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

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By the 1820s as a result of the protracted struggle with France the market value of the British Government debt was 2.3 times GNP. It has been assumed that this debt crowded out much private investment. The paper constructs measures of rates of return on farmland, houses, rent charges, mortgages and bonds in England from 1725 to 1840 from the purchases and sales of charities. These imply that neither the government deficits nor the mounting debt displaced much private investment. By examining the balance of merchandise trade the paper also argues that the government debt was mainly financed domestically. The rise of government debt in the late eighteenth century must have created great increases in private saving. The mechanism by which this sudden increase in saving occurred is unclear, and the rise is indeed quite puzzling.

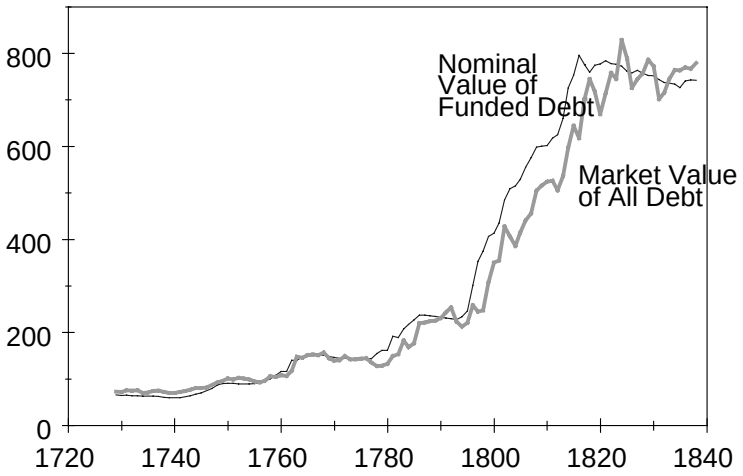
INTRODUCTION

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. These estimates are constructed to measure how much either the government deficit or the stock of government debt reduced private investment in the Industrial Revolution period.

From 1692 to 1815 the British government was engaged in a protracted struggle with the French for military predominance that is sometimes called the "Second Hundred Years War." War expenditures were a heavy burden on the government, typically accounting for over 90% of government expenditure before 1799. Most of the war expenditures were financed by government borrowing, thus greatly increasing the nominal stock of government debt over time. The market value of government debt is, the amount the government would have had to pay at any time to buy out its debt is however, the more meaningful economic quantum. The market value is calculated by dividing up government debt into its various constituent elements - 3%, 3.5%, 4%, and 5% 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.[1]

[1]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.

FIGURE 1: THE MARKET VALUE OF GOVERNMENT DEBT COMPARED TO THE NOMINAL VALUE OF FUNDED DEBT, 1727-1840 (£ m.)



Notes: Values are given in £ million at current prices.

Source: See the appendix.

The market value of the debt got very large over this period compared to the net reproducible wealth of Britain. Thus by 1830 government debt was worth 78% of the net value of reproducible assets in the economy, compared to 36% in 1760.[2] Indeed if we look at the estimates of the value of all assets in the economy in this period we see that government debt was much larger than the value of all structures in the economy (valued at £518 million). Government debt in 1830 would represent 25% of the private non-human wealth of individuals. Land was the major component at 44%. The debt to GNP ratio was correspondingly large. Using the estimates of nominal GNP detailed in the appendix at its maximum in the 1820s the market value of government debt was 2.3 times GNP. This can be compared to the US debt burden of about .70 times GNP in 1992, and the debt burden in 1946 of 1.3 times GNP (Economic Report of the President, 1992, p. 385).[3] Figure 2 shows the ratio of government debt to GNP from 1727 to 1840.

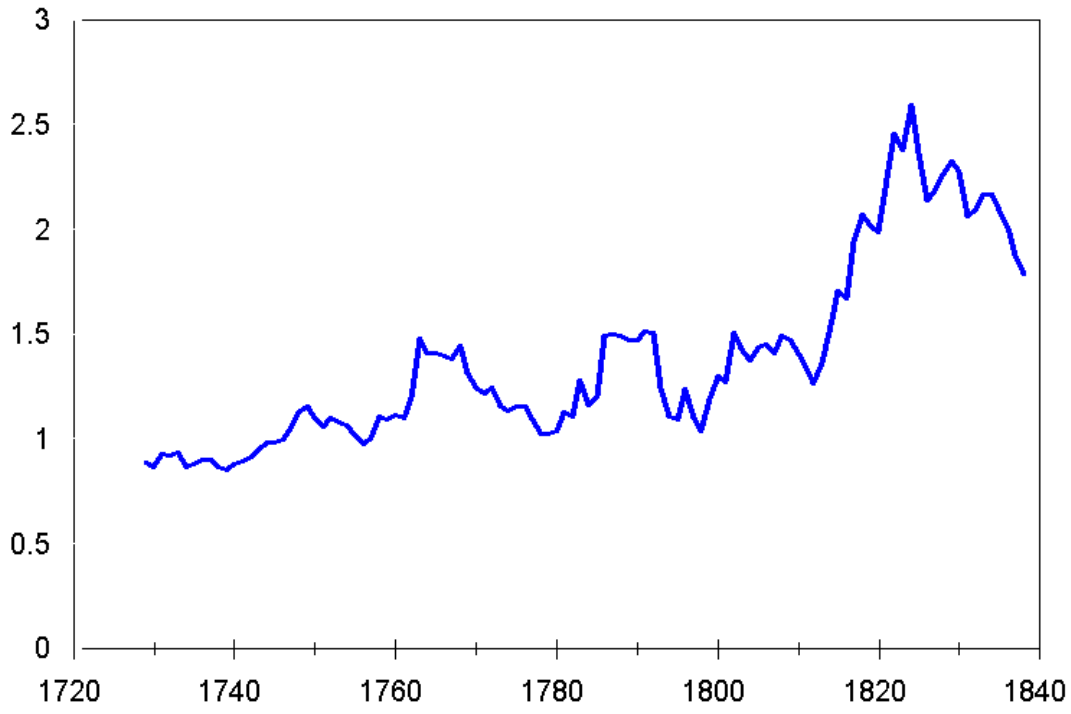
We can also construct a series on the net receipts from borrowing of the government in each year relative to GNP, which shows the net cash flow into the government from sales of new debt minus payoff of old debt.[4] Net receipts from debt sales, which measures the amount of resources the government commanded 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.[5] 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 GNP. In 1761 the government net receipts from borrowing reached 12% of GNP, and in 1796 a remarkable 15%. There were net receipts from borrowing

[2]The capital stock is from Feinstein (1988), Appendix, pp. 439, 464-5.
[3] These ratios are calculated using the nominal value of government debt only.
[4] 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.
[5]See for example, Heim and Mirowski (1987), Oppers (1993).

FIGURE 2: THE MARKET VALUE OF GOVERNMENT DEBT RELATIVE TO GNP

1727-1839



Source: See Appendix 1.

above 10% of GNP also in 1762, 1782, 1795, 1797, and 1814. Figure 3 shows also military expenditures as a percentage of GNP.[6] We can compare this to a measured government deficit relative to GNP which reached a maximum of 3.8% 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 1840 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% 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 generally the years of large military expenditures. This suggests to some that government borrowing to finance wars in Britain in this period crowded out private capital. Individual investors were clearly aware of the choices between different investments even in the early eighteenth century, and a rise in the rates on government debt would seemingly imply a rise also in private rates.[7] However the consol rate depended not just on private market rates but also on the level of investor confidence in the government's ability to honor its obligations. There has been little systematic information for this period on the various rates of return in private capital markets.

This paper assembles an array of information on private rates of return from the reports of the Charity Commissioners to measure whether there was indeed crowding out. The information consists of both the return represented by individual sales of land, houses, rent charges and bonds and mortgages, as well as the return inferred from the average rental of land and housing compared to its average price.

