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JEL codes: N13, N23, N43

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DANGER TO THE OLD LADY OF THREADNEEDLE STREET?
THE BANK RESTRICTION ACT AND THE REGIME SHIFT TO PAPER MONEY, 1797-1821[1]

Patrick K. O'Brien
Department of Economic History, London School of Economics

Nuno Palma
Department of Economics, Econometrics, and Finance, University of Groningen

Abstract

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1. Introduction

Britain's first war against Revolutionary France (1793-1802) was associated with a series of financial panics and runs on banks in Britain. The Bank of England's reserves suffered a significant drain from 1795. In Monday 27th February 1797 the Bank of England suspended convertibility of its notes into gold. This decision had Pitt's agreement and was later also confirmed by the Bank Restriction Act, passed by Parliament on May 3rd, 1797.[2] While initially announced that it was to last one year, it was later decided to extend it until a definite peace had been signed.[3] The decision was a success. It saved the Bank from insolvency, inflation stayed at moderate levels, there was no effect on the long-term (consol) interest rate, and despite Bank of England notes becoming more common as a means of payment, their discount remained moderate as well. No major financial crisis resulted.[4] In the words of Schumpeter (1987/1954, p. 690-1): "In spite of the suspension … war finance did not produce any great effects upon prices and foreign exchange-rates until about 1800. To the modern student who is inured to stronger stuff, the most striking feature of the subsequent inflation is its mildness … at no time was the government driven to do anything more unorthodox than abnormally heavy borrowing from the Bank, and even this borrowing never surpassed the limits beyond which the term 'borrowing' becomes an euphemism for printing government fiat".[5]

Why did the Restriction possible, and why did it succeed? The current historical consensus is that the Restriction occurred as a response to short-term pressures: the state's need to finance the war, France's remonetisation following the end of the *assignats* monetary regime, a loss of confidence in the country banks, and the run on the Bank of England's reserves (Feaveryear 1931, p. 173; Roberds and Velde 2016, p. 471, Chadha and Newby 2013, p. 5). We argue that these factors help us understand the timing of the Restriction period, but not its success. Why did people trust the Bank's inconvertible notes?[6] In this paper we deploy new long-term data which leads us to a complementary explanation: the Restriction Period succeeded thanks to the reputation of the Bank of England,

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[2] The possibility of suspension was being discussed by Pitt, the Bank, and other bankers and merchants since January 1797 (Clapham 2008a, p. 271). Once the news of a French landing in Wales reached London on the 25th of February, the Privy Council, which met the following day, decided to suspend convertibility, a decision communicated to the Bank of England late that night. For a recent account of these events, see Chadha and Newby (2013, pp. 5-7).

[3] As it were, the policy lasted until 1821. Peel's resumption bill was passed in 1819; actual resumption of specie payments by the Bank of England took place in 1821.

[4] The South American bubble, which bursted in 1810 leading to a commercial crisis (and to the hostile Bullion Report of 1810 which was hostile to the Bank), had in fact not been stimulated by the Bank (Clapham 2008b, p. 20).

[5] We take our title from a contemporary cartoon by a critic, James Gillray, which depicts the Bank of England as an old lady covered in £1 and £2 banknotes (which were being issued for the first time in 1797), complaining that the Prime Minister Pitt was endangering her reputation to pay for his debts (see Figure A1 in our appendix).

[6] A similar attempt to create an analogous bank for the Netherlands – the Bank of Amsterdam did not issue notes, lend to the government, or operate a discount window – failed, as the public did not consider the banknotes credible (Hart et al 1997, p. 96).

achieved through a century of prudent behavior. The Restriction also led to a long-term unintended consequence in the form of a permanent shift to a paper money regime, which continued after the full restauration of convertibility at the inauguration of the classical gold standard regime in 1821.

To make our case, we document quantitatively, for the first time, the timing of the expansion of paper money relative to coin supply in England during the eighteenth century, with a particular focus on the run-up to the Restriction Period, which we identify as encompassing a regime shift. We analyze the process through which the Bank of England accumulated a credible reputation over time, and the checks and balances that allowed for its increasing role as manager of the public debt work, as well as the way in which bankers in London and in the provinces reacted to specific events and policy measures. Before the 1790s the Bank did not expand its money supply in tandem with warfare, in contrast to what happened with taxes or the size of government. But as a response to the extraordinary threat of the French revolution and subsequent overseas events, from 1789 to 1821 per capita M2 increased from £5 to £8 in real terms, while per capita coin supply fell from £4 to £3 over the same period (Palma 2016). Upon suspension of convertibility by the Bank in 1797 the market did not crash, financing continued at a renewed pace, and businessmen as well as the general public trusted the newly issued banknotes, which for the first time became common as a means of payment. The events of the last decade of the eighteenth century lead to a regime shift in the form of a decisive move towards an increased public role of the Bank, and once warfare was over, the increased liquidity stayed in the financial system, despite the full restoration of convertibility in 1821.

A study of the history of the Bank is complementary to our understanding of the building-up of the government's reputation, a matter which has received a great deal of attention in the economic history literature. But while Bordo and White (1991) focus on the credibility of the public finances of the British State, our focus here is on the credibility of the outstanding liabilities of one particular institution, the Bank of England. We hence argue that the credible commitment underpinning the success of British public finance consisted of two parts: the government's commitment to sound public finance, and the Bank's commitment to sustaining both public and private credit. In this paper we focus on the latter, and in particular on the matter of how by the late eighteenth century the Bank managed to implement a set of monetary policies that were highly unconventional by the standards of the time, with a good measure of success.

According to some authors, the Suspension was an inflationary policy geared towards increasing the government's seigniorage revenues (Bordo and Kydland 1995, Bordo and Redish 1993). However, while it is true that the government did take advantage of the liquidity provided

by the Bank, most of the profits from issuing paper money went to the Bank's shareholders, not to the government.[7] Others argue that increasing private profits was the point of the suspension (Ricardo 1951/1811). By contrast, Chadha and Newby (2013), argue that through the Restriction the Bank of England was able to reach a closer alignment of the duration of its liabilities and assets, as well as providing some war finance to the government "by allowing some leverage in its loans relative to its market value" (p. 3). Our interpretation is closer to this viewpoint, but while Chadha and Newby (2013) focus exclusively on the period after 1793, we argue that understanding the success of the Restriction Period requires thinking about the public's trust, which implies taking a longer-term view.

While the reputation of the state and the Bank of England were separate, they cannot be said to have been independent. On the one hand, the Bank of England lent considerable amounts to the government[8], and assisted in the formation of an effective fiscal-naval state in Britain, while at the same time promoting the development of a system of financial intermediation for the economy as a whole (O'Brien and Palma 2016). But on the other hand the state's high fiscal capacity, constrained by Parliamentary oversight, meant it could borrow and had sufficient revenue to pay the loans to the Bank, while committing not to monetize the debt beyond certain limits.[9]

2. Historical background

2.1. The monetary system and the money supply, 1694–1821

Between 1694 and 1821, the national supply of money and credit consisted of gold, silver and copper coins, privately issued tokens, bills of exchange, and the liabilities of banks, including notes of the Bank of England, notes of private country banks of issue and bankers' deposits. Bills of exchange in the hands of businessmen may have been an important component of the nation's money supply in certain parts of the country (Ashton 1953). Bank deposits were not generally employed as a means of payment in the provinces, and even if within the capital cheques and drafts upon bankers could at times have exceeded the value of Bank of England notes in circulation, this was certainly not the case elsewhere. Until surprisingly late it was coin that dominated the money supply (Table 1).

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[7] Roberds and Velde (2016, p. 471) write that "seigniorage [did not] play much of a role in government finance, since a large part of it accrued to the bank's shareholders as profit'.
[8] Barro (1987) finds that government purchases increased significantly during the Restriction.
[9] During the suspension period, the Bank's notes were to a large extent (though not exclusively) the counterpart to public securities held by the Bank. So the Treasury's reputation as a good debtor certainly mattered for the Bank's credibility, since the credibility of the Bank's notes (which were an important component of the Bank's liabilities), indirectly depended on the securities that backed them.

	1600 (Mayhew)	1688 (Cameron)	1700 (Capie)	1750 (Cameron)	1750 (Capie)	1790 (Capie)	1870 (Capie)
Coin	3.5	10	7	15	18	44	95
Bank of England notes	-	-	1.5	4.3	4	8	35
Other notes	-	-	0	0.7	1	4	4.9
Bank balances at the bank of England	-	-	-	1.9	-	-	6.5
Other means of payment	1	10	n/a	18.1	n/a	n/a	n/a
Total (M2)	4.5	20	>8.5	40	>23	>56	>141.4

Table 1. Estimates for various components of English nominal money supply. Unit: millions of £. Sources: Mayhew (2013), Capie (2004) and Cameron (1967). The category "other means of payment" includes Cameron's £ 6m in government tallies and £2 m in inland bills in 1688 and £3.1m in deposits in private banks in 1750.

While much of the development of the English financial system during the eighteenth century can be represented as catching up with best practices on the continent (Coffman et al 2013), after almost a century of growth of financial intermediation under the auspices of the Bank of England, by the outbreak of the French Revolution a number of goldsmiths had turned into proper banks (Temin and Voth 2006), and the scale, density and spread of provincial banks had already reached a level where the British economy conducted a non-negligible share of its wholesale transactions with bank notes[10], deposits[11] and other forms of paper credit (negotiable bills of exchange).[12] The latter were convertible with greater ease than anywhere outside the Netherlands into the liabilities of specialized institutions for the funding of trade, agriculture and industry, as well as the state (Ashton 1953). But their circulation at the retail and wage-paying levels nevertheless remained limited, and it was only with the Bank restriction act of 1797 that non-coined money really took off (Figure 1).

[10] Nonetheless, at least prior to the Restriction, circulation of country banknotes was "far below that of the Bank" (Clapham 1944, p. 265)

[11] The practice of deposit banking was more advanced in eighteenth century Britain than in contemporary Amsterdam (Jonker 1996, p. 233-6, Quinn and Roberds 2014, p. 12).

[12] In the Netherlands, money of account was additionally used to record credit granted to counterparts (Gelderblom and Jonker 2015), but it remains to be determined if these practices were used in Britain. Nevertheless, "From the 1770s, private banks started to formalize ways of clearing inter-bank payments, resulting from customer transactions, and used Bank notes to settle amounts outstanding between themselves" (Hotson 2012, p. 12).

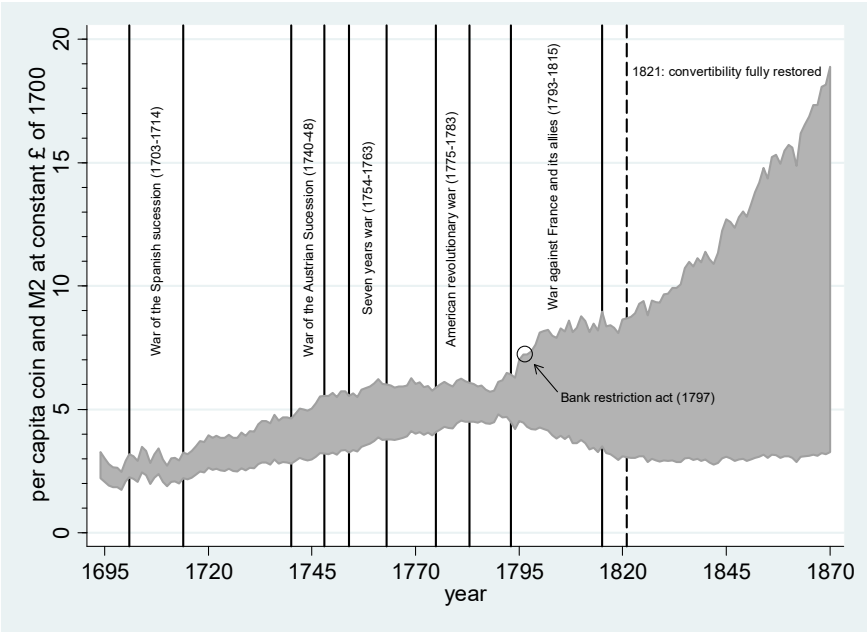

Figure 1. British per capita coin supply (lower line) and M2 (higher line), at constant prices of 1700. The area in grey can be interpreted as the approximate size of non-coin money in circulation or held as store of value. Some important periods of warfare are marked out. Sources: this figure is derived using the indirect method described in Palma (2016), which in terms of data relies on Broadberry et al (2015), Capie (2004) and Mayhew (2013).

