

**DEBT, DEFICITS, AND CROWDING OUT:  
ENGLAND, 1727-1840**

Gregory Clark, University of California, Davis, California 95616 – 8578, USA  
([gclark@ucdavis.edu](mailto:gclark@ucdavis.edu))

By the 1820s as a result of the protracted struggle with France the market value of the British Government debt was twice British GDP. It has been argued that this debt represented a huge institutional failure by the government, significantly slowing growth in the Industrial Revolution period by crowding out private investment. The paper constructs measures of private rates of return in the years 1725-1839 and shows these imply that neither the government deficits nor the mounting debt are associated with much higher private rates of return on capital. The reason the government could issue so much debt without raising rates of return is unclear. One possibility is that crowding out was occurring, but population growth in 1770-1839 was reducing rental income as a fraction of GDP, creating a demand for other asset income so that we do not observe tightness in capital markets.

## 1. Introduction

The political system created in Britain by the Glorious Revolution of 1688-9 was one of extraordinary stability. This institutional stability has been identified by a number of writers as a key element in creating the Industrial Revolution of 1760-1860.<sup>1</sup> One feature of British stability was the confidence the markets had in public debt. By the 1720s the government was able to borrow large sums of money at interest rates lower than those paid by private lenders. The protracted struggle with the French for military predominance from 1692 to 1815 that is sometimes called the "Second Hundred Years War" created heavy but episodic government expenditures. These sudden demands were most easily met, given the limited tax instruments available in the eighteenth century, by the sale of debt. The ability of the British Government to sell more debt at lower rates of return than the French allowed a midget Britain to raise war resources commensurate with those of giant France. Again political reforms of the Glorious Revolution seemingly gave the British an advantage.<sup>2</sup>

There has, however, been another stream of argument about the Industrial Revolution which claims, ironically, that the vaunted stability of the British political system actually led the government into a very bad policy of accumulating debt which caused huge losses of potential income. For Jeffrey Williamson and others have argued that the large government debt of the French war years must have "crowded out" a very large amount of private investment thus slowing British growth in the Industrial Revolution. Williamson notes in particular that, "Crowding out seems to have seriously constrained residential housing investment in the cities...rents and/or urban disamenities rise" (Williamson, 1987, p. 287). As a result of the protracted military struggle with the French the stock of British government debt grew greatly over the eighteenth and early nineteenth century as a fraction of GDP. I shall show below that

the value of this debt by the 1820s was about twice the national income. This may be a record for the size of a government debt. It can be compared to the US debt burden of about 0.70 times GNP in 1992 when the debt was a huge concern, and the debt burden in 1946 in the US after a major war was of 1.3 times GNP (Economic Report of the President, 1992, p. 385).<sup>3</sup> If the crowding out was approximately one for one as Williamson argues then at the maximum of the debt relative to GDP in the 1820s output would have been depressed by up to 20 per cent as a result of crowding out.<sup>4</sup> Thus if Williamson is correct many of the supposed gains to the economy from greater political stability after 1688 would have been countered by the losses from government financing policy.

There is, however, surprisingly little direct information from Britain in these years to support the idea that government debt policy was depleting the private capital stock. The rate of return has been measured by the interest rate on consols or by East India Company six month bonds, which were a semi-private bond. These instruments have the advantage that they were not subject to usury laws.<sup>5</sup> Both these rates were higher when debt sales were greater. But were they higher because of a general stringency in the capital market caused by crowding out, or because of investor fears of default by the government? This paper constructs estimates of the return on a variety of private assets in England from 1725 to 1839 from the reports of the Charity Commissioners to measure the effects of government debt and deficits on the private capital market.

## **2. The Debate about Crowding Out**

The argument for debt crowding out private investment is the following. Suppose we conceive consumers as holding a stock of capital in order to smooth their lifetime consumption. The wars were largely financed by borrowing. If consumers did not recognize the future tax

obligations stemming from this borrowing they would not desire to hold any larger total stock of capital than they were currently holding when the government issued debt. Thus the government debt would displace private capital in peoples' portfolios, and the wars would be financed by this displacement. Investment would fall as a result, not consumption. The reduction in the private capital stock would lead to an increase in all rates of return which would reduce private demands for capital, and also increase private savings. Thus the crowding out of private investment by government debt would not be one for one. This situation is shown in figure 1. As the government sells more debt the demand for capital at any interest rate moves out by the amount of the government debt.

The situation in Britain at this time was complicated by the usury laws which limited the rate of return on mortgages and bonds to 5 per cent, but did not limit the rates of return on government debt, on rent charges, or on real assets such as land. Williamson argued that this will make the crowding out effect of government debt even stronger. Government debt had a lower rate of return than private debt in Britain in the mid and late eighteenth century because it was safer and more liquid. As the stock of government debt was increased it would drive up all rates of return. But bonds and mortgages would soon hit the usury ceiling. At this point, argues Williamson, any further issue of government debt would crowd out private lending one for one. Thus the issue of large amounts of government debt might have quite modest effects on government interest rates once private rates were driven up to the usury ceiling. The effect of the usury ceiling is also shown in figure 1.

An example of this rationing effect is found in a letter in 1759 from Hoare's, a bank which lent much money on mortgage, to a customer,

At present we do not advance Money to anyone on any security....The uncommon supply of millions and millions granted and now raised [to pay for the Seven Years War] obliges all of our Profession to be prepared for the Payments [to customers moving their money from the bank into government stock] coming on,

so that instead of lending out money, we have called it in on this occasion (Joslin, 1960, p. 168).

An implication of Williamson's argument that usury ceilings would produce almost one for one crowding out is that the shadow rate of return on capital in the private economy would rise sharply. The usury ceiling limits severely any inducement for new saving. Thus most of the accommodation to the government debt demands has to come through displacement of private capital. There is thus rationing at the usury rate. But the rationing means that the capital stock will yield a high rate of return to the owners. Thus rates of return not limited by usury laws have to rise strongly in this period. Consider, for example, the housing market. The reduced supply of housing would have to be rationed among housing demanders by rent increases.<sup>6</sup> But housing prices would not increase proportionally. Otherwise constructing new housing would become very profitable. Thus crowding out in the housing market has to take the form of an increase in the rate of return on owning housing. This in turn will change the incentives of investors. Those who would previously have lent on mortgage will now have an inducement to become direct property owners and act as landlords, or form equity partnerships with those who built and managed rental housing. Similar arguments show that all rates of return not restricted by usury laws will rise strongly in the presence of significant crowding out. The upward movement of rates of return on owning land will induce those who lent land to agricultural property owners on mortgage to become land owners, taking on the direct management of the asset. Thus the existence of the usury laws probably had less distortionary effect on the capital market than Williamson imagines. They should mainly have distorted the form of asset holding, rather than changing greatly the outcome from the free market one.

It might be objected that if investment demand is very interest elastic then the demand curves for loanable funds in figure 1 will be close to horizontal. But the majority of the capital stock in Industrial Revolution Britain was dwellings and other structures. Modern estimates of the price elasticity of demand for housing fall between  $-0.5$  and  $-1.0$ . At the normal rate of return on housing in Britain circa 1820 to get a 10 percent decline in housing consumption would

require interest rates to rise between 0.5 and 1.0 percentage points. Thus any substantial crowding out of the private capital stock would show up as large increases in the private rate of return.<sup>7</sup>

Williamson's conclusion that economic growth in the Industrial Revolution was slowed by "crowding out" has been criticized on a number of different grounds. Mokyr (1987) and Neal (1990) argue that Williamson overstated the size of the government debt in many years by using its face value and not its market value, and that the market value was typically much less than the face value because of higher interest rates in the years of highest debt. This paper uses the calculated market value of debt for each year. But as can be seen from figure 1 while the market value of the debt is generally below the face value, in the years of the highest debt to GDP ratio in the 1820s this effect is largely absent. The reason there is not more divergence between the market value and face value of the debt is that the market value used here includes a number of elements normally excluded in measuring the face value of the debt - the market value of the term annuities and life annuities the government had contracted, the market value of the land tax obligations the government had sold in the years after 1799, and the short term "unfunded" borrowing of the government.

Mokyr and Neal also argue that much of the government debt was owned by foreigners and by Irish investors which would have again reduced the magnitude of crowding out. If the British government was borrowing in an international capital market, then the ratio of government debt to the world capital stock would be small even in the 1820s when the value of the debt was at its greatest. This argument that government debt would have little impact on domestic capital markets in an integrated world capital market has as a corollary the implication that in the years of the greatest increases in debt there should be corresponding increases in capital imports. These capital imports would show up as a deficit in the merchandise balance of trade.

Barro has more generally rejected the crowding out argument in general on the grounds that if people were rational and well informed they would regard government debt as presaging a

heavier tax burden in future and would consequently save an extra amount equal to the debt to generate an increase in income in future to meet the anticipated tax burden. In this case the debt itself would have no impact on the level of investment or the rate of return in the private capital market.<sup>8</sup> This situation is called **Ricardian Equivalence** after Ricardo who first realized (and also first dismissed) this possibility. The increased military expenditures themselves, however, might drive up interest rates and reduce investment. If the war is expected to be temporary it is like bad weather hitting the economy. Available output falls, but since people expect to be richer again in future they try to borrow to smooth consumption, hence driving up interest rates. The higher interest rate will be associated with lower levels of private investment, though the size of the effect on interest rates and the capital stock is indeterminate.<sup>9</sup> One implication of Ricardian Equivalence, however, is that once we include measures of military expenditure the size of the government debt itself should have no effect on interest rates or on the balance of trade. The financing decision itself is unimportant.

Heim and Mirowski (1987) have argued against crowding out in this period in part on the very different grounds that capital markets were segmented so that investment and rates of return in many markets would be unaffected by the size of government debt in the financial capital markets.

The above discussion suggests that the variables of interest will be the size of military expenditures and the stock of government debt. Modern empirical studies of Ricardian Equivalence, however, have often used the government deficit as the measure of the expected degree of crowding out. Seater (1993) points out the problems with this approach. In particular we should measure the deficit as the change in the market value of government obligations. But in the tests below I will also look at whether there was any link between deficits measured as the receipts from borrowing by the government and private interest rates and private investment.

### **3. Measuring the Debt**

Before I can consider the effects of government debt on the private economy, I have to measure which were the years of the largest debts and deficits relative to GDP and to the private capital stock. The nominal stock of the funded debt in various perpetuities in Britain in these years is well known. But the market value of government debt, the amount the government would have had to pay at any time to buy out its debt is the more meaningful economic quantum. And even more importantly we need to know the market value of debt relative to GDP to have an idea of when crowding out should really occur. In the appendix I set out details of how I have estimated the real debt stock and British GDP for the years 1727 to 1839.

The market value of British debt is calculated by dividing up government debt into its various constituent elements - 3 per cent, 3.5 per cent, 4 per cent, and 5 per cent perpetuities, short term debt, term loans, life annuities, and redeemed land taxes - and calculating the value of each from quotes of the trading price of various obligations in the Gentleman's Magazine.<sup>10</sup> Table – in the appendix shows the calculated market value of the debt attributable to Great Britain. The nominal funded debt is much greater than the market value of the debt in most of the years 1776-1815 because prices of government debt in these years fell well below par. However with the return of peace and stability in 1815 the market value of the debt rose rapidly to equal its nominal value.

I estimate the GDP of England and Wales from factor incomes and indirect taxes. Land and building rentals are derived from the property holdings of charities. Wage income from Feinstein's new wage series for the years 1770-1839 adjusted for population, and from wages of building workers and farm laborers for the years 1727-1770. In the 1860s this measure of income encompasses 93 percent of the full GDP reported by Deane and Cole.<sup>11</sup>

The market value of the debt got very large over this period compared to GDP. Using the estimates of nominal GDP detailed in the appendix at its maximum in the 1820s the market value of government debt was twice the GDP. Figure 2 shows the ratio of government debt to GDP from 1727 to 1840. According to Feinstein's estimates of net reproducible assets and wealth by 1830 government debt was worth 78 per cent of the net value of reproducible assets in the economy, compared to 36 per cent in 1760.<sup>12</sup> Indeed on Feinstein's estimates government debt in 1830 was worth more than all structures in the economy, valued at £518 million.

The appendix also gives a series on the net receipts from borrowing of the government in each year relative to GDP, which shows the net cash flow into the government from sales of new debt minus payoff of old debt.<sup>13</sup> Net receipts from debt sales, which measures the amount of resources the government commanded by trading them for debt has been assumed to be the measure of the likely extent of crowding out in some of the previous discussion of this period.<sup>14</sup> I will argue below, however, that the market value of the debt (or changes in this) is a more appropriate measure, since rational consumers will not be indifferent to revaluations of their current holdings of government debt. In the estimate of net receipts from borrowing I include sums that were borrowed in Britain for the government of Ireland in the years 1797 to 1816. Though this borrowing was to be serviced by Irish taxes, it represented to the British lender an equivalent asset to British government debt.