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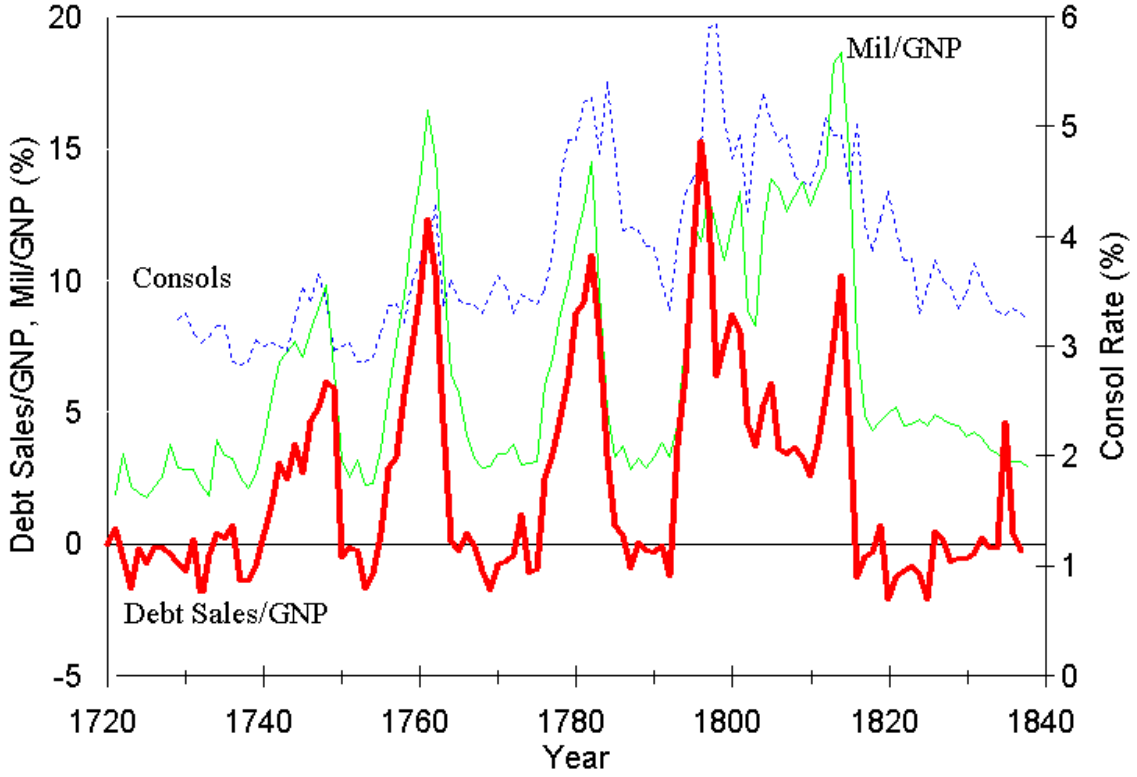
[6] These figures misreport exactly which year some military expenditures occurred. But they will correctly reveal the overall pattern of expenditures.

[7] See, for example, Pressnel (1960) and Joslin (1960).

FIGURE 3: NET RECEIPTS FROM DEBT ISSUES AND MILITARY EXPENDITURES AS A PERCENTAGE OF GNP, 1727-1840



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

THE EFFECTS OF THE WARS AND GOVERNMENT DEBT: THE DEBATE

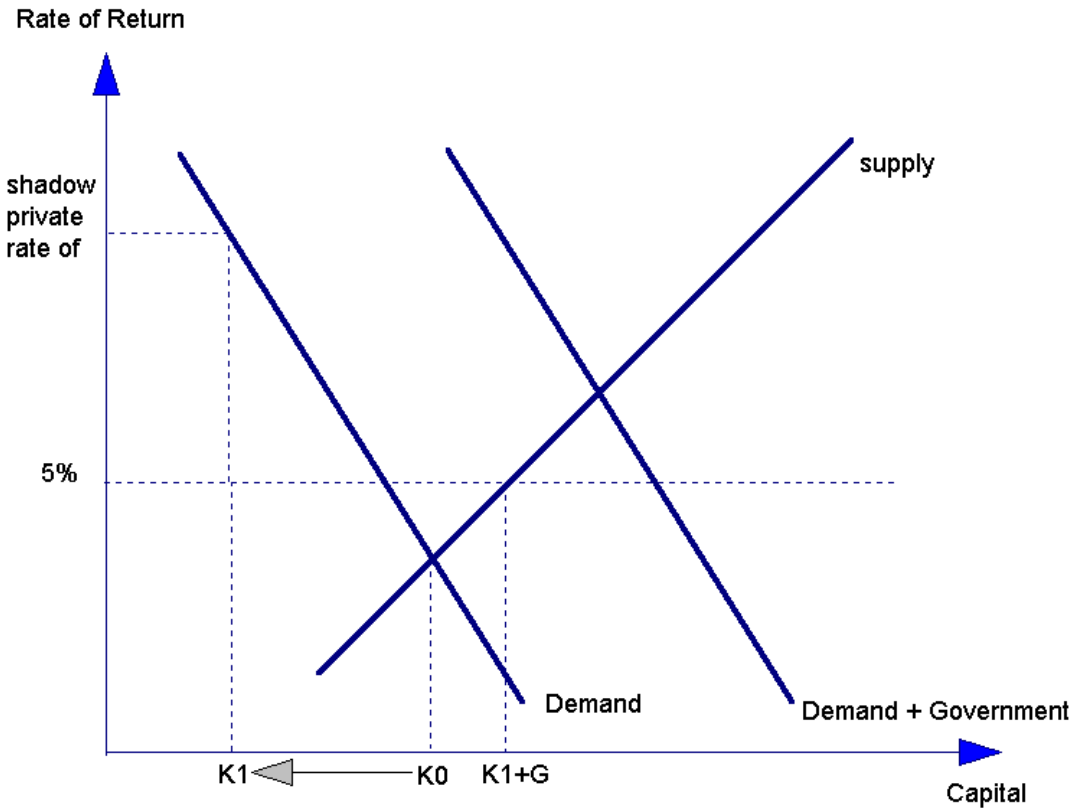
Jeffrey Williamson and others have argued that the large government debt of the French war years must have "crowded out" a very large amount of private investment thus slowing British growth in the early Industrial Revolution. Suppose we conceive consumers as holding a stock of capital in order to smooth 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 reduces 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 4. As the government sells more bonds 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%, 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 4.

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

FIGURE 4: CROWDING OUT WITH USURY LAWS



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

Source: See the text.

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

If the crowding out was approximately one for one as Williamson argues then at the maximum of the debt relative to GNP in the 1820s, when government debt averaged a value of 2.3 times GNP, output would have been depressed by up to 23% as a result of crowding out.[8] 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).

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. Williamson assumes that the supply of capital to this market through private mortgages would dry up since that capital would be diverted to government debt. The reduced supply of housing would have to be rationed among housing demanders by rent increases.[9] But housing prices would not increase proportionally with the rise in rents. If the price of old homes rose significantly above the cost of supplying new ones then there would be nothing to stop existing owners from selling their housing stock to finance the construction of new houses, and hence reaping great profits. They would keep selling till the price of the old housing was driven down to its replacement cost. 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.

[8]Assuming that returns to capital were 30% of GNP, and that the marginal return to capital was the same as the average return.

[9] 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.

The upward movement of rates of return in the housing market means that rates of return on land ownership have to move up also. Land owners have an inducement to sell land to buy houses, or to build housing themselves, while no new mortgages will be available to buy agricultural land. Thus the price of farm land should fall and rates of return on land ownership rise. Similarly the price of rent charges should fall as capital becomes scarce, driving up rates of return on rent charges as well. 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.