2.2. The Bank of England and the money market

London banks obtained their reserves from several sources including the deposits of clients (largely landowners and merchants), handling public funds *en route* to or from the Exchequer, deposits from country bankers and finally credit extended from the Bank of England itself (Joslin 1954, p. 167, 176-7). Before 1797, the Bank did not permit London banks to rediscount bills of exchange, but this regulation could easily be circumvented by arrangements between the London bankers and one of the Bank of England's mercantile clients. But London banks could open drawing accounts at the Bank and borrow money in that way, and in 1793 just under half of them kept balances at the Bank (Clapham 2008a). As long as alternative ways existed for London bankers to obtain Bank notes and specie, direct and immediate control over their reserves could not be exercised by the Bank. Nevertheless, since the Directors determined the level of Bank notes and deposits in circulation, by expanding or contracting the Bank's credit they could ultimately affect the reserves of London Bankers.

The Bank incurred liabilities (issued notes or created deposits) in four ways: in exchange

for gold or silver, as advances to individuals or firms, by discounting bills for the Government and by discounts for the private sector (Clapham 2008a, pp. 169, 172 and 204-5; Clapham 1941, pp. 83-4). The exchange of Bank notes for gold did not add to the supply of reserve currency since gold already took that form, but advances and discounts for either the private or the public sector certainly did. The Bank followed normal banking practice and matched liabilities with assets and its accounts for the years 1789-91 show that about half of its liabilities were backed by public securities, 41 per cent by bullion, and the remainder by private assets. If the portion of notes and deposits backed by bullion is excluded from view and attention is focused on the monetisation of private and public assets, it then appears that some 80 per cent of the Bank's outstanding liabilities in the years immediately before the war were incurred in the form of loans afforded to the state. This picture changed radically during the war years when the amount of reserves in the form of bullion held at the Bank fell sharply and discounts for the private sector became a more important proportion of total assets.[13]

Nevertheless, the point to stress is that the creation of reserve money by the Bank of England originated as a response to requests for loans. By refusing to meet either Government or private demands the Bank could effectively curtail the supply of reserve money upon which London and indirectly provincial bankers conducted their operations and expanded credit. When the Treasury offered a larger amount of public securities (bills as well as bonds) directly to the money market (and the Bank of England concurrently failed to increase its discounts and advances to the private sector), bankers found themselves confronted with higher levels of demand for loans and credit. Unless they lowered the ratio of Bank notes and specie to outstanding liabilities, demands for loanable funds exceeded the available supplies and interest rates rose. Rates on public securities, unaffected by the operation of usury laws, inevitably went higher than rates on private bills, shares and mortgages.

As state assets were less risky and more liquid than mercantile bills of exchange, a greater share of the available supply of investible funds passed into the hands of the Government and the private sector experienced shortages of credit. Furthermore, the higher profits made on Government paper prompted clients of London bankers to withdraw their deposits (which paid no interest) in order to invest in liquid Government bills. This reduction or slower rise of cash de-

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[13] The data on liabilities and assets of the Bank of England 1720-1815 refers to: Notes in Circulation; Drawing accounts; Private Deposits; Total Deposits; Bullion Reserves; Public Securities: Private Bills and Notes Discounted; Private Securities, and Miscellaneous. It can be reconstructed from statistics published by Clapham (1944, pp. 295-96) and Report from the Committee of Secrecy on the Expediency of Renewing the Charter of The Bank of England, Parliamentary Papers 1831-32 (volume 6) appendixes 5, 24 and 32. See also Bank of England (1967).

posited with London bankers reduced still further their capacities to create credit. Thus when pressure from the Bank forced the Treasury into the market and the market obtained no compensatory reserve money in the form of discounts from the Bank of England, facilities for borrowing money diminished and interest rates increased.[14]

Although the Bank could only divert demands from the Treasury to the market, it held powers to refuse to discount bills or make advances to the private sector. In wartime when higher profits could be made from speculation in public securities, merchants, landowners, farmers and industrialists often found it difficult to secure accommodation from London bankers and turned to the Bank of England (Joslin 1954, Parliamentary Papers 1826, pp. 17, 43, 71,145 and 207). Provided they expressed willingness to pay 5 per cent and the Bank complied with their requests, the level of private finance available would not fall. Moreover, as the Bank increased its loans the supply of reserve currency available to London bankers also rose and credit conditions in the metropolis did not become stringent.

But when the Bank behaved as it did between December, 1795 and February, 1797 (when the Directors not merely forced the Treasury into the market but rationed credit to the private sector at the same time), the private sector inevitably experienced real difficulty in raising funds and interest rates rose sharply. Moreover, the effects of the Bank's policy went beyond restriction in loans and reserve currency and adversely affected the confidence of London Bankers, who withheld accommodation and operated with higher reserve ratios.[15] While the experience of 1795-97 revealed clearly how the liquidity of the London money market depended on the credit policies of the Bank of England the indirect dependence of banks outside the metropolis was only elucidated by Pressnell (1956).[16]

During the restriction period, controversy arose not on the problem of the Bank's relations with London banks, a subject generally ignored at the time, but about its influence upon issues by banks outside the metropolis. One school of thought, ("bullionists") maintained that the expansion of credit by country bankers could be determined by the Bank. Malthus, for example,

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[14] Parliamentary Papers 1826, pp. 22, 35-7, 43, 72, 157, 175, 178, 180, 191-2, 212, 303; Committee of the House of Commons on 10 Naval Report, Parliamentary Papers 1805 (5), pp. 42, 47 and 69; Thornton (1802), pp. 281, 289 and 291; Boyd (1811); Minutes of the Committee of the Treasury of the Bank of England 15.4.96, 23.6.96 and 3.11.96; Pitt Papers 03/08/115; Auckland Papers BLAM 34454; Wakefield (1797, pp. 26 and 54) and Monthly Magazine (May 1796, p. 326 and July 1796, p. 498).

[15] Parliamentary Papers 1826 (3), 35-7, 173-5, 190 and 215 and Pitt Papers 30/8/115.

[16] Although some appreciation of their subordinate position can be detected from the evidence of country bankers to Parliamentary Committees in 1797 and 1810 (Parliamentary Papers 1826, p. 179 and Parliamentary Papers 1810, p. 113-5 and 140.)

considered it "a point of susceptible of complete demonstration that an increase in the issue of Bank of England notes is attended with a proportionate increase in the issue of country bank notes".[17] On the other side, a few contemporary writers denied all connexion between the Bank of England and the note issues of country banks; Bosanquet (a Bank Director), and economists such as Wheatley[18] and (Chancellor of the Exchequer) Vansittart came close to this position.[19]

Yet nearly all bankers who appeared before Parliamentary Committees investigating the monetary system during the war admitted they followed the lead of the Bank in the expansion and contraction of credit.[20] Gilchrist, Chairman of the British Linen Bank, to take but one example, stated quite unequivocally that, "If the Bank of England were to restrict the issues of course Scots Banks would find it necessary to restrict their issues".[21] Parliamentary reports had no doubt, to quote one, that "the Bank of England is at the head of circulation", or to cite another that the credit of private bankers was "a superstructure raised upon the foundation of the Bank of England".[22]

Most contemporaries might well have shared such general opinions but the mechanisms through which the Bank brought about variations in the money supply at the end of the eighteenth century were not elucidated until modern times by Wood (1939), Clapham (2008a, b) and Pressnell (1956). Briefly stated, their conclusions are that the Bank affected the overall creation of credit by influencing the reserves of London banks and through them (indirectly) the reserves of banks located outside the metropolis. London bankers regulated the liabilities they incurred on reserves of specie and Bank notes.[23] During the war years, when specie became increasingly

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[17] Malthus (1811, p. 457-8). See also Ricardo (1811/1951, pp. 87-88); Boyd, 1811, p. 23); Fetter (1957, p. 46); Parnell (1828) and Cannan (1925, p. 61).

[18] Wheatley, while classified by O'Brien (2004) as a "rigid" bullionist, conceded that the country banks could increase their banknotes significantly by varying their reserve ratios, and could cause an expansion of Bank of England notes (given its apparent adherence to the Real Bills Doctrine) by discounting bills with the Bank in times of pressure (O'Brien 2004, p. 181).

[19] Bosanquet (1810, p. 78); Wheatley (1803, pp. 209-21); Parliamentary Papers (1803/4-1812, vols. 1-22; vols. 23-31); See also Silberling (1924) and Angell (1926), who argue that the Bank exercised little influence over variations in the money supply.

[20] Committee of the House of Commons on Suspension, 1797, Parliamentary Papers 1826 (3), pp. 142, 190 and 212; Committee of the House of Commons on Bullion, together with Minutes off Evidence from the Select Committee on the High Price of Gold Bullion in Parliamentary Papers 1810 (3), pp. 141 and 143.

[21] Committee of the House of Commons, Parliamentary Papers (1810, p. 114).

[22] Committee of the House of Commons on Suspension, 1797, Parliamentary Papers (1826), pp. 142-162; Cannan (1925, p. 61); and Committee of the House of Commons on Bullion; Parliamentary Papers 1810 (3), 90 and 13)

[23] E. Morgan (1943, p. 52); Committee of the House of Commons on Suspension, 1797; Parliamentary Papers (1826, pp. 35-7, 43 and 191-2); Boyd (1811, p. 23).

scarce in circulation[24], Bank notes increased their importance as a form of reserve money, as well as becoming much more common as a means of payment (Figure 2).

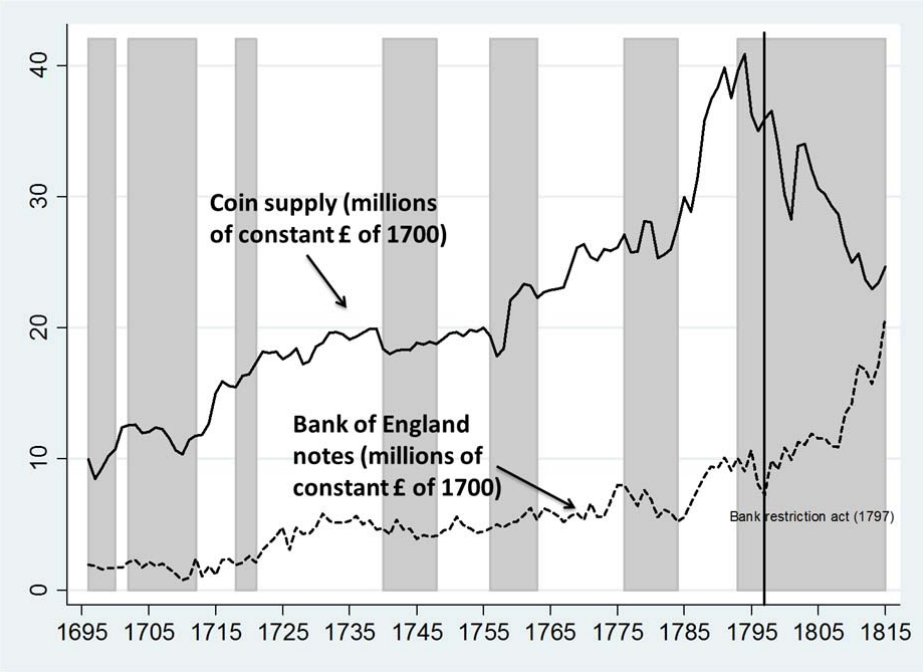

Figure 2. Coin supply and Bank of England notes, at constant prices of 1700. Sources: Bank of England (1967), Palma (2016); for the deflator, Broadberry et al (2015).

2.3. Influence of the Bank of England on provincial banks

Outside London the dominant component of the money supply (apart from coins and bills of exchange) consisted of notes issued and to a lesser extent deposits created by bankers. Since liabilities incurred by provincial banks were legally convertible either into gold or – after the suspension of specie payments in 1797 – Bank notes, some limits to their abilities to create credit existed, namely their need to retain a certain amount of reserve currency in order to meet fluctuations in demand. Provincial banks did not however, regulate their liabilities simply upon a reserve of specie and Bank notes but on reserves which included gold, notes of the Bank of England and portfolios of London assets. The latter consisted of highly liquid securities including exchequer bills convertible at call into cash and a balance on deposit with a corresponding Lon-

[24] Feavearyear (1931, p. 192) writes that "Not only was the country losing its gold, but it looked as though it would lose all its other metallic money as well". Chadha and Newby (2013, p. 10) argue convincingly that concern about the state of circulation and credit was a motivation for the Suspension itself.

don banker.[25] London assets had to be purchased with London money. Deposits with London bankers could only be created or maintained if country bankers left a balance of Bank notes and specie in the hands of a banker in the metropolis or London bankers extended credit to them.