Figure 3 shows net receipts from borrowing as a percentage of GDP. In 1761 the government net receipts from borrowing reached 11 per cent of GDP, and in 1796 a remarkable 15 per cent. There were net receipts from borrowing above 10 per cent of GDP also in 1782, 1795, 1797. Figure 3 shows also military expenditures as a percentage of GDP.<sup>15</sup> We can compare this to a measured government deficit relative to GDP which reached a maximum of 3.8

per cent in the USA in 1983 at a time when the deficit was regarded as extraordinarily large and was the cause of much public concern (Seater, 1993, p. 178).

As can be seen the extraordinary military expenditures of the war years were largely met by free market means through the debt sales until the Napoleonic War when taxes were raised substantially from 1799 until 1815. The correlation coefficient between debt sales and the level of military expenditure from 1727 to 1839 is 0.83. Notice that the deficit position of the government as measured by net receipts from borrowing will be very different from the position as measured by changes in the market value of government debt. Net receipts from borrowing were high during the wars. But the market value of government debt typically rose only when the wars ended. This was because the interest rates on government debt rose during the wars, and in the 1793-1815 wars general prices also rose with the abandonment of gold convertibility. Thus in some years of the largest debt sales the “real” government deficit, measured as the change in the market value of government obligations, actually fell.

Figure 3 also shows the rate of return on 3 per cent annuities and consols from 1727 to 1840. As can be seen the consol rate typically is high in the years of large borrowing, which are also the years of large military expenditures. But if I regress the consol rate by quinquennia on the deficit relative to GDP and also on military expenditure relative to GDP the results are

$$\begin{aligned}
 \text{RET}_{Ct} &= 3.034 + 0.038\text{DEBTSALES}/\text{GDP}_t + 0.117\text{MIL}/\text{GDP}_t \\
 &\qquad\qquad\qquad (.058) \qquad\qquad\qquad (.048) \\
 &\qquad\qquad\qquad\qquad\qquad\qquad\qquad n = 23, R^2 = 0.62, DW = 1.72
 \end{aligned}$$

where  $\text{DEBTSALES}/\text{GDP}_t$  is net debt sales as a percent of the GDP, and  $\text{MIL}/\text{GDP}_t$

is military expenditures as a percent of GDP.<sup>16</sup> The regression estimates imply that consol rates were in fact more closely linked to military expenditures than to debt. This is consistent with Barro's views, but it also raises the possibility that the consol rate in part just reflects the level of confidence in the government solvency. This confidence could well be influenced by such things as the intensity of the military struggle the government was engaged in. To determine whether the high rates on consols reflected crowding out in the entire capital market, or varying degrees of confidence in the government we need to know private rates of return.

#### **4. Returns in the Private Capital Market**

To get measures of private asset returns this paper constructs measures of the returns from owning land and houses, the returns on private perpetuities (rent charges), and the return on bonds and mortgages (including mortgages on turnpike tolls) from 1725 to 1839 drawn principally from transactions recorded in the Charity Commission reports.<sup>17</sup> The Charity Commission examined the asset holdings of charities in all parishes in England and Wales in the course of its investigation which lasted from 1818 to 1840. Often the commissioners gave details on the purchases and sales of assets such as land, tithes, houses, rent charges, mortgages, and private bonds. A rent charge was a fixed perpetual nominal obligation secured by a house or a piece of land. It could only be redeemed if the owner of the rent charge agreed to accept a capital sum for it. In the later period the most numerous observations are on private bonds and mortgage lending. Money lent on bond was generally secured only by the bond of the borrower, and was recallable at will. Money lent on mortgage was secured by land or housing, and was recallable or repayable at 6 months notice.<sup>18</sup>

Table 1 summarizes the amount of information available by period from 1725 to 1839. The bulk of charities were run by local landowners and churchwardens. Their purchases and sales of assets should consequently have reflected local capital market conditions, even if the charities themselves were not adjusting their portfolios in response to the sale of government debt. In at least some cases we do see charities adjusting their investment portfolios as the price of government debt changes, just as private investors did. Thus Sir Thomas Heathcote, Baronet and trustee of John Nowes' charity in Yeovil, Somerset noted that "In January 1818, there being a considerable balance in hand, we wished to lay it out on mortgage, in consequence of the funds being very high" (4<sup>th</sup> Report, p. 605). Similarly in 1823 the Charity School in the township of Warton in Kirkham parish in Lancashire had Charity had £400 in cash, lent out at 4.5 per cent interest, noting "It was in the funds but it was sold out to an advantage" (11<sup>th</sup> Report, p. 283). The proceeds of sale of some church land in Cold Ashby, Northampton in 1819 was invested in consols. But "the stock was sold in 1822, in order that the money might be laid out on mortgage, and a profit made from the then advanced price of stock" (13<sup>th</sup> Report, p. 29).

The returns earned by charities seem to have approximated well the returns of private owners. Charities, for example, earned as high a return from their land purchases as private land purchasers (Clark, 1998b, pp. 71-2). They also earned as much in the eighteenth century as was charged by the Sun Fire insurance company in London for mortgages. Table 2 shows the decade by decade returns for charity mortgages compared to those invested in by Sun Fire. Charity land, similarly, rented for as much as private estates (Clark, 1998c). Thus the return on charity investments should provide a good guide to the economy as a whole.

Rent charges, bonds, and mortgages are nominal assets. Their real return is thus the nominal return minus the rate of inflation. i.e. if  $P$  is the price of the asset and  $R$  its current annual rent, then the real rate of return  $r_n$  for such a nominal asset is given by,

$$r_n = (R/P) - \pi$$

where  $\pi$  is the rate of inflation. For assets such as land and houses, the real rate of return is

$$\begin{aligned} r_r &= (R/P) - \pi + \rho \\ &= (R/P) + (\rho - \pi) \end{aligned}$$

where  $\rho$  is the rate of growth of the assets nominal value, and  $(\rho - \pi)$  is the rate of growth of the real value of the asset. The long run rate of growth of real asset values,  $(\rho - \pi)$ , will be close to zero. Nominal farmland rents in England increased by about 200 per cent between 1760 and 1814, in part as a consequence of the inflation of the Napoleonic war period. But real rents increased by only about 28 per cent which implies an average rate of growth of land values of only 0.45 per cent per year in this interval. Thus the current rate of return on holding land or housing is generally a good proxy for the real rate of return in the economy.

The usury restrictions in the period 1727 to 1840 applied to only bond lending and mortgages, but not to rent charges. The reported rates of return on rent charges sometimes exceed the usury limits, while those for bonds and mortgages almost never do. Thus rent charges have another attraction for looking at interest rates, in that they were not legally constrained.

Table 3 shows the calculated return on land and houses by quinquennia for the years 1725-1839 using this data, as well as the 5 per cent confidence intervals around the estimates. The return on holding land and houses is derived as a weighted average of two series. The first is the gross return on land or houses derived from cases where we have both the price and the rent of a piece of land or a house. The second is the rate of return derived from estimating the ratio of average rents to average prices in each quinquennia, controlling for land or house characteristics,

and dividing the one by the other. The best estimate of returns is the weighted average of these two estimates weighting based on the standard errors of each estimate.<sup>19</sup> This means that for the years before 1720 the directly estimated returns have the predominant weight in the combined series, while for the years after 1840 the indirectly estimated returns predominate. On average the gross return on houses is about 1.76 per cent higher than on land, which reflects the greater depreciation of houses. In 96 cases from 1813 to 1837 where we know the expenditures by owners on repairs in the last five years, these averaged 43 per cent of gross rents. Since the average gross return on housing was 5.0 per cent in this period, this implies repairs were about 2.1 per cent of prices.

Figure 4 shows these returns graphed against the government debt sales as a share of GDP. As can be seen there is no sign that the years of high deficits when consol rates would move up saw any increase in the rate of return on land. As noted above in a world where consumers pay attention to changes in the value of the stock of assets they hold, what would matter is not the sale of debt by the government, but the value of the total stock of debt outstanding. Figure 5 shows the return on land and housing plotted against the ratio of debt to GDP. Again there is no sign of any relationship. In particular the sharp rise in the ratio of the value of the debt to GDP caused in part by the deflation at the end of the Napoleonic Wars is not associated with any increase in the return on land or housing.

To consider whether the debt sales of the war years crowded out private investment I can also consider what happened to housing rents relative to construction costs. The years 1800 to 1840 were ones of rapid population growth in Britain. Consequently there had to be a steady expansion of the housing stock to house the additions to the population. If crowding out was to prevent this expansion of the stock it would do so by increasing the return on housing so that rents rose relative to construction costs. Figure 6 shows an index of rents in England and Wales for housing of constant quality compared to an index of construction costs.<sup>20</sup> Over the long period 1770 to 1869 rents and construction costs rose by very similar amounts. The long run upward movement of rents seems to have been mainly driven by increases in construction costs.

But rents actually rose slightly less in the years of high debt issue, 1780-1815, than did construction costs. Nor are rents particularly high relative to construction costs in the 1820s, the years of the particularly high ratio of debt to GDP. So neither version of the crowding out story seems to work very well. The housing stock was not being constricted in the war years by high interest costs embodied in rents in the war years. If anything the data suggests the reverse. But also rents did not rise much relative to construction costs in the years after the wars ended when the debt stock became large.

## **5. Nominal Rates of Return**

We can also look at the link between debt and nominal rates of return, though the interpretation of any such link for real interest rates is difficult. The first set of nominal returns we have is the returns on rent charges, which were as noted above perpetuities, not limited by usury laws, secured by land or houses. The numbers of rent charges we have for each five year period is given in table 1. Figure 7 shows the average return on rent charges by five year periods compared to the average government deficit in the same five year period. As with the return on land there is no perceptible effect of the size of the deficit on the rate of return on rent charges. The blip upwards in rent charge returns in 1830-4 it should be noted is based on only two observations.

In the case of bonds and mortgages, comparing their returns with the size of the deficit or the debt is more complicated because of the usury limit of 5 per cent on such loans in this period. If the government borrowing crowded out such lending, then it would show up as loans mostly being made at the usury interest rate limit. To measure the effects of government borrowing in these markets I estimate the five year averages of returns assuming that the data is censored at the 5 per cent upper limit. The assumption here is that there is a normal distribution of rates on bond and mortgage lending, and all the rates which would be above the usury limit are truncated to that limit. This would in part occur through the usury laws being circumvented by borrowers paying additional unrecorded considerations to secure the loan at the usury limit. To maximize

the data availability I pool bond, mortgage and turnpike mortgage returns assuming they all move in the same direction but can be at different levels. The regression estimates suggest that on average returns on mortgages were .16 per cent higher than for bonds, and returns on turnpike mortgages .56 per cent higher than for bonds.

Figure 8 shows the movement of the average returns on these assets.<sup>21</sup> As can be seen the average implied rates on bonds exceeds the usury limit in many years. The rate clearly moves up in the years of substantial deficits. It also clearly is correlated with the rate of return on consols, which is shown in the same figure. Here at last there is some evidence of crowding out. But it seems that the gap between the consol rate and the rate on bonds or mortgages narrows when the consol rate rises. A 1 per cent rise in the consol rate is associated with only a .47 per cent increase in implied private nominal rates. Thus the estimated relation between the change in the “shadow” private bond rate and the change in the consol rate for five year periods was:

$$\Delta RET_B = -0.030 + 0.465\Delta RET_C$$

$$(0.077) \quad (.146)$$

$$n = 22, R^2 = 0.34, DW = 2.63$$

where  $RET_B$  is the average of returns on bonds, mortgages and turnpike mortgages and  $RET_C$  is the return on 3 per cent consols (or annuities). The relationship was estimated with first differences because the errors showed first order serial correlation when estimating with levels. But though private bond rates were clearly linked to consol rates, they were not clearly linked to either the deficit or the debt. Thus if I regress the change in the shadow bond rate by quinquennia on the change in debt sales relative to GDP and also on the change in military expenditure relative to GDP the results are

$$\Delta RET_{Bt} = -0.02 + 0.018\Delta DEBTSALES/GDP_t + 0.028\Delta MIL/GDP_t$$

$$(0.059) \quad (0.058)$$

$$n = 23, R^2 = 0.17, DW = 2.12$$

Differences were used because of autocorrelation. The individual coefficient estimates have large standard errors, but this may be due to the high correlation between debt sales and military expenditures. Similarly if I regress the change in the shadow bond rate on the change in the debt relative to GDP and also on the change in military expenditure relative to GDP the results are

$$\Delta \text{RET}_{Bt} = -0.027 + 0.132 \Delta \text{DEBT}/\text{GDP}_t + 0.041 \Delta \text{MIL}/\text{GDP}_t$$

(0.73) (0.029)

n = 22, R<sup>2</sup> = 0.17, DW = 2.16

where  $\text{DEBT}/\text{GDP}_t$  is the market value of the debt as a fraction of GDP. In both cases the point estimates suggest that debt sales and the value of the debt themselves had very little impact on the shadow bond return, but the standard errors are large. If debt sales are 10 percent of GDP then bond rates rise 0.2 per cent for example. Similarly a debt which is double GDP raises bond rate by about 0.25 per cent. In the war years because military expenditures themselves were also associated with higher bond rates the increase in bond rates was of the order of 0.5-0.7 percentage points. But much of this may owe to the wars per se, and not to the method of financing them.