This has an important implication. We would expect the government's interest rate to be driven up substantially if it was to compete away private capital, despite the existence of usury laws. If changing the forms of asset holding was relatively costless then we would expect that normal premium that existed on holding land, houses, or rent charges compared to holding government debt in the mid seventeenth century would also hold in the period of high debt. If changing the forms of asset holding was costly then the premium on holding real assets or rent charges should increase as government debt increased. Either way the 'crowding out' argument implies that the rate of return on land, houses, and rent charges should all be increased by increases in government debt.

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 GNP 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.[10] 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.[11] 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.

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[10]The military expenditures which caused the debt would imply lower private incomes, and hence lower levels of private saving.

[11] See Barro (1987).

This paper seeks to determine empirically how much either the war expenditures or the consequent huge government debt reduced the private capital stock and hence slowed the rate of growth in Britain between 1727 and 1840. 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.

RETURNS IN THE PRIVATE CAPITAL MARKET

To get better 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.[12] 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.[13]

Table 1 summarizes the amount of information available by five year periods from 1725 to 1839.

[12] 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).
[13] 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).

TABLE 1: INFORMATION ON THE RETURN ON LAND, RENT CHARGES, BONDS, AND MORTGAGES 1725-1839

	Land			Houses				
Period	Rent/ Price	Rent	Price	Rent/ Price	Rent	Price	Rent Charges	Bonds, Mortgages
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).

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. Further in at least some cases we can see charities adjusting their investment portfolios as the rate of return on 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" (4th 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% interest, and it is noted "It was in the funds but it was sold out to an advantage" (11th Report, p. 283). When part of the church land in Cold Ashby, Northampton was sold in 1819 the money was invested in 3% 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" (13th Report, p. 29). The returns earned by charities seem to have approximated fairly well the rates of return of private owners. Charity owners, for example, earned as high a return from their land purchases as private land purchasers (Clark, 1998b, pp. 71-2).

Charities earned as much on average in the eighteenth century as was charged by the Sun Fire insurance company in London for mortgages. Thus, the decade by decade average returns were:

	Sun Fire	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[14]

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.

[14] Homer, 1977, p.163.

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 π is the rate of inflation. For assets such as land and houses, the real rate of return is

$$r_r = (R/P) - \pi + \rho$$

$$= (R/P) + (\rho - \pi)$$

where ρ 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% 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% which implies an average rate of growth of land values of only 0.45% per year in this interval. Thus the current rate of return on holding land 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 2 shows the calculated return on land and houses by quinquennia for the years 1725-1839 using this data, as well as the 5% 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.[15] This means that for the years before 1720 the

[15] The means in column three were calculated from the formula

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 1.9% 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% of gross rents. Since the average gross return on housing was 4.9% in this period, this implies repairs were about 2.1% of prices.

Figure 6 shows these returns graphed against the government debt sales as a share of GNP. 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 7 shows the return on land and housing plotted against the ratio of debt to GNP. Again there is no sign of any relationship.

I also conduct regression tests of the relationship between these variables to measure what the extent of confidence we can have in what our eyes tell us, that there is no relationship between these variables. Thus to test the effect of deficits I regress

$$RET_{it} = \alpha + \beta DEBTSALES/GNP_t + \gamma t + \varepsilon_{it}$$

where $DEBTSALES/GNP_t$ is net debt sales as a fraction of the GNP, and t is the year. The estimated coefficients are shown in table 3 for returns on land and returns on housing. As expected the estimated relationship between deficits and returns is close to zero in both cases. For land, for example, the estimate is that a 10% deficit would increase the return on land by 0.07%. In the greatest years of government borrowing in such as the late 1790s land prices were not falling relative to rents despite the huge stock of government debt flooding the capital markets.

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

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

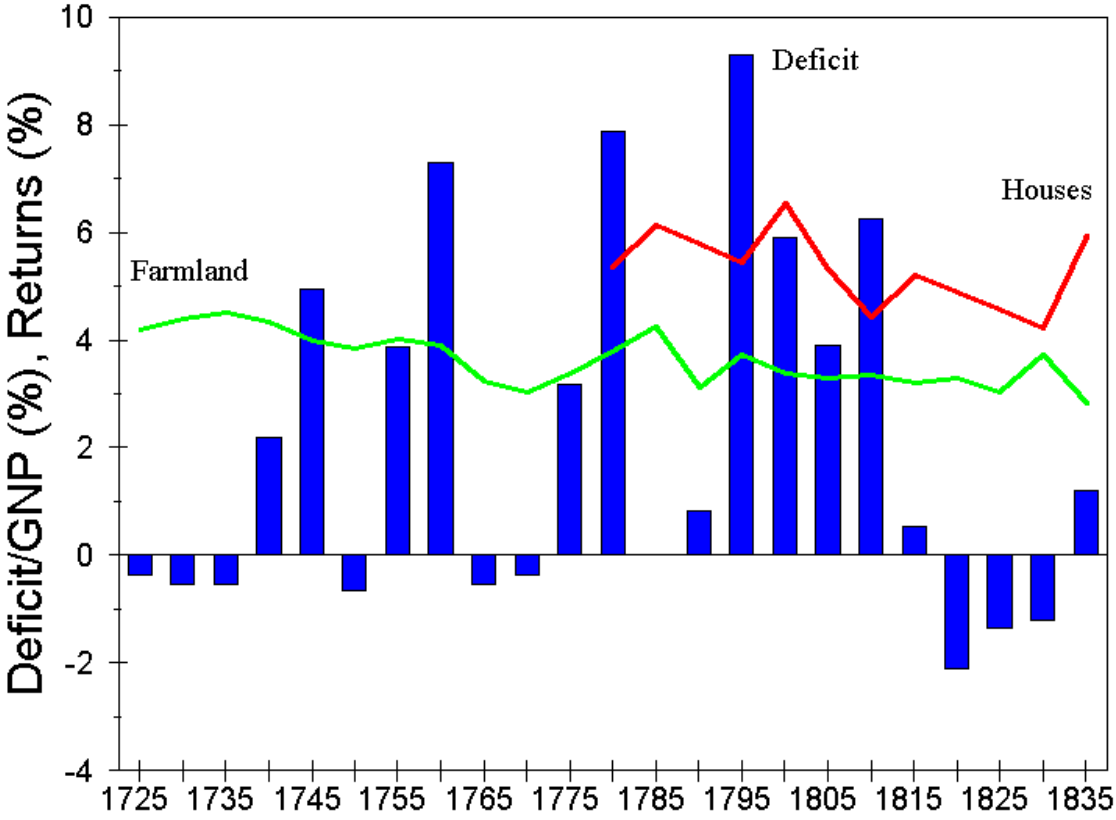
$$\sqrt{\frac{se_1^{\,2} se_2^{\,2}}{se_1^{\,2} + se_2^{\,2}}}$$

TABLE 2: INFORMATION ON THE RETURN ON LAND, RENT CHARGES, BONDS, AND MORTGAGES 1725-1839

	Land			Houses		
Period	Lower Bound	Estimated Return	Upper Bound	Lower Bound	Estimated Return	Upper Bound
1725-9	3.79	**4.20**	4.66	-	-	-
1730-4	4.03	**4.40**	4.82	-	-	-
1735-9	4.11	**4.51**	4.94	-	-	-
1740-4	3.90	**4.34**	4.83	-	-	-
1745-9	3.59	**4.00**	4.45	-	-	-
1750-4	3.44	**3.84**	4.28	-	-	-
1755-9	3.58	**4.01**	4.49	-	-	-
1760-4	3.42	**3.90**	4.45	-	-	-
1765-9	2.77	**3.24**	3.78	-	-	-
1770-4	2.63	**3.03**	3.49	-	-	-
1775-9	2.88	**3.36**	3.91	-	-	-
1780-4	3.32	**3.77**	4.29	3.90	**5.34**	7.32
1785-9	3.72	**4.23**	4.80	4.87	**6.12**	7.70
1790-4	2.69	**3.13**	3.63	4.40	**5.78**	7.59
1795-9	3.25	**3.71**	4.23	4.21	**5.44**	7.03
1800-4	3.08	**3.39**	3.73	5.46	**6.55**	7.87
1805-9	2.98	**3.29**	3.63	4.52	**5.31**	6.24
1810-4	3.04	**3.34**	3.68	3.53	**4.43**	5.56
1815-9	2.96	**3.21**	3.48	4.37	**5.20**	6.17
1820-4	2.99	**3.30**	3.63	4.06	**4.89**	5.88
1825-9	2.74	**3.02**	3.32	3.68	**4.55**	5.64
1830-4	3.33	**3.72**	4.15	3.35	**4.22**	5.32
1835-9	2.25	**2.82**	3.54	4.35	**5.94**	8.12