Country banks obtained their reserve currency and London assets through several channels and in a variety of forms. Undoubtedly the most important source included deposits from clients who, as merchants, landowners, farmers and industrialists, traded either with or through the capital and received remittances in the form of specie, Bank notes, or, more commonly, bills of exchange drawn upon banks located in London. Deposits from officials concerned with the despatch of taxes to the Exchequer formed another but less important source of reserve funds. Other deposits came from local Government bodies, turnpike trusts and the carriage, haulage, canal and coastal shipping companies involved in the business of transporting passengers and goods overland and by sea. Given the dominance of London as a market for the consumption of provincial products and also as a centre of internal and international trade, the flow of funds from the metropolis to its hinterland provided country bankers with a more or less constant supply of London money or assets such as bills of exchange, readily convertible into money in the capital.

Thus country banks could increase credit when permitted to draw upon the resources of banks in London. By the late eighteenth century nearly all provincial bankers had established close working arrangements with a bank in the capital. They maintained a balance of funds surplus to their needs in London to redeem their bills of exchange and other drafts made payable there. London bankers also acted as intermediaries for country banks in the purchase of public and other securities sold on the metropolitan capital market (Pressnell 1956, pp. 45, 60-67, 76, 77, 122 and 243-59.) In brief London bankers held and used the reserves of country bankers and could increase their reserves by extending credit to them.[26] Banks located in the agricultural counties rarely called upon banks in London for advances, because usually their balances on deposit more than sufficed to meet any payments in the capital. But banks located in the industrial parts of the country often borrowed from metropolitan banks in order to provide their customers with facilities for the finance of their purchases through London.[27]

Since the Bank of England could bring about changes in the amount of reserves (Bank

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[25] Pressnell (1956, pp. 116, 120, 197, 285-8, 408 and 416); Thornton (1802, pp. 215-7); Parliamentary Papers (1810, pp. 113-5 and 140); Leighton-Boyce (1958, pp. 111 and 116) and Sayers (1957, p. 110).
[26] Joslin (1954, pp. 180 and 183), Pressnell (1956, pp. 76-7, 80-1, 84, 98, 117-25, 285, 408 and 416), and Fulford (1953, p. 96).
[27] Morgan (1943, p. 21); Feaveryear (1931), and Pressnell (1956, pp. 76 and 288).

notes, specie and London assets) held by country bankers, it was in a position to influence their ability to create credit. The Bank could do little to affect the propensity of the population outside London to exchange cash for bank deposits, although the effects of its credit policies on confidence might increase the general preference for liquidity. (Parliamentary Papers 1826 (3), pp. 35-7). But the Bank could certainly inflate or deflate demand for provincial products in London by expanding or contracting the supply of credit afforded by London bankers and *mutatis mutandis* the flow of remittance from the capital to the countryside. Moreover, since London financed and handled a large share of the country's exports any alteration to supplies of metropolitan credit to provincial merchants and industrialists affected the level of receipts from exports. If the Bank deflated, country banks, with a time lag, would find that deposits from clients would either fall or fail to rise and unless they obtained reserve currency from an alternative source their ability to grant credit diminished.

Their only important alternative consisted of advances from London bankers. But if the Bank restricted its credit either to the government or to its private customers, the ability of London bankers to make advances to country banks declined, and because country banks depended on London banks for advances the Bank of England could thereby "influence" not merely the liquidity available to the London capital market, but the overall supply of bank money for the economy at large. Influence is not, however, the same as control and it cannot be proved that the expansion or contraction of credit by the Bank ever led to proportionate changes in the liabilities of the entire banking system. In the eighteenth century the Bank of England never occupied a position strong enough to maintain the money supply at some pre-determined level (Wood 1939). It had, for instance, only slight influence on the volume of bills of exchange circulated as money.

Inflows or outflows of bullion which accompanied changes in the country's balance of payments position also changed the gold reserves of private bankers and *parri passu* their ability to create credit. While movements in exports and imports or remittance on capital account were certainly not as independent of the policies pursued by the Bank of England as its Directors asserted at the time, there are no reasons to describe monetary policy as having not more than an "influence" on international trade (Parliamentary Papers 1810, pp. 95-7). Furthermore, changes in the level of cash on deposit with bankers could come about through changes in general preferences for liquidity without any contraction or expansion of credit by the Bank. Only if the Bank's policies influenced confidence could the Directors affect the public's disposition to switch between bank deposits and cash holdings. Here again the Bank policies constituted only one factor

among many which disposed the public towards liquidity (Morgan 1943, pp. 52-4).

But by the rationing credit and forcing the Treasury into the market the Directors could force up interest rates and initiate a switch from bank deposits into public securities. Provided the money then expended by public departments did not pass back immediately into bank deposits private bankers would be prompted to contract liabilities. Fourthly, the Bank could not effectively control its advances to the Treasury and any increase in government expenditure financed by the Bank created possibilities for a multiple expansion of credit throughout the banking system. In order to restrain rises in the money supply during periods when the level of public expenditure increased the Bank could only encourage the Treasury to borrow directly from the market and to cut back its own advances to the private sector.

Perhaps most important of all, the Bank's powers over the money supply were limited by the fact that both London and country banks regulated their liabilities on flexible rather than fixed reserve ratios.[28] Abundant statistical evidence demonstrates pronounced variations in the ratios maintained by country bankers for the early nineteenth century (Pressnell 1956, pp. 196, 203-6 and 214; Sayers 1957, p. 177 and Morgan 1943, p. 12). Unfortunately no comparable statistics exist for London bankers, but remarks by Henry Thornton and John Wheatley's in their pamphlets suggest that similar flexibility prevailed in the capital.[29] The range of variation depended very much on confidence. If bankers took an optimistic view of business prospects their advances expanded. If their perceptions tended towards pessimism the money supply often contracted. Many economic crises of the eighteenth century originated in changes of liquidity preference among the public and bankers. The ratio of reserves to the outstanding liabilities of the banking system usually fell in the upswings of business cycles and rose in downswings.[30]

Given these constraints on the Bank's powers it is hence inappropriate to use verbs like "control" to refer to its status *vis a vis* the rest of the banking system. Since the Bank had never made any consistent attempt to exercise control it is difficult to decide how serious these limitations were. The experience of the years 1795-97 suggest that the expansion of credit by the Bank

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[28] As did the Bank of England; Lovell (1957) shows that during 1720-97 the Bank did not maintain a fixed ratio of bullion to either its note issue or its outstanding liabilities of notes plus deposits.
[29] Thornton (1802, pp. 113 and 286); Wheatley (1802), Parliamentary Papers 1810 (3), 147-8 and Viner (1937, p.159).
[30] Report from the Select Committee Appointed to Take into consideration the Present State of Commercial Credit 1793, in Parliamentary Papers 1826 (3), pp. 125-33; Tooke (1838, pp. 177); Parliamentary Papers 1826 (3), p. 69 and 303; Report of the Lords Committee of Secrecy to Enquire into the Causes which Produced the Order of Council of 26 February 1797 in Parliamentary Papers 1810 (3) pp. 284-5; Thornton, *Paper Credit.* p. 280 and Committee of the House of Commons on Resumption, Two reports from the Committee of Secrecy Appointed to consider the stale of the Bank of England with Reference to the Expediency of the Resumption of Cash Payments in Parliamentary Papers 1819 (3) [henceforth -pp I819 (3)], 166-7.

created conditions for expansion by other banks and that any significant contraction of its advances either to the State or the private sector lead to some unmeasurable contraction in the overall money supply. Bankers operating at the time accepted this view and no record exists of credit contraction by the Bank coinciding with expansion by private banks. By the late eighteenth century if the Bank was not yet in control, it certainly stood at the head of the banking system.

3. Why did the Restriction Period happen?

3.1. Origins of the restriction period: the traditional narratives

There is reasonably broad agreement in the literature about some basic facts which characterize the Restriction Period. For long stretches of the eighteenth century the supplies of coins only barely made up for the economy's growing demands for fractional payments. The seriousness of this problem intensified in the run up to, and during, the wars with France (1793-1815) when the event which was known to contemporaries as the "bullion crisis" happened: an expectations-driven "flight-to-quality" increased levels of hoarding and increased the market price for bullion (Figure 3) to a point that for a short period of time coins all but disappeared from circulation (as seen in Figure 2, p. 10).[31] When market prices increased, people got more money for their precious metals on the market than at the mint. Minting decreased (at times ceasing altogether) because there was a better deal to be made on the market. 1£, 2£, and 5£ bills were issued by the Bank, and by provincial banks, to replace the hoarded (or exported) specie as a means of payment.[32]

[31] Nonetheless notice that "There was no permanent and important divergence between the market price of gold and the mint prince before 1808: margins were known to bullion dealers, not ordinary people" (Clapham 2008b, p. 8). See also Feavearyear (1931, pp. 169, 183 and 187), Pressnell (1956, p. 159), Committee of the House of Commons on Suspension, 1797: Three Reports from the Committee of Secrecy on the Outstanding Demand on the Bank of England and on the Restriction of the Payments in Cash, 1797, in Parliamentary Papers (1826); Thornton (1802, p. 97); and Mathias (2004, pp. 68-83). Notice that our Figure 2 shows coin supply greatly decreasing at this time, but even from the supply that remained it is possible that some was hoarded as opposed to remaining in circulation.

[32] It is tempting to interpret this shift in terms of Gresham's law, but we do not favor that interpretation because "without some private information we would not observe either the phenomenon of circulation by tale or Gresham's Law, since these both revolve around what happens when one meets a uniformed seller." (Velde, Weber, Wright 1999; see also Redish 2000, p. 30). Hence Gresham's law cannot apply here, as no one would have had any difficulty distinguishing Bank of England notes from coin. Instead, the agio evolved as shown in Figure 3; after some time coin gained a premium; equivalently, Bank of England notes gained a discount. (Under Gresham's law this too is impossible, because this "law" assumes different currencies are accepted at the same nominal value, which is what drives the selection of "bad" coin when making payments).

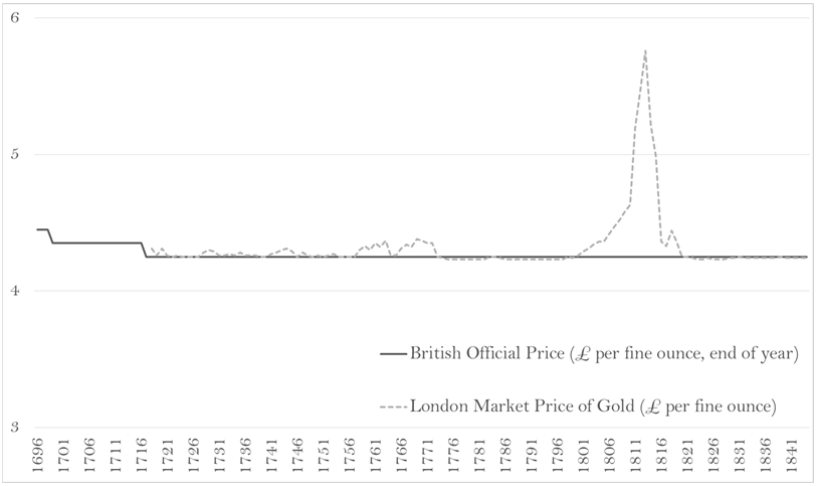

Figure 3. Official and market price of gold. Sources: Officer and Williamson (2016a).

In response to this, within the metropolitan area and increasingly in the provinces as well, notes issued by the Bank circumvented the problem left by the negligence (or incapacity) of the government to mint adequate supplies of coins. The notes of the Bank of England increased dramatically after 1797, in part to compensate for the reduced availability of precious metals; these were flowing to France which was remonetizing following the collapse of its paper currency system (Roberts and Velde 2016). This contrasted with the situation prevailing until late in the eighteenth century, when Bank of England notes had seldom circulated beyond a thirty mile radius of central London. Furthermore, the dramatic expansion of the balance sheet of the Bank of England after 1797 was accompanied by a similar expansion that of the balance sheets of provincial banks (Pressnell 1956). By the beginning of the Revolutionary War the amount of their notes outstanding throughout Great Britain probably equaled the issues by the Bank, and by the battle of Waterloo may have exceeded them.[33] Nonetheless, this expansion would not have been possible without that of the Bank of England.

