supply shortage and, thus, an increase in the market price of gold. Yet, under convertibility, gold still exchanged into bank notes for the same predetermined amount of pounds. In itself, this discrepancy in value (mint versus market) implied an incentive to convert even more bank notes into gold. Under these circumstances, minor French military actions triggered a bank run aiming at converting bank notes into gold specie (Chadha and Newby, 2013). The consequences of that run were felt throughout the country, putting numerous (country) banks out of business (Feavearyear, 1964).

Subsequently, on 27 February 1797 the Bank of England (BoE henceforth) was given permission, to cease payment of its notes in gold, before running out of reserves. With the suspension, local bank notes were convertible only into BoE notes. The 1797 suspension of the BoE to convert its notes into bullion shifted Britain's monetary system from a commodity standard towards a flexible exchange rate.

Note (over) issue or the lender of last resort

The internal and external value of the paper pound started decreasing around 1809 (figures 1 and 2).[3] Classical value theory, to which Ricardo (1817) was a major contributor, held that the equilibrium price of a good was determined by its production costs. It was believed that the production prices of gold and silver were relatively stable. A rise in the sterling price of gold bullion, and, hence, an increase in the difference between the mint and the market price of gold, was perceived as evidence for inflation (figure 3). After the suspension of convertibility of Bank of England notes into gold in 1797, a fall of the exchange rate on foreign currencies was interpreted identically (Laidler, 2000).

These evolutions induced government to appoint an investigating committee that published its work in 1810 as the Bullion Report. According to it, rising prices and falling exchange rates had a common source in the over-issue of BoE notes. The latter was undertaken to buy government debt - used to finance the Napoleonic Wars -, which would

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[3]The price indices presented here were constructed *ex post* and not available at the time of the Bullion Report.
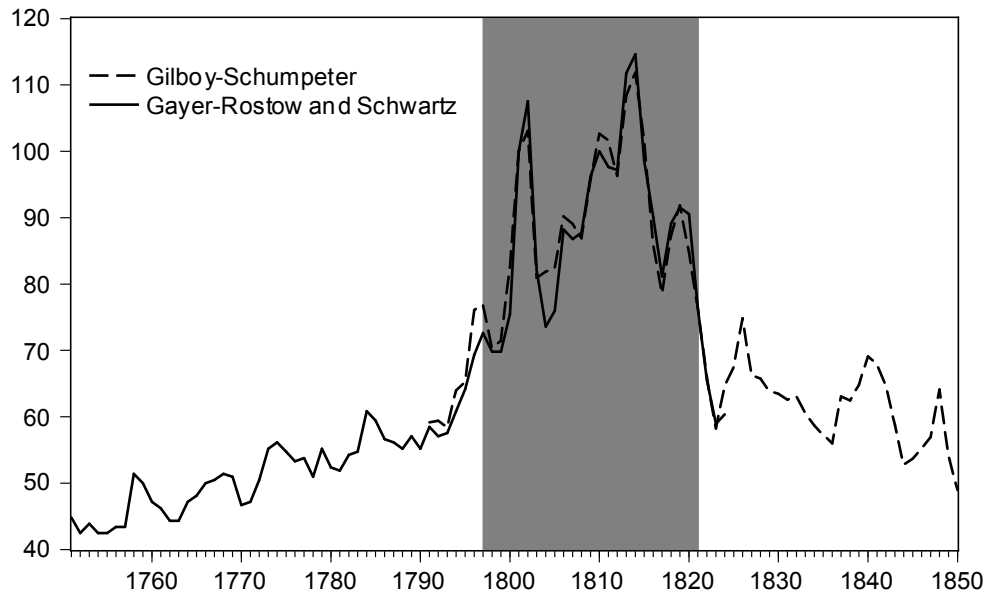
Figure 1: Price indices, 1750 to 1850

The shaded area marks the suspension of the gold standard from February 1797 to May 1821. Sources: Gayer, Rostow and Schwartz, 1953; Schumpeter, 1938.

have been impossible had the BoE still the obligation to convert its liabilities into bullion.

The BoE had indeed expanded its note issue. The peak in the BoE's and note issue was reached when the burst of the South America bubble in late 1810 induced wide spread panic and business failures (Feavearyear, 1964; O'Brien, 2010). Amid spreading commercial distress, country banks had started contracting their note issue drastically. The liquidity shortage had been broadly acknowledged and the authorities had attempted to overcome it by issuing commercial Exchequer Bills (O'Brien, 2010; Clapham, 1944; Flinn, 1961). Thus, at least part of it could be accounted for to its normal function as a lender of last resort, when other forms of credit disappeared.