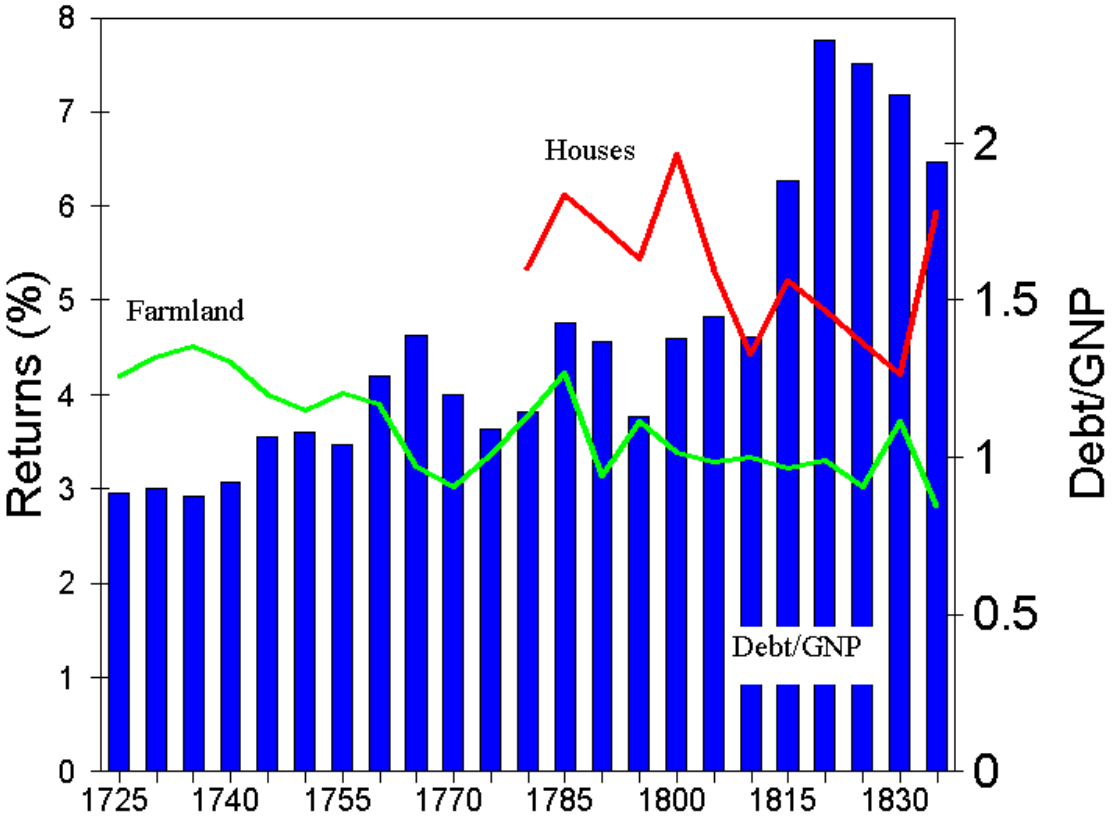
Source: See table 1.

FIGURE 6: THE RETURN ON LAND AND HOUSES COMPARED TO NET DEBT SALES, 1727-1840



Source: See the text.

FIGURE 7: THE RETURN ON LAND AND HOUSES COMPARED TO THE DEBT, 1727-1840



Source: See the text.

TABLE 3: THE ESTIMATED EFFECTS OF DEBT AND DEFICITS ON PRIVATE RETURNS

Dependent Variable	Return on Land (%)		Return on Houses (%)		Return on Rent Charges (%)	
DEBTSALES/ GNP	0.74 (2.17)	-	-0.46 (6.42)	-	-3.38 (2.31)	-
DEBT/GNP	-	.235 (.429)	-	-1.72 (1.05)	-	.619 (.454)
T	-0.011 (.002)	-0.014 (.006)	-0.019 (.014)	0.007 (.021)	.006 (.002)	-0.002 (.006)
MIL/GNP	-	1.25 (2.40)	-	-10.71 (5.88)	- (2.53)	0.359
n	23	23	12	12	23	23
R^2	.56	.57	.23	.47	.28	.30
DW	1.75	1.74	1.94	2.17	2.06	2.20

The standard errors of these estimates imply further that in the case of land we can say with that there is only one chance in twenty that a 10% government deficit raised the return on land by as much as 0.45%. For houses the number of periods where the return is observed is smaller, and the return varies by more from period to period. In this case we can say with 95% confidence that a 10% deficit raised the return on houses by less than 1.06%. Given that the average return on housing was 4.9%, this implies that the deficit must have boosted the real cost of housing by less than one fifth even in 1795-99 when it was at its maximum extent.

In the case of the stock of debt I estimate

$$RET_{it} = \alpha + \beta DEBT/GNP_t + \gamma t + \delta MIL/GNP_t + \varepsilon_{it}$$

where MIL/GNP is military expenditures relative to GNP included for the reasons explained above. Table 3 shows the estimated coefficients. Here again the coefficient estimates suggest either a weak positive relationship between the debt stock and returns for land, and a strong negative relationship in the case of houses. The size of the standard errors, however, means that while we can rule out any positive relationship for houses, for land what we can say is that there is less than one chance in twenty that the increase of the debt by the amount of the GNP would drive up returns on land by 1%. The failure of returns on housing to show any relationship to debt or deficits is particularly interesting because the years 1800 to 1840 were ones of rapid population growth in Britain, and consequently ones where there had to be a steady expansion of the housing stock to house the additions to the population. The resources the government commanded for the wars by borrowing seemingly did not constrict the housing supply by driving down house prices relative to house rents as Williamson anticipated.

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 5 year period is given in Table 1. Figure 8 shows the average return on rent charges by 5 year periods compared to the average government deficit in the same 5 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 2 observations. Again the formal tests shown in