There are two reasons usually given in the literature for the Restriction Period. First, it was the result of demand for liquidity in the context of a military emergency. Second, it was the result of France's increased demand for precious metals following its return to a commodity-money system. As France's remonetization began to drain gold out of the country (a couple of years before Suspension) the Bank immediately starting rationing its discounts (Clapham 1944, p. 269). This was not enough to prevent the dwindling of the Bank's reserves, which fell from 8 million pounds ster-

[33] Coppieters (1955, p.1), Pressnell (1956, p.15, 16, 136, 142 and 159).

ling in 1791 to as just over 1 million during 1797.[34] Evidently, these two motives interacted; and indeed, it would be too simplistic to say that the Suspension was simply due to the Bank's low reserves. During 1783-4, for instance, the Bank carried business for over a year with less bullion than at time of Suspension fourteen years later. This had been possible because "1783 was a year of peace with commercial prospects … while 1797 was a year of dangerous war" (Clapham 1944, p. 256).

These two reasons are focused on the role of short-run pressures on the Bank's reserves.[35] We argue, however, that while such liquidity-type reasons are important (as necessary conditions), they cannot explain the Suspension's success. Indeed, not only did the British public accepted the new state of affairs[36], but the Bank of England's reserves grew back to 8 million by late 1799, and the public's confidence in most provincial banks was restored as well (Feavearyear 1931, p. 177). The above-mentioned factors traditionally mentioned in the literature help explain the timing of the Restriction Period, but they cannot explain why it worked, especially in light of similar but failed experiences in the continent – including in the Netherlands (Hart et al 1997, p. 96). To understand this success, we need to take a longer view; we argue that it was the Bank's long-run reputation which mattered.[37]

3.2. A new long-term and quantitative view

All societies require liquidity, but they face restrictions in the form of access to precious metals or commitment problems which do not allow for paper money to be held and to circulate. Hence, demand for liquidity alone cannot explain the timing, or the sudden scale, of the adoption of paper money. In turn, short-term military pressure can help us understand the timing of the adoption, but cannot explain why earlier pressures of the same nature had not led to the same

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[34] Feavearyear (1931, p. 177). Roberts and Velde (2014) argue that following France's remonetisation, which started in the Spring of 1795, "[T]he subsequent drain on the Bank of England's reserves forced a suspension of convertibility of the Bank's notes in February 1797". See also Feavearyear (1931, p. 167) or Clapham (1944, p. 169-70). For the continental capital inflight to Britain after 1793, see Neal (1990, p. 180, 216-7) or Clapham (1944, p. 257).

[35] To these short-term pressures we must add two others which are not usually mentioned in the literature. First, this was also a period of limited access to precious metals for Europe as a whole. Precious metals, which Britain obtained through trade, were the critical input to the production of coin, and this motive combined with increasing hoarding levels to cause minting output to diminish to historically low levels (including several years of zero minting) from the 1790s to the 1810s (Challis 1992). Second, this was a period of robust economic growth in Britain, both at the intensive (per capita) and extensive (population) levels, as well as a period of structural change and increased urbanization. All of these factors increased the demand for banknotes as means of payment.

[36] In Monday 27th of February 1797 hundreds of leading merchants publicly agreed not to refuse Bank of England notes in payment, and to make provision to make all payments in such matters (Feavearyear 1931, p. 170; see also Shin 2015). Soon after, in March 2nd, an Act was passed which allowed the Bank to issue notes of less than £5, and Bank of England notes became more common all over the country (Feavearyear 1931, p. 171).

[37] Chadha and Newby (2013, p. 10) also place emphasis on the Bank's reputation: "practical men of the City of London [which publicly committed not to refuse the Bank's notes] would not have supported policy in which they did not have faith, and therefore merchant's willingness to support the Bank notes can be seen as a testimony to the Bank's credibility".

outcome. Nor can it explain why the policy ultimately succeeded, rather than turning into conventional debt monetization for fiscal purposes, which would have led to inflation and to the ultimate abandonment of the system, as happened in France. Equally, demand for precious metals in France following the failure of its own paper money policy can explain why pressure was exerted on the equilibrium price of precious metals in Britain, but not why the adoption of the Restriction Period policies was possible as a way out.

In order to understand why the Restriction Period was possible and ultimately successful, we need to consider the history of the Bank prior to that event. So far, scholars have analyzed this mostly at a qualitative level. While the balance sheets of the Bank of England are well-known, economic historians have lacked comparable measures for both coin supply and broader forms of money, leading to the possibility of only analyzing the outcomes in a rather unsystematic manner, for years when information happens to be available.[38] We now take advantage of new data on money supply, which, by contrast, allows for a much more detailed quantitative analysis, which can then be cross-checked against historical events.

The picture that results from our exercise shows that, throughout most of the eighteenth century, the Bank's actions during times of warfare did not proceed in parallel to those of the government. While times of war were associated with enormous increases in military expenditure (Figure 4)[39], and, through a "ratchet effect", permanent increases in fiscal capacity and government size (O'Brien 1988; see also our appendix Figure A3)[40], prior to the 1790s the actions on the fiscal side of government finance were not mirrored by the Bank of England.[41] Indeed, up to the 1790s there is no evidence that the Bank of England expanded banknotes relative to coin supply faster at times of war (Figure 5), nor that the size of fiat (more broadly defined) in circulation grew any faster in times of war (as is visible in Figure 1). In several periods of war, such as the American revolutionary war period, these stocks actually decreased. This was largely because wars were often associated with financial crises and, prior to Bagehot's doctrine well into the nineteenth century, the Bank of England's first and foremost priority was to defend its own position, maintaining adequate reserves to avoid a run.

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[38] For instance, Roberds and Velde (2014) write that the "Bank's note circulation peaked at £28m in 1814, more than the gold coined during the recoinage of 1773–79".

[39] In Figure A1 of the appendix we show instead real military spending in per capita terms, and the same basic pattern emerges.

[40] Given the importance of military expenses for the government's budget, it is not surprising that the equivalent figure for the size of government looks rather similar as well; see Figure A2 in the appendix.

[41] Furthermore, the fact that the Bank of England was a private institution meant that profits from seigniorage largely accrued to stockowners rather than the government, so direct monetary finance was not an important source of funds for the government. (See, however, O'Brien and Palma 2016).

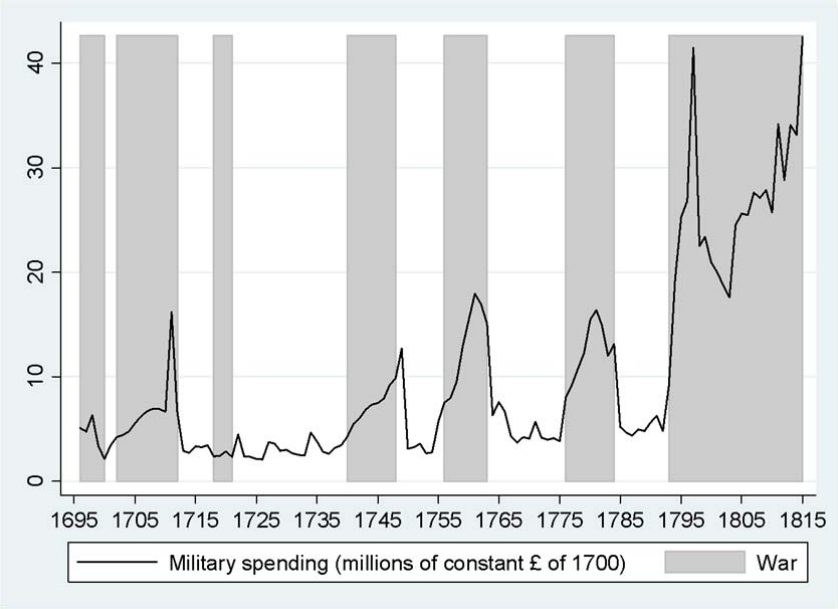

Figure 4. Total military spending 1696-1815, at constant prices of 1700. Total military spending corresponds to spending by the army plus spending by the navy. Naval spending equals total grant plus navy debt plus transport (added from the army), plus funding operations. Army spending equals total grants (grants for army and ordinance services including militia) plus transport (added to the navy) plus funding operations, plus votes of credit, plus subsidies and pay of foreign troops, plus Irish military expenditure (army, ordinance and votes of credit). The shaded areas correspond to years of war. Sources: For naval and military spending, O'Brien and Duran (2010), for the deflator, Broadberry et al (2015).

The data in these figures shows clearly that, unlike what has been shown to be the case for military spending or fiscal capacity, until the 1790s war had no discernible effect on the growth of fiat supply (which might have increased for fiscal reasons at times of war though lending from the Bank to the Government). Only in the last decade of the century would this change decisively; it was then that in real terms, both notes of the bank of England – and the size of financial intermediation – expanded considerably.[42] As one authority (who, unlike us, takes a negative view of the extension of the Restriction Period beyond the immediate resolution of the 1797 liquidity problem) writes, "while there was no forcing of the paper issues there was little if any limitation of them" (Feaveayear 1931, p. 178).

[42] It is also the case that provincial banking expanded gradually in the second half of the eighteenth century, and considerably right after 1797. The direct observable evidence concerns, however, the number of banks, as the issues of each cannot be calculated (Pressnell 1956); see also Joslin (1954). According to Coppetiers (1955), country banks rose from 280 in 1793 to 657 in 1815 and London Banks with privileges to discount at the Bank from 63 in 1792 to 80 in 1814. As the Bullion Committee pointed out, commercial discounts had greatly increased since 1796, and the quantity of country bank notes did so as well. These, it was argued, in practice depended closely on the quantity of Bank of England paper notes in circulation (Feavearyear 1931, p. 183).

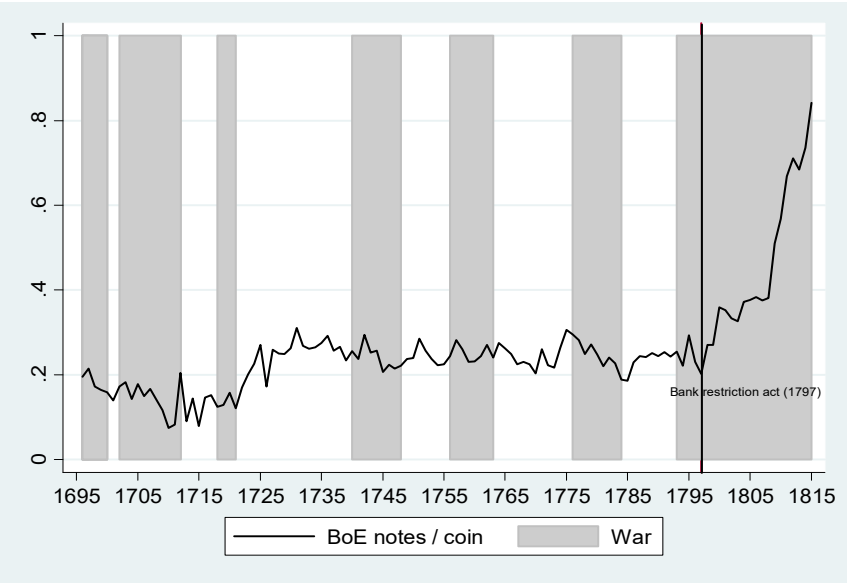

Figure 5. The ratio between Bank of England notes and coin supply, 1694–1815. Sources: Bank of England (1967), Palma (2016)

Even in wartime the state did not flood the market with bills and credits delivered from the Bank in the form of discounts, and notes provided the reserves needed not simply to complement bullion but to assist the continued operation of external and internal trade in the adverse circumstances occasioned by warfare. The South Sea Bubble episode (which did not concern the actions of the Bank of England, although it had initially tried to get involved) excepted, there were, in short, no serious financial crises and little crowding out of commercial activity upon which tax revenues depended because both the state and bank behaved prudently even in wartime, when pressures to print money invariably intensified.[43]

During the Great Recoinage (1696) and the Jacobite invasion of 1745, temporary suspension of cash payments had been necessary. In both cases convertibility was soon restored, suggesting to the public that suspensions did not last longer than necessary. Decade after decade of good behavior matured to maintain supplies of reserve assets, money and credit in line with the increasing demands of the private economy, and provided creditors with a reserve asset – Bank notes – and means of exchange in which they deposited increasing confidence. At the end of a long history of prudence, when demands by the state for both credits and loans intensified to levels never before experienced, the economy was finally well prepared to make a transition to inconvertible paper, which was indispensable for the conduct of more expensive warfare coupled with the continuation of flexible support for the demands of the private economy.