Fiscal pressure and the long path to resumption

Fiscal pressure further delayed resumption. The Bank Restriction Act of 1797 had ini-
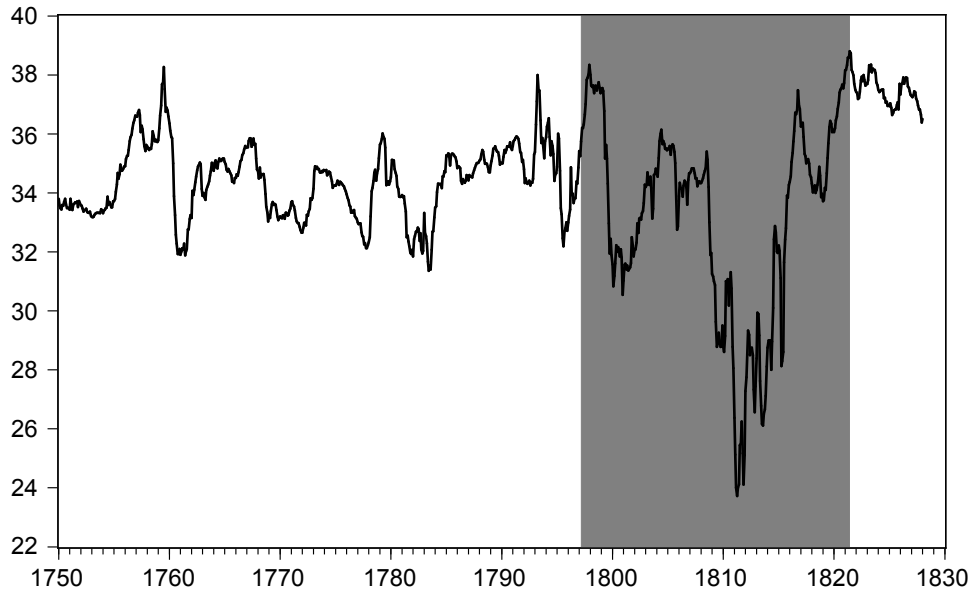
Figure 2: Exchange rate on Hamburg: Schilling per Pound Sterling, sight, 1750 to 1830

The shaded area marks the suspension of the gold standard from February 1797 to May 1821. Sources: Boyer-Xambeu et al., 1994

tially determined that specie payments would be resumed six months after the end of the war. Yet, between the end of the Napoleonic wars in June 1815 and the resumption of the gold standard, the legal limit had to be extended several times. Cannan (1919) explains that the BoE's unfortunate financial situation in 1816 was caused by its lending to the Treasury and exacerbated by inadequately high dividend payments.[4] Clapham (1945) emphasizes that the Bank's high average of notes outstanding in 1817 and 1818 was due to the incessant lending to the Treasury; commercial lending was abnormally low over the same period. This had contributed to the failed resumption of July 1818.

In total, the Bank's holdings of public securities, almost exclusively exchequer bills, had increased by 40% between February of 1816 and August of 1818. This evolution reflected

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[4]While a decline in the BoE's after war profits would have called for a reduced distribution, the Bank continued to pay its dividend at the usual 10% meaning that it paid its proprietors nearly £300,000 per annum more than it did over the 1807-15 period.
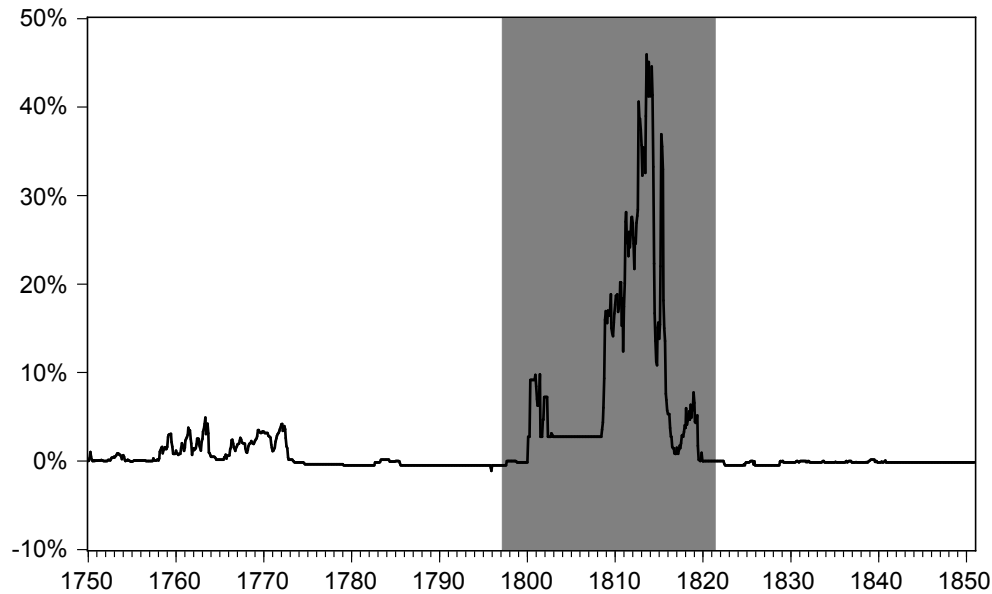
Figure 3: The agio, market minus mint price, 1750 to 1850

The shaded area marks the suspension of the gold standard from February 1797 to May 1821. Sources: Neal, 1990.

the sizable increase of public debt over the period: by 1815, the debt to GDP ratio had reached 226%, up from 120% in 1793. The increase was of the same order of magnitude as the one caused by World War 1 (see figure 4).

Note that in terms of taxation, room for maneuver was very limited, placing the British economy close to its fiscal limit or the peak of its Laffer curve. After four years of unsuccessful warfare and the growing perception that the war against Revolutionary France was going to be more dangerous and costly than previously thought, Pitt the Younger, Prime Minister and Chancellor of the Exchequer, was able to impose Britain's first income tax. How strong the opposition to this measure was, can be seen from the fact that it was instantly repealed at the Peace of Amiens in 1802 and after the final victory at Waterloo in 1816. In addition, the broad social consensus entailed that it was indecent to tax the poor's necessities, taxing, hence, mostly goods consumed by the affluent. The government had, however, virtually exhausted its possibilities for direct taxation;

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further increases in tax rates had become self-defeating - as when notable families ceased to exhibit armorial bearings or to use hair powder (O'Brien, 2007).[5]