FIGURE 8: THE RETURN ON RENT CHARGES COMPARED TO THE DEFICIT, 1727-1840

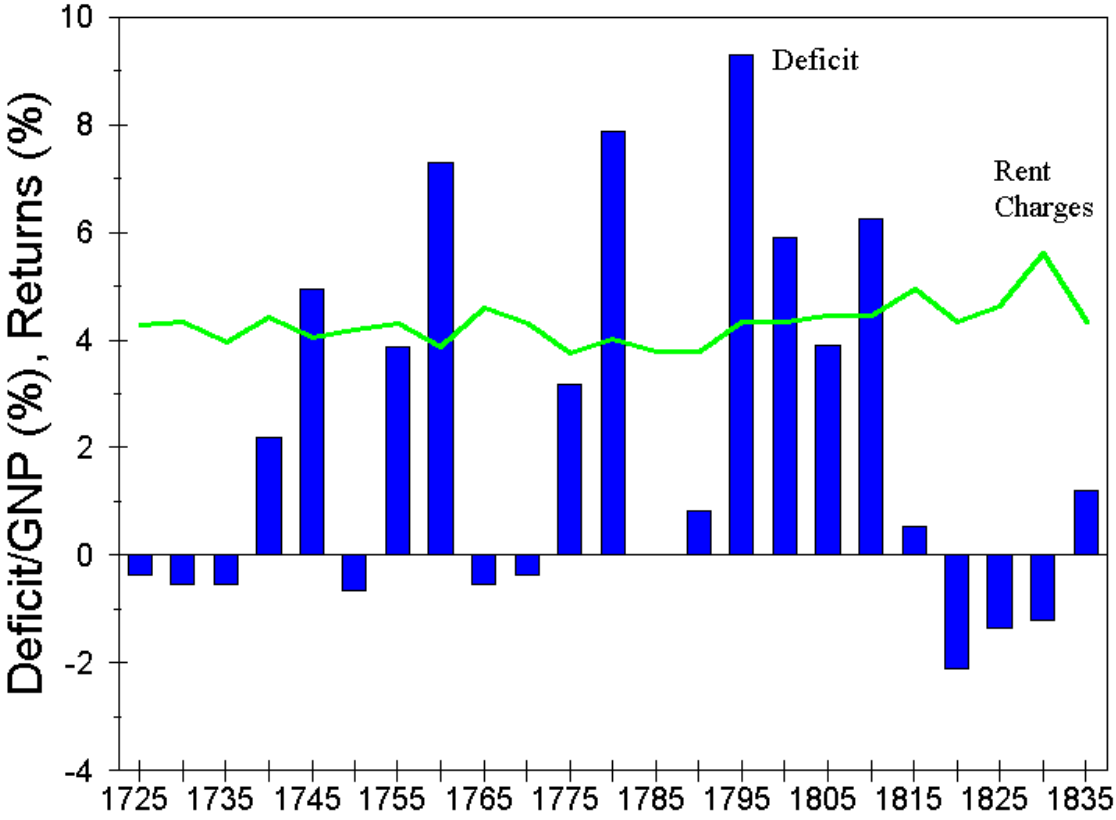


Table 3 suggest no connection between rent charges and the deficit. There is an apparent connection between rent charges and the stock of debt, but this is entirely dependent on the observation for 1830-4.

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% 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 5 year averages of returns assuming that the data is censored at the 5% 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% higher than for bonds, and returns on turnpike mortgages .54% higher than for bonds.

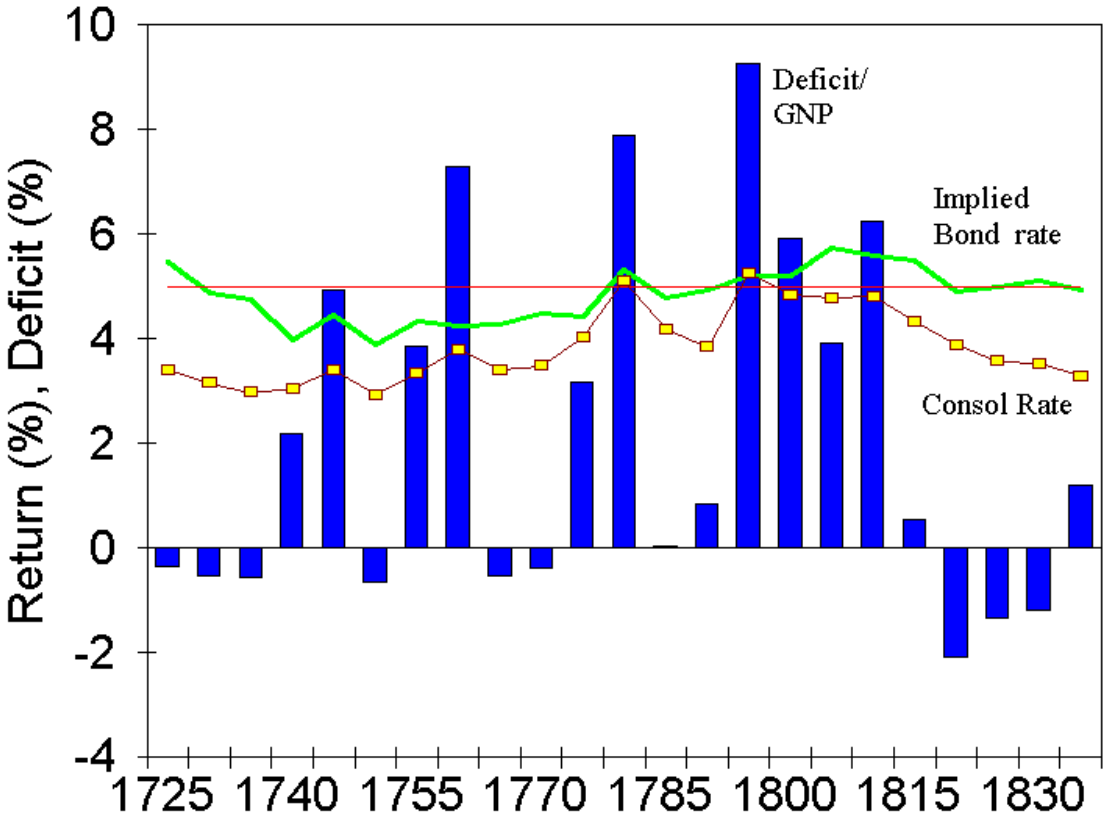
Figure 9 shows the movement of the average returns on these assets. As can be seen the average implied rates on bonds exceeds the usury limit in many years. The rate clearly moves up in the years of substantial deficits. It also clearly is correlated with the rate of return on consols, which is shown 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% rise in the consol rate is associated with only a .4% increase in implied private nominal rates. Thus the estimated relation between the "shadow" private bond rate and the consol rate for five year periods was:

$$RET_t = -3.30 + \underset{(.0028)}{0.0037t} + \underset{(.136)}{0.396RET_{Ct}}$$

$$n = 23,\ R^2 = 0.47,\ DW = .82$$

where RET_t is the average of returns on bonds, mortgages and turnpike mortgages, t is the year, and RET_{Ct} is the return on 3% consols (or annuities). Since there is autocorrelation in the errors in this case the standard error estimates are too low, but the coefficient estimate will be unbiased. Depending on whether a time trend and the ratio of the total value of debt to GNP is included, net debt sales of 10% of GNP raises private bonds rates by

FIGURE 9: THE RETURN ON BONDS COMPARED TO THE DEFICIT, 1727-1840



between .25% and .5%. This is small relative to a base return of close to 5% on these nominal assets. There is no clear association between the total size of government debt and the private bond rate, since a simple time trend included in the regression equation explains the upward movement as well as the level of the debt.

