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**Consols, Financial Stability, and Pax Britannia**

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## **Consols, Financial Stability, and Pax Britannia<sup>\*</sup>**

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This paper identifies a sharp decline in the volatility of consol prices after the end of the Napoleonic wars in 1815. The volatility of consol returns drops by more than half after 1815 and our empirical testing confirms a long period of remarkable stability that includes the entire Victorian era at the height of Pax Britannia. Over our 1729-1959 sample period significant shifts in the consol series, reflecting military events and monetary and fiscal policy shifts, are concentrated in the period between the Seven Years' War and Waterloo. There are no outliers between 1816 and 1914.

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## Consols, Financial Stability, and Pax Britannia

We don't want to fight,  
But by jingo if we do,  
We've got the ships,  
We've got the men,  
We've got the money too!

(Popular music hall song from the Victorian era)<sup>1</sup>

### I. Introduction

Kindleberger (1986, p. 11) stresses the need for leadership of the international economic and monetary system of the sort that Britain provided “in the century to 1913.” It is generally agreed that the high watermark of the British Empire under Queen Victoria was also reached during this same period. Our focus in this paper, however, is on the remarkable degree of *financial* stability that was also attained in the nineteenth century – as reflected in the dramatic decline in the volatility of consol returns after the end of the Napoleonic wars in 1815. Based on a sample period that goes back to the 1720s, we contrast the much greater volatility of the pre-1815 era, when Britain was vying with France for world supremacy, with the much lower variance seen not only in unadjusted consol returns but also in their conditional variance after Waterloo. Volatility then increases again with the outbreak of the First World War and the end of Pax Britannia. The apparent linkage between hegemonic power and financial stability emerges well prior to the period of the classical gold standard and surprisingly seems to have never been formally examined in the existing literature.

Consols themselves are well known to students of economics as a textbook case where the bond price is exactly inversely related to interest rates. This special property follows from

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<sup>1</sup> Quoted in Farwell (1972, p. 219) and kindly suggested by Farrokh Langdana.

their not having a fixed redemption date but rather promising a fixed coupon payment indefinitely – or, at least, so long as the British government stood behind its obligation to bondholders. Today consols have been eclipsed by more conventional debt instruments just as the world significance of British government securities has been supplanted by US Treasuries. By the end of the eighteenth century, however, consols were an established bellwether security and remained an important debt instrument into the early part of the twentieth century.<sup>2</sup> The Napoleonic wars were financed primarily through consols and by the end of the American War of Independence consols “had gained that position which led subsequently to funding taking place almost exclusively in them” (Hargreaves, 1930, p. 66). Buchinsky and Polak (1993, p. 18) also argue that the great debt increase necessitated by the various wars with France in the late eighteenth and early nineteenth centuries “led to the creation of an integrated national capital market that did not formerly exist.”

Before Britain’s exit from the gold standard in 1931, nominal debt obligations were effectively fixed in real terms. Under these circumstances, Barro (1999) argues that consols, as indexed perpetuities with constant real payouts, are the optimal form of debt finance. Conversely, under a fiat money system the value of consols and other long-term debt becomes highly exposed to fluctuations in inflation. The declining role for consols in the twentieth century, as well as their dominant role earlier on, is therefore quite consistent with the shift from a world where deficits were temporary and paid off in real terms to a world where deficits became more permanent and debt obligations could, at least in part, be inflated away. Janssen, Nolan and Thomas (2002) find no relation between government debt growth and inflation over

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<sup>2</sup> Giffen (1899, p. 357), while pointing to the consol market’s gradual decline from the dominant position enjoyed at the end of the Napoleonic wars, argues that until the last few years of the nineteenth century consols still “occupied a

their full 1705-1996 sample period for consol data. The implied independence between these two series was likely not maintained over the fiat money era, however, when the evolution of fiscal policy was dramatically different from the near-textbook-perfect Ricardian pattern observed before the First World War.

There is a large body of research that relies on using changes in security prices to determine the effects of events on firms or governments. The consols provide a sterling opportunity to study how political and economic events affected the world's leading economic and military power over the rise and decline of her empire. Prior to the First World War, British deficits reflected temporary increases in wartime military spending that were reversed once peace was restored. Barro (1987, p. 225) also points to the absence of “most other governmental interventions, such as extensive price and interest-rate controls, which often accompany wars.” Barro (1987) finds that, over the 1730-1913 period, a one percentage point increase in the ratio of temporary spending to GNP raised consol interest rates by 6.1 basis points.<sup>3</sup> The estimated effect fell, however, if the sample was extended to include the First World War. One explanation for this may be the imposition of interest rate ceilings during the First World War. There is also the fact that financial markets were initially closed after the outbreak of war and the London Stock Exchange did not reopen until January 1915.

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pre-eminent if not a pre-dominant position, and they were the leading market.”

<sup>3</sup> There have been since been surprisingly few attempts to explain the movement of consols prices or yields over the long available sample period. Brown and Easton (1989) test for weak-form efficiency over the 1821-1860 sub-period and Mitchell, Brown and Easton (2002) examine ARCH effects over this same interval. This sub-period includes only one of the major wars—namely the Crimean War of 1854-1856—found by Barro (1987) to be of key importance for consol yields. Ferguson (2003b), in examining the 1845-1914 period, also captures the Boer war and the outbreak of the First World War, but misses the Napoleonic era and the prior wars with France. Finally, Elmendorf, Hirschfeld and Weil (1996) test for effects of news items — as derived from two alternative secondary sources—on consol prices over the 1900-1920 sub-period.