Over the whole after-war period, BoE directors had insisted that an effective resumption was only possible if the government paid back a substantial amount of debt to the Bank. The legal framework governing the definite resumption of specie payments - Peel's Act, enacted 2 July 1819 - imposed the repayment of £10 million of government short-term debt and also made it illegal for the BoE to lend money to the government for more than 3 months without approval of Parliament. This paved the way for resumption, undertaken by 1 May, 1821.
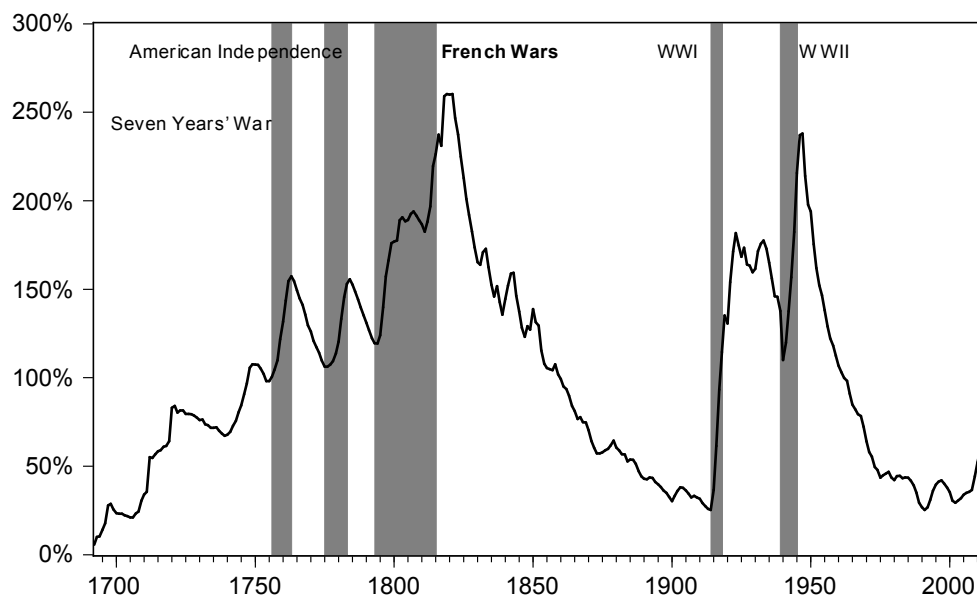
Figure 4: Debt to GDP ratio, 1692-2011

Sources: Mitchel, 1988; Officer and Williamson, 2013

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[5]For details on the tax incidence of the Sinking Fund, see O'Brien 2006.

4 Econometric methodology

4.1 The data

In order to most accurately capture the nexus between expectations regarding the sustainability of public finance and evolutions in prices, I focus here on the series that contemporaries used to assess inflationary tensions. To a minor extent, this is a technical constraint as price indices did not exist at the time and available data were not exploited thoroughly (Arnon, 1990). Primarily, this is, however, done to grant historical coherence between my findings and the Bullion Report's sources and basic hypotheses.

The Bullion Committee and the broader public paid attention to prices of specific, widely traded goods, such as wheat, gold bullion and sterling bills of exchange (notably on Hamburg and Amsterdam). Of these data, I will concentrate on the difference between the market and the mint price of gold bullion[6], the *agio* (see also section 3.2), for the following reasons:

- Absent efficient storage technologies, wheat prices were affected by various real factors, such as bad harvests (Tooke, 1824) or the various trade barriers installed during the period under consideration (for the Continental System, see Crouzet, 1964; for the US embargo, see Frankel, 1982). These factors stood in no connection with agents' expectation on fiscal sustainability and would render the interpretation of thus noisy price data difficult.

- The exchange rate was affected by (real) factors that had no direct relevance for the internal valuation of the currency. When, for instance, the pound sterling depreciated on the Hamburg exchange between 1800 and 1801, this was due to bad harvests and deflation in Hamburg (Newby, 2008).

- The supply of precious metals was stable during the Restriction Period (Barro, 1987). In addition, melting down and export of British coin were prohibited. I also posit that changes in the demand for non-monetary uses of gold did not occur

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[6]In 1717, Newton fixed the pound sterling at a gold price of £3 17s 10.5d. This mint price lasted with lapses for the two restriction periods until 1931.

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during the Restriction Period.[7]

- Finally, financial data offer the advantage of reflecting subjective expectations of decision makers about the future. Therefore, their use avoids certain selection biases: financial decisions have pecuniary consequences, which implies incentives to behave as a profit-maximizer. Traders attempt to pin down what did or will happen, not for its own sake or historical purposes, but in order to assess the future value of the asset they hold or intend to acquire (Frey and Kucher, 2000).

The data set spans the years 1718-1873 and is based on Castaing's Course of the Exchange, published twice a week (reproduced in Neal, 1990 and Boyer-Xambeu et al. 1994). As presented in figure 3, the *agio* increased substantially after 1808 and reached a peak of 45% mid 1813. Recall that contemporaries interpreted increases in the *agio* as a metric of the pound's internal devaluation. An increase of gold's market value in terms of paper pounds entailed that more pounds were required to purchase the same commodity. Absent any significant changes in the supply of gold, an increase in the *agio*, therefore, necessarily implied a devaluation of the pound. Table 3 in the appendix provides descriptive statistics for the *agio*.

4.2 Estimation procedure

I presume that certain events allow forming anticipations regarding the outcome of the Napoleonic Wars. Thus, these events convey real time information on the future path of public finances. Important enough changes in agents' expectations regarding the sustainability of British public debt should then affect the internal value of the currency and, hence, the *agio*. Therefore, I should be able to identify these events as structural breaks in the *agio*.