Overall when we look at the private interest rates in the economy we find no evidence that the huge increase in the stock of debt from 1727 to 1824 crowded out much private investment. In the war years when government debt sales were high the only rates to clearly rise were the implied rates on private bonds and mortgages. But these implied rates rose proportionately much less than the consol rate, the rose more in line with military expenditures than with debt sales, and they would be associated with modest reductions in the capital stock. It is, however, puzzling that these rates were linked with the consol rate while the return on land, houses and rent charges showed no connection. For the rate of return on mortgages should be related to the rate of return on land, for example. Perhaps it was the case that these investments

were those most easily substituted for consols, and land, houses and rent charges were more distinct.

There is one other nominal rate series that we can get for the period 1794-1840. This is the rate of interest charged by the Crown Commissioners to those who bought back rent charges that were owned by the crown.<sup>22</sup> The crown commissioners in valuing these rent charges for sale would establish a ratio between the annual charge and the purchase price (the number of years purchase in the parlance of the time), whose inverse tells us the rate of return the purchasers received on their investment. This unlike consols was an absolutely safe asset, which was not subject to any potential renegotiation or default by the crown. Consol income was subject to income tax in the war years, however, while crown rent charges would have been paid without any allowance for tax. Thus for comparison we need the rate of return on consols net of tax, though those with incomes below certain levels paid lower rates of tax, or no income tax at all. Thus the difference between the return on redeeming crown rent charges and the return on consols net of tax is the lower bound on the true difference. Figure 9 shows the interest rates on crown rent charges compared to the net consol interest rates. While these rates broadly follow the consol rates, for the war period 1794-1815 the consol rate is on average 0.67 per cent higher, but this premium disappears by the 1820s when the two rates are very similar. Why would people who could invest a sum of money in consols accept a much lower rate by investing it to repurchase a rent charge, but only in the years before 1820? The only obvious reason is a perceived insecurity of consol yields in the war years. Thus again the rise in consol rates in the war years may owe as much to default risks on government debt as to any general upward movement of returns in the private capital market.

## **6. Other Indicators of Crowding Out**

The modest effects, if any, of government debt and military spending on real rates of return suggests that there should be no connection between debt and investment. We have a good index of investment in structures in Britain from 1785 on, in the form of statistics on brick production.

I constructed an index of brick production relative to real GDP from 1785 to 1839, using estimates of real GDP from Clark (2001).

Figure 10 shows the ratio of brick output to real GDP stays roughly constant from 1785 to 1840, with seemingly random fluctuations around the mean. It is clear that there will be no detectable association between the stock of debt and brick sales, since brick sales are trendless at a time when the stock of debt more than doubled. The figure also shows net sales of debt as a percentage of GDP in this period. The graph suggests some possible link between brick output and debt sales, but a very modest one. Regressing the change in brick sales relative to GDP against the changes in the deficit as a percent of GDP gives the following estimates (with the standard error in parentheses).

$$\Delta \text{BRICKS}/\text{GDP}_t = 0.091 - 0.091 \Delta \text{DEBTSALES}/\text{GDP}_t$$

$$(0.215) \quad (0.098)$$

$$n = 52, R^2 = 0.017, DW = 1.83$$

BRICKS/GDP<sub>t</sub> is an index of brick sales relative to GDP set to average 10 for the years 1785 to 1837. The regression was done in differences because in levels there was autocorrelation of the errors. The regression finds little connection between debt sales and brick production. The estimated effect is that a deficit of 10 per cent of GDP would reduce brick production by 9 per cent, but the standard error on this estimate is large. Thus all I can say based on the data is that a deficit of 10 percent of GDP is associated with a movement in brick sales somewhere between a 10 percent increase and a 30 percent decline.

## 7. The Operation of the Capital Market

The general finding of the empirical estimation above is that the level of government debt in the years 1727 to 1840 had little effect on real rates of return in the British economy, and sales of debt to finance the deficit were associated only with modest increases in some nominal rates of return. Neither debt nor war expenditure had any clear impact on brick production. This is

surprising given that this implies that in years such as 1796 consumption had to drop by close to 15 per cent of GDP to accommodate these debt sales without reducing private investment. The percentage drop in private consumption would be even greater because of the normal burdens of investment and taxation.

The literature on the effects of government debt offers three explanations for these modest effects of debt or deficits on private investment. Below I shall suggest a possible fourth.

1. The issuance of government debt brought forth an equivalent amount of private saving in anticipation of future taxes, through Ricardian Equivalence (Barro, 1987).

2. The British government debt was substantially financed from abroad. This is the argument of Joel Mokyr and Larry Neal (Mokyr, 1987, Neal 1990, 1991).

3. Capital markets were segmented so that many people were constrained to save less than they desired from a lack of investment opportunities. The creation of a large body of government debt brought forth this saving by providing an appropriate vehicle. This might be called “crowding in.” Patrick Colquhoun in his Treatise of 1815 prefigures this argument. But while his enthusiasm for the debt as a means of enlarging the private capital stock is clear, his reasoning is obscure.<sup>23</sup>

The first argument, that of Barro, imposes a very strong knowledge requirement on consumers, as well as various requirements on intergenerational altruism. How would a person in Britain in the period 1727-1840 know how much to save in anticipation of their share of the tax burden? The first population census was only in 1801, so the debt burden per capita would not even be very well known before this date. The size of the government debt would itself be known only by the most financially sophisticated, since it was composed of many elements which would have to be valued in different ways to arrive at its real value. There were books and pamphlets written from the late eighteenth century on discussing and debating the issue of the debt, such as J. J. Grellier, The History of the National Debt from the Revolution in 1688 to the Beginning of 1800, published in 1810. But even this 420 page volume gives only the nominal value of the debt, and has no mention of the size of debt relative to GDP. It is intended

to alert the reader to the alarming size of the national debt, but what the reader is supposed to do with the knowledge contained therein is very unclear. Suppose you have an income of £1,000 in 1810, and learn that the debt in 1800 (the last date given in the book) was £491 million. What does that imply about the extra saving you should undertake to cover the anticipated tax payments this debt implies?

Neal argues that the debt, particularly in the years of the Revolutionary and Napoleonic Wars, was financed in part by capital from France, the Netherlands, and Germany fleeing the confiscatory appetites of the French Army and administration. The amount of foreign debt holding he identifies from the Bank of England Accounts is however, pitifully small in relation to the overall debt in the years 1801-1816: £14-18 million in nominal terms compared to a total debt of around £600 million, or less than three per cent (Neal, 1991, pp. 68-72). Recently John Wright has shown systematically that government debt in the years 1750-1815 was increasingly held by British investors. In the 1750s to 1770s 13 to 16 per cent of funded debt was held by foreigners. Yet by 1815 this had shrunk to 2 per cent (Wright, 1997, 1999).

Also Neal focuses on the war years, while we see above that the market value of government debt relative to GDP did not rise to its highest levels till the deflation and decline of the rate of return on consols after the end of the war in 1815. If the stock of government debt was what mattered for crowding out there had to be massive imports of capital in the years 1816 to 1824, years Neal identifies with the repatriation of Continental capital.

Neal could argue that the foreign capital was invested in other areas of the British economy. But what other asset would foreigners invest in? Land and houses, the two major assets both required supervision, and so should be more attractive to local investors than to foreigners. An investor in Amsterdam could easily know at any date the value of his holdings of British government debt, and could easily trade these holdings to another investor in Amsterdam. But the situation was much more difficult with respect to land. An agent would have to be hired both to purchase it and to rent it. Liquidation of the holding would typically require a sale in England, since an investor in Amsterdam would have no means of reliably ascertaining the value

of the land. Charities who invested in land overwhelmingly preferred to invest in local land. When they were left land at a distance the costs of journeys to inspect the property were large, so that only large estates could practically be held at a distance. If foreigners were investing in Britain they should be investing in government debt.

So it has to be the case that the sale of government debt brought forth more domestic saving, though by a mechanism other than the anticipation of future taxes. We do see in the records of the Charity Commission that in the period before the wide diffusion of government debt finding a safe investment vehicle for funds was difficult. In country parishes there might be a lapse of 10, 20 or even more years before money left to be invested in land would be so invested, presumably because of the difficulty of finding a seller of the appropriate sized parcel in the vicinity of the parish. In the interim it would be lent to the parish, to the vicar, or to local farmers, merchants, or gentry. But by the 1730s or 1740s government debt was widely available, at least in the large population concentrations around London, so any further issues of government debt thereafter should not have been able to induce a mobilization of savings. A reflection of this is the fact that in the period 1727 to 1840 the bulk of reports of mortgage and bond contracts coming from the charity commission reports are drawn from those counties remote from London where government debt was issued. 21 per cent of the pages of the Reports are devoted to London and the six counties adjacent to it or Middlesex, yet these counties produce only seven per cent of the bond and mortgage reports in this period.

If government debt was in large part bought using idle stores of cash which could find no productive investment then the sale of government debt would effectively induce inflation by issuing debt by increasing the velocity of money. There is little evidence in the Charity Commission reports, however, of idle cash balances being kept on any large scale, even though we would expect charities to be more lax on this score than private individuals. Money that could not find any safe long term investment was generally lent out to one of the trustees of the charity at interest, to the local vicar, or to a local farmer.

One force that could induce more saving would be the calling in of money lent on bond and on mortgage when the government floated new debt. Those who had borrowed using these instruments to finance the purchase of houses and land, and to provide working capital for trade and manufacture could in principle have sold the assets that secured the mortgage or bond in response to the credit rationing created by the usury laws. But if they had a strong aversion to selling assets (perhaps because liquidation at short notice is costly) their response instead might be to sharply curtail consumption in order to pay back their bonds or mortgages. In this case the credit crunch created by the sale of government debt might lead to induced saving as a response. Even this argument should produce only a temporary boost in savings, not the long run effects we find above. It is also not clear if the amounts of bond and mortgage lending would be large enough, and the credit rationing effect anywhere near strong enough, even with such an effect, to allow the amount saved from year to year to increase by over ten per cent of GDP.

## **8. Conclusion**

Above I have created a puzzle. The private rates of return developed suggest that debt and deficits had at worst a very modest impact on private rates of return. There was little crowding out. This implies savings increased in line with government debt issues. But above I examine the various explanations offered for the increase in savings and find them all wanting: Ricardian Neutrality, capital imports, and segmented capital markets. The GDP data do reveal, however, another possible explanation that would reconcile crowding out with the absence of any serious signs of tightness in the capital markets.

Just at the same time the government debt service began to grow substantially as a share of GDP with the American War of Independence another fundamental shift was beginning to take place in the British economy. In the 1780s rental income from land and housing began to decline as a share of GDP. Figure 11 shows the trends in debt service as a fraction of GDP compared to land and house rents as a share of GDP. The figure is based on quinquennial data given in table 6 in the appendix. In the first half of the eighteenth century land and house rents

were about 27 per cent of GDP. By the 1830s these rents had declined to about 18 per cent of GDP. The decline was created by the decline of farmland rents as a share of income. British population was growing rapidly after 1770. The increase in population relative to land raised real farmland rents to some extent. But imports of food and raw materials from the Americas, Ireland, and Eastern Europe kept this gain in land rents modest. As Davis shows the volume of imports of food and raw materials surged in the 1780s (Davis, 1979). This coincides nicely with the decline of farmland rents as a share of GDP. In part land rents were replaced by rental income from canals, turnpikes, and mines. But these other sources of rental income, even by the 1840s, only partially offset the overall decline in rental income as a share of GDP.

Interest payments on government debt rose in line with the decline of rents on private assets. Thus while interest payments on government debt were only about three per cent of GDP in the early eighteenth century by the 1820s they had risen to 7.5 per cent. Thus the decline in private rental incomes was only partially offset by a rise in income from government debt. Since we do not have a good understanding of the mechanics of asset holding in the Industrial Revolution period the association between the decline of private rental income as a share of GDP and the rise of government interest income can be only suggestive. But the suggestion would be that the huge debt issues of the years 1776-1815 did not drive up the rate of return of capital in the economy as a whole because the decline of rental incomes as a share of GDP led to an enhanced demand for other assets for consumption smoothing and other purposes in just the period the government was selling debt. Thus rates of return on private capital in Britain might have been going to decline in the absence of the large public debt, and that is why the huge debt issues do not show up as any tightness in the private capital market. In a sense crowding out may have taken place, but is not observable from private rates of return because of the underlying trends in private rental incomes. In terms of figure 1 the possibility is that at just the same time as the government was selling debt there was an increase in the supply of loanable funds so that even though crowding out did take place it is not observable from looking at rates

of return because of the coincidence of debt sales and the relative decline of rental incomes in the economy.