[43] Hence Adam's Smith remark with which we started this paper, "the stability of the Bank of England is equal to that of the British government" (Smith 2003/1776). Credibility was a two-way street.

3.3. 1793-1815: extraordinary measures for extraordinary times

Though the French wars were not completely unanticipated – rearmament had been going on for decades, much prior to 1793 or even 1789 (Knight 2013) – their scale and intensity surprised all contemporaries. Compared with earlier conflicts in the century, the wars against revolutionary, and then Napoleonic, France were simply of a different order of magnitude. With the exception of the two twentieth-century world wars, the Napoleonic wars cost more lives in battle than any other modern conflict (Clodfelter 2008, p.152).[44] For the British, these wars were something altogether different from earlier conflicts, whether measured by number of battles, military expenditure (Figure 4), or war casualties (Figure 6). Importantly, while previous eighteenth-century wars were fought on the oceans, overseas or in the colonies, the wars of the 1790s-1810s corresponded to a perceived threat to the security of human life and property – certainly that of the aristocracy – in the British Isles themselves.

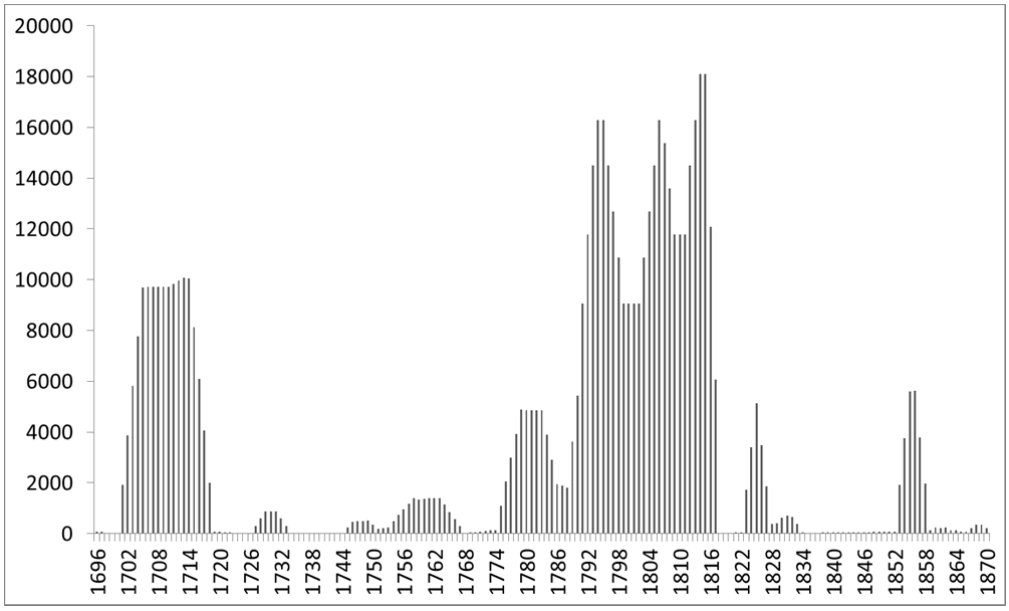

Figure 6. British external conflict war casualties, 1696-1870 (six-year moving average). Sources: Dincecco and Prado (2012) for 1700-88 and 1816-1870 (which for the latter period rely on the Correlates of War project) and our own series otherwise (see the appendix), relying on Clodfelter (2008).

Although throughout the 1780s the British government had been rearming and preparing for an eventual conflict with France, the scale of the French revolution and its subsequent course can

[44] Given that the population was much smaller in this period than in the twentieth century, this may be in fact an understatement.

be interpreted as a "black swan"-type event to hit the English economy. The revolution itself and its military aftermath, such as mass conscription after 1793 during the French Revolutionary Wars (*Levé en masse*), and the threat of the *Grand Armée* were truly new and unprecedented events.

The Bank of England's response did not simply consist of increased lending in the form of a shock or a series of shocks to the money supply, but to what in modern terms we might call a change in the systematic component of monetary policy.[45] The political elites who owned contracts set in nominal terms were willing to tolerate these risky measures because they knew that should the French successfully invade, their properties (and perhaps their lives) were at risk.[46] The arrival of a French fleet to Bantry Bay, Ireland, in December 1796, followed by a French landing in Fishguard, Wales, in February 1797, induced the elites to accept the regime change.[47] A large number of merchants all over the country signed (and publicly announced) declarations in which they promised to accept and keep using banknotes. The most prominent of these meetings was that of London; while the Bank of England had a role in arranging this meeting[48], the fact is that it could not force the merchants to take that decision, which was also publicly announced through publication in *The Times*.

The standard account is that although the Directors could legally refuse requests for credit from the Treasury, in practice they had little choice but to accede to the demands of the state. There is some truth in this. Outright refusals at critical times could have disrupted military and naval mobilization and no government would long tolerate the frustration of its strategic policies by a private corporation. The Bank had enjoyed a monopoly as a joint stock bank of issue for continued services to the state and Ministers took good care to make the Bank's privileges subject to periodic review and renewal.[49] According to this viewpoint, the Directors recognized that they had to obey and always did so.

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[45] As we detail below, this consisted not only in the quick expansion of the Bank's balance sheet (accompanied by a similar trend in provincial banks), but also in the issue of much lower banknote denominations, opening the way to their much more widespread usage; until 1797 bearer notes of less than £5 issued by any English bank had been more or less illegal (Feavearyear 1931, p. 163).

[46] It would be expectable that dropping convertibility would generate at least some inflation. Politically influent elites would have feared the effects of this on their nominal incomes. For a related argument which applies to a later period, see Eichengreen (1992), who argues that the interwar gold standard was not dropped earlier, among other reasons, because of the limited political influence of the groups that would gain from inconvertibility and depreciation. When Pitt promised the Bank in early 1797 that its suspension would be confirmed in Parliament – as it turned out to be – he must have known that support would exist. And given the help that the Bank gave to the government, the Bank's insolvency would have been seen as an outcome to avoid, especially in the wartime circumstances of 1797 and the years that followed.

[47] Other factors were also at play, as discussed in section 2.2.

[48] The meeting was sponsored by the Bank with no involvement by the government (Shin 2015, p. 424).

[49] Clapham (1944, vol 1, p. 177) and Committee of the House of Commons on the Bank, Parliamentary Papers (1807, volume 2, p. 111. See also Broz and Grossman (2004).

Indeed, the Director's conflict with the Treasury during the years 1795-97 reveals how their power to curtail loans to the government consisted of no more than putting pressure on the Chancellor to borrow more money directly from the London money market.[50] And it was also the case that after August 1797, the Treasury increased its demands on the Bank to take a contracted amount of Exchequer Bills, and to purchase more on the market, under a gentleman's understanding that the Bank should not resell them (Clapham 2008b, p. 11).

However, two facts prevent our acceptance of the idea that the Bank of England was simply following government orders. First, the Bank could deliberately ration lending to the government, and in many instances did so (Clapham 2008b, p. 5; Duffy 1982, p. 80). Second, while after Suspension took place the Governor of the Bank often complained of having to meet increasing Navy and other government bills to greater amounts that it seemed to them reasonable (Clapham 2008a, p. 266), the quantitative evidence suggests that total government securities held by the Bank in fact decreased in the years immediately following the Suspension (Figure 7).

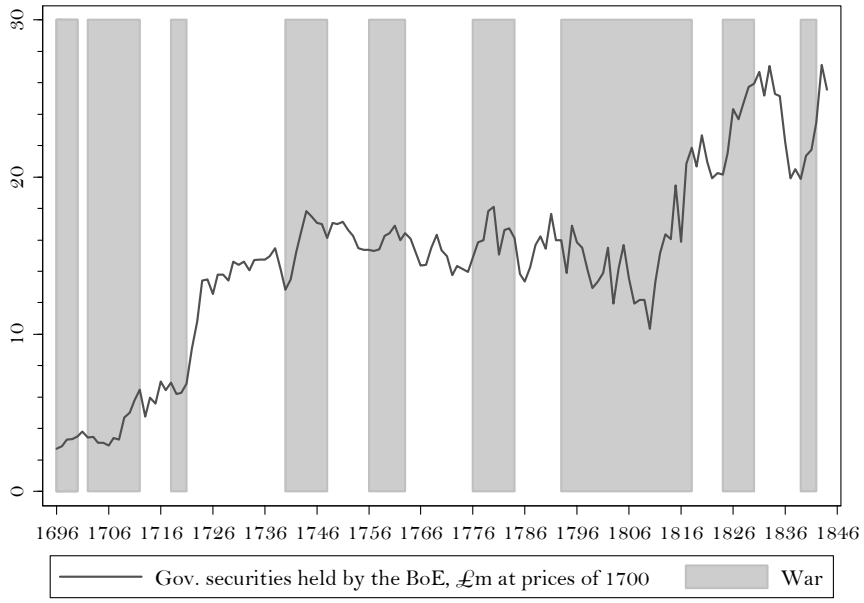

Figure 7. Total government securities held by the Bank of England, millions of £ in constant prices of 1700. Total securities include government debt plus other government securities held by the bank. Source: Bank of England (1967), and for the deflator, Broadberry et al (2015).

[50] Committee of the House of Commons on Suspension 1797, in Parliamentary Papers (1826, volume 3, pp. 17, 73, 145, 157 and appendix 9). The monetary history of these three years is also revealing for the light it sheds on the influence exerted by the Bank and the Treasury on the liquidity position of London's money markets. Between 1795 and 1797 the Chancellor of the Exchequer as head of the Treasury attempted to comply with the Directors' pressure to market bonds rather than bills and to issue a higher proportion of bills direct to the capital market. Whenever the Bank exchanged its notes for exchequer and other government bills, subsequent expenditure by the navy, army and other departments of state added to the supply of Bank notes in the hands of the public, who then deposited surplus cash with private bankers. Finding themselves with more reserve currency in their tills bankers then granted additional credit to clients and the money supply and transactions increased.

It seems likely that after Suspension Pitt and the Treasury followed the Directors pressure from 1795-97 and tried to contain short term borrowing by departments of state by borrowing long term (bond finance substitution for bill finance, i.e. short term credit), and by increasing inflows of new and old taxation to fund warfare. Bond finance left the Bank to provide liquidity for loan contractors and appears as private assets on the Bank's account. The Bank was anxious to avoid rationing credit for the private sector and so was the Treasury because that would lower revenues from taxation. They were trying to rebalance competing demands on the money market.

The observed decrease in government securities held by the bank was briefly interrupted around the time of the Treaty of Amiens, when net lending stagnated. It was only as the war against Napoleon intensified, that Bank of England purchases of government securities did so as well, jumping from less than £20 million in 1810 to over £32 million in 1813 in real terms (constant prices of 1700). In any case, what is certain is that the Bank was more than a pawn of the Government; it had a certain level of autonomy and independence, and cared for its own reputation. Indeed, "Much of the correspondence written and verbal, between Pitt and the Bank ... concerned mainly ... pressure for advances which the Bank so stubbornly resisted" (Clapham 2008a, p. 267).

3.4. Inflation and the Bank of England

Despite the accusation of the bullion committee and other subsequent analysts, the Bank's suspension during 1797-1821 was unlikely to have been responsible for much of the observed wartime inflation pattern. Two motives allow for this conclusion. First, prices had been slowly rising since the 1760s, with an acceleration noticeable from the late 1780s (Figure 8). The motives for this include real-side factors such as the growth of the population (Clark 2001), and after 1793, shortages associated with the war economy, a concentration of bad harvests, disruptions to trade, taxes, and the reallocation of resources towards the army and navy. Secondly, prices peaked in 1813 and started falling after that date, hence after the first bullion committee had been set up but well before convertibility was restored. (And at a point in time when it was far from certain whether a return to gold would happen at pre-suspension parity.)