My analysis is different from an event study or the so-called narrative approach, as the starting point is not a predefined list of historically important dates with the data

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[7]It is well known that prices for precious metals increase in times of financial or political turmoil. This reflects precautionary motives for the detention of gold or 'the flight to quality'. As this entails a hedge against future inflation, I consider that this motive for the acquisition of gold is in line with my hypothesis and that it can be understood as a future monetary use of gold.

telling which matter. On the contrary, the methodology employed here allows detecting the events that contemporaries considered to be significant for the future course of British finances without any *ex post* bias. This pays attention to the concern that historical events are not a prequel to what ensues but have to be analyzed in their historical context (see Chamley, 2011 for importance of market expectations).

In addition, the understanding of contemporaries' perception is enhanced by the use of financial market data. The latter are highly informative when one wishes to assess the contemporaneously perceived importance of events, since any misinterpretation of incoming information has adverse pecuniary consequences (Frey and Waldenström, 2008 and Oosterlinck et al. 2013).

My approach bears the risk of 'over-interpretation', i.e. the risk that historical events of minor importance are matched with the determined break dates at any costs. I will verify the importance of events matched with the detected break dates by considering contemporary sources, namely the *The London Times* and the *The London Gazette*, government's official journal.

The procedure used to estimate the break dates is based on Bai and Perron (1998 and 2003).[8] It offers the advantage of allowing for a very wide range of specifications (serial correlation and heteroskedasticity in the errors, lagged dependent variables, trending regressors, as well as different distributions for the errors and the regressors across different segments). The procedure also encompasses a whole battery of different break point tests (sequential and global methods), increasing greatly the robustness of results.

Consider the following multiple linear regression model with m breaks and $m+1$ regimes:

$$y_t = x_t^{'}\beta + z_t^{'}\delta_j + u_t \tag{1}$$

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[8]Various other studies in the field of economic history have used break point tests; a non-exhaustive list includes: Guinanne et al., 1996; Brown and Burdekin, 2000; Frey and Kucher, 2001; Oosterlinck, 2003; Frey and Waldenström, 2008; Zussman et al., 2007; Flandreau and Oosterlinck, 2011.

for $t = T_{j-1} + 1, .., T_j$ and $j = 1, .., m + 1$. y_t is the observed endogenous variable, $x_t(p \times 1)$ and $z_t(q \times 1)$ are vectors of co-variates and β and δ_j are the corresponding vectors of coefficients. u_t is the disturbance at time t. Given the T observations of (y_t, x_t, z_t) I attempt to estimate the unknown regression coefficients β and δ_j and break dates. For the *agio*, I will posit that all coefficients are subject to change, obtaining a pure structural change model ($p = 0$) of the following form:

$$y_t = z_t^{'}\delta_j + u_t \tag{2}$$

Note that the variance of u_t does not need to be constant. Breaks in the variance are permitted, provided they occur at the same dates as the breaks in the parameters of the regression.

I define a break in the series as a change in the conditional mean of the series y_t, i.e. I specify that the intercept can change ($z_t = 1$). The focus is here on abrupt structural changes in the mean that reflect the advent of unexpected news affecting Britain's war fate and, hence, public finances. For that reason, I also exclude past values of the endogenous y_t. When lagged values are included, changes in the level of y_t also depend on the auto-regressive dynamics of the series; thus, the change takes effect gradually.[9] On the contrary, when specifying $x_t = \oslash$, all the dynamics are contained in the error term and the change is, hence, abrupt (Bai and Perron, 2003).[10] [11]

In the following, I first run the break point procedure on monthly data for the 1795-1823 period. This data set is comparable to the ones used in earlier studies (Neal, 1990) and contains 340 observations. I then use the daily data, in order to detect more precise break dates. Due to data availability issues, I do only estimate daily break dates for the 1811-1823 period. The daily data set encompasses 1350 data points.

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[9]The 1802-1807 period reflects data issues rather than persistence in the series.

[10]When no lagged variable is part of (z_t, x_t), the conditions on the residuals allow for autocorrelation and heteroskedasticity.

[11]Including a lagged value for the endogenous variable does not alter the results for the break tests.

Increasing the number of observations included in the sample, also allows detecting more break dates, as the number of breaks depends on the possible size of segments, i.e. the number of observations between two adjacent breaks (Bai and Perron, 2003). A minimal segment size warrants that each segments contains sufficient observations to estimate parameters precisely.

In the presence of autocorrelation and heteroskedasticity, as it the case here, each segment should include at least 24 observations (Bai and Perron, 2003). Finally, a trimming parameter ϵ links the minimal segment size, h, to the maximal number of breaks, k, allowed: $\epsilon = \frac{h}{T}$. For a sample of T observations one obtains the maximal number of breaks, k: $\epsilon = 0.05 \Rightarrow k = 10; \epsilon = 0.10 \Rightarrow k = 8; \epsilon = 0.15 \Rightarrow k = 5; \epsilon = 0.20 \Rightarrow k = 3; \epsilon = 0.25 \Rightarrow k = 2;$.

5 Results

5.1 Monthly data

The monthly break dates are displayed in figure 5 and table 1 (table 4 in the appendix provides confidence intervals and parameter estimates). The events that coincide with the detected break dates are outlined below:

- **January 1800**: The winter of 1799 brought General Napoleon Bonaparte to power as first Consul of France, a position granting him broad and unchecked authority. Given his military successes during the war of the First Coalition (1792-1797), his accession to power was thought to reestablish France's place in the concert of nations (Mignet, 1826). When Britain declined Napoleon's offers to begin peace negotiations - as announced in the *London Times* on 6 January 1800 - the *agio* increased.[12]

- **April 1802**: The Treaty of Amiens ended hostilities between the French Republic