Consistent with Barro (1987), we find that many of the largest changes in consol are associated with wartime events that likely signaled increases or decreases in the required level of military spending. The easing of financial conditions after gold convertibility was suspended in 1797 and other shifts in financial policy also appear to be important, however. In the twentieth century further large shifts in consol prices coincide with Britain's exit from the gold standard in 1931 and the sharp interest cuts in June 1932 at the bottom of the Great Depression. A final large decrease in consol prices in February 1937 occurs in midst of the deteriorating world political situation leading up to the Second World War and coincides both with rearmament pressures and the new entry of Italian forces in the Spanish Civil War.

Perhaps the most striking feature of the consols' performance, however, is not the presence of these shifts but rather their *complete absence* between 1816 and 1914. After Napoleon's defeat at Waterloo in 1815, Britain enjoyed hegemonic status as the world's only true superpower. Britain did not clearly lose this status until the First World War (following which Kindleberger, 1986, points to the damaging consequences of the "power vacuum" during the 1920s and 1930s). Although there were many "small wars" in the later nineteenth century, Britain's dominion was never seriously challenged over this period – which includes, of course, all of Queen Victoria's long reign. After many highly volatile monthly movements over the course of the various struggles with France in the eighteenth and early nineteenth century, monthly fluctuations steadily diminish after Waterloo until "bottoming out" in the last three decades of the nineteenth century. The long period of relative quiescence in consol prices in the nineteenth century is a key focus in our analysis of the time series properties of the data.

## II. The Data

Our series on British 3% consols is drawn from the international database provided by Global Financial Data, Inc. (<http://www.globalfindata.com>). Pre-1751 data is based on the perpetual 3% annuities that were first issued in 1726 – with the various series all being combined into 3% consols under the 1751 Consolidating Act (Neal, 1990, p. 117). The 1751 debt was redeemed and replaced by new “Goschen” consols that yielded 2.75% from 1889-1903 and 2.5% after 1903. Under the terms of this conversion, first proposed by Chancellor of the Exchequer G. J. Goschen in his March 9, 1888 speech, the new consols could be redeemed at par after April 1923 (for details, see Miller, 1890; Harley, 1976; Klovland, 1994). The old consols had previously been redeemable at any time upon receipt of a year’s notice, and this may have limited the scope for further upward movement in consol prices after they rose above par in April 1881. Klovland (1994) concludes, however, that redemption expectations -- whether assessed in terms of the period in the 1880s when the old consols traded near par or in the years leading up to 1923 -- likely had negligible effects on the long-term properties of the consol series. Finally, although the prices of consols are subject to the usual ex-dividend effects on the days when the quarterly (or, until 1884, semi-annual) interest payments were made, we have not corrected for this as, like the callability feature, it could not be expected to significantly change the long-run evolution of consol prices over the 230 year sample period that we examine.

We begin with an overview of the evolution of consol prices over the post-1729 period as depicted in Figure 1. By ending the sample period in 1959 we exclude the inflationary period that sets in during the 1960s. This means that nominal returns remain roughly equivalent to real returns over our estimation period and -- in sharp contrast to later developments -- it is unlikely

that inflation expectations exerted more than a negligible influence on investor behaviour.

Although a case could also be made for ending the estimation period even earlier, either at the time of the First World War (Barro, 1987) or with Britain's final exit from the gold standard in 1931, the results of formal structural break tests suggest no major shift in the series occurs until the late 1950s.<sup>4</sup>

Consol prices are remarkably stable over the 230 year period. Following brief spells below 80% of par during such episodes as the Jacobite Rebellion (1745-1746), the latter part of "King George's War" with France (March 1748), and the Seven Years' War (1754-1763), the consols return to these depressed levels at the beginning of the American Revolution and experience a continual decline until 1785. From 1785, a year when a major debt reduction act was passed, until 1792 we see an uptrend that brings consol prices nearly back to par. The war with post-revolutionary France (1793-1802) begins another period of increased volatility and price declines, however, that despite intermittent reverses did not come to an end until the final defeat of Napoleon at Waterloo in 1815.

The majority of the major shifts in the consol series uncovered by the empirical work fall between the Seven Years' War and Waterloo. Over that period, Britain and France were essentially competing for world supremacy and consol prices appear highly sensitive to military events and news signaling the outbreak or cessation of hostilities. After Waterloo, the consols begin a period of slow increase and seem to be much less sensitive to military events. While some financial events play a role, consols after 1815 seem much less a barometer of Britain's military and geopolitical outlook – which is reasonable given that Britain's status as the

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<sup>4</sup> Testing for structural breaks in consol prices over the full available sample of 1729-2002 using the Bai and Perron (1998) and Banerjee, Lumsdaine and Stock (1992) procedures always identifies a single break in the period around

hegemonic power was now relatively secure. The sustained uptrend in consol prices is briefly interrupted by a sharp decline during the 1819-1820 period, which coincided with a return to the gold standard, and then another decline beginning in early 1825 and lasting until mid 1826 that coincided with a banking crisis (Neal, 1998). Kynaston (1995) notes that this banking crisis was itself in large part triggered by the return to the gold standard. From April 1831 until September 1910 the bonds never traded below 80% of par value and frequently traded at above 100% of par value, peaking at 113.75% of par in May 1897.

The extended period of strength and stability in consol prices coincides roughly to the reign of the Queen Victoria (1837 to 1901) at the zenith of the British Empire. This was a period of remarkable political stability within Britain and worldwide. The most significant drop during the period occurs over the 1846 to 1850 period, coinciding with both the 1848 revolution in France and the Irish potato famine -- and closely following the budgetary problems of the 1840s that saw the reintroduction of the income tax in 1842 under Prime Minister Robert Peel.<sup>5</sup> Neither the Crimean War (1854-1856) nor the American Civil War (1861-1865) appears to have had effects on consol prices remotely comparable to major pre-1816 military events. Although Ferguson (2003b) argues that European debt series generally remain highly sensitive to war and political shocks until 1880, our analysis suggests that these effects had already become less important for British consols by the 1820s. Even large losses like the 10,000 men annihilated by the Mahdi's forces in Sudan in 1883, while causing great consternation in England at the time (see, for example, Farwell, 1972, p. 272), appear to have made no dent in consol prices.