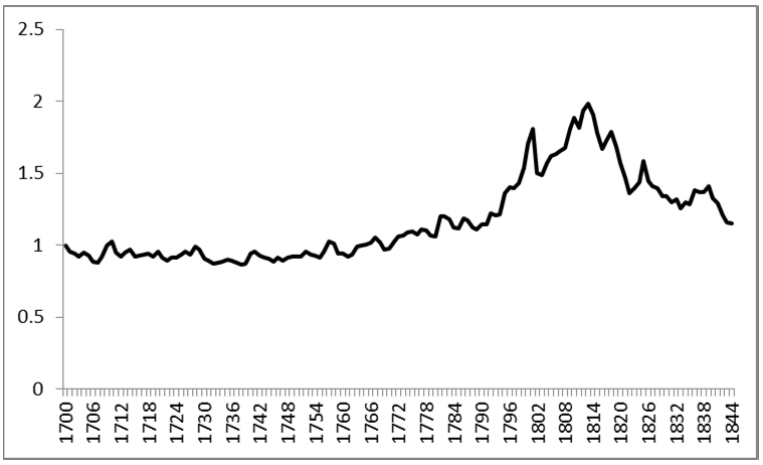

Figure 8. Price level in Britain, index with 1700=1. Source: Broadberry et al (2015).

It was Parliament which ultimately forced resumption as early as 1819-21. But this does not prove that the Government had been committed to dynamically consistent policies all along while the Bank was not, or that the Bank was just blindly following Government orders. Indeed from a modern perspective, fiat money is a more efficient monetary system.[51] The stability of a fiat money system requires that the monetary authority is able to credibly commit to a stable inflation rate, but inconvertible banknotes may not have been the main culprit behind wartime inflation, as there was no simple causal chain from the quantity of Banknotes in circulation to the price level (Clapham 2008b, p. 16-19).[52] Inflation as well as the market price of gold fell considerably once the war was over, as markets opened, the balance of payments adjusted, and the war drain ended (Clapham 2008b, p. 37). It had not been the case that the Bank had wanted Suspension to continue indefinitely, or even that it had always been in less of a hurry to restore it. Despite the fact that inconvertibility was rather profitable for the Bank, as early as October 1797 the Bank had wanted to resume payments. (Pitt had not allowed this, despite the Bank's reserves having largely recovered by then; see Clapham 2008b, p. 4.) Even if some inflation did result from the Bank's actions, this may have optimal. As Clapham (2008b, p. 32) put it: "No one said frankly – accept a measure of inflation for victory's sake". Overall, there is no evidence to conclude that the Bank followed irresponsible policies. As Duffy (1892, p. 81) concludes, "the Bank's awareness of the need to regulate discounts did not fall into abeyance during the Restriction".[53]

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[51] The resumption of convertibility at the prewar standard was predated by deflation which continued after 1821 and created difficulties for the transition from a wartime to a peacetime economy (Acworth 1925). It also led to "speculative ventures in the capital markets, and the eventual collapse of the financial system … followed by widespread bankruptcies and unemployment" (Neal 1998, p. 53). Neal takes a more positive view of its long-term consequences.
[52] Indeed, some wartime inflation peaks "cannot be connected at all closely with the mere quantity of notes in circulation" (Clapham 2008b, p. 9).
[53] Even the Bank's theoretical adherence to the real bills doctrine did not correspond to its de-facto discount policy (Duffy 1982).

4. Long-term consequences

4.1. A policy shift

The consequences of the new regime of paper money would continue to be felt for a long time, despite the establishment of the classical gold standard in 1819-21. Once people got used to fiat money, the system never went back to the predominantly coin-based system which had been in place before the late-eighteenth century. The 1793-1815 wars caused a monetary policy regime shift. The shift was conditioned, and indeed made possible, not just by the military and geopolitical circumstances of the last decade of the eighteenth century but also, importantly, by a prior history of prudent financial management by the Bank as well as the state. The state, while accepting as necessary the Bank's liquidity provision, always refrained from requesting amounts that would lead to problems such as unstable currencies and exchange rates, hyperinflation, and consequently widespread refusals to accept notes and deposits, frequent features of comparable experiments with public banks linked to states on the mainland.

Figures 1 and 5 show that the Bank of England shifted gears in the 1790s, but it would be wrong to assume that after 1821 there was a return to the previous status quo. Figure 9 now extends the horizon of Figure 4 to the mid-nineteenth century, emphasizing the special nature of the Restriction Period. The figure shows three important facts about this period. First, after a long period of stability, there was a spike in Bank of England notes at the time of the Restriction Period. Second, when the supply of notes was later reduced, the reversal was only partial: the level did not return that of the 1790s. Third, and crucially, the previously stationary distribution then gained an upward trend – the growth which started in the 1790s continued into the nineteenth century.[54] The regime change to the system caused by the Bank Restriction in the 1790s persisted well into the future, long after that act was repealed. Through a process of path-dependence, it caused a permanent shift to a fiat-based monetary system, which – despite the later imposition of the classical gold standard (Redish 1993) – allowed for continuous growth of fiat money relative to slower-growing quantities of precious metals well into the nineteenth century.

[54] The endpoint for our analysis is1844, when the Currency School triumphed by imposing a 100% reserve ratio of specie through Peel's act

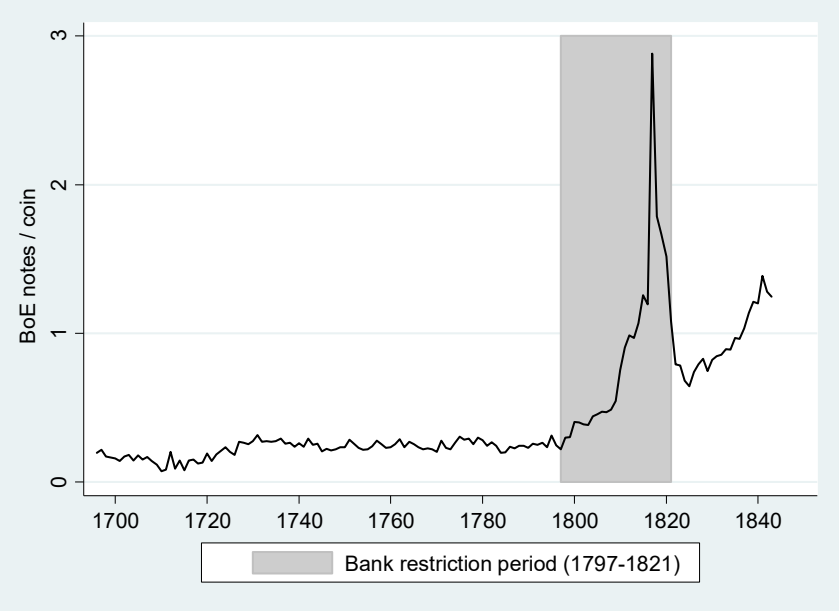

Figure 9. The ratio of Bank of England notes to coin supply, 1696-1844. Despite the existence of bills of exchange throughout the entire period, growth during the Restriction Period is likely to be underestimated relative due to the spectacular growth of private provincial banking, which here lies unaccounted for, especially after 1797. Sources: for banknotes, Bank of England (1967); for coin supply, Palma (2016).

What our new long-term data (Figures 1 and 5) hence emphasize is that it was a long history of previous prudence by the Bank of England that allowed this to occur successfully. Eventually, when it was ultimately necessary, the Bank and the government abandoned their previous orthodoxy; this move was successful thanks to a century of accumulated reputation for trustworthiness which led the public to believe that the value of the Bank's paper money (and the public securities that backed it) would be honored.[55] This helps us understand the context behind the pre-Bagehot doctrine mind-set of the Bank's directors – by the nineteenth century the Bank was playing a much more central public role than it had before, but there was awareness by its Directors that the success of its policies had been largely due to the long-term accumulation of a reputation for prudence; only very "special times" would justify deviating from such policies.[56]

4.2. Unintended long-term consequences

The long-term consequences of the Restriction Period were profound at several levels. In

[55] This belief was based not only on the returns to a century of "good behavior" by the Bank but also with the public's belief that Britain would ultimately win the war – an outcome towards which the Bank of England's support to the government turned out to be more than incidental as well (O'Brien and Palma 2016).
[56] Acworth (1925), Gordon (1976, 1979), Gambles (1996).

the words of Clapham, "Englishmen of rank and file – wage earners and small traders – knew little of paper money, and in the early years of suspension they had learnt its use only gradually" (Clapham 2008a, p. 162).[57] But it was with, and indeed because of, the 1790-1810s wars and the Restriction Period that most people learned to use it. While up to the 1790s £10 notes were the lowest note denomination[58] issued by the Bank of England (over £1,000 in 2015 prices)[59], it was only in 1793, at the start of the war against Napoleonic France, that £5 notes were first issued.[60]

Denominations of £5 were in turn followed by £2 and £1 banknotes, issued in 1797, coinciding with the Restriction Period. Crucially, also allowing for a margin of contemporaneous inflation, £1 was then just enough to pay a laborer's weekly wage (Schwarz 1985).[61] Despite the Bank's suspension and dramatic expansion of banknotes in circulation, Bank of England notes were accepted by the public and began to be used not only as a store or value or at the retail level, but also, for the first time, as a means of exchange for ordinary people. Bank of England notes became legal tender through a 1811 act of Parliament, but they had in fact been de-facto legal tender since the Bank Restriction Act of May 1797.[62] Furthermore, the Bank of England's expansion encouraged that of provincial banks, which held reserves at the Bank, to expand their issues as well.[63] The increased interest of the public in the usage of banknotes is suggested by Figure 10, which shows not only that written references to banknotes spiked at the time of suspension, but also that interest in them continued thereafter, mirroring what we find in Figure 8. In the words of Shin (2015, p. 418), "the experience of paper money had a profound impact upon the popular notion of money".

Once people got used to using paper money there was no going back. Despite the adoption of the "classical gold standard" in 1821, banknotes continued their steady rise as a percentage of the total money supply into the nineteenth century. For the State, a more monetized econ-

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[57] See also Clapham (2008b, p. 2-3), who writes: "As gold became scarcer the £1 and £2 notes were used more and more for wage-paying and retail trade"

[58] Payments through the Bank of Amsterdam (which did not issue circulating notes) were even larger and exclusively wholesale (Quinn and Roberds 2014, p. 6).

[59] £10 in 1793 correspond to £1,058 in 2015 prices (Officer and Williamson 2016b).

[60] Additionally, the modal denomination of Bank of England notes prior to suspension in 1797 had been £20 (Hotson 2012, p. 12).

[61] The Government was understandably concerned with counterfeits and stiff penalties – execution (or under mitigating circumstances, transportation) – were promised for "uttering false bank notes". This was enforced: for instance in 1817, there were 32 capital convictions, 95 other convictions "for having forged Bank Notes in Possession", while only 15 people were acquitted. (House of Commons Papers, Volume 16, p.222, in Parliamentary Papers 1818).

[62] For a recent review, see Chada and Newby (2013, pp. 11-12).

[63] The number of country banks rose from 280 in 1793 to 657 in 1815. The London Banks with privileges to discount at the Bank rose from 63 in 1792 to 80 in 1814. This was accompanied by dramatic expansion of the balance sheet of provincial (and London) banking after 1797 (Pressnell 1956, Joslin, 1954, Coppetiers 1955).

omy was also easier to tax, further encouraging a positive loop between monetization and state capacity (Capie 2004, O'Brien and Palma 2016). As the nineteenth century advanced and the process of modern economic growth started to take place, increased monetization helped attenuate deflationary pressures, though it would not completely eliminate them, especially later in the century.

Figure 10. Google Ngram viewer for "Banknotes", from the corpus of "English", for the period 1650-1840 (with zero smoothing).

Once paper money became the dominant means of payment, coin never regained its prominence. Furthermore, while convertibility was restored in 1821, and Peel's Act of 1844 (predated by Palmer's rule) curtailed the liberties of the Bank in terms of issuing paper money, the restriction that the Bank's issues had to be fully backed (or partially so after Palmer's rule) was less of a constraint to the growth of paper money than it may at first appear. Reserves could be in the form of either bullion or public securities (including deposits), and the latter were available elastically. And secondly, convertibility could be again dropped as needed. Faced with a real shock the Bank of England temporarily suspended Peel's act as early as 1847, and issued fiat money without being constrained to having full gold backing (Dornbusch and Frenkel 1984).