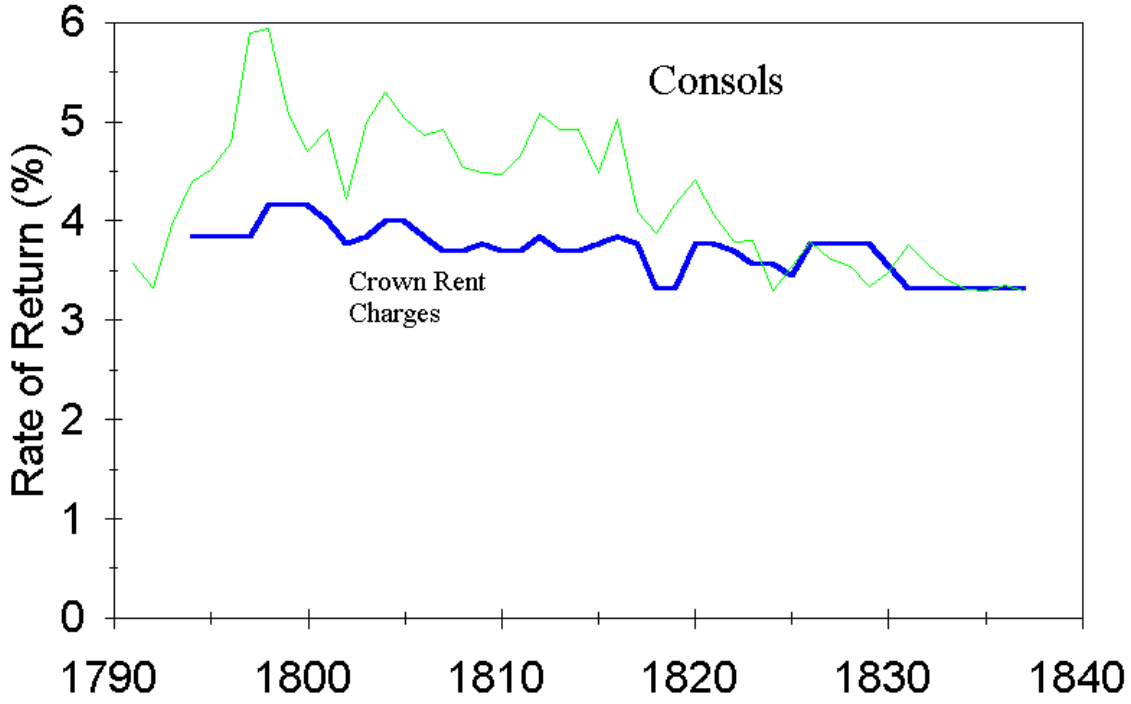
Since the upward movement of private bond rates in the war years is only estimated to be about .5% at maximum, the effect of the wars on the capital stock even if this rate, rather than the rates on land, houses or rent charges, were the measure of the true return on capital would be rather small. If we assume a Cobb-Douglas production function, and assume that depreciation of capital is on average 2% (since most of the capital is structures), then a .5% increase in the interest rate would represent only an 8% increase in the rental cost of capital. If capital received 30% of income the interest elasticity of capital would be 1.4. Thus the capital stock would shrink by 11% and income by 3% in the worst of the war years. Since the government raised an amount by borrowing which was roughly one year of GNP in the years 1793 to 1815, this would imply that each £1 of government debt crowded out less than £0.1 of private capital.

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 rise were the implied rates on private bonds and mortgages. But these implied rates rose proportionately much less than the consol rate, and 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.[16] 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

[16] See Great Britain, Parliamentary Papers (1797, 1802, 1806, 1809, 1812, 1816, 1819, 1823, 1826, 1829, 1830, 1831, 1831-2, 1833, 1834, 1835, 1836, 1837) listed under Parliamentary Papers.

FIGURE 10: THE RETURN ON CONSOLS AND CROWN RENT CHARGES, 1790-1840



Source: See the text.

subject to any potential renegotiation or default by the crown. Figure 10 shows these interest rates compared to consol interest rates. As can be seen while these rates broadly follow the consol rates, for the war period 1794-1815 the consol rate is generally 1-2% 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? Part of the reason may be a perception of greater security in the case of the redeemed rent charge. 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.

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 relative good index of investment in structures in Britain from 1785 on, in the form of statistics on brick production. I thus construct an index of brick production relative to real GNP from 1785 to 1839, using the most recent Crafts and Harley measures of real GNP. Did the size of the government debt have any effect on the pace of housing construction?

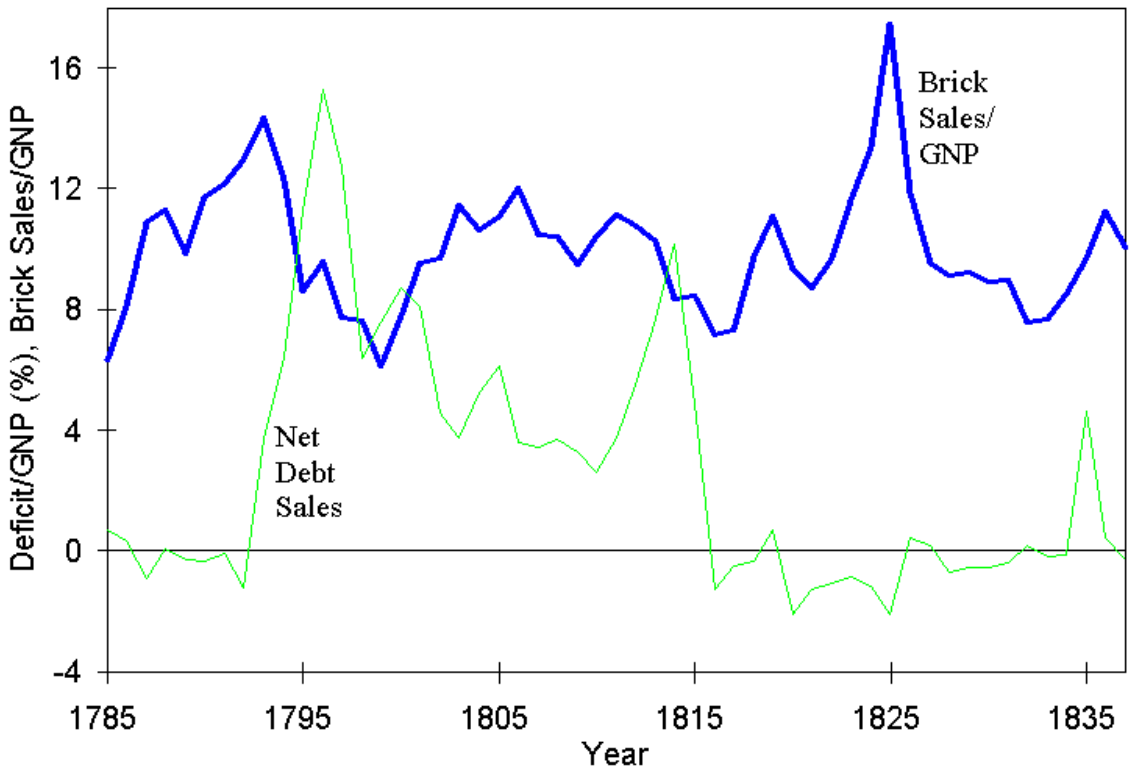
Figure 11 shows the ratio of brick output to real GNP stays roughly constant from 1785 to 1840, with seemingly random fluctuations around the mean, despite the much greater public debt in the period after 1820. The figure also shows net sales of debt as a percentage of GNP in this period. The graph suggests some possible link between brick output and debt sales, but a very modest one. Regressing brick sales relative to GNP against the deficit as a fraction of GNP gives the following estimates (with the standard error in parentheses).

$$BRICKS/GNP_t = 10.3 - \underset{(6.85)}{10.76} DEBTSALES/GNP_t$$

$$n = 53,\ R^2 = 0.05,\ DW = .68$$

$BRICKS/GNP_t$ is an index of brick sales relative to GNP set to average 10 for the years 1785 to 1837. The regression suggests that higher net sales of debt were associated with lower brick production, though the effect is

FIGURE 11: BRICK PRODUCTION AND DEBT SALES, 1785-1840



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

Source: See text.

not statistically significant. As can be seen the error terms display serial correlation, so that the standard error of the estimate will also be too low, so that even more strongly the data does not show any statistically significant association between debt sales and brick sales. The estimated coefficient on debt sales suggests that a government deficit that was 10% of GNP would be associated with brick sales that were 11% lower than average. Thus the data here indicates that constuction activity would decline only slightly what would be predicted from the level of GNP in response to the large deficits of the late 1790s.

It is clear from figure 11 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. Regression analysis suggests that even when we look at changes in the stock of debt versus changes in the level of brick sales there is no association.

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 the deficit was associated only with modest increases in some nominal rates of return. Neither debt nor war expenditu had any impact on brick production. Another illustration of the small impact of government debt comes if we consider the net receipts of the government from borrowing in each year - that is, the sales of debt minus the buying back of government debt. The finding of little evidence of crowding out in response either to the size of the debt or sales of government debt implies that consumption had to drop by close to 15% of GNP in some years such as 1796 through the sale of debt. The percentage drop in private consumption would be even greater because of the normal burdens of investment and taxation.

There seem to be three possible explanations of these findings.