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1960. (Testing for breaks in consol returns yields no significant break points.)

<sup>5</sup> The income tax had previously been abolished in 1816 after the conclusion of the Napoleonic wars.

In short, the inclusion of the eighteenth century experience leaves the effects of the post-Napoleonic nineteenth century wars dwarfed by the seemingly much larger responses to the earlier conflicts with France. This period of stability begins well before the heyday of the classical gold standard from 1870-1913 (see, for example, Obstfeld and Taylor, 2003). At the same time, the restoration of the gold standard in the 1820s actually appears to have been an agent of temporary *instability* in the consol series, interrupting the lower volatility that set in after Waterloo. (Nor do either of Britain's other periods on the gold standard prior to 1797 or from 1925-1931 appear to have promoted stability in consol prices.) From the 1897 peak, consol prices begin a slow but steady decline with prices bottoming at less than 50% of par in the early 1920s. This period of decline includes the Boer War (1899-1902), the creation of the Commonwealth of Australia (1901), the First World War (1914-1918), and the Irish Home Rule Crisis and eventual division of Ireland into the Irish Free State and Northern Ireland (1912-1921). The rise in consols in the latter half of the nineteenth century and subsequent fall in the early twentieth century also occurs in conjunction with the transition from a period of sustained deflation to one of inflation – prior to the swing back to deflation in the 1920s.

As the end of the First World War approaches the consols make a brief attempt at recovery but then decline to only 44% of par value by December 1920, the lowest value over the whole 1729-1959 period. This decline may reflect postwar social, political and economic pressures and the burgeoning Irish Crisis. The return to gold in 1925 and growing worldwide economic problems leaves the consols trading in a narrow range just below par until the early 1930s. Britain's exit from the Gold Standard in 1931 seems to have triggered an upward movement in the consol prices, however, that lasts until 1934. This recovery may have been

boosted by monetary easing and the establishment of an exchange rate stabilization fund in 1932, coupled with the fact that the post-1925 gold standard seems to have never come close to achieving the credibility associated with the prewar era (Obstfeld and Taylor, 2003). The period following Hitler's rise to power in 1933, coupled with worldwide economic depression, sees a continued decline in consol prices until the outbreak of the Second World War in September 1939. At this point, the consols begin an upward climb that continues until the beginning of 1947. While the existence of capital controls in and around the war period make it difficult to interpret these changes, some of these gains may reflect a renewed "flight to quality" of funds exiting Continental Europe. The consols decline almost continually from 1947 until the end of the sample period. These declines are likely the combined results of increasing inflation, the removal of price controls and the accelerated decline of Britain's empire and its eclipse by the American and Soviet "superpowers."

The ten largest upward and ten largest downward monthly price shifts are set out in Table 1. Nine of the ten largest monthly price increases occur between 1748 and 1814 and appear to be associated either with favorable developments in the various wars with France or with major financial policy changes. There are three shifts in 1761-1762 in the face of British captures of French territory near the end of the Seven Years' War and there are four further shifts in 1798-1801 during the further conflict with France following the French Revolution. Additional large gains occur in 1748 with the conclusion of "King George's War" against France. The 1797 gains coincide with the easing of credit conditions after the suspension of gold convertibility in February 1797, while the June 1799 increase occurs in the midst of the first collections from Britain's new income tax as well as Britain's entry into the Second Coalition against France.

The imminent defeat of Napoleon in early 1814 appears to lie behind another large price increase in January 1814. The single top-ten price increase in the twentieth century occurs in July 1932. This shift occurs in the month following the hefty interest rate cuts in June 1932 that formed part of the War Loan conversion. As was true in 1797, the easing not surprisingly triggered a bond market rally.

As was the case with the increases, a majority of the ten largest monthly price declines are concentrated in the late eighteenth and early nineteenth centuries. Seven of the ten largest shifts occur between 1778 and 1815. The March 1778 shift appears to be associated with French entry on the American side in the fight against British rule and further shifts occur in 1792 and 1799 following the outbreak of France's own revolutionary war. There is another negative shift in 1803 in the year when renewed fighting erupted against Napoleon and a March 1815 shift occurs at the time that Napoleon reclaimed Paris after escaping from exile on Elba. There are three top-ten decreases in the twentieth century. The first of these, in January 1915, occurs in the first month that trading resumed following the outbreak of the First World War. The second shift in September 1931 appears to be triggered by Britain's exit from the international gold standard. The final shift in February 1937 occurs during a Nationalist offensive in the Spanish Civil War coincident with a new UK Government proposal for a £400 million loan to fund re-armament expenditures.<sup>6</sup> The existence of a 1937 shift but no large shift with the outbreak of the Second World War in 1939 may reflect the interest rate controls -- as well as capital controls --

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<sup>6</sup> The *Financial Chronicle* (February 13, 1937, p. 991) refers to the capture of Malaga as an event that "broke the long deadlock in the Spanish rebellion" and also discusses the role played by Italian "volunteers" in the assault on the city. Re-armament concerns were also rising at the same time, however (see the *Financial Chronicle*, February 20, 1937; and *The Economist*, February 13, 1937 and February 20, 1937), and the sharp downturn in consol prices likely reflects budgetary concerns as well as the events in Spain.

that were imposed during the war with Germany.<sup>7</sup> The temporary recovery of consol prices after September 1939 is also likely a product of these controls.