5. Econometric analysis

5.1. Structural breaks

We now perform a number of structural break tests, which are likelihood-ratio (or Wald) tests of whether the coefficients of a time-series regression of the size of fiat relative to coin supply

vary over the periods defined by break dates set a priori.[64] Notice that unlike what is the case with familiar Chow tests, these tests are robust to unknown forms of heteroscedasticity.

The results are shown in Table 2. There are two test-type options. The first is to perform a test for a single, endogenously determined break. An alternative is to perform a multiple structural break test. For this second test, we need to set candidate dates. Both narrative historical evidence and Figure 6 suggest possible breaks in 1797 and 1821. For each test option, and for a variety of specifications and subsamples, we focus on the ratio of Bank of England notes to coin supply.[65] The results are shown in columns (1) to (6).

	(1)	(2)	(3)	(4)	(5)	(6)
Variable	BoE/coin	BoE/coin	BoE/coin	BoE/coin	BoE/coin	BoE/coin
Type of test	Single, unknown break	Single, unknown break	Single, unknown break	Single, unknown break	Multiple breaks: testing for 1797 and 1821	Multiple breaks: testing for 1797 and 1721
Specification	Levels	Levels	Natural logs	Natural logs	Levels	Natural logs
Period	1696-1815	1696-1844 (full sample)	1696-1815	1696-1844 (full sample)	1696-1844 (full sample)	1696-1844 (full sample)
Observations	120	149	120	149	149	149
Outcome at conventional levels	Break date detected in 1798	Break date detected in 1802	Break date detected in 1796	Break date detected in 1822	1797 and 1821 detected as breakpoints	1797 and 1821 detected as breakpoints
p-value	0.00	0.00	0.00	0.00	0.00	0.00

Table 2. Structural break tests following a time-series regression of the "BoE notes/coin" variable on a constant and a time (years) variable; standard errors are robust the trim is 15%.

[64] Our formal discussion of structural change is focused solely on the issue of testing parameter stability, and on the first moment of the distribution; cf. Stock (1994), Perron (2006), Bai and Perron (1998).

[65] This is in fact a lower bound to the true notes/coin ratio, since the banknotes of provincial are not included.

Whether we specify the equation in levels or natural logs, we reject the null hypothesis of no-structural break at our key dates.[66] These formal tests confirm that a structural break happened between 1796 and 1800, and another happened around 1821, a result also easily visible by inspection of Figures 1 and 6. In the case of single-break tests for the natural logs specifications – column (4) – the tests suggest that the break occurred in 1822, but this is because we are assuming that only one break occurred, while visual inspection of Figures 1 and 6 suggests that at least two did. Indeed, this is what the multiple break tests in columns (5) and (6) show.

5.2. Unit root tests

The break found in specification in columns (1), (3) is close to the trim, but at the same time, that of columns (2) and (4) is not clearly superior, not only because more than one break occurred – as suggested by the results of the multiple break test – but also because structural break tests may not be valid in the presence of unit roots (and vice versa). Since the distribution is stationary until 1790, this is not a problem for that period. And the fact that a unit root appears around the time of the Restriction Period is precisely the main point we are making. As Figure 6 suggests, the distribution gains a persistent upwards drift or trend after 1797.[67] The bank Restriction Period of 1797-1821 is one of disruption, but after the imposition of the classical gold standard in 1821 the distribution does not return to its pre-1797 mean.

We now formally test this visual conjecture using augmented Dickey-Fuller (ADF) tests. The results for the ratio of Bank of England notes to coin supply are in Table 3. For each specification, the number of lags has been chosen according to the BIC criteria. Starting with the full sample, nonstationarity cannot be rejected if no drift or trend terms are allowed (column 1), as we would expect from visual inspection of Figure 6. Even if the sample is restricted to the pre-1797 period, nonstationarity is not rejected because of an early trend in the first quarter of the century (column 2); but if the sample is restricted to the 1726-1796 period, nonstationarity is safely rejected (column 3). As we would expect, extending the sample up to 1821, and even excluding the pre-1726 period, the distribution is once again nonstationarity (column 4), a result that evidently also holds if the sample is instead extended to 1844.[68]

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[66] There may have also been a small increase in the mean of the distribution in the first quarter of the eighteenth century.

[67] The alternative methodology of Figure 1 leads to the same pattern of results.

[68] The same qualitative conclusions hold if the variable is set in natural logs rather than levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Variable	BoE/coin	BoE/coin	BoE/coin	BoE/coin	BoE/coin	BoE/coin	BoE/coin	BoE/coin	BoE/coin	BoE/coin	BoE/coin	BoE/coin
Type of test	No drift and no trend	No drift and no trend	No drift and no trend	No drift and no trend	Drift included	Drift included	Drift included	Drift included	Trend included	Trend included	Trend included	Trend included
Specification	Levels, 1 lag	Levels, 1 lag	Levels, 1 lag	Levels, 1 lag	Levels, 1 lag	Levels, 1 lag	Levels, 1 lag	Levels, 1 lag	Levels, 1 lag	Levels, 1 lag	Levels, 1 lag	Levels, 1 lag
Period	1696-1844 (full sample)	1696-1796	1726-1796	1726-1821	1696-1844 (full sample)	1696-1796	1726-1796	1726-1821	1696-1844 (full sample)	1696-1796	1726-1796	1726-1821
Observations	147	99	71	96	147	99	71	96	147	99	71	96
Outcome at conventional levels	Cannot reject non-stationarity	Cannot reject non-stationarity	Reject nonsta-tionarity	Cannot reject non-stationarity	Cannot reject non-stationarity at 1% and 5%, reject at 10%	Cannot reject non-stationarity at 1%, reject at 5% and 10%	Reject nonsta-tionarity	Cannot reject non-stationarity	Cannot reject nonsta-tionarity	Cannot reject non-stationarity	Reject nonstation-arity	Cannot reject non-stationarity
p-value	0.5423	0.2596	0.00	0.6532	0.0702	0.0209	0.0000	0.1078	0.1988	0.1390	0.0046	0.5705

Table 3. ADF tests for the "Bank of England notes/coin supply" variable.

5.3. Discussion

Let us not lose sight of the forest in the middle of these econometric trees. Our breaks in stationarity[69] simply identify periods of important historical change. What they suggest is that while the period before 1797 was one of remarkable stability, the Restriction Period of 1797-1821, represented a historical discontinuity, and one which would continue to be felt after 1821 as well, when the distribution gained an upward trend. Some of our econometric tests also cannot reject a structural break in the first quarter of the eighteenth century, but there are three important differences relative to the post-1797 period. First, the statistical evidence in favor a break around 1720 is weaker than is the case for 1797. Second, the economic magnitude of the break of the first quarter of the century is much smaller too, as is shown in Figures 1, 4 and 7. But more importantly, unlike what happened after 1797, the break was followed by a long period of stability. In other words, there may have been a small upwards shift in the mean of the distribution around 1720, but the distribution did not gain a trend or unit root, unlike what would happen in the late century. By contrast, the Restriction Period of 1797-1821 was a regime shift towards the permanent dominance of paper money.

6. Conclusion

The Restriction was associated with one of the first successful transitions to a paper money system for a major economy.[70] Despite the eventual return to convertibility in 1821, coin supply never regained its previously central role in money supply: the age of the banknote had begun. Britain's regime shift was mechanically implemented through the Bank Restriction Act but it was the result of two distinct causes. Over the short run, it resulted from the unusually dangerous military circumstances of the last decade of the century, combined with increased pressure on France's return to a commodity-money system. These reasons have been emphasized before in the literature, and we agree that they mattered. But alone, they would have not sufficed for the policy's success. The public would not have accepted money if it anticipated loss of value.[71] It was the reputation of the Bank, accumulated over a century of prudence, which interacted with that of the state to make the actions

[69] Our formal tests and discussion are restricted to the notion of weak stationarity, though of course broader definitions which take into account the entire distribution also exist.

[70] We are here using the term paper money as intrinsically worthless money with positive market value. Other paper money systems remained partial and limited to peripheral regions (as in Scotland or North America) or eventually failed (as in medieval China or eighteenth-century France). However, Sweden's Riksbank banknotes were inconvertible since 1745, and had "by the middle of the eighteenth century, become and essential if not predominant component of the Swedish monetary environment" (Roberds and Velde 2016). See also Quinn and Roberds (2014) for the case of the Dutch Republic.

[71] In France, paper money was only held as long as the Terror lasted: it was a guillotine-enforced system (Sargent and Velde 1995). This strongly contrasts with Britain's experience, where "inconvertible paper money was grounded less in coercion … and more on … trust" (Shin 2015, p. 419).

and promises of both credible during the Restriction.[72]

Our data from 1698 to 1821 suggests that the Bank never became an agency of the state, even in wartime.[73] Over time the Bank build up a reputation for prudence. Thus when the constraint imposed by convertibility was removed the public could rely on the Directors of this private corporation whose shareholders would expect them to maximize profits to maintain the established, prudential and traditional rules and conventions for both loans to the state and discounts for its clients. At the time the Directors and Ministers, made this very point when confronting attacks that the Bank was "forcing" notes into circulation. They were correct.

Wartime military pressures also mattered, and interacted with the reputation of the Bank and the state. The extraordinary danger that the external war against France and its allies represented called for, and allowed, much bolder monetary policy experiments than would otherwise have been possible to implement.[74] They would not have been possible in "normal" times in Britain (including at previous times of warfare), but they were also not possible in continental countries where institutions of comparable reputation to the Bank of England did not exist. At the beginning of these unusually serious wars, for practical purposes it may have seemed impossible for people in Britain to estimate the probability of future outcomes, such as winning the war or being invaded.[75] Well-informed contemporaneous observers knew well that the outcome of the war was far from certain (Knight 2013). The pessimist's view of Britain's chances of prevailing was suggested by the political cartoonist James Gillray when he depicted French alarmists urging John Bull, representing the English public, not to accept paper money; the suggested reasoning was that once the French landed, Bank of England notes would surely be worthless. But he had to concede that the public accepted it.[76]

Despite the seriousness of the military threats, and the unprecedented injection of liquidity in

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[72] This trust was reflected in the declaration movement whereby mostly merchants, but also people such as "farmers, grocers, inn-holders, butchers, bakers" (Shin 2015, p. 430) signed regional declarations, publicly promising to accept and keep using banknotes for payment. In the case of the London declaration, there were signatures by many "drapers … warehousemen … haberdashers … stationers … sugar refiners … brewers … ironmongers" (Shin 2015, p. 431). The declarations were targeted at a wide audience, and specifically, the lower classes Shin (2015, p. 429).

[73] Nevertheless, as we documented, the Bank did provide high levels of support to the Government during the Restriction Period.

[74] Bordo and Kydland (1995) interpret the gold standard as a contingent rule, in the sense that temporary suspension was possible during an emergency, such as a war, but it would be expected that once that emergency was over, convertibility would be restored at the original parity. But repeated suspensions would not be credible, especially if lasting for a long period.

[75] In economics this is known as a situation of ambiguity or Knightian uncertainty.

[76] See, in our appendix, Figure A4.

the economy which we have documented here, no major panic ensued, and inflation remained moderate when compared both with that in other countries at the time, and with the next war-time suspension, World War I. As the evidence we discussed in this paper suggests, the British public accepted the Bank's fiat – essentially debt repackaged as money – at a moderate discount, certainly by continental standards.[77] While some inflation did occur, possibly in part as a consequence of the very aggressive monetary policy pursued by the Bank, Britain won the war and, importantly, by the time normal conditions returned the credibility of the Bank had not been compromised. By showing a willingness to be pragmatic during unusual times, the government and the bank may have in fact reinforced the public's confidence in the financial system.[78] We have here emphasized that in order for this to be possible, the government's credible commitment was not enough. In order for Britain to withstand the test of the revolutionary and Napoleonic war, the Bank of England's patiently built up money management was also required.