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[12]Market sentiment was right in that the following months would play out unfavorably to Britain. The battles of Marengo (14 June 1800) and Hohenlinden (3 December 1800) sealed Austria's defeat, leaving the British as the only army opposing France.
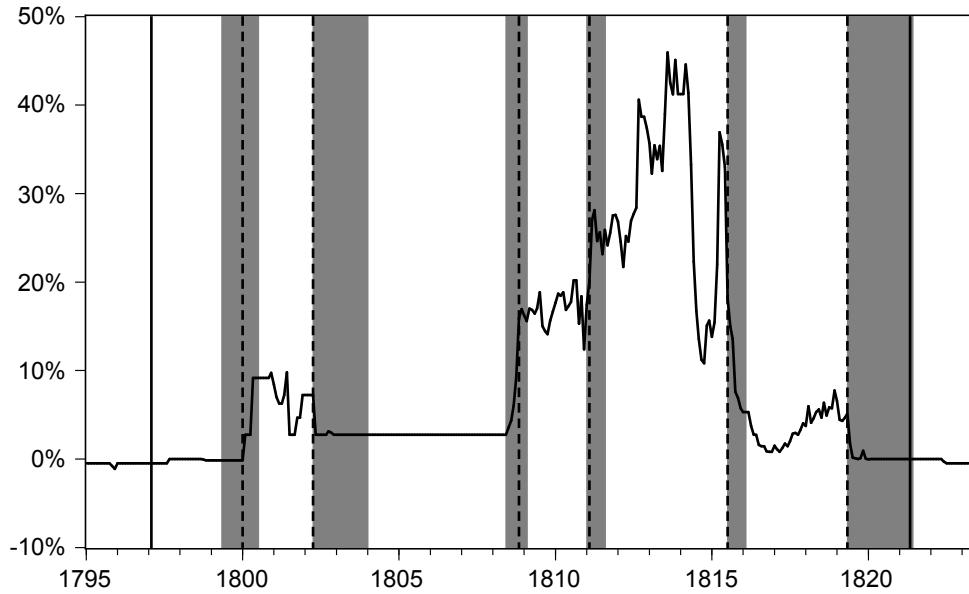
Figure 5: Break dates, monthly data, January 1795 to May 1823

Solid lines mark the beginning and end of the gold standard's suspension, February 1797 and May 1821 respectively. Dashed lines highlight the detected break dates; the shaded areas represent the 95% asymmetric confidence intervals.

and the United Kingdom and, thus, the war of the Second Coalition (1798-1802). The Bank Restriction Act would have expired six months afterwards, and the Bank of England had signaled its readiness to resume convertibility at several occasions (Clapham, 1944; Newby, 2012).[13] Following these to Britain favorable events, the *agio* decreased.

- **November 1808**: The battles of Tudela (23 November) and Somosierra (30 November) resulted in the complete victory of the French and Poles over the Spanish. The battles precede Madrid's capitulation to Napoleon on 4 December and the installation of his brother Joseph as the King of Spain. In line with these events, the *agio* increases, entailing the pound's internal devaluation.[14]

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[13]It was the government that had urged Parliament to extend the Act several times, until a new war would put an end to the discussions about the early resumption in April 1803.

[14]In the meantime, Napoleon had initiated the Peninsular War. In order to punish the Portuguese

Table 1: Break dates, monthly data, January 1795 to May 1823

Break date	Event	Agio
January 1800	Coup of 18 Brumaire and ensuing constitution install Napoleon as sole ruler over France	↗
April 1802	Treaty of Amiens ends hostilities between France and Britain	↘
November 1808	French victories at Tudela and Somosierra enable Napoleon's brother Joseph to become King of Spain (Britain's ally)	↗
February 1811	Outnumbered French forces nearly destroy Spanish Army of Extremadura	↗
July 1815	Prussians seize Paris, Napoleon surrenders to the British	↘
May 1819	Peel's Act definitely fixes details and timing for resumption of convertibility	↘

- **February 1811**: An outnumbered French force nearly destroyed the Spanish Army of Extremadura at the battle of Gebora (19 February).This victory allowed the French to seize the important fortress town of Badajoz. At this occasion, the *agio* increased further.

- **July 1815**: The month of July witnessed decisive military and political events, sealing Napoleon's final defeat. On 3 July, the French lost Paris to the Prussians at the Battle of Issy. On 15 July, Napoleon surrendered himself to the British and was in the following sent to the the island of Saint Helena, where he died in May 1821 (see also section on daily data).

- **May 1819**: Peel's Act definitely fixes the details for the resumption of the gold standard (for more details see section on daily data further below).

5.2 Daily data

I now turn to the results of the break date estimation on the daily data, presented in figure 6 and table 2 (tables 5 and 6 in the appendix provide confidence intervals and

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for not enacting the Continental System against the British, French troops were sent to Spain, France's ally. Taking advantage of the troops' presence in Spain, Napoleon had turned on his ally.