1. The issuance of government debt brought forth an equivalent amount of private saving in anticipation of future taxes, through Ricardian Equivalence, as Barro would argue.

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

3. The capital markets of the period before 1840 were segmented so that crowding out did take place but not in the capital markets for which we have rates of return. Heim and Mirowski (1987, 1991) argue strongly that in this

period there was a segmented capital market, and Buchinsky and Polak (1993) provide evidence for regional segmentation of the capital market.

4. 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.

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 GNP. 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 £1000 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, pitiably 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 3% (Neal, 1991, pp. 68-72). Also Neal focuses on the war years, while we see above that the market value of government debt relative to GNP 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 Amersterdam 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.

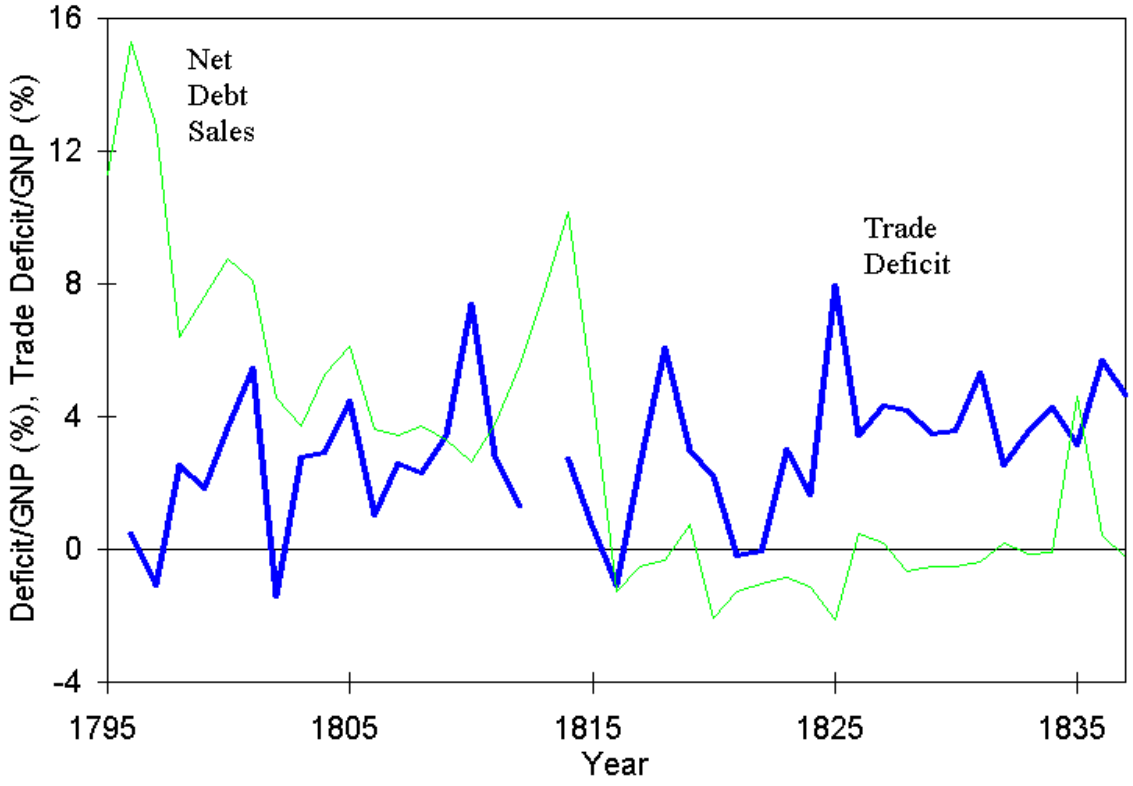
If capital was flowing in to finance the British debt sales, then it should show up as a deficit in the merchandise balance of trade. Figure 12 shows the merchandise trade deficit for the United Kingdom for the years 1796 to 1840 as calculated by Imlah relative to British GNP.[17] The deficit is here defined as imports minus exports. As can be seen there was a persistent merchandise trade deficit between 1796 and 1840 of about on average 3% of the estimated GNP of Britain. The figure also shows net sales of debt relative to GNP in the same years. But we can find no sign that this deficit was responsive to either changes in the real value of the government debt relative to GNP or sales of debt by the government. Thus, for example a regression of BOFT, the merchandise trade deficit as a percentage of GNP on DEBTSALES/GNP_t, the receipts from borrowing, yields the estimate.

$$BOFT_t = 3.29 - \underset{(.078)}{0.140}DEBTSALES/GNP_t$$

$$n=41,\ R^2 = .05,\ DW = 1.77$$

[17] Imlah (1958), pp. 37-38. The figures thus include the trade of Ireland, but Ireland was a very small economy compared to England, and one where there would be much less trade given the preponderance of self-sufficient peasants.

FIGURE 12: THE MERCHANDISE BALANCE OF TRADE AND DEBT SALES, 1796-1840



Source: See text.

In years where there were large sales of debt there was a smaller merchandise trade deficit. If foreigners were buying much of this debt then when the government deficit got bigger so should have the trade deficit. Similarly the relationship between the balance of trade and the change in the real value of the debt as a percentage of GNP (Δ DEBT/GNP$_t$) and the level of military expenditure as a percentage of GNP (MIL/GNP$_t$) is estimated as

$$BOFT_t = \underset{(0.7)}{3.6} - \underset{(.022)}{0.060}\Delta DEBT/GNP_t - \underset{(.066)}{0.057}MIL/GNP_t$$

$$n=40,\ R^2 = .19,\ DW = 1.62$$

Now we find a statistically significant relationship whereby when the value of the outstanding debt gets larger, trade flowsd are more balanced, though the gain in the balance of trade is only £.06 for each £1.00 of change in the value of the debt.[18] If the deficit was being largely financed from abroad the balance of trade should move one to one in line with changes in the value of the debt, and in the opposite direction as in the regression estimates above. Thus there is little evidence of foreign financing of the deficit.

Could it be that the capital market was segmented so that the rates of return I observe cover only a part of the capital market, a part which was isolated from the market in government debt? Heim and Mirowski (1991) argue, for example, that "a rise in the London consol rate would not have a major impact on industrial investment" because firms mainly used retained earnings and credit from suppliers and workers as a source of capital.[19] This seems quite plausible. Could crowding out have occurred in the other elements of the capital market which my rates of return do not cover? The problem is that there are no other sectors of the capital market which are plausibly linked to the government debt market which are at all large. As noted in 1820 government debt would be 23% of private wealth. My data covers the land, farms, housing, and road transport sectors which together would constitute another 57% of private wealth. This leaves only about 20% of private wealth where returns are not observed. But Feinstein estimates that 14% of the remaining wealth would be stocks and work in progress, which we would think is the type of capital least likely to be integrated with the government debt market. Another 2% would be manufacturing and mining fixed capital, again unlikely to be integrated with government debt. This leaves about 4% of private wealth

[18] There is some indication of serial correlation in the Durbin-Watson statistic here, but estimating the expression with a first order autocorrelation adjustment does not change the estimated coefficient on the change in debt.
[19] Heim and Mirowski (1991), p. 702.

in 1820 as the unobserved sector that might be experiencing crowding out from government debt. Clearly the huge stock of government debt was not financed by crowding out in a segment of the capital market I did not observe.[20]

Nor will the putative regional segmentation of the housing capital market observed by Buchinsky and Polak (1993) allow crowding out to have gone on unnoticed in the London housing market. For my data on all types of returns in this period shows no difference in returns between the areas close to London and the areas remotest from London. Yet given the long persistence of large stocks of government debt their would have to be persistent differences in rates of return between the housing and land market close to London and that in the rest of the country if the two markets were truly segmented.

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% of the pages of the Reports are devoted to London and the 6 counties adjacent to it or Middlesex, yet these counties produce only 7% 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 or to the local vicar or a local farmer.

[20] The composition of private wealth in 1820 is derived from Feinstein (1988), pp. 437, 464-5.