This potential reconciliation of crowding out with unchanged returns on private capital would need to be developed within a formal model before than it is other than suggestive. Such a model would be beyond the scope of this paper. Nevertheless I think I have established that some such explanation will have to be developed to explain the operation of capital markets in this period.

## **Appendix: The Value of Debt, Debt Sales and Nominal GDP 1727-1840**

### **Market Value of Government Debt.**

The obligations of the government over the years 1727 to 1840 included a changing mix of 3 per cent, 3.5 per cent, 4 per cent, 5 per cent long term debt as well as a set of term annuities issued in different years for different fixed length, a set of life annuities, the sale of fixed perpetual land tax obligations, and a set of short term debts of the Exchequer, the Navy, and the Army.<sup>24</sup> Some of the fixed interest debt could be redeemed at any time by the government if interest rates fell, some had limits on redemption dates. I get the various components of the debt stock for 1786-1838 from United Kingdom, Parliamentary Papers (1890-1), and for 1727-1786 from United Kingdom, Parliamentary Papers (1898). Both these publications list in detail the various date issues and their dates of retirement or conversion.

To estimate the market value of the debt stock I use where possible quotations of the selling price of the various debts. The average price of 3 per cent annuities, and later 3 per cent consols, for 1727 and 1729 on is given by Homer and Sylla (1991). The Gentleman's Magazine, published in London from 1731 on, gives the prices of many other denominations of debt, including the various issues of 3.5 per cent, 4 per cent and 5 per cent perpetuities, and both the fixed term Long Annuities and Short Annuities. Prices taken from the Gentleman's Magazine include South Sea Annuities (1731-50), "4 per cent of 1746" (1747-50), "4 per cent of 1747" (1747-50), "4 per cent of 1748" (1749-50), "3.5 per cent of 1756" (1757-60), "3.5 per cent of

1758” (1759-70), “3.5 per cent of 1818” (1819-38), “Reduced 3.5 per cent” (1825-38), “New 3.5 per cent” (1832-1838), “4 per cent of 1760” (1761-63), “4 per cent of 1762” (1764-81), “4 per cent of 1763” (1765-1767), “4 per cent of 1777” (1778-1824), “New 4 per cent” (1823-31), “4 per cent of 1826” (1827-34), “5 per cent Navy” (1785-1822), “5 per cent of 1797” (1798-1812), Long Annuities (1762-1838), Short Annuities (1778-1806). For each type of debt I take the first quote in January of the year as the price. In the few years where a quote is unavailable for the year for a particular type of debt I value the stock using the price of 3 per cent consols as a benchmark, unless the implied value was greater than the face value in which case the face value was used.<sup>25</sup>

The market values of terminable annuities without a market quote was calculated by calculating the net present value of the set of future payments each annuity committed the government to in each year (United Kingdom, Parliamentary Papers (1890-1), pp. 47-8). The market value of life annuities in each year was calculated by calculating the net present value of the stream of payments actually made for the five most important annuities till 1840 given in the same source.

The short term debt was calculated for the years 1727 to 1754 from Dickson (1968), and for the years 1788 to 1815 from O’Brien (1967), Table 16, p. 495. For 1755-1787 and 1816-1840 the short term debt is from the annual income and expenditure statements in United Kingdom, Parliamentary Papers (1868-9), which is a less satisfactory source. However, as table -- shows, short term debt was always a relatively small fraction of the total value of government debt. The present value of redeemed land tax obligations was calculated by calculating the present value of the annual land tax obligations that had been bought out by each year. The present value of each future stream of obligations was calculated using as a discount rate the return on 3 per cent perpetuities. The short term debt was assumed to have a market value equal to the face value. Up till 1817 separate accounts were kept for Britain and Ireland, and thereafter accounts for the United Kingdom as a whole. In the years 1818-1840 the British share of the debt was assumed to have the same proportion to the total as in 1817.

Table 4 shows the percentage each type of debt constituted in each of four years. Perpetuities and the debts to the Bank of England and the East India Company always constitute at least 85 per cent of the market value of the debt. Life annuities and the short term “unfunded” debt, the most difficult to value, constitute no more than 9 per cent of the debt in any year.

### **Net Receipts from Borrowing**

The amount of finance raised by the sale of debt minus redemptions of debt is calculated for the years 1793 to 1815 using figures from O’Brien (1967), table 4, p. 9. There are inadequacies in the standard government income and expenditure accounts which O’Brien is able to escape by use of archival sources. For the other years the procedures suggested by O’Brien (1967) to calculate the net receipts from borrowing are used as far as the data in United Kingdom, Parliamentary Papers (1868-9) allows. This is the same procedure as used by Heim and Mirowski (1987) and Oppers (1993). After 1817 British receipts from borrowing were taken as the same percentage as they were in the five preceding years of the United Kingdom total.

### **Debt Service**

Debt service is the amount the government paid each year to service its existing debt stock. Since some debt was being retired over time – such as the term and life annuities – I only counted the interest component in the payments on these obligations. Table 6 shows debt service as a per cent of GDP by quinquennia.

### **Gross Domestic Product**

Gross domestic product is calculated as the sum of property income and wage income. Property income is that from farmland, houses and canals, turnpikes, mines and railways. The most important components of this series, farmland and house rents derive also from the Charity Commission records. The details of construction are discussed further in Clark (2001).

## **Acknowledgements**

This research was funded by NSF grant #SES 91-22191. I thank the following for advice, help, and responses to queries, without implicating them in any way in the conclusions of the article: Carol Heim, Peter Lindert, Joel Mokyr, Larry Neal, Partick O'Brien, Alan Olmstead, Steven Sheffrin, David Weir, and the anonymous referees for the journal.

## **BIBLIOGRAPHY**

- Albert, William. (1972). The Turnpike Road System in England, 1663-1840. Cambridge: Cambridge University Press.
- Barro, Robert. (1987). "Government Spending, Interest Rates, Prices, and Budget Deficits in the United Kingdom, 1701-1918," Journal of Monetary Economics, 20(2), 221-249.
- Brewer, John. (1989). The Sinews of Power: War, Money and The English State, 1688-1783. London: Unwin Hyman.
- Cameron, Rondo. (1989). A Concise Economic History of the World. Oxford: Oxford University Press.
- Clark, Gregory. (1998a). "The Reports of the Charity Commissioners as a Source in Economic History" Research in Economic History, 18, 1-52.
- Clark, Gregory. (1998b). "Land Hunger: Land as a Commodity and as a Status Good in England, 1500-1914," Explorations in Economic History, 35(1), 59-82.
- Clark, Gregory. (1998c). "Renting the Revolution" Journal of Economic History, 58(1), 206-210.
- Clark, Gregory. (2001). "Shelter from the Storm: Housing and the Industrial Revolution." Working Paper, University of California, Davis. (Available at [www.econ.ucdavis.edu/faculty/gclark/index.html](http://www.econ.ucdavis.edu/faculty/gclark/index.html))
- Colquhoun, Patrick. (1815). A Treatise on the Wealth, Power, and Resources of the British Empire ... the Rise and Progress of the Funding System Explained ... (2d ed.). London: J. Mawman, 1815.
- Crafts, N. F. R. (1985), British Economic Growth during the Industrial Revolution. Oxford: Clarendon Press. Crafts, N. F. R., and C. K. Harley (1992), "Output Growth and the British

Industrial Revolution: a Restatement of the Crafts-Harley View," Economic History Review, 45(4), 703-730.

Davis, Ralph. (1979). The Industrial Revolution and British Overseas Trade. Leicester: Leicester University Press.

Dean, P. and Cole W. A. (1968), British Economic Growth, 1688-1959. Cambridge: Cambridge University Press.

Dickson, P. G. M. (1967), The Financial Revolution in England. London: MacMillan.

Feinstein, C. H. (1988), "National Statistics, 1760-1920" in C. H. Feinstein and Sidney Pollard (eds.), Studies in Capital Formation in the United Kingdom, 1750-1920. Oxford: Clarendon Press, pp. 258-471.

Heim, Carol and Mirowski, Philip (1987), "Interest Rates and Crowding Out During Britain's Industrial Revolution," Journal of Economic History, 47 (3), 117-140.

Heim, Carol and Mirowski, Philip (1991), "Crowding Out: A Response to Black and Gilmore," Journal of Economic History, 51 (3), 701-706.

Homer, Sidney and Richard Sylla. (1991). A History of Interest Rates. New Brunswick: Rutgers University Press.

Hope-Jones, Arthur. (1939). Income Tax in the Napoleonic Wars. Cambridge: Cambridge University Press.

Joslin, D. M. (1960), "London Bankers in Wartime, 1739-84" in L. S. Pressnell, ed., Studies in the Industrial Revolution, pp. 156-177. London: University of London, Athlone Press.

Mitchell, B. R. and P. Deane (1971), Abstract of British Historical Statistics. Cambridge: Cambridge University Press.

Mokyr, Joel (1987), "Has the Industrial Revolution Been Crowded Out? Some Reflections on Crafts and Williamson," Explorations in Economic History, 24, July, 293-319.

Neal, Larry (1990), The Rise of Financial Capitalism. Cambridge: Cambridge University Press.

Neal, Larry (1991), "A Tale of Two Revolutions: International Capital Flows 1789-1819," Bulletin of Economic Research, 43(1), 57-92.

North, Douglass C. and Barry Weingast (1989), "Constitutions and Commitment: the Evolution of Institutions Governing Public Choice in Seventeenth Century England" Journal of Economic History, 49(4), 803-832.

O'Brien, Patrick (1967), "Government Revenue, 1793-1815: A Study in Fiscal and Financial Policy in the Wars Against France," D. Phil. thesis, Oxford University.

Olson, Mancur (1993), "Dictatorship, Democracy, and Development," American Political Science Review, 87 (3).

Oppers, Stefan (1993), "The Interest Rate Effect of Dutch Money in Eighteenth Century Britain," Journal of Economic History, 53(1), 25-43.

Pressnell, L. S. (1960), "The Rate of Interest in the Eighteenth Century" in L. S. Pressnell, ed., Studies in the Industrial Revolution, pp. 156-177. London: University of London, Athlone Press.

Seater, John (1993), "Ricardian Equivalence," Journal of Economic Literature, 31 (March), 142-190.

Turner, Tracy. (2000). "Does Investment Risk Affect the Housing Decisions of Families?" Manuscript, University of California, Davis.

United Kingdom, Parliamentary Papers (1857-58), Return of the National Debt of Great Britain and Ireland 1691-1857. Vol. XXXIII.

United Kingdom, Parliamentary Papers (1868-69), Accounts of Public Income and Expenditure of Great Britain 1688-1868. Vol. XXXV.

United Kingdom, Parliamentary Papers (1890-91), Report of the Proceedings of the Commissioners of the National Debt from 1786 to 1890. Vol. XLVIII.

United Kingdom, Parliamentary Papers (1890-91), History of the Funded Debt from 1694 to 1786. Vol. LII.

Weir, David R. (1989). "Tontines, Public Finance, and Revolution in France and England, 1688-1789." Journal of Economic History, Vol. 49, No. 1. (Mar., 1989), pp. 95-124.

Williamson, Jeffrey (1984), "Why Was British Growth so Slow During the Industrial Revolution?" Journal of Economic History, 44 (3), 687-712.

Williamson, Jeffrey (1987), "Debating the British Industrial Revolution," Explorations in Economic History, 24(3), 269-292.

Wright, J. F. (1997). "The Contribution of Overseas Savings to the Funded National Debt of Great Britain, 1750-1815." Economic History Review, 50(4): 657-674.

Wright, J. F. (1999). "British Government Borrowing in Wartime, 1750-1815." Economic History Review, 52(2): 355-361.

Wrigley, E. A. and R. Scofield (1997), English Population History from Family Reconstitution, 1580-1837. Cambridge: Cambridge University Press.