The fact that the majority of the largest movements occur before 1816 is consistent with the earlier discussion of the stability of consols during most of the nineteenth century. Figure 2 provides the monthly percentage changes in the consol series. Volatility clearly seems to decline during the first quarter of the nineteenth century and is much lower during the second half of century than in the rest of the sample. The majority of the movements prior to 1816 are associated with war and political instability. The Victorian period was mostly free of events that threatened Britain's hegemonic status. Figure 2 also indicates that there is a sharp decline in volatility during the period surrounding the Second World War, which is consistent with the existence of wartime control measures. The apparent shift in the volatility of the consols series after 1815 is formally addressed in Section IV below.

### **III. Testing for Outliers in the Consol Data**

In testing whether any of the large monthly movements in the consol series were actually associated with turning points in the behaviour of consol prices, we apply the outlier analysis developed by Tsay (1986) and later extended by Balke (1993). This procedure uses the entire data set to test for shocks that have either permanent or one-time effects on a time series. Shocks that have a dynamic effect on all subsequent realizations of a variable are called innovative

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<sup>7</sup> Exports from Britain not deemed necessary to the war effort were disallowed and countries exporting to Britain largely accrued funds that were placed in special accounts and could not readily be remitted outside their own territory (see Harrod, 1958, Chapter 5). Domestically, rent controls were imposed upon the outbreak of war and general price controls followed at the beginning of 1940. Brown (1955, p. 211) points out that all this left little room for interest rates to be affected by expectations of inflation: "Income receivers accumulated funds because their opportunities for spending on consumer goods and services were curtailed, mainly by rationing and price control."

outliers, while innovations that have only a one-time effect are called additive outliers. Disturbances that have a permanent effect on the series mean are called level shift changes. The Tsay methodology uses a simple iterative procedure to identify and correct for the presence of innovative and additive outliers, and level changes in a time series. First, an ARMA model is estimated and test statistics are calculated for each of the three types of disturbance. The maximum test statistic, in absolute value, is chosen and compared to a parsimonious cut-off level of 4.5. If a significant disturbance is detected, then the initial and dynamic impact of the shock is subtracted from the observed data to obtain a corrected series and the residuals and residual variance are recalculated. Iteration continues until no more disturbances are found. The ARMA model is then re-estimated and a new search for outliers and level shift changes is initiated.

Application of this test procedure yields numerous innovative and iterative outliers that include all of the largest monthly changes in consol prices discussed earlier.<sup>8</sup> No level changes are identified, however, and this remains the case even if a white-noise initialization procedure is added to the basic Tsay (1986) methodology as suggested by Balke (1993). The apparent absence of mean level shifts in the consol data is consistent with the fact that testing for structural breaks also yielded negative results over the pre-1960 sample. These statistical findings likely reflect the relative stability in the consol series that is evident in Figure 1. Unlike many other debt series where significant default risk helps impart extreme ups and downs in the series (see, for example, Brown and Burdekin 2000; 2002), market participants could generally count on continued coupon payments. The value attached to the fixed coupon payment stream

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<sup>8</sup> The use of the Bannerjee, Lumsdaine and Stock (1992) procedure to identify turning points contained within “windows” is much more problematic without the clear and sharp shifts seen in the more volatile series. With the consol data, identification of the windows would clearly be highly arbitrary and so we have instead focused exclusively on Tsay’s outlier procedure in this case.

remains highly sensitive to market interest rates, however, the expected values of which in turn respond to the major financial and military events that seem to underlie most of the large moves seen in the data.

The results of our outlier analysis are presented in Tables 2 and 3. The equations are estimated in first-difference form. The additive outliers in Table 2 reflect the impact of a one-time shock whereas the innovative outliers in Table 3 are generated by shocks that have at least limited persistence. These latter shocks still evince no shift in the series mean, however, and should not be interpreted as “turning points,” *per se*.<sup>9</sup> Thirteen of the seventeen additive outliers and six of the eight innovative outliers appear to be tied to military events. The greatest concentration of outliers occurs between 1792 and 1815 in the period between the French Revolution and Napoleon’s defeat at Waterloo. Other shifts occur in 1748 in the year that England and France signed a peace agreement, in 1761 and 1762 during the Seven Years’ war, in 1778 when France joined the American side in the Revolutionary War, in 1915 during the First World War and in 1937 during the Spanish Civil War (coupled in this case with re-armament pressures on government finance). The concentration of wartime-induced shifts in consol prices during the earlier part of our sample is consistent with Barro’s (1987) finding that temporary spending increases had large effects on interest rates up to 1913 but had smaller effects thereafter. Indeed, interest rate ceilings came into play during the First World War and the absence of any outliers during the Second World War may further reflect the imposition of capital controls that prohibited taking funds out of the country (thereby precluding any exchange of consols for, say, Swiss or US debt in the face of the German invasion threat).

The six outliers that do not coincide with major military actions appear to reflect major

financial or commercial policy changes.<sup>10</sup> There is a positive innovative outlier in October 1785 that appears to be tied to the National Debt Reduction Act that was passed in 1786 and which established Prime Minister William Pitt's sinking fund for the consols. These measures followed a proposal by Dr. Richard Price that was referred to in the King's Speech of 1782 and which was the subject of correspondence between Pitt and Price after Pitt became Prime Minister in 1784 (see Hargreaves, 1930, Chapter VI). The October 1785 shift date may well reflect prior expectations that the sinking fund would be established. In any event, the boost to bond prices upon news of debt retirement can be set against the negative effects seen in cases where adverse war news implied increased debt issuance to finance new military spending.