Which factors interacted with the Bank of England's initial reputation to make the policy a success? Three reasons stand out. First, the Bank of England's expansion of banknotes during the restriction was of a much smaller magnitude than had been the case in France a few years before. In 1797, the ratio of Bank of England notes over nominal GDP was just under 23%, and in the next few years issues were never such that the 20% percent mark was crossed again, a target made easier by the economic growth performance of the British economy during those years (Bank of England 1967, Broadberry et al 2015). This strongly contrasts with the case of France during the *assignats* debacle, where the expansion of fiat was eventually exponential (Sargent and Velde 1995). In contrast with France, the Bank of England's policies were subject to a series of checks and balances, being closely monitored, as exemplified by the "Bullion report", and related controversies and debates (see for instance Feavearyear 1931, pp. 190-2).[79] Second, not only did Britain's already have a comparatively high level of fiscal capacity, being able to credibly borrow[80], but the policies of the Bank were also at this time accompanied by a series of fiscal reforms. An example was the introduction of an income tax

[77] This is not to say that the Restriction Period transition was immediately accepted by everyone (Shin 2015). But while the discount could be up to 50% (though usually less), it must also be recognized that "In the ordinary occurrences of life, and in small transactions … [notes and coin] might serve as well as the other" (The Times 1811). It was only for large-scale transactions that a discount took place.

[78] The Restriction period permitted the ongoing solvency of the Bank of England (Chadha and Newby 2013), with implications for the financial stability of the country as a whole.

[79] There is a debate on whether the Bank discounted too liberally in 1808-9 (especially to the commercial sector, rather than the government); see for instance Duffy (1982). It is nonetheless not clear that the 1810 financial crisis and inflation was due to too many banknotes in circulation. It may even have been that the "very issue of [the Bullion] Report, followed as it was almost at once by the failure of several 'several houses of first respectability', had made bankers tighten the purse strings and had forced still more borrowers on to the Bank" (Clapham 2008b, p. 29).

[80] Sussman and Yafeh (2006) illustrate the long process of rendering public finances credible before the French Wars.

in 1798, which complemented the monetary reforms and allowed for the sustainability of the government's budget constraint, while ruling out hyperinflation.[81] Finally, the policy was promised (and believed) to be a temporary, wartime measure.

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[81] For the introduction of the income tax, see O'Brien (2011). For the well-known interdependence between the general price level and the government's finances, see Sargent and Wallace (1981), and Sims (1994).

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APPENDIX (for online publication only)

Upon publication the data used in this paper will be made available at:
https://sites.google.com/site/npgpalma/research

Construction of the warfare intensity variable

Our proxy for warfare intensity is the number of casualties (dead or wounded, plus missing or captured soldiers) per capita, that is, relative to the population of Britain during that year. The source for the casualties is the latest (third) edition of Clodfelter (2008). We have built a new dataset for Britain which partly relies on, but also improves on, that of Dincecco and Prado (2012) in several ways. First, while they present country averages, our data is of a higher (yearly) frequency, which allows for time series analysis, albeit at the loss of a comparative dimension; second, while they only consider external conflicts for 1700-88 we consider the 1694-1699 and 1789-1815 periods as well; third, we include internal conflicts (such as the Jacobite risings of 1715 and 1745); finally, our measure is set in not only absolute (in the main text) but also in per capita terms (in this appendix) as it is worthwhile to check that the results do not change when measuring conflict intensity in this time-comparable way.

An alternative measure would use total men mobilized. This has several disadvantages, however, when compared with our measure of "hot" war. First, unlike in the case of battle casualties, this data is much more often unavailable. Second, it is a more direct measure of present fiscal capacity, hence leading to confounding problems (countries with a larger population but weaker states have more difficulty recruiting and paying armies.) Finally, note that if a strong state is able to credibly threaten the formation of an efficient army this will scare enemies into strategically accepting conditions even without any causalities or even any mobilization at all.

We included casualties for all the major (as defined in Clodfelter) land, coastal and sea battles, as well as sieges. Only British men were considered: hence Hessians for instance, were not, even though they were contracted by the British government. As with Dincecco and Prado, our definition of casualties includes captured, wounded and missing soldiers, as well as those dead of diseases, which in the tropics could easily outnumber battle casualties. Unfortunately it is not possible to build an alternative measure which excludes these since Clodfelter often gives the joint number only. When a battle crossed over from a year to the next casualties were classified in the year which covers the majority of the time. If the battle spanned over more than two years, which was very rare and obviously only possible for sieges, we simply took the average. For several battles, Clodfelter gives the overall figure for Britain's side (e.g. the Allies during the war of

the Spanish Succession) but does not break down the casualties of Britain, though often this is done. Indeed at times Clodfelter explicitly says the casualty numbers for Britain's side are unavailable. For the benchmark estimate for this variable we have taken the conservative choice and assumed Britain's casualties were proportional to those of its allies in that particular battle. So for instance, if Britain had two allies in that war, its casualty distribution toll was simply assumed to be one third. Though a helpful first estimate, this is likely to suffer from the following biases. First, if because of superior fiscal capacity Britain was putting in a larger share of soldiers for its alliances then it is not surprising that casualties would be superior as well, which suggests an underestimate of Britain's war effort; second, a possible offsetting factor is that the benchmark estimate is not scaled by country population size or the location of the war (it is natural that it would be easier to mobilize an army of the same size for countries physically closer to the actual battle). In order to control for both these factors, we build an alternative measure to which we apply an average war effort figure based on those cases for which we do know Britain's contribution exactly, as spelled out in the following table. In summary, when the number of British casualties for a given battle is known, we simply used that number. When a British ally entered a battle but Britain did not, we counted zero casualties for Britain.

Appendix references

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Additional figures

Figure A1. The Old Lady of Threadneedle Street in Danger, by James Gillray. Published at Hannah Humphrey's print shop on St. James Street, London, May 27th, 1797.

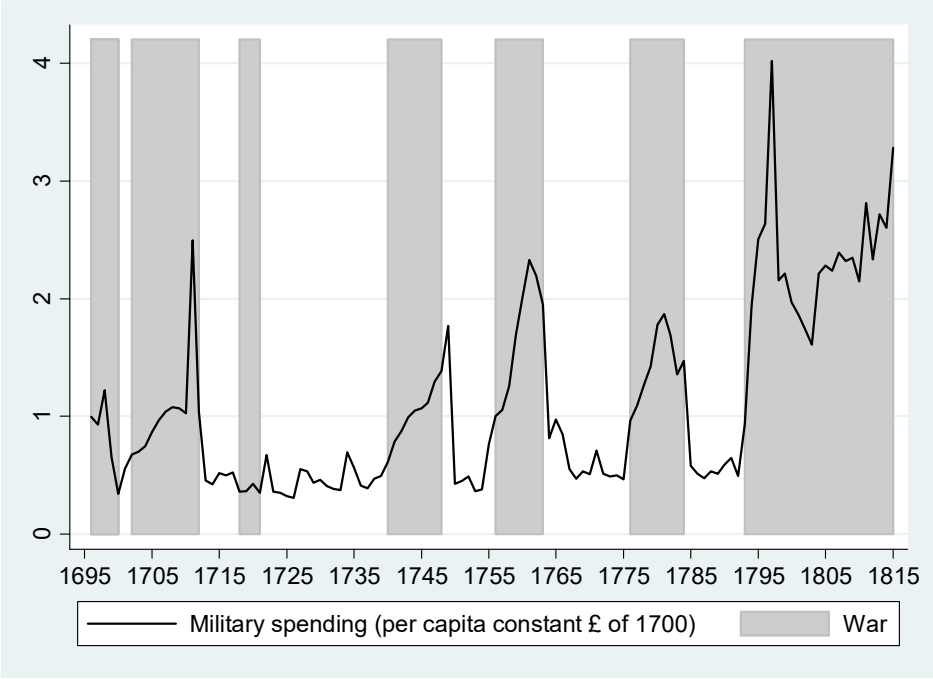

Figure A2. Real military spending in per capita terms and war. Sources: For naval and military spending, O'Brien and Duran (2010), for the deflator and population levels, Broadberry et al (2015).

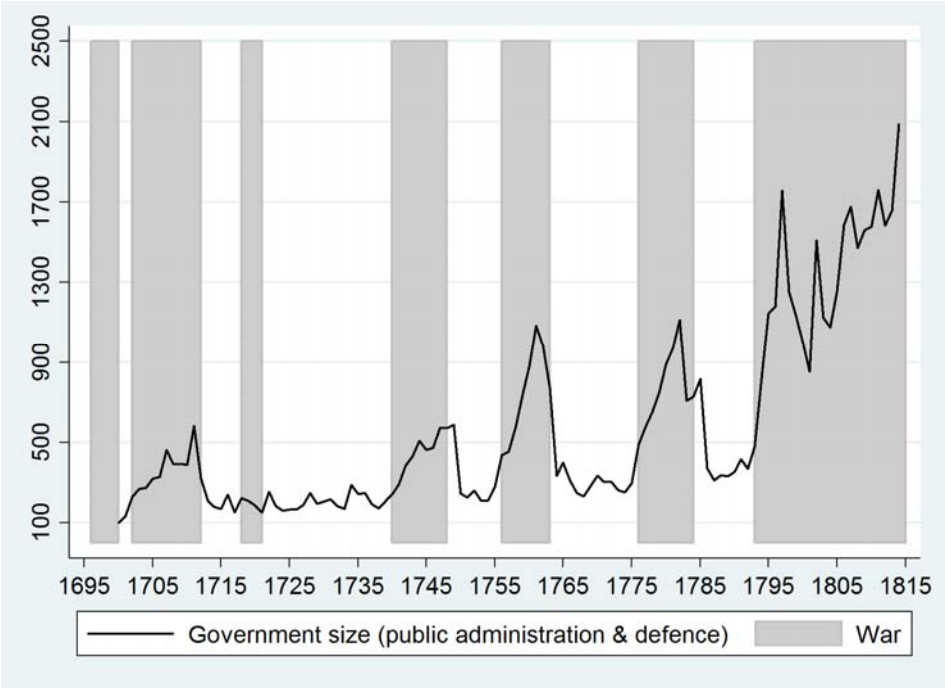

Figure A3. Government size and war (unit: Index, 1700=100). Source: Broadberry et al (2015)

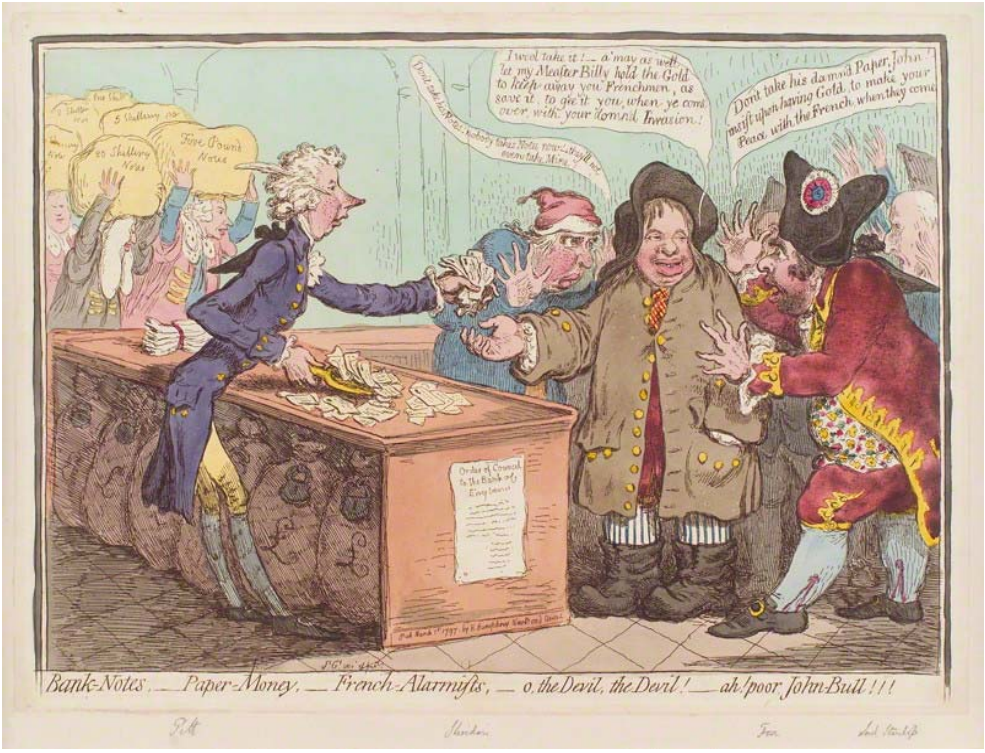

Figure A4. John Bull accepts paper money despite the warnings of French alarmists, by James Gillray. Published at Hannah Humphrey's print shop on St. James Street, London, March 1st, 1797.