**Table 1: Information on the Return on Land, Rent Charges, Bonds, and Mortgages 1725-1839**

Period	Land Rent/Price	Land Rent	Land Price	House Rent/ Price	House Rent	House Price	Rent Charges	Mortgages and Bonds
1725-9	10	63	90	2	5	16	12	5
1730-4	14	47	137	-	8	14	18	6
1735-9	12	70	112	-	12	15	17	10
1740-4	5	44	94	-	10	11	11	15
1745-9	7	52	90	-	7	14	11	12
1750-4	8	43	72	1	8	9	9	1?
1755-9	8	63	57	-	16	9	15	20
1760-4	5	69	50	1	21	12	6	37
1765-9	2	68	38	1	16	18	3	29
1770-4	3	65	42	1	13	13	10	48
1775-9	7	82	28	-	26	8	4	36
1780-4	8	112	39	1	29	20	12	34
1785-9	8	286	39	6	46	24	5	40
1790-4	9	141	20	2	159	24	9	55
1795-9	9	141	22	1	86	32	11	39
1800-4	20	311	42	8	215	39	11	45
1805-9	19	556	44	14	201	34	6	48
1810-4	21	798	50	3	327	33	20	65
1815-9	33	1,589	49	14	722	37	13	89
1820-4	16	3,344	52	10	1,847	25	8	96
1825-9	19	3,258	39	6	1,407	31	7	78
1830-4	18	2,597	36	4	1,166	26	2	57
1835-9	10	2,722	23	2	1,452	15	7	31

Source: Charity Commission Reports. For details see Clark (1998a).

**Table 2: Return on Mortgage Investments, per cent.**

Decade	Sun Fire Insurance	Charities
1740-9	4.50	4.28
1750-9	4.25	4.31
1760-9	4.62	4.53
1770-9	4.25	4.65
1780-9	4.88	4.68
1790-9	4.75	4.82
Average	4.54	4.54

Source: Charity Commission Reports. Homer, 1977, p.163.

**Table 3: The Return on Land and Housing, 1725-1839**

Period	Land	Land	Land	Housing	Housing	Housing
	Lower Bound	<b>Best Estimate</b>	Upper Bound	Lower Bound	<b>Best Estimate</b>	Upper Bound
1725-9	3.79	<b>4.20</b>	4.66	-	-	-
1730-4	4.03	<b>4.40</b>	4.82	-	-	-
1735-9	4.11	<b>4.51</b>	4.94	-	-	-
1740-4	3.90	<b>4.34</b>	4.83	-	-	-
1745-9	3.59	<b>4.00</b>	4.45	-	-	-
1750-4	3.44	<b>3.84</b>	4.28	-	-	-
1755-9	3.58	<b>4.01</b>	4.49	-	-	-
1760-4	3.42	<b>3.90</b>	4.45	-	-	-
1765-9	2.77	<b>3.24</b>	3.78	-	-	-
1770-4	2.63	<b>3.03</b>	3.49	-	-	-
1775-9	2.88	<b>3.36</b>	3.91	-	-	-
1780-4	3.32	<b>3.77</b>	4.29	4.42	<b>6.16</b>	8.59
1785-9	3.72	<b>4.23</b>	4.80	4.04	<b>5.03</b>	6.27
1790-4	2.69	<b>3.13</b>	3.63	4.12	<b>5.28</b>	6.76
1795-9	3.25	<b>3.71</b>	4.23	3.41	<b>4.47</b>	5.87
1800-4	3.08	<b>3.39</b>	3.73	5.85	<b>7.00</b>	8.37
1805-9	2.98	<b>3.29</b>	3.63	4.56	<b>5.29</b>	6.14
1810-4	3.04	<b>3.34</b>	3.68	4.09	<b>5.02</b>	6.17
1815-9	2.96	<b>3.21</b>	3.48	4.47	<b>5.19</b>	6.02
1820-4	2.99	<b>3.30</b>	3.63	4.11	<b>4.85</b>	5.71
1825-9	2.74	<b>3.02</b>	3.32	4.21	<b>5.07</b>	6.12
1830-4	3.33	<b>3.72</b>	4.15	3.27	<b>3.98</b>	4.83
1835-9	2.25	<b>2.82</b>	3.54	4.04	<b>5.01</b>	6.21

Notes: The upper and lower bounds are the 5 per cent confidence limits.

Source: See table 1.

**TABLE 4: THE COMPOSITION OF THE STOCK OF GOVERNMENT DEBT**

Year	3 per cent Perpetuities (%)	3.5 per cent Perpetuities (%)	4 per cent Perpetuities (%)	5 per cent Perpetuities (%)	Term Annuities (%)	Life Annuities (%)	Short Annuities (%)	Redeemed Land Tax (%)
1731	11	0	62	0	4	1	4	0
1751	74	1	1	0	3	2	4	0
1786	58	0	13	9	9	0	4	0
1817	57	0	8	18	3	0	9	2
1837	57	31	0	0	4	0	3	3

Notes: The debts of the government to the Bank of England and the East India Company are not included above, so that the percentages add to less than 100 per cent.

Source: See text..

**Table 5: GDP, Market Value of Debt, Net Debt Sales.**

Year	GDP adjusted to 1860s (England and Wales) (£. m.)	Market Value of Debt (Great Britain) (£. m.)	Debt/GDP	Net Debt Sales (Great Britain) (£. m.)	Net Debt Sales/GDP (%)
1720	77.9			-0.00	-0.00
1721	77.4			0.46	0.50
1722	78.8			-0.45	-0.48
1723	80.2			-1.35	-1.41
1724	79.1			-0.15	-0.16
1725	76.5			-0.62	-0.68
1726	77.5			-0.08	-0.08
1727	77.8	74.0	0.80	-0.10	-0.11
1728	78.3			-0.32	-0.34
1729	78.1	73.6	0.79	-0.59	-0.63
1730	78.2	72.3	0.78	-0.82	-0.88
1731	78.8	75.7	0.81	0.12	0.13
1732	77.8	75.0	0.81	-1.74	-1.88
1733	78.9	75.7	0.81	-0.36	-0.39
1734	78.8	70.3	0.75	0.34	0.36
1735	80.0	71.5	0.75	0.18	0.19
1736	80.8	74.8	0.78	0.59	0.61
1737	79.8	75.0	0.79	-1.17	-1.23
1738	80.3	72.1	0.75	-1.12	-1.17
1739	81.9	70.8	0.73	-0.69	-0.71
1740	79.0	71.0	0.75	0.27	0.29
1741	78.4	72.8	0.78	1.19	1.28
1742	80.4	74.8	0.78	2.50	2.61
1743	80.6	77.8	0.81	2.01	2.10
1744	80.4	80.5	0.84	3.10	3.24
1745	80.8	80.6	0.84	2.21	2.29
1746	80.4	82.0	0.86	3.86	4.04
1747	81.1	87.3	0.90	4.24	4.38
1748	81.3	92.9	0.96	5.06	5.23
1749	81.6	95.5	0.98	4.86	5.00
1750	84.6	101.5	1.01	-0.45	-0.45
1751	85.9	99.1	0.97	-0.13	-0.13
1752	86.2	102.8	1.00	-0.24	-0.23
1753	85.6	101.2	0.99	-1.55	-1.52
1754	86.0	99.3	0.97	-1.05	-1.03
1755	90.3	95.0	0.88	0.40	0.37

---

1756	89.5	93.2	0.88	2.80	2.62
1757	91.3	96.5	0.89	3.17	2.92
1758	92.0	105.9	0.97	5.43	4.96
1759	91.9	104.7	0.96	7.22	6.60
1760	93.1	108.6	0.98	9.24	8.34
1761	94.2	106.6	0.95	11.99	10.70
1762	92.9	117.8	1.06	10.05	9.09
1763	94.5	148.3	1.32	4.62	4.10
1764	95.3	146.6	1.29	0.13	0.12
1765	98.5	151.8	1.29	-0.27	-0.23
1766	99.6	153.4	1.29	0.44	0.37
1767	100.1	151.9	1.27	-0.08	-0.06
1768	100.1	157.8	1.32	-1.15	-0.96
1769	101.1	144.3	1.20	-1.93	-1.60
1770	110.1	140.0	1.07	-0.85	-0.65
1771	110.8	140.8	1.07	-0.75	-0.57
1772	111.6	149.7	1.13	-0.51	-0.38
1773	112.3	143.0	1.07	1.37	1.03
1774	112.7	142.5	1.06	-1.36	-1.01
1775	117.0	143.6	1.03	-1.21	-0.87
1776	117.8	144.7	1.03	3.12	2.23
1777	119.9	136.1	0.95	4.30	3.01
1778	121.7	128.1	0.88	5.98	4.13
1779	123.1	129.3	0.88	7.90	5.39
1780	122.5	133.4	0.91	11.30	7.75
1781	126.3	149.8	1.00	12.20	8.12
1782	127.0	153.5	1.02	15.15	10.02
1783	125.5	182.6	1.22	11.37	7.60
1784	125.8	168.9	1.13	4.87	3.25
1785	127.5	177.5	1.17	1.06	0.70
1786	128.9	220.4	1.44	0.51	0.33
1787	131.0	222.0	1.42	-1.36	-0.87
1788	133.4	224.6	1.41	0.10	0.07
1789	135.1	226.1	1.41	-0.41	-0.26
1790	146.3	231.4	1.33	-0.48	-0.28
1791	150.0	244.4	1.37	-0.13	-0.08
1792	153.1	253.9	1.39	-2.07	-1.14
1793	157.7	224.0	1.19	6.70	3.57
1794	163.6	213.5	1.10	12.40	6.37
1795	177.5	221.4	1.05	22.80	10.79
1796	183.4	258.8	1.19	32.00	14.66
1797	188.1	245.3	1.10	28.30	12.64
1798	195.5	248.2	1.07	15.30	6.57
1799	205.6	308.6	1.26	19.70	8.05
1800	229.7	350.4	1.28	23.50	8.59
1801	232.3	355.3	1.28	22.60	8.17

---

---

1802	233.6	428.2	1.54	13.00	4.68
1803	241.2	406.8	1.42	10.60	3.69
1804	253.1	385.6	1.28	14.80	4.91
1805	276.1	415.2	1.26	17.70	5.38
1806	281.6	441.0	1.32	11.00	3.28
1807	288.8	456.5	1.33	11.20	3.26
1808	292.6	505.2	1.45	12.50	3.59
1809	298.7	515.8	1.45	11.60	3.26
1810	326.3	524.4	1.35	9.80	2.52
1811	328.3	526.4	1.35	14.80	3.79
1812	336.6	506.0	1.26	22.10	5.52
1813	341.0	537.1	1.32	30.30	7.46
1814	341.7	597.5	1.47	39.50	9.71
1815	327.8	644.8	1.65	18.60	4.77
1816	325.9	617.8	1.59	-4.70	-1.21
1817	326.1	702.2	1.81	-1.85	-0.48
1818	327.9	745.6	1.91	-1.23	-0.31
1819	329.0	718.5	1.83	2.55	0.65
1820	322.1	669.6	1.75	-7.03	-1.83
1821	316.1	714.6	1.90	-4.09	-1.09
1822	315.0	758.8	2.02	-3.21	-0.86
1823	314.1	744.9	1.99	-2.64	-0.71
1824	320.3	828.9	2.17	-3.70	-0.97
1825	332.8	789.6	1.99	-7.06	-1.78
1826	336.0	726.0	1.82	1.51	0.38
1827	335.2	744.2	1.86	0.56	0.14
1828	339.7	758.0	1.87	-2.33	-0.58
1829	342.2	786.7	1.93	-1.77	-0.43
1830	339.6	772.7	1.91	-1.79	-0.44
1831	341.6	701.9	1.73	-1.28	-0.32
1832	346.6	716.0	1.74	0.66	0.16
1833	348.9	745.3	1.79	-0.56	-0.14
1834	352.5	764.4	1.82	-0.45	-0.11
1835	351.1	764.4	1.83	16.82	4.02
1836	361.6	769.8	1.79	1.61	0.37
1837	368.4	767.4	1.75	-1.10	-0.25
1838	378.8	779.6	1.73		
1839	388.8				
1840	392.9				
1841	397.8				