A positive additive outlier in June 1797 follows Britain's suspension of gold convertibility on February 27, 1797. This suspension occurred in the midst of a near doubling of the national debt in the period since Britain went to war against France in 1793. Interest rates soared as the Bank of England began rationing credit and sharply reducing its purchases of government debt in an attempt to limit the drain on its gold reserves (Bordo and White, 1991, p. 311). O'Brien (1988, p. 21) describes the state of crisis that had developed by early 1797:

In the closing months of 1796 peace negotiations failed, and amid mounting fears of invasion the country realized the war would be prolonged. In February 1797, 1000 French troops landed at Fishguard. For the first time during a century of warfare, Parliament authorized the Bank of England to suspend the convertibility of currency into gold; a step which removed the traditional constraint on credit creation by central government for purposes of funding military spending.

Bordo and White (1991, p. 311) point out that, once specie payments were suspended, sales of short-term government debt to the Bank of England rose dramatically – with the share of

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<sup>9</sup>The additive and innovative outliers differ little in their economic significance in this case.

<sup>10</sup>General financial stability may also be influenced by aggregate price shocks (Bordo, Dueker and Wheelock, 2003) and the importance of events like the suspension of gold convertibility in 1797 and 1931 may derive, in part, from

unfounded loans rising from a low of 19.3% in 1797 to eventually reach a peak of 76% in 1808. Hawtrey (1918, p. 61) further observes that, once the crisis of February 1797 was past, “[c]onfidence was quickly restored, and the foreign exchange became more and more favourable ...” In short, the British government’s response to the war-induced financial crisis ended up boosting consol prices through allowing an easing of the very tight credit markets that prevailed while the gold standard was still in place.

In an additional response to the size of the military expenditures required for the war against France, Prime Minister William Pitt introduced Britain’s first national income tax. This tax was first announced by Pitt on December 3, 1798 and was enacted the following year with the first payments due in June 1799. The tax rate was originally set at 10% of all income above £60, with reductions on income up to £200. The income and property taxes introduced by Pitt accounted for as much as 20% of total tax revenue by the end of the war (Bordo and White, 1991, p. 312). Although O’Brien (1988, p. 22) argues that large contributions from the new income tax were not realized until after 1808, the new commitment to tax finance may well explain the positive innovative outlier in the consol series seen in June 1799.<sup>11</sup> Indeed, Neal (2000, p. 138) describes how, from this point on, interest payments on new 3% consols (sold for the first time via competitive bidding) were guaranteed against income tax revenues, allowing

the government to tap into the profits of European merchants now directing all their affairs from London rather than dividing them among London, Paris, Amsterdam and Hamburg. The existing liquid market for British national debt allowed huge sums to be raised on the capital markets.

While June 1799 also saw Britain enter the Second Coalition against France, it is not clear how

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their implications for the aggregate price level.

<sup>10</sup> In sharp contrast to the dependence on debt-finance during the earlier years of the war, Schumpeter (1938, p. 27) calculates that “after 1797 and 1798 proceeds from taxation greatly exceeds proceeds from loans.”

that would have been positive for consols. Rather, the positive reaction of financial markets to the promise of reduced reliance on debt finance, like the earlier reaction to the suspension of specie payments, seems the most likely explanation for the extended gains in consols that occurred in the midst of the dark days of the struggle against Napoleon.

Following a positive additive outlier in April 1802, as the Treaty of Amiens provided a temporary respite in the fighting against Napoleon, there is another positive shift coinciding with the December 1802 Treaty of Bassein. This treaty expanded the influence of the East India Company and strengthened Britain's commercial prospects. The apparent boost to consol prices at this time can be set alongside the earlier gains following the expulsion of the French from India in 1761 and the capture of French Caribbean colonies in 1762.<sup>12</sup> Each of these effects helped expand the British sphere of influence. The remaining outliers of September 1931 and July 1932 appear to represent an initial negative reaction to Britain's exit from the international gold standard followed by a positive response to the June 1932 cut in the bank rate under the War Loan conversion.<sup>13</sup> The gains that consols enjoyed after this easing of credit conditions appears to parallel the aftermath of the earlier exit from the gold standard in 1797. In both cases the government's response to crisis led to a bond market rally even in the face of the most severe exigencies.

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<sup>12</sup> These successes in the Caribbean were closely followed by the initiation of settlement talks by French emissaries in the early spring of 1762 (Koehn, 1994, p. 15) and this may also be a factor in the positive outlier. Koehn (op. cit.) adds that the lands gained after the Seven Years' War were "of enormous commercial and geopolitical potential ... The sheer weight of territory ceded to the British Empire was unheard of in the context of previous eighteenth-century conflicts."

<sup>13</sup> Other positive factors in early 1932 were the establishment of the Exchange Equalization Fund in April 1932 and growing confidence in the National Government, which also help account for a rapid reversal of 1931's capital outflow (see Harrod, 1958, pp. 49-50).

#### IV. Volatility vs. Stability in Consol Prices

Over the earlier part of our sample, unfavourable military news or the threat of new or extended military conflict had their expected negative effects on consol prices. By far the largest concentration of negative outliers occurs in the period preceding Napoleon's final defeat at Waterloo in 1815. Although there is a further negative shift when trading first resumes after the outbreak of the First World War, post-1815 conflicts do not consistently lead to major shifts in consol prices. This is especially true of the 1816-1914 period during which events such as the Crimean War and the Boer War do not lead to significant breaks in our consol series. This may well reflect the greater stability of Britain's finances, and its unrivalled position of worldwide supremacy, over the Victorian era. Aside from the First World War, significant negative breaks in the consol series do not occur until the 1930s and the 1932 shift is, in fact, the only significant positive outlier dating from after Waterloo.<sup>14</sup>

The post-Waterloo period of stability is clearly established in Figure 3, that lays out the conditional standard deviation of consol returns over the 1730-1959 period. These conditional standard deviations are derived from estimation of the time series properties of the variance of consol returns. The data are modeled as an integrated generalized autoregressive conditional heteroscedastic (IGARCH) process with one autoregressive (AR) term, a constant, and the lagged squared residuals included alongside a "leverage" term that allows for possible asymmetric effects of positive and negative values (see Table 4).<sup>15</sup> Substituting non-integrated GARCH estimation for IGARCH estimation has no meaningful impact upon the representation

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<sup>14</sup> By terminating our sample in 1959 we do, of course, miss the ensuing prolonged decline in consol prices that sets in with the inflationary trend of the 1960s and 1970s that drove interest rates to higher and higher levels.