parameter estimates). The results for overlapping periods from the daily procedure corroborate the monthly results. The following events coincide with the detected break dates:
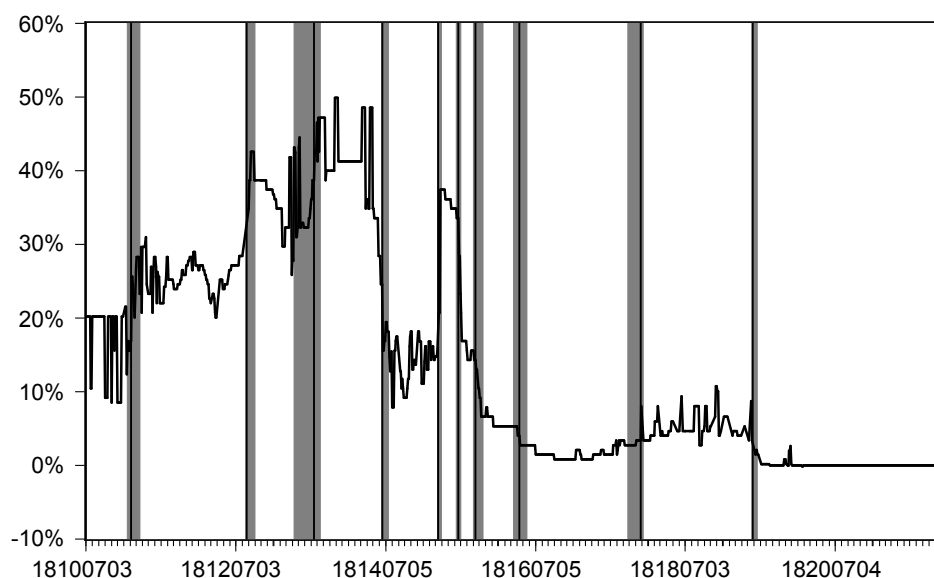

Figure 6: Break dates, daily data, July 1810 to December 1821

Solid lines highlight the detected break dates; the shaded areas represent the 95% asymmetric confidence intervals.

- **8 February 1811**: No military or political events occurred at that exact date. However, the confidence interval encompasses the battle of Gebora, on 19 February (refer to monthly results) and the battle of Barrosa, on 5 March. The latter was an unsuccessful maneuver to break the French siege of the essential naval base of Cádiz. Following these events, the *agio* on gold increased.

- **25 August 1812**: The summer of 1812 was marked by Napoleon's attack of Russia. On 17 August, French forces won a first major battle by seizing the city of Smolensk, situated on the main Western route to Moscow.[15]

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[15]The confidence interval includes also the battle of Borodino, on 7 September, won by the French.

Table 2: Break dates, daily data, January 1811 to May 1823

Break date	Event	Agio
8 February 1811	Battles of Gebora and Barrosa allow French holding on to the essential naval base of Cádiz	↗
25 August 1812	First French victories in Russia; American declaration of war	↗
20 July 1813	Bad news from American and European fronts	↗
17 June 1814	Treaty of Paris temporarily ends Napoleonic Wars	↘
17 March 1815	Napoleon enters Paris after having escaped his exile on Elba	↗
17 June 1815	Napoleon suffers his decisive defeat at Waterloo	↘
15 September 1815	Treaty of Holy Alliance: Russia, Prussia and Austria attempt to restore pre-Napoleonic social order	↘
16 April 1816	Currency reform and partial resumption	↘
28 November 1817	After war depression, new issuance of public debt, and political upheaval	↗
25 May 1819	Peel's Act definitely fixes details for resumption of convertibility; reimbursement of government debt	↘

At the same time, the series of British military successes was coming to an end on the Peninsular. Wellington's earlier territorial gains had put the British in difficulties, as they entailed that the French had less territory to garrison, whilst being in clear majority.[16].

In addition, given transmission speed of news at the time, the American declaration War reached London by mid August. In conjunction with these events the *agio* rose.

- **20 July 1813**: News coming from the American front were negative. By the end of May, the Americans had two out of three British forts, necessary to defend Upper

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[16]Ironically, Napoleon was going to face the same problem in Russia: as his troops advanced, ever growing numbers of soldiers were needed to assure supply lines, diminishing his front line troops

Canada.[17]

On the European front, the situation was not more favorable either. While the armistice of Pläswitz was to last until 20 July, but both sides primarily used the armistice to rebuild their armies. Britain had also engaged in the great Russian and Prussian loans and had offered Austria sizable financial support in case it joined the Allied war effort. In order to permit Austria's complete mobilization, the armistice was extended to 16 August. Both parties knew that hostilities would resume after-wards. The events caused the *agio* to rise.

- **17 June 1814**: The Treaty of Paris, signed on 30 May 1814, ended the War of the Sixth Coalition. In addition to the cession of hostilities, the treaty provided a rough draft of Europe's new boarders. The ratification of the peace treaty was published in the *London Gazette* on 18 June. At this occasion, the *agio* fell by 60%.

- **17 March 1815**: After having escaped his exile on Elba, Napoleon enters Paris on 20 March. Upon reaccession of the throne, he commenced to organize his armed forces. By the end of May, he had formed 'l'Armée du Nord', consisting of approximately 200,000 troops ready for deployment in the Waterloo Campaign (Chesney, 1868). At the mere prospect of a new war against Napoleon, the *agio* doubles (see also Viner, 1937). The evolution of the *agio* at this particular event emphasizes that it is the expectation of future public spending that affects the price level.

- **17 June 1815**: Napoleon suffered his decisive defeat at Waterloo on 18 June, ending his Hundred Days of reign. At this occasion *agio* declined again (refer also section on monthly data).

- **15 September 1815**: The Treaty of the Holy Alliance was signed in Paris, the 14-26 September. This treaty was essentially an attempt by conservative rulers, Russia, Prussia and Austria,[18] to return to and preserve the pre-revolutionary social order (Fischer-Galati, 2007). In that sense it complemented the Treaty of

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[17]Number three was Kingston, Britain's main naval base.

[18]George IV of England did not join the Holy Alliance for constitutional reasons, but consented in his capacity as King of Hanover; France joined in 1818

Vienna, which consisted in the resettlement of European political boundaries. The conclusion of these treaties marked the end of nearly a quarter of a century of warfare. In line with these events, the *agio* decreased.