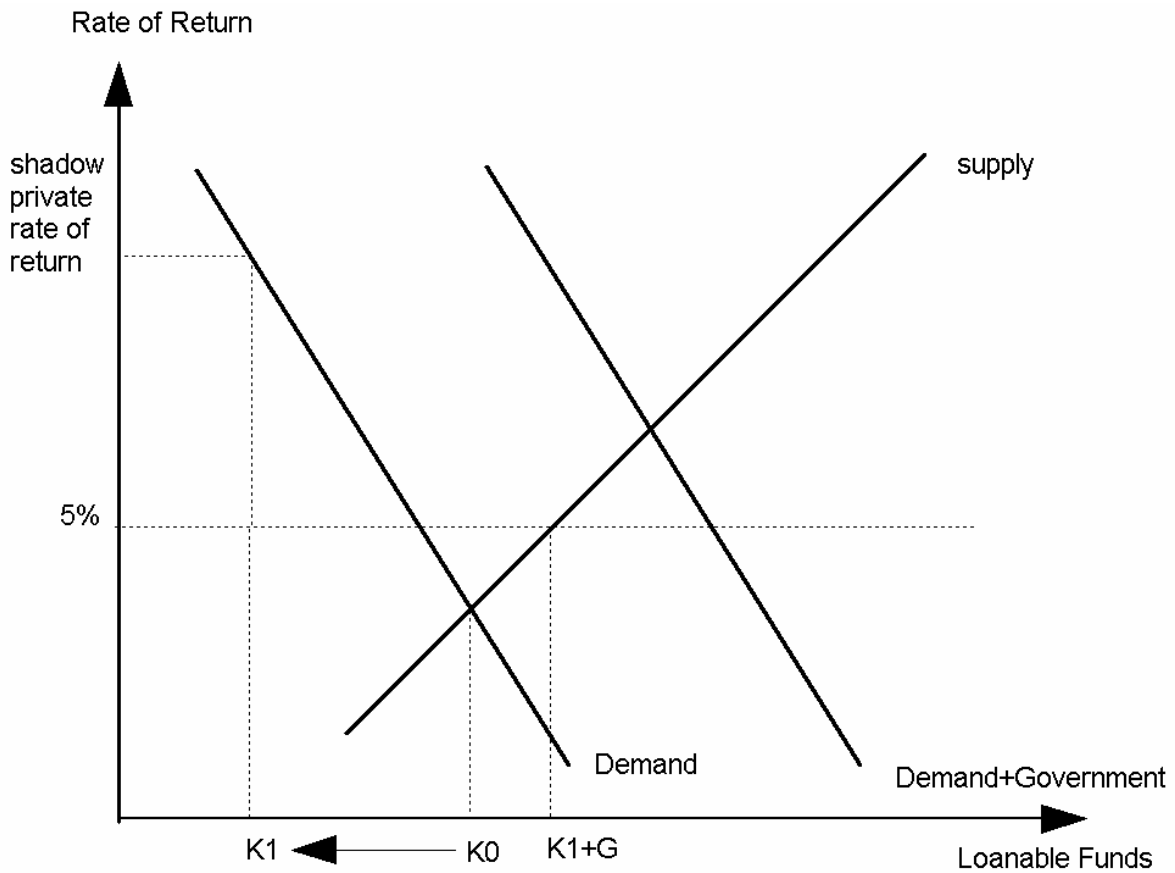
---

**Table 6: Five Year Averages of Debt/GDP etc.**

Period	Debt /GDP	Deficit /GDP (%)	Military Expenditure /GDP (%)	Debt Service/ GDP (%)	Net Land and House Rents /GDP (%)	“Shadow” return on bonds (%)	Consol/3% Annuity Return (%)
1720-4	-	-0.31	2.07	-	-	5.41	-
1725-9	0.80	-0.37	2.35	3.13	28	5.61	3.41
1730-4	0.79	-0.53	2.40	2.98	27	5.27	3.15
1735-9	0.76	-0.46	2.41	2.77	27	4.89	2.96
1740-4	0.79	1.90	5.39	2.89	26	3.95	3.05
1745-9	0.91	4.19	6.93	3.58	24	4.45	3.40
1750-4	0.99	-0.67	2.47	3.16	26	3.89	2.93
1755-9	0.91	3.50	6.76	3.11	28	4.28	3.34
1760-4	1.12	6.47	10.96	4.25	25	4.21	3.79
1765-9	1.28	-0.50	3.50	4.48	25	4.24	3.39
1770-4	1.08	-0.32	3.00	3.83	25	4.45	3.48
1775-9	0.96	2.78	6.08	3.82	26	4.45	4.03
1780-4	1.06	7.35	9.78	5.02	24	5.39	5.11
1785-9	1.37	-0.01	3.07	5.60	22	4.75	4.18
1790-4	1.28	1.69	4.30	4.90	23	4.96	3.83
1795-9	1.13	10.54	11.92	5.72	20	5.23	5.25
1800-4	1.36	6.01	10.82	6.37	21	5.21	4.83
1805-9	1.36	3.75	12.56	6.36	20	5.75	4.77
1810-4	1.35	5.80	15.18	6.42	21	5.63	4.81
1815-9	1.76	0.68	6.91	7.81	20	5.47	4.33
1820-4	1.97	-1.09	4.06	7.87	19	4.95	3.88
1825-9	1.90	-0.45	3.90	6.97	20	5.02	3.56
1830-4	1.80	-0.17	3.23	6.51	18	5.13	3.51
1835-9	1.77	1.38	2.84	6.05	18	4.91	3.29

Source: Table 5. Clark (2001).

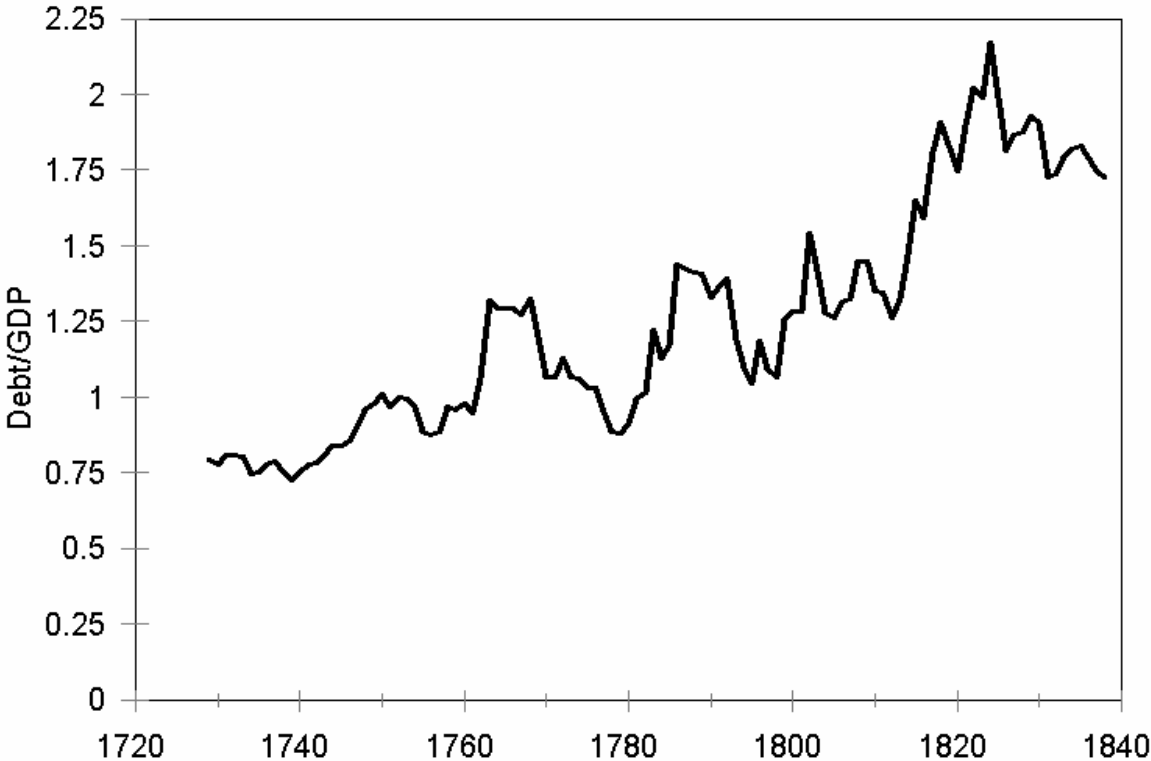
**Figure 1 : Crowding Out With Usury Laws**



Notes: The usury limit is assumed to be 5 per cent. The demand schedule on the right is the demand when the government has issued debt.

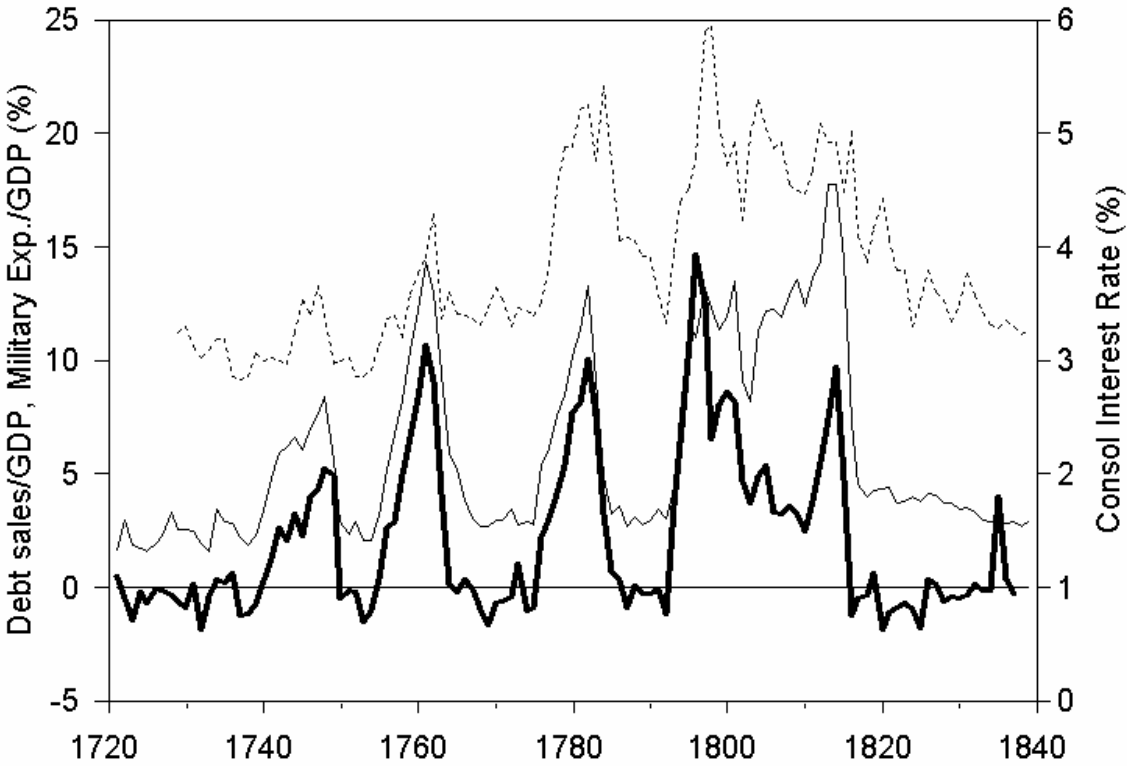
Source: See the text.

**Figure 2. The Market Value of Government Debt Relative to GDP (1727-1839)**



Source: See the appendix.

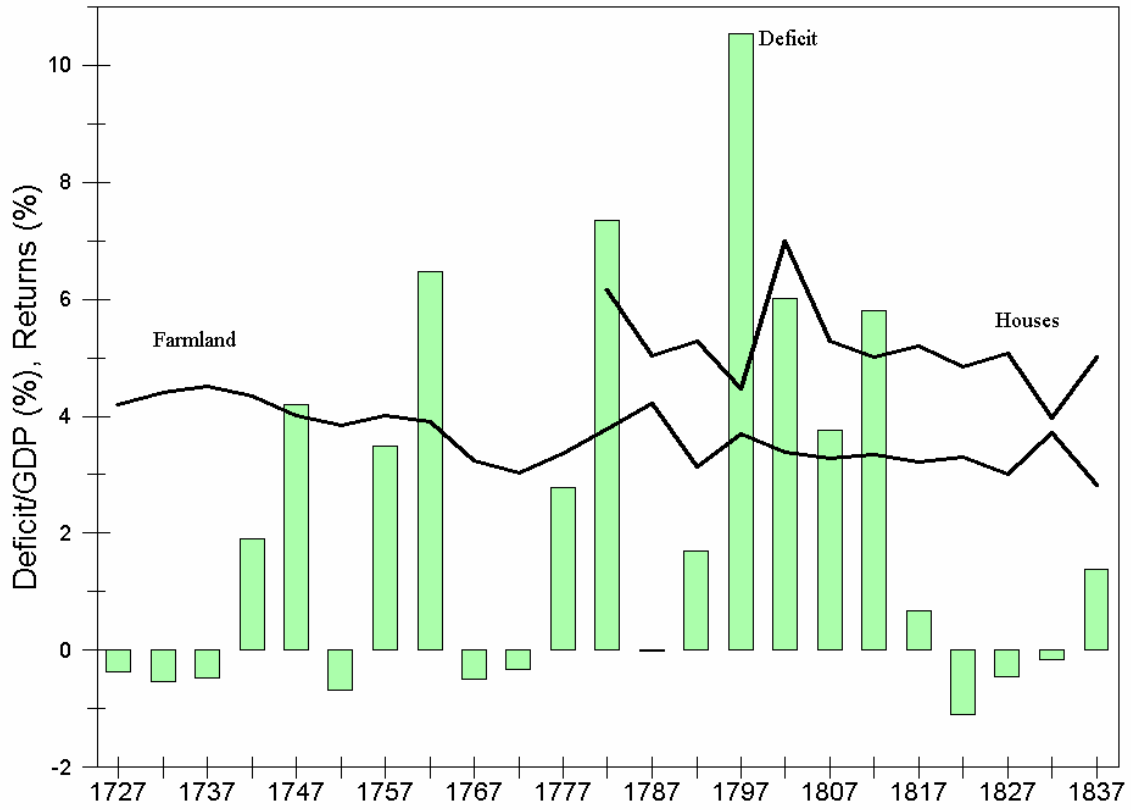
**Figure 3: Net Receipts From Debt Issues and Military Expenditures as a Percentage of GDP, 1727-1840**



Note: The bold line shows net receipts from the sale of debt as a percentage of GDP. The thin line shows military expenditures as a percentage of GDP. The dotted line shows the 3 per cent annuities or consol interest rate in percent.