<sup>15</sup> Both GARCH and IGARCH have been shown to be asymptotically normally distributed processes with finite variance (Lumsdaine 1996).

of the data set out in Figure 2. The AR and leverage terms appear to be, at best, marginally significant in either case.

The high volatility period before Waterloo reaches its peak around the turn of the eighteenth century, with some of the greatest volatility seemingly arising around the time of the 1789 French revolution. Widespread conflicts of the type seen in the second half of the eighteenth century and early nineteenth century afterwards remain largely absent until the First World War, however. The Victorian era was also marked by considerable domestic political and financial stability with no constitutional crises of the type that emerged in the late eighteenth century. The decline in volatility after Waterloo is really quite dramatic, with the extent of the fluctuations falling to less than half of the earlier levels. Although this decline is briefly punctured by events such as the banking crises of the 1820s, the 1848 uprising by the “Decemberists” in France (closely followed by the Crimean War), and the outbreak of the Boer War in 1899, the contrast with the earlier period remains unequivocal.

The First World War appears to trigger another high volatility period. The fluctuations do not, however, match the magnitudes seen in the early part of the sample. Interestingly, the large “spike” in the standard deviation of the series at the beginning of the 1930s exceeds anything seen during either of the two world wars. The 1930s volatility, in fact, accords well with the outliers previously identified in 1931 and 1932, when Britain left the international gold standard in September 1931 and then eased monetary conditions the following year. Indeed, analysis of the variability of the consol data is generally quite consistent with the preceding outlier testing. The greatest concentration of outliers in the eighteenth century and early nineteenth century emerge over the time period when consol prices, just like the status of the

British Empire itself, were subject to the greatest volatility and uncertainty. Outliers do not reemerge until after 1914 when the “Guns of August” signaled the beginning of the end of the British Empire and ushered in a new period of instability during which Britain was no more the world’s pre-eminent superpower.<sup>16</sup>

The sharp decline in the volatility of consol returns after the end of the Napoleonic wars in 1815 itself occurs well in advance of the heyday of the classical gold standard, which is usually dated from 1870-1913. Although the return to gold in 1821 may well have been a factor in the ongoing financial stability, this reversion to gold convertibility was at first closely followed by a banking crisis and a temporary disruption to consol prices (Kynaston, 1995). Moreover, high volatility in consol returns prevailed during both the other gold standard periods prior to 1797 and from 1925-1931. The low volatility period does, however, correspond well with the period of Britain’s hegemonic leadership under Pax Britannia. The consol data certainly suggest that British financial interests benefited from this leadership via greater financial stability. Although this proposition has not before been formerly tested, Kindleberger (1986) has also made the more far reaching – and controversial -- suggestion that the world system was better off under this regime as well.

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<sup>16</sup> A current controversy concerns the extent to which parallels can be drawn between Britain’s former hegemonic role and the position of the United States today (see Ferguson, 2003a).

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**Table 1: Biggest One Month Changes in 3% Consol Prices, 1729-1959**

Positive Shifts		Major Events
1. October 1801	15.96%	French evacuation of Egypt in September 1801
2. August 1762	13.95%	Havana captured from Spain on August 12, 1762
3. June 1797	13.58%	Easing of credit market conditions after the financial crisis of February 1797
4. April 1761	13.37%	French expelled from India; Pondicherry surrendered on January 15, 1761
5. April 1748	12.23%	War with France over; Treaty of Aix-la-Chapelle set for October 1748
6. July 1932	11.47%	Bank rate cut to 2% in June 1932 under the War Loan conversion
7. January 1814	11.16%	Napoleon on the ropes; Marshall Murat signs peace treaty with the Allies on January 11, 1814
8. October 1798	11.14%	Irish rebellion crushed in September 1798; French expeditionary force defeated
9. June 1799	10.49%	Britain joins the Second Coalition against France on June 22, 1799; income tax collections begin
10. February 1762	9.90%	Capture of French Caribbean territories; Martinique falls on February 13 and St. Lucia on February 25, 1762
Negative Shifts		
1. November 1792	-12.86%	French revolutionary war underway against Austria and Prussia; revolutionary victory at Jemappes on November 6, 1792
2. March 1778	-12.84%	France joins the American fight against British rule; American treaties with France and the Netherlands signed in February 1778
3. March 1803	-12.65%	War with Napoleon imminent; fighting begins in May 1803
4. March 1814	-10.83%	French victories in early March but Napoleon defeated and Paris surrendered on March 31, 1814; fighting continues with the United States
5. January 1915	-9.82%	First month of trading after the outbreak of the First World War; market closed from August-December 1914
6. February 1937	-9.37%	Nationalist offensive in Spain with Malaga captured on February 6, 1937; Govt. proposes £400 million loan for re-armament expenditures
7. September 1799	-9.01%	Russian army defeated at Zurich on September 26, 1799; withdraws from Second Coalition against France
8. July 1803	-8.95%	Beginning of Napoleonic wars; war declared on May 16, 1803
9. March 1815	-8.81%	Napoleon returns from Elba; Paris reclaimed on March 20, 1815
10. September 1931	-8.69%	Britain exits the gold standard on September 21, 1931