- **16 April 1816**: While the Restriction Period was due to end on 5 July 1816, government postponed the resumption for another two years in mid April. The public still remained sanguine regarding resumption for two reasons: Government's prior currency reform was understood as a necessary step towards stabilization of the Pound (Clapham, 1944; Redish, 1990; and Sargent and Velde, 2002). In addition, as the conditions for resumption were favorable (Fetter, 1965), the BoE experimented with partial resumption of small denominations. The BoE's efforts signaled a strong commitment to returning to the pre-war parity in the near future (Newby, 2008), and the *agio* on gold declined.

- **28 November 1817**: After-war depression and deflation started in Britain in early 1816 (Broadberry et al., 2011; Clapham, 1944). Due to a bad harvest, and even more so to the Corn Laws, wheat and bread prices rose, however. Eventually, this combination caused social unrest.

  The political *status quo* was called into question by riots claiming electoral reform and universal suffrage. A prerequisite for becoming a Member of Parliament were property qualifications that guaranteed an important intersection between Members of Parliament and creditors of public debt (Johnston, 2013). Since deflation increased the real value of debt to the advantage of creditors, parliamentary support for the reimbursement of public debt was strong. Universal suffrage could have seriously challenged this.[19]

  Amid this situation, a new issue of Exchequer Bills (Flinn, 1961) and the abolition of the income tax, further increased government's outstanding short-term debt, making resumption of cash payments less probable (Clapham, 1944). At this occasion the *agio* rose again.

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[19]The most ardent proponents of maintaining the paper pound indefinitely could be found among industrialist around Birmingham and more generally in the North of Britain (Clapham, 1944). Not only did the Northern parts of the kingdom suffer economically, but they were also lacking political representation: at the time, Manchester, for instance, had a population of 200,000 and no Member of Parliament.

- **25 May 1819**: Parliamentary debates regarding the resumption of convertibility started on 21 May and were concluded unanimously on 26 May, stating the exact resolutions governing the resumption of specie payments.[20] The final version of Peel's Act[21] was made law by July 2 and provided for gradual resumption of payments at the pre-war parity over a period of four years (see section 3)[22]. Clapham (1944) emphasizes the immediate impact the new regulation had on the Paris exchange and the *agio* on gold, which fell to zero.

6 Discussion

6.1 Hard versus soft default

What I have stated so far hinges on the assumption that if default there is, it will be default by inflation. In practice that means the following: suppose worst comes to worst, Britain loses the war and hits its fiscal limit. My assumption of soft rather than hard default entails that contemporaries attached a higher probability to the event of getting back to the gold standard at a devalued par than to the event of defaulting on some or all of outstanding debt.

Many authors have pointed out that contemporaries indeed excluded the possibility of outright default (Acworth, 1925; Neal, 1990). O'Brien (2010) states that 'neither domestic nor foreign investors in the securities of the island could have rationally contemplated [..] that the government's debt be repudiated either as an outcome of conquest or as the result of any unmanageable fiscal and financial crisis [..]. Reasons for this certainty were numerous:

- British public finances had been in order for more than a century, ever since Parliament had gained spending and taxing power with the Glorious Revolution (North and Weingast, 1987; Sussman and Yafeh, 2006). Partisan constellations had further contributed to excluding outright default from the politically acceptable (Stasavage, 2007).

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[20]I Hansard XL, 802-04, 26 May 1819

[21]59 Geo. III, c.49

[22]The BoE resumed specie payments on 1 May 1821, two years ahead of schedule.

- The credibility of British public debt was essential for the funding of war. It was part and consequence of an institutional environment that facilitated war finance, leading eventually to Britain's military and, hence, commercial supremacy over most of continental Europe (Bordo and White, 1991; Brewer, 1988).

- A broadly acknowledged national consensus entailed that national elites contributed to the war effort by holding government debt. In return, war debt would not be defaulted on, as successful wars enhanced prospects for growth and investment opportunities, thus rendering war debt self-amortizing (Ritschl, 1996). In addition, due to property qualifications that guaranteed an important intersection between Members of Parliament and creditors of public debt, default became even more unlikely, given Parliament's prerogatives on the issue (Dickson, 1967; Johnston, 2013).

By contrast, alleviating some of the debt burden by increased inflation would have implied a more extensive mutualization of war losses. Moreover, this was the first long suspension of the gold standard. The discussion around resumption and its exact modalities was vivid: no options, including devaluing the pound and maintaining the paper pound indefinitely, were excluded *ex ante*. The decision to resume at the pre-war parity was, thus, by no means predetermined (Kindleberger, 2000).

The above entails also that the choice between soft and hard default was above all a redistributive one. Outright default would have entailed a capital levy on the holders of government debt, while default by inflation would have affected everybody, but to a lesser extent. Given the political circumstances of the time - 1.5% of the British population were registered to vote in Parliamentary elections (Johnston, 2013) - I have supposed the latter to be more probable than the former.

6.2 'Unpleasant monetarist arithmetic' versus the Fiscal Theory of the Price Level

The evidence provided here emphasizes that expectations regarding the sustainability of public finances affect the price level. As pointed out in the literature review, this type of nexus can be brought about in frameworks related to either the 'unpleasant monetarist

arithmetic' (Sargent and Wallace, 1981) or the FTPL (Leeper, 1991; Woodford, 2001).
My results and the broader institutional settings seem to favor the latter for the following
reasons:

- While monetary and fiscal institutions in 18th century Britain were sound, monetary policy decisions were subordinate to fiscal needs. At the time, the Bank of England primarily financed the government and it was Parliament that made decisions decisions regarding the suspension and resumption of cash payments (Clapham, 1944 and Homer and Sylla, 1991). Moreover, the suspension of convertibility was clearly understood as part of the Nation's war effort (Newby, 2008; O'Brien, 2010). Thus, monetary policy decisions were subordinate to fiscal needs.