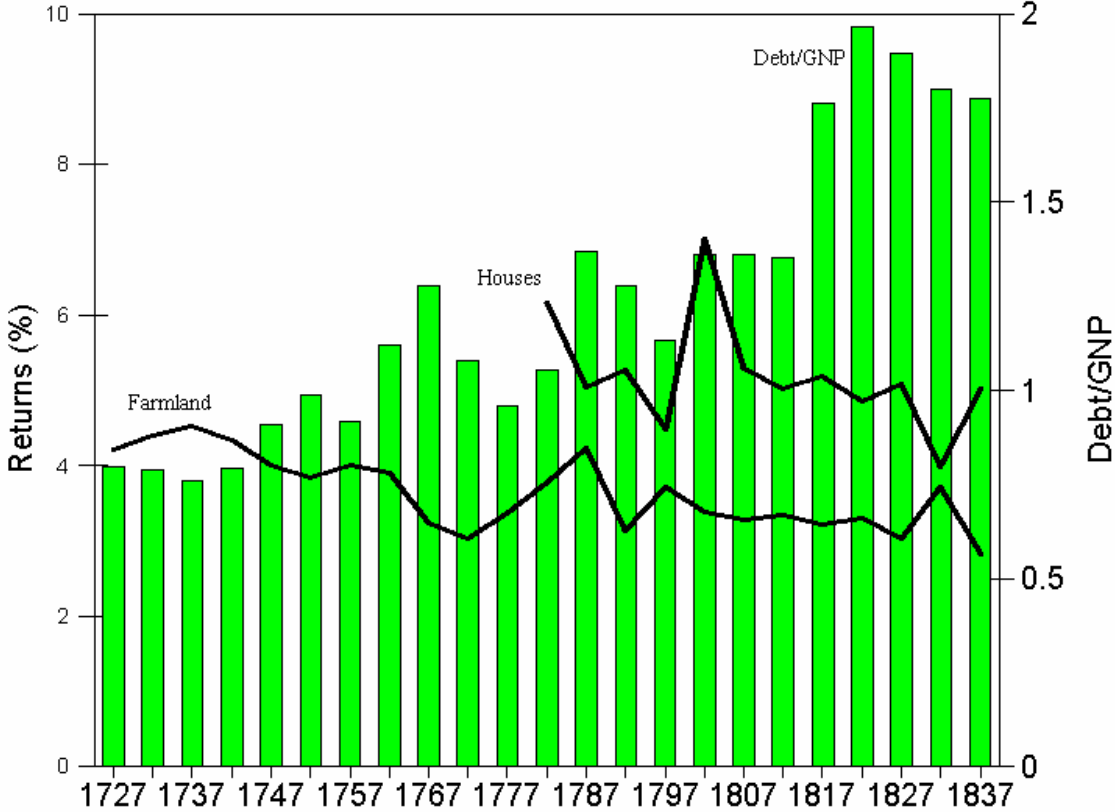
Source: See the appendix.

**Figure 4: The Return on Land and Houses Compared to Net Debt Sales, 1727-1840**



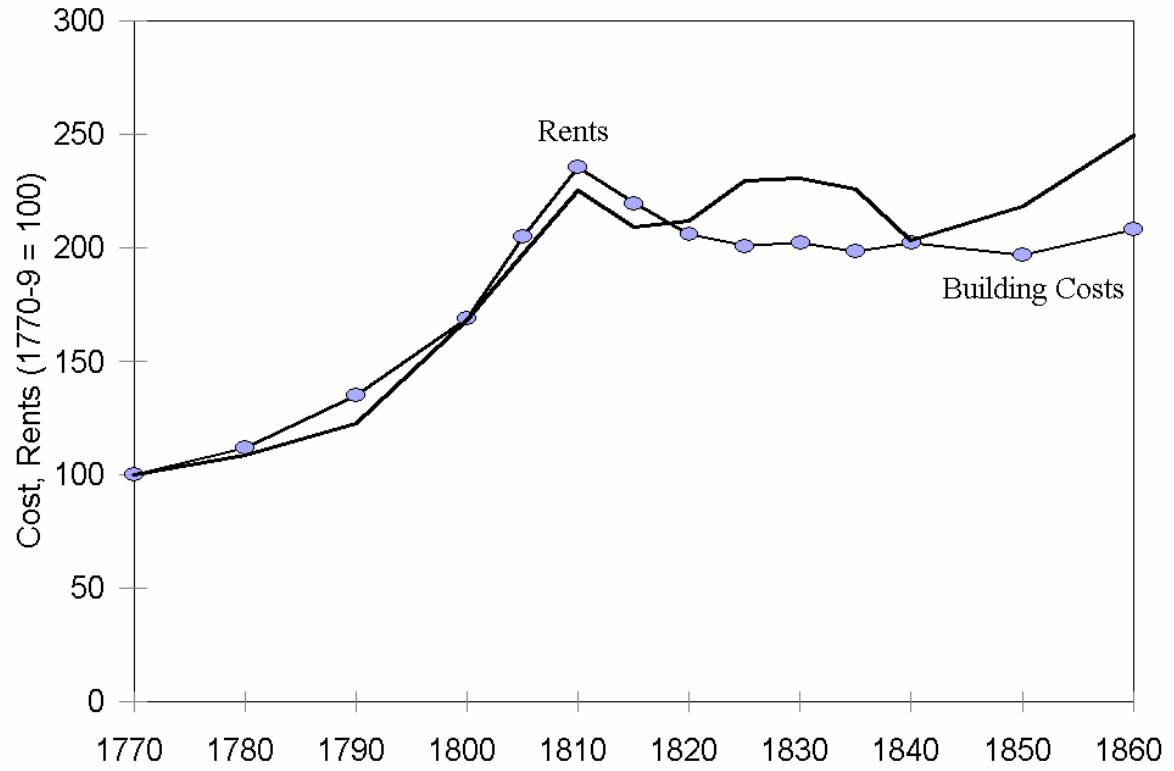
Source: See the text.

**Figure 5: The Return on Land and Houses Compared to the Debt, 1727-1840**



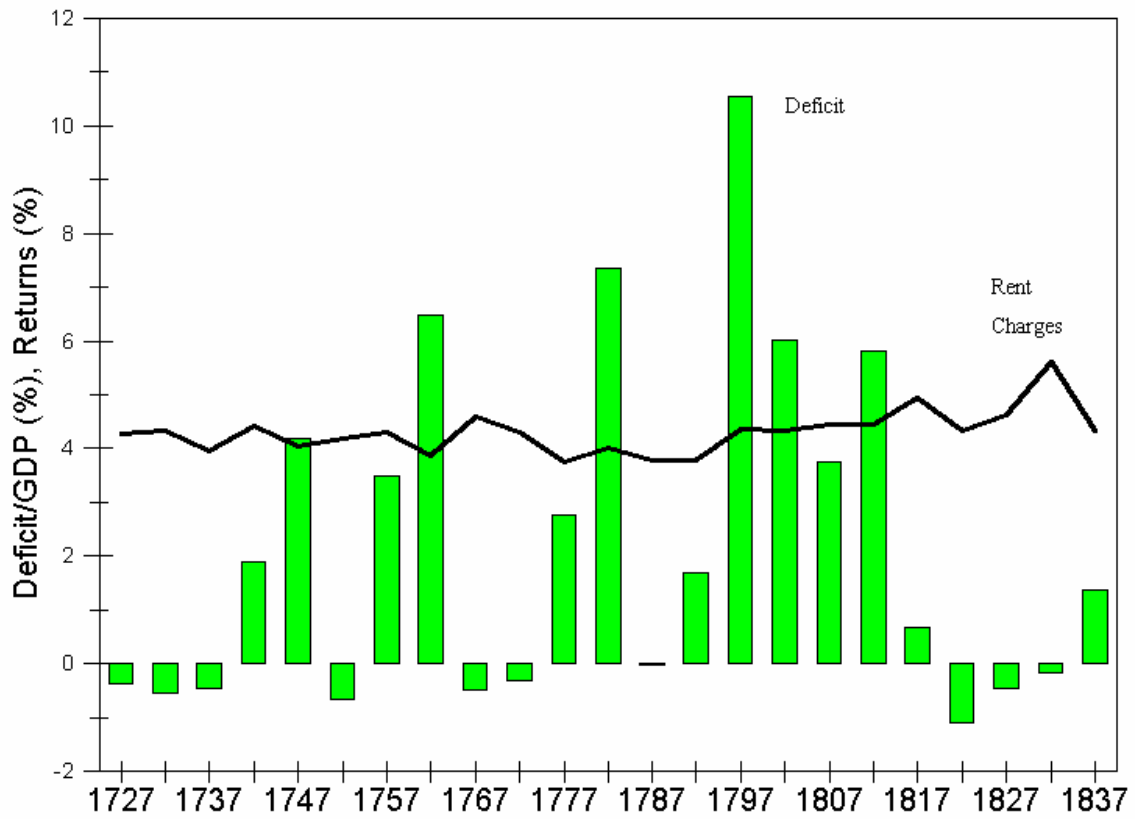
Source: See the text.

**Figure 6: Housing Rents and Construction Costs, 1770-1869**

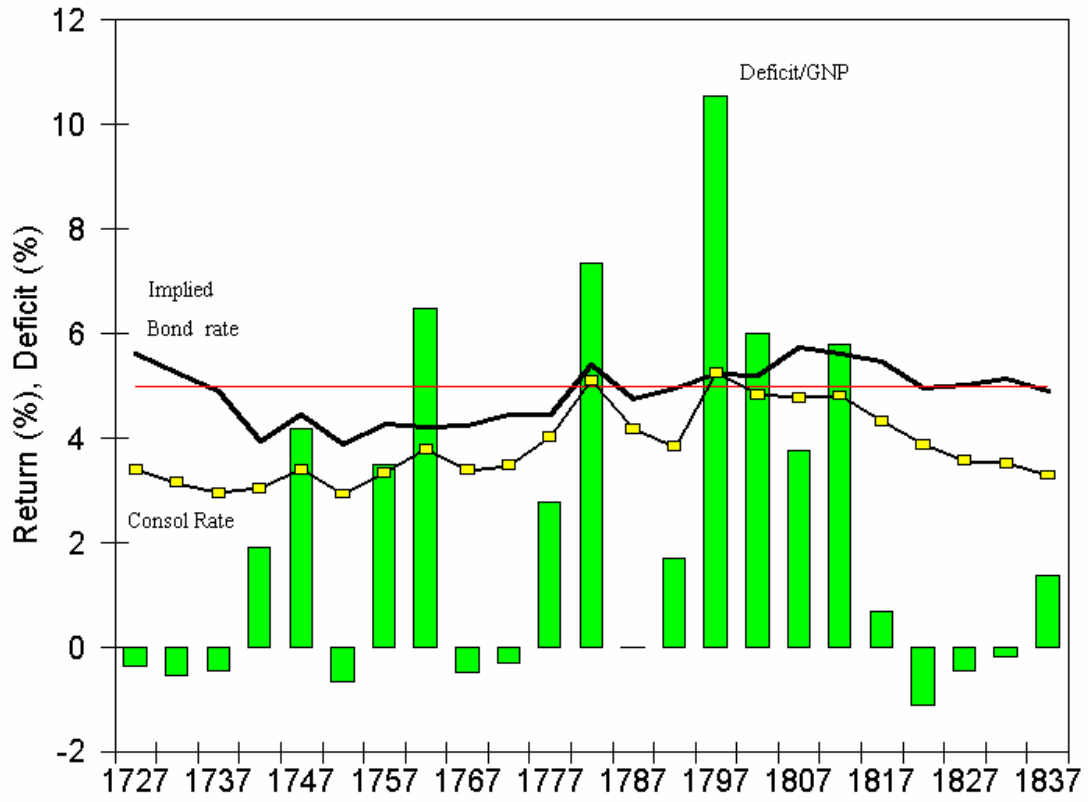


Source: Clark (2001).