**Table 2: Additive Outliers in 3% Consol Prices, 1729-1959**

Date	Estimated Impact	Major Events
April 1761	12.35%	French expelled from India; Pondicherry surrendered on January 15, 1761
August 1762	13.00	Havana captured from Spain on August 12, 1762
March 1778	-13.65	France joins the American fight against British rule; American treaties with France and the Netherlands signed in February 1778
November 1792	-13.79	French revolutionary war underway against Austria and Prussia; revolutionary victory at Jemappes on November 6, 1792
June 1797	12.86	Easing of credit market conditions after the financial crisis of February 1797
October 1798	10.76	Irish rebellion crushed in September 1798; French expeditionary force defeated
September 1799	-9.63	Russian army defeated at Zurich on September 26, 1799; withdraws from Second Coalition against France
October 1801	14.95	French evacuation of Egypt in September 1801
April 1802	8.45	Peace with France through the March 27, 1802 Treaty of Amiens
December 1802	8.71	Treaty of Bassein signed on December 31, 1802; expanded influence of the East India Company
March 1803	-13.61	War with Napoleon imminent; fighting begins in May 1803
July 1803	-9.34	Beginning of Napoleonic wars; war declared on May 16, 1803
March 1814	-11.92	French victories in early March but Napoleon defeated and Paris surrendered on March 31, 1814; fighting continues with the United States
January 1915	-10.33	First month of trading after the outbreak of the First World War; market closed from August-December 1914
September 1931	-9.36	Britain exits the gold standard on September 21, 1931
July 1932	10.82	Bank rate cut to 2% in June 1932 under the War Loan conversion
February 1937	-9.82	Nationalist offensive in Spain with Malaga captured on February 6, 1937; Govt. proposes £400 million loan for re-armament expenditures

**Table 3: Innovative Outliers in 3% Consol Prices, 1729-1959**

Date	Estimated Impact	Major Events
April 1748	11.71%	War with France over; Treaty of Aix-la-Chapelle set for October 1748
February 1762	9.71	Capture of French Caribbean territories; Martinique falls on February 13 and St. Lucia on February 25, 1762
October 1785	8.72	National Debt Reduction Act passed in March 1786; Pitt's sinking fund established
January 1794	-8.78	Napoleon's French troops retake Toulon from the British on December 19, 1793
June 1799	9.94	Britain joins the Second Coalition against France on June 22, 1799; income tax collections begin
January 1801	-8.68	Franco-Austrian Armistice of Treviso signed on January 15, 1801
January 1814	10.57	Napoleon on the ropes; Marshall Murat signs peace treaty with the Allies on January 11, 1814
March 1815	-9.14	Napoleon returns from Elba; Paris reclaimed on March 20, 1815

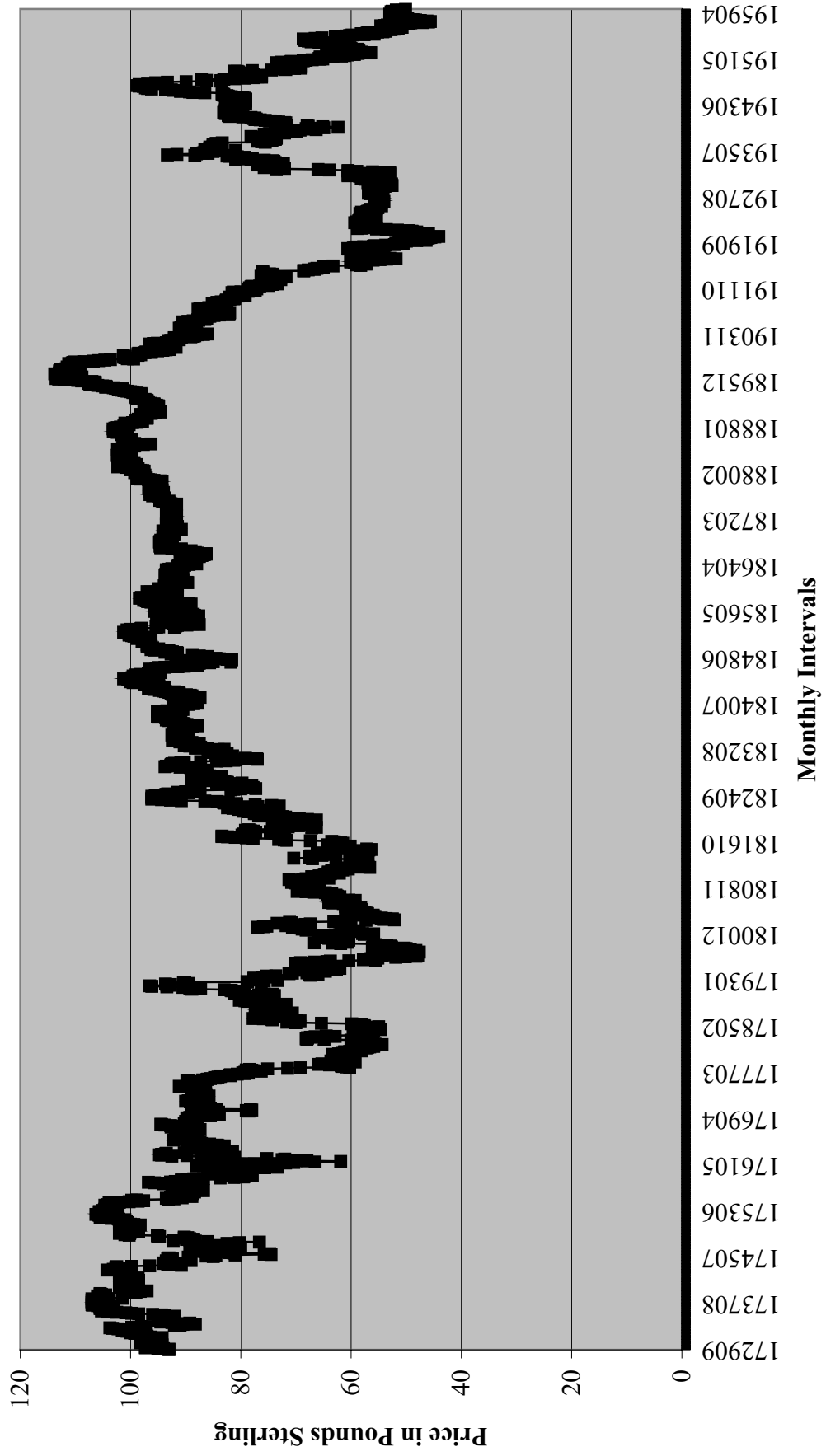
**Table 4: Estimation of the Conditional Variance of Consol Returns**