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 10% of GNP.

The failure of private interest rates to increase in line with government debt in years 1727-1840 is profoundly puzzling. In particular in a number of periods the government was able to borrow between 5 and 10% of GNP for five years or more while having little effect on real private rates of return. This implies that the capital market in this period operated in a way of which we have little comprehension.

APPENDIX: THE VALUE OF DEBT, DEBT SALES AND NOMINAL GNP 1727-1840

To calculate the debt of the government relative to GNP, and net debt sales relative to GNP we have to estimate both the market value of the debt attributable to Britain, the cash raised by sale of debt, and nominal GNP for Britain for the years 1727 to 1840.

Market Value of Government Debt: The obligations of the government over the years 1727 to 1840 included a changing mix of 3%, 3.5%, 4%, 5% 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.[21] 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.

[21] 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.

I get the various components of the debt stock for 1786-1838 from Great Britain, Parliamentary Papers (1890-1), and for 1727-1786 from Great Britain, Parliamentary Papers (1898). Both these publications list in detail the various date issues and their dates or retiral 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% annuities, and later 3% 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 types of 3.5%, 4% and 5%, and both the fixed term Long Annuities and Short Annuities. Prices taken from the Gentleman's Magazine include South Sea Annuities (1731-50), "4% of 1746" (1747-50), "4% of 1747" (1747-50), "4% of 1748" (1749-50), "3.5% of 1756" (1757-60), "3.5% of 1758" (1759-70), "3.5% of 1818" (1819-38), "Reduced 3.5%" (1825-38), "New 3.5%" (1832-1838), "4% of 1760" (1761-63), "4% of 1762" (1764-81), "4% of 1763" (1765-1767), "4% of 1777" (1778-1824), "New 4%" (1823-31), "4% of 1826" (1827-34), "5% Navy" (1785-1822), "5% 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% consols as a benchmark, unless the implied value was greater than the face value in which case the face value was used.[22]

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 (Great Britain, 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 Great Britain, Parliamentary Papers (1868-9), which is a less satisfactory

[22] The option for the government to pay off debt holders at face value existed for most stock, leading to period conversions of high interest debt into lower interest debt. For this reason the market value of the long term debt rarely exceeded 10% above the face value.

source. However, as Table 6 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% government perpetuities (3% annuities 1727 and 1729-52, 3% consols thereafter (Homer and Sylla (1991), pp. 161-2, 195). 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 calculated total debt in each of four years, and the percentage each type of debt constituted. Perpetuities and the debt to the Bank of England and to the East India Company always constitute at least 85% of the market value of the total debt. Life annuities and the short term “unfunded” debt, the most difficult to value, constitute no more than 9% of the debt in any year.

TABLE 4: THE COMPOSITION OF THE STOCK OF GOVERNMENT DEBT

Year	SHARE (%) IN MARKET VALUE OF:							
	Perpetuities				Term	Life	Short	Redeemed
	3%	3.5%	4%	5%	Annuities	Annuities	Term	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%.

Source: See the appendix.

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 Great Britain, 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.

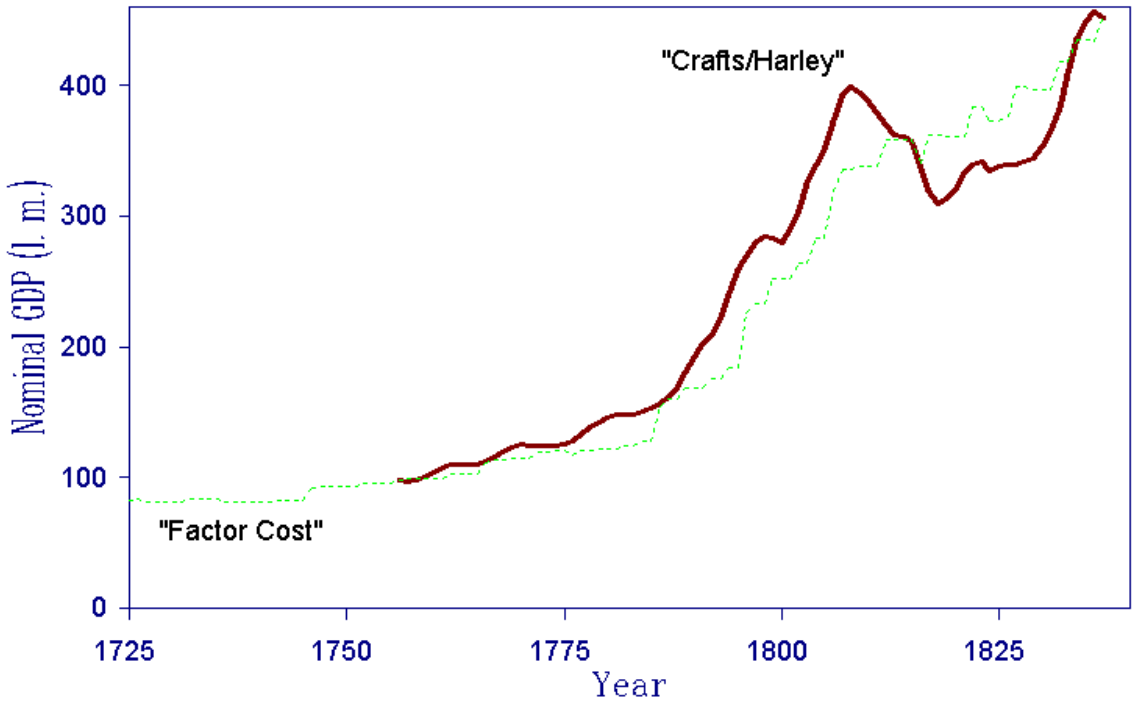
Gross National Product:

(a) 1760-1831. For these years this was estimated using the benchmark estimates of real GNP derived by Crafts and Harley (1992), p. 715, interpolated at constant growth rates. To make this nominal GNP I used the Gayer, Rostow and Schwartz price index for 1790 to 1840 and the Schumpeter-Gilboy index for 1760 to 1790, taking five year averages of prices (from Mitchell and Deane (1971)).

(b) 1831-41. Here real GNP was taken from Deane and Cole (1968), again interpolated at constant growth rates. It was made into nominal GNP using a five year average of the Gayer, Rostow and Schwartz price index.

(c) 1725-1759. Nominal GNP was extended back from 1760 to 1725 using estimates of land rents (from the Charity Commission Reports), house rents (using a rent index for houses constructed from the Charity Commission Reports), and wage payments. The movement of land rents was estimated taking rents as estimated by the 1842 tax returns and extrapolating them back using the movement of average rent per acre. The movement of house rents was again calculated from the 1842 tax returns, extrapolating back using average house rents combined with the movement of population from Wrigley and Schofied (1997). The movement of weekly wages in agriculture was estimated from farm accounts. These showed wages in 1720-9 to have been 87% of those in 1780-89. The movement of wages in urban areas was estimated from those of building workers as reported by Gilboy (1934). Building wages in 1720-9 were 83% of those in 1780-9. A total wage bill was estimated assuming wages in urban areas were on average 50% higher than in agriculture, that 55% of the labor force was in agriculture before 1760, and that the labor force was proportionate to population (from Wrigley and Schofield (1997)). The two nominal GNP series were then set to equality in 1760. To check that this method of estimation was reasonable for the years before 1760 nominal GNP was estimated by the same means all the way up to 1841. The GNP estimated from wages, land rents and house rents in 1841 was £454 m. compared to £452 m. as estimated from the movement of real GNP and prices. In the intervening years the two series did diverge somewhat, as is shown in Figure 13. But on average from 1760 to 1841 the nominal GNP series estimated using Crafts and Harley and price indices is just 6% higher than the series estimated using these measures of factor price movements and factor supplies.

FIGURE 13: NOMINAL GNP, 1725-1841



Source: See the text.

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