- As various authors have pointed out, outright default on public debt became absent of British public finances after Parliament gained broad decisionary powers over public expenditures and taxation through the Glorious Revolution (North and Weingast, 1987; Stasavage, 2007; Sussman and Yafeh, 2006). The absence of outright default implied, however, that creating unanticipated inflation was the only option for debt relief had the outcome of the war pushed the economy towards its fiscal limit.

- Seigniorage accounted for less than 5% of war revenues (Bordo and White, 1991). Given that seigniorage contributed so little to the real backing of public debt, it is unlikely that anticipated future money growth affected agents' inflationary expectations.

- Most scholars put forward that at least around the 1813-14 price peak, the BoE's monetary policies were expansionary (Duffy, 1981). In Sargent and Wallace's framework this should induce a decline in inflation, as accommodative monetary policy, reduces the need for future money growth and, hence, seigniorage (Loyo, 1999).

- As predicted by the Fiscal Theory of the Price Level, discrete jumps in the price level adjusted the real value of outstanding debt. When unfavorable news brought about a change in expectations regarding the sustainability of public finances, a higher price level increased the nominal backing for public debt (Leeper, 2013).

7   Concluding remarks

I have provided evidence on how expectations regarding the sustainability of public finances affected the price level during Britain's first experience with fiat money. The parallels between Britain then and modern economies today are striking. Britain disposed of well functioning financial markets that allowed for an ever increasing national debt: by the beginning of the French Wars in 1793, the debt to GDP ratio had stood at 120% and reached 226% when Napoleon was finally defeated at Waterloo in 1815. For a quarter of a century, Britain operated a fiduciary currency regime with flexible exchange rates. These similarities should, thus, allow drawing some conclusions for contemporary policy issues.

In addition, the study discriminates between the 'unpleasant monetarist arithmetic' (Sargent and Wallace, 1981) and the Fiscal Theory of the Price Level (Leeper, 1991 and Woodford, 2001). The evidence provided here favors the latter. Monetary policy decisions were subordinate to fiscal needs (Newby, 2008; O'Brien, 2010). Hard default became absent of British public finances after the Glorious Revolution (North and Weingast, 1987; Sussman and Yafeh, 2006). Seigniorage never rose above 5% of war revenue (Bordo and White, 1991). And, as predicted by the Fiscal Theory of the Price Level, fiscal shocks entailed discrete jumps in the price **level**.

Finally, several questions still need to be dealt with in greater detail. Expanding the study of available newspapers of the time should further corroborate that the detected events shaped market sentiments. Examining other (stock) prices could allow detecting default premia and their evolutions. Undertaking the same type of analysis on data for France - the other main belligerent of the Napoleonic Wars - would provide a valuable cross check, as the same news should have the inverse impact on French prices.

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A   Appendix: tables and figures

Table 3: Descriptive statistics for the *agio*, monthly data

	Whole sample 1718-1873	Pre-restriction 1718-1797	Restriction Period 1797-1821	Post-restriction 1821-1873
Mean	0.06	0.02	0.35	-0.01
Median	0.00	0.01	0.11	-0.01
Maximum	1.79	0.19	1.79	0.01
Minimum	-0.04	-0.04	-0.02	-0.02
Standard Deviation	0.22	0.04	0.45	0.00
Skewness	5.02	1.60	1.54	-1.38
Kurtosis	30.48	5.33	4.39	6.25
Jarque-Bera	66681.45	618.78	137.89	477.76
Probability	0.00	0.00	0.00	0.00
Observations	1870	948	291	631

Table 4: Break dates, monthly data, January 1795 to May 1823

Break date	1-1800	4-1802	11-1808	2-1811	7-1815	5-1819
Confidence Interval	5-1799 ; 7-1800	4-1802 ; 1-1804	6-1808 ; 2-1809	1-1811 ; 8-1811	7-1815 ; 2-1816	5-1819 ; 6-1821
Regime	1-1795 - 1-1800	2-1800 - 4-1802	12-1802 - 11-1808	12-1808 - 2-1811	10-1811 - 7-1815	8-1815 - 5-1819
Constant	-0.01	0.23	0.12	0.73	1.17	0.17
Observations	61	27	72	27	46	46

Table 5: Break dates, daily data, July 1810 to May 1823 (1)

Break date	8-2-1811	25-8-1812	20-7-1813	17-6-1814	17-3-1815
Confidence Interval	22-1-1811 ; 22-3-1811	21-8-1812 ; 2-10-1812	13-4-1813 ; 17-8-1813	14-6-1814 ; 15-7-1814	14-3-1815 ; 31-3-1815
Regime	6-7-1810 - 8-2-1811	12-2-1811 - 25-8-1812	25-8-1812 - 20-7-1813	23-7-1813 - 17-6-1814	21-6-1814 - 17-3-1815
Constant	0.68	1.00	1.40	1.59	0.56
Observations	63	161	94	95	78

Table 6: Break dates, daily data, July 1810 to May 1823 (2)

Break date	23-6-1815	15-9-1815	16-4-1816	28-11-1817	28-5-1819
Confidence Interval	13-6-1815 ; 4-7-1815	5-9-1815 ; 20-10-1815	19-3-1816 ; 21-5-1816	26-9-1817 ; 9-12-1817	25-5-1819 ; 18-6-1819
Regime	21-3-1815 - 23-6-181	27-6-1815 - 15-9-1815	19-9-1815 - 16-4-1816	19-4-1816 - 28-11-1817	2-12-1817 - 28-5-1819
Constant	1.35	0.69	0.24	0.07	0.20
Observations	28	52	61	169	156