IGARCH procedure  
Sample: 1729-1959  
Skewness: -0.552  
Kurtosis: 7.169  
Implied lagged conditional variance: 0.873

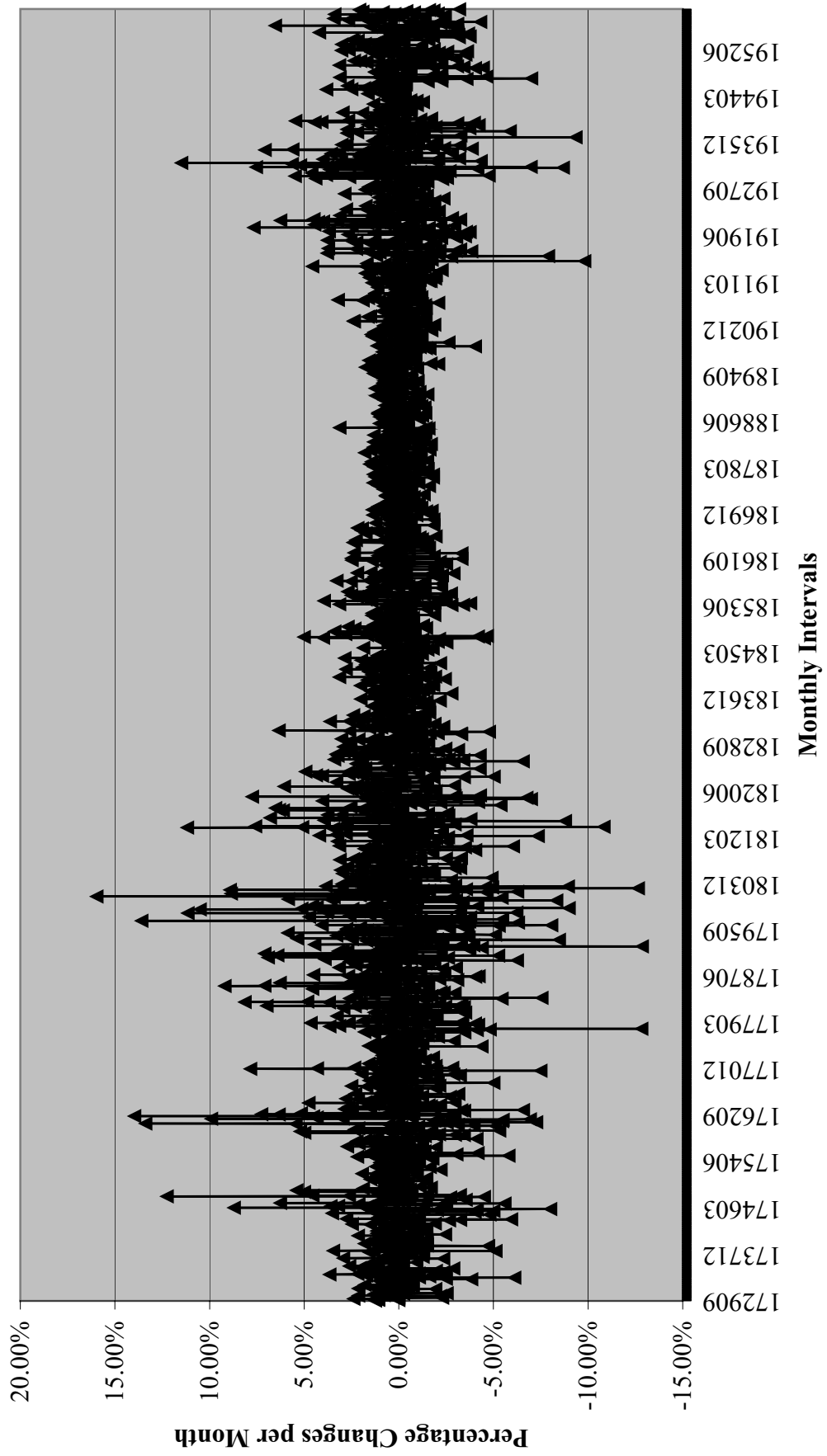
<i>Right-hand-side variable</i>	<i>Coefficient</i>
Constant	0.049*** (0.014)
Lagged squared residuals	0.127*** (0.013)
Autoregressive term	0.031 (0.019)
Leverage (asymmetry) term	0.039** (0.019)

Notes: Standard errors are in parentheses,  
\*\*\* and \*\* denote significance at the 1% and 5% levels, respectively.

**Figure 1**  
**3% Consol Prices, 1729-1959**



**Figure 2**  
**Monthly Consol Returns, 1729-1959**



**Figure 3**  
**Conditional Standard Deviation of Consol Returns, 1729-1959**