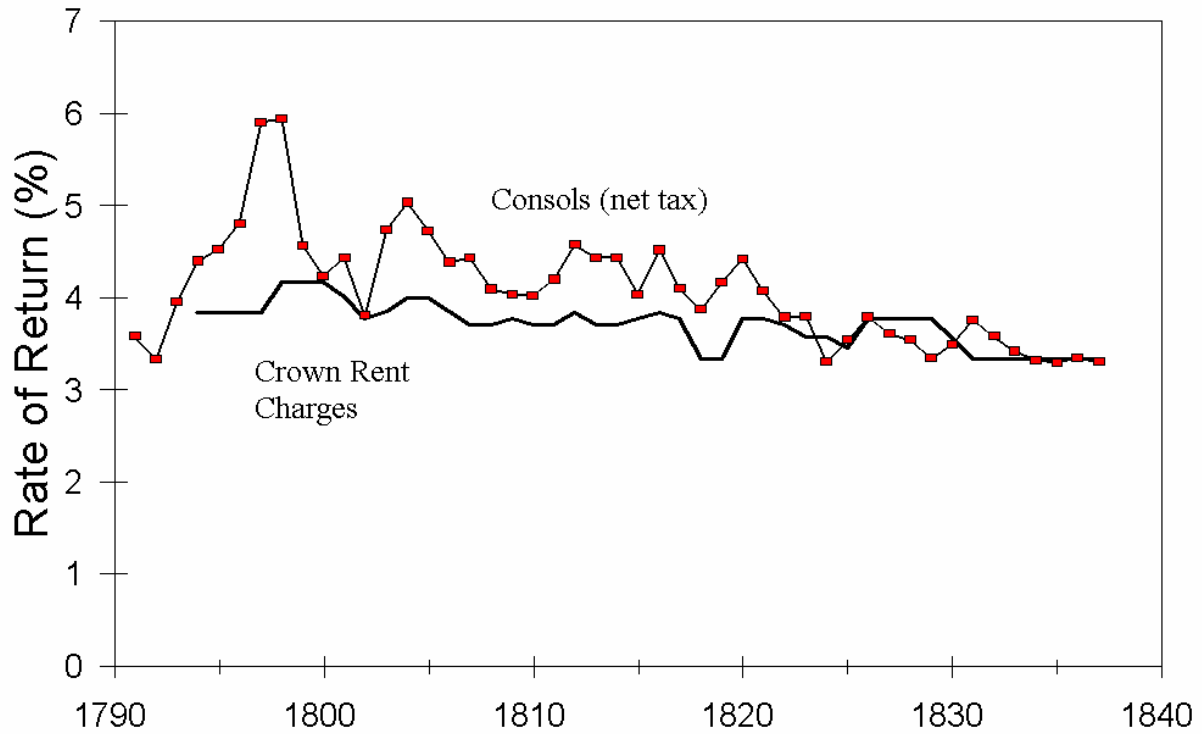
Figure 7: The Return on Rent Charges Compared to the Deficit, 1727-1839



**Figure 8: The Return on Bonds Compared to the Deficit, 1727-1840**



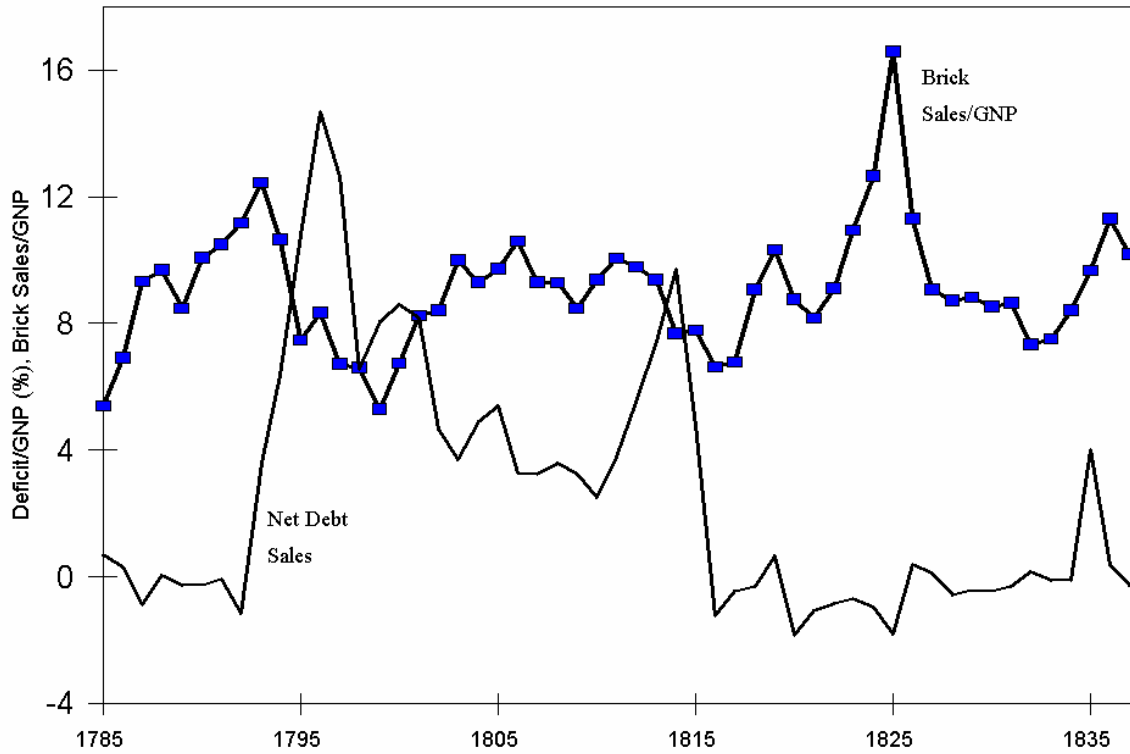
**Figure 9: The Return on Consols and Crown Rent Charges, 1790-1840**



Note: The income tax paid on consols has been assumed to be 10 per cent for the years 1799-1802, 1806-1816, 5 percent for 1803-4, and 6.25% for 1805.

Source: The tax rates are from Hope-Jones (1939), pp. 15, 23-29.

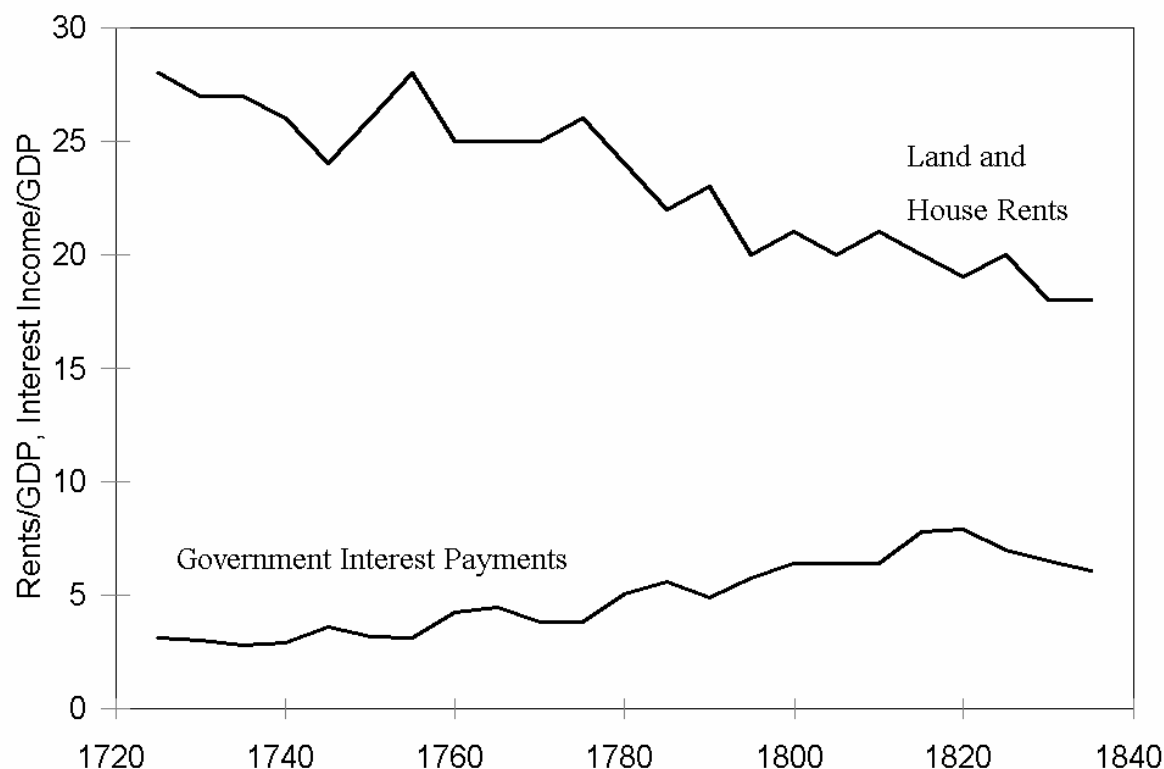
**Figure 10: Brick Production and Debt Sales, 1785-1837**



Notes: Brick production is measured as an index of production relative to GDP set to average 10 from 1785 to 1837.

Source: See text.

**Figure 11: Debt Service and Land and House Rents as a per cent of GDP**



Notes: Land and house rents as a share of GDP are for England and Wales. Gross house rents have been reduced by an allowance for repairs and depreciation, calculated from the average difference in rates of return between land and housing. Housing here includes public houses, shops and other commercial buildings.

Source: Table 6.

<sup>1</sup> See, for example, North and Weingast (1989), Olson (1993), p. 574, Cameron (1989), p. 155.

<sup>2</sup> See, for example, Weir (1989).

<sup>3</sup> These ratios are calculated using the nominal value of government debt only.

---

<sup>4</sup>Assuming that returns to capital were 30 per cent of GDP, and that the marginal return to capital was the same as the average return.

<sup>5</sup>See, for example, Heim and Mirowski (1987).

<sup>6</sup>If the war expenditures were financed completely by a reduction in investment so that consumption was unaffected then the demand for housing would be unaffected by the government debt.

<sup>7</sup>Turner (2000) finds an even lower price elasticity of  $-0.25$ .

<sup>8</sup>The military expenditures which caused the debt would imply lower private incomes, and hence lower levels of private saving.

<sup>9</sup>See Barro (1987).

<sup>10</sup>The details of this calculation are given in the appendix. After 1817 when Britain and Ireland had joint accounts the debt attributed to Britain is the share of the debt which was British in 1817.

<sup>11</sup>The details of these estimates are given in Clark (2001).

<sup>12</sup>The capital stock is from Feinstein (1988), Appendix, pp. 439, 464-5.

<sup>13</sup>This number is very close to the government deficit, defined as expenditures minus tax receipts, except that it excludes changes in the balance in the Treasury. Again the details of the calculation are discussed in the appendix.

<sup>14</sup>See for example, Heim and Mirowski (1987), Oppers (1993).

<sup>15</sup>These figures misreport exactly which year some military expenditures occurred. But they will correctly reveal the overall pattern of expenditures.

---

<sup>16</sup>Quinquennia are used because of the autocorrelation of the errors in the annual series. Even with quinquennia as can be seen the hypothesis of autocorrelation is barely rejected.

<sup>17</sup>I also use supplementary information mainly on land sales from the reports of the Commissioners of Woods, Forests, and Land Revenues for 1797 to 1828, and information on turnpike mortgages from Albert(1972).

<sup>18</sup>The reliability of the Charity Commission Reports as a source on economic conditions in England between 1600 and 1912 is discussed at length in Clark (1995).

<sup>19</sup>The means in column three were calculated from the formula

$$\frac{se_2^2}{se_1^2 + se_2^2} \mu_1 + \frac{se_1^2}{se_1^2 + se_2^2} \mu_2$$

where the se's are the standard errors and the  $\mu$ 's the estimated means. In a similar way the standard error of the combined estimate is calculated as,

$$\sqrt{\frac{se_1^2 se_2^2}{se_1^2 + se_2^2}}$$

<sup>20</sup>The sources of this information is discussed in Clark (2001).

<sup>21</sup>Table 6 in the appendix gives the calculated returns by period.

<sup>22</sup>Clark (1998a) lists the sources of these reports. There were some sales of crown rent charges in all the years 1794 to 1837.

<sup>23</sup>Colquhoun appeals mainly to the empirical observation that large debts had not reduced the stock of investments in the economy. As to why this was the case his account is unclear. He notes, for example, that “every new loan creates a new artificial capital... It should seem to have all the properties of a capital which did not exist before.” (Colquhoun, 1815, p. 281). Elsewhere he seems to hint that the national debt may more effectively allow the circulation of capital.

---

<sup>24</sup>Up till 1817 there were separate accounts for the debt of Britain and of Ireland, but any division of debt between the two countries is somewhat arbitrary. Here I calculate the market value of British debt including Irish debt funded in Britain before 1818. After 1817 I calculate the debt of Britain as the share of UK debt funded in Britain in 1817.

<sup>25</sup>The option for the government to pay off debt holders at face value existed for most stock, leading to periodic conversions of high interest debt into lower interest debt. For this reason the market value of the long term debt rarely exceeded the face value by more than 10 per cent.