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Conjectures of English and UK Economic Surplus, Investment, Tax Revenues and Deficit Amounts from the 13th to the 19th Century

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Abstract

This paper attempts to estimate trends in the levels of economic surplus, public and private investment, and national government surpluses and deficits from accumulated capital income, taxation, and rents estimated by different economic historians for England and the UK. The data support historical accounts that income per capita growth begins to increase around the 1600s in Britain perhaps due to the level of capital, tax, and land income achieving an adequate threshold amount. According to some historians, this would also be about the time of capitalism's ascent as the dominant economic system in England. Even then, dramatic increases in investment and economic growth do not appear until the late 18th Century when investment and deficits reach even higher levels. The data developed in this research note are offered as additional macroeconomic data supplements to works created by other authors and researchers.

Keywords: Economic Surplus, Deficits, Investments, Private Investment, Public Investment, Tax Revenues

JEL Codes: B50, C80, N13, O11, O52

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Introduction

Early economists were among the first to note how many business establishments and ventures took part or all of the proceeds of their profits and used them to buy more property, plant, inventory, and equipment if opportunities to expand and earn greater profits existed. This was in contrast to the way that most economic entities operated during feudalism, an economic system that was generally characterized as one that lacked the incentives or property rights to encourage producers to re-invest in or add to their productive capital (North and Thomas 1971 and 1973, McCloskey 1972, Brenner 1976 and 1985, Dimmock 2014). Since the serfs who worked on feudal manors had weak or little ownership in the lands they worked, their livestock, and the tools they used, there was little incentive to use any gains from their work to try to expand their efforts and output. This was especially true during the early middle ages. Any production above a level of subsistence for the peasant farmers and their families went to lords and barons as surplus, and therefore efforts to invest or innovate were not worthwhile. There was also supposedly little incentive for the lords to encourage the serfs to reinvest and innovate since the lords could often coerce and gain more output from them through simple intimidation and brute force (Rogers 1906, Dobb 1947, Brenner 1976 and 1985). Additionally, any economic surplus extracted from the feudal economy often was believed to be wasted mostly on “unproductive” expenditures by the aristocracy on large palaces, court jesters, minstrels, the military, and cathedrals, or items which did not create use value or expand the productive capacity of a society by increasing the productivity of a labor force and/or by spending on education, agriculture, or public works (Baran 1953 and 1957, Engels 1957, Smith 2000).¹

The concept of an aggregate, macroeconomic level economic surplus as distinct from the concept of surplus in microeconomics is an idea developed by Paul Baran (1953 and 1957) and Paul Baran and Paul M. Sweezy (1966). Basically it is the amount of output or income left over after all of the necessities for a society (food, housing, clothing, health care, education, etc.) have been produced and consumed

¹ This paper uses Britain and British interchangeably for England and the UK and of things pertaining to England and the UK so as to minimize verbiage, although Britain often refers to England and Wales alone.

within a given time period. It can take the form of rents and profits earned, government taxes collected as well as any amounts spent on unproductive activities such as opulent spending by an aristocracy, earnings of noblemen and clergy, or any activity which does not supply the necessities of life or advance a society's productive capacity. The wastefulness of such spending and occupations was noted by classical economists such as Adam Smith (2000) and Karl Marx (1990) although in modern mainstream economics the distinction between productive and unproductive endeavors is really no longer emphasized.² However, these issues are not one of the themes of this paper, and the economic surplus defined in this paper only include rents, profits, and capital income.

As time passed, feudalism was weakened due to less and less arable land being available for food production, the trauma of plagues and famines³, and these in turn caused labor shortages and rising labor costs. As agricultural production could not keep up with increases in population due to shortages of arable land, small petty producers, merchant traders, and yeoman farmers started taking some of the surplus they earned and reinvested it into their operations to finance greater productivity and expansion (Brenner 1976 and 1985, Heller 2011, Dimmock 2014). As Colander (2020, 73-75) and others have claimed, some time during the 15th Century mercantilism evolved from feudalism thanks to the growth of markets, trading, urban areas, global exploration and a larger presence of the government in economic activities through its sanctioning of guilds and sponsorship of exploration. Finally, it was probably not until the acceleration of the enclosure movement, the Industrial Revolution and the ascendancy of manufacturers and major commodities producers that capitalism fully replaced mercantilism, although farming in some parts of Europe had already been transformed through innovation and greater investment

² Hatcher and Bailey (2001) examine what they call the three "super models" or main theories of economic history by Malthus, Smith, and Marx regarding the middle ages and conclude that each is lacking and somewhat over simplistic. Dyer (2005) claims that late medieval times might not have been as bad or dire economically as some may think due to his research on probate records. It is not the purpose of this paper to critique or support any one of these three perspectives, yet they are still useful frameworks for setting a general framework for medieval economies and are still dominant theories in the history literature.

³ Which some have claimed were also caused indirectly by a mini-ice age (e.g, Fagan 2000, Blom 2019 among others).

and output (Dobb 1946, Heller 2011 page 89, Briggs, Kitson, and Thompson 2014, Colander 2020 pages 74-75).

The main contribution of this paper is the data generated especially for such a long time period as seven centuries.⁴ The data generated by the research for this paper along with others supports and underscores the historical accounts and writings by historians that it probably was not until the 1600s and through the 1800s, an era which roughly took in the time periods of the British slave trade, English Agricultural Revolution, the English Enclosure Acts, the English Civil War (Revolution), the Glorious Revolution, and the Industrial Revolution, that capital income, investment spending, government spending, and investment levels began to reach a critical threshold of a society's economic output and economic surplus, that is, a society's cumulative capital income and land income plus taxes. This was especially the case from the late 18th Century and forward. With this, real GDP per capita dramatically began to advance in England and the United Kingdom (UK) with the greatest advances being made in the late 1700s and 1800s. Productive outlets for investment made themselves available at this time which helped per capita growth, although capital income had to rebound as a share of economic surplus and net national income after being lower for several prior centuries (1400s to 1600s). If the main data source for this paper is correct—Clark 2009—real economic surplus per capita levels might have been higher in the 13th and 14th Centuries than in the next several centuries and did not reach higher levels again until the 1700s in Britain, and the latter in turn helped to propel British per capita economic growth.⁵ See Figure 1.

⁴ There are other data sources which give estimates for similar variables but only for limited periods of time or only going back to the 18th Century such as those on the Bank of England website in their "A Millennium of macroeconomic data", much of which is comprised of the Broadberry, et al data (2015) used in this paper (<https://www.bankofengland.co.uk/statistics/research-datasets#:~:text=of%20business%20conditions-,A%20millennium%20of%20macroeconomic%20data,year%20of%20the%20Domesday%20Book.&text=Version%203.1%20of%20the%20dataset%20has%20now%20been%20updated%20to%202016.>).

⁵ Both Clark (2009) and Broadberry, et al (2015) provide seven centuries worth of estimates or conjectures of British economic activity, although Clark takes a more Malthusian approach in his estimates whereas Broadberry, et al believe that the time period examined was not as bad or as subject to net zero economic growth over prolonged periods of time. The author for this paper could not find longer and more comprehensive listings of data to provide a more coherent time series.

This paper proceeds as follows. The next section, Data and Conjectures, describes the data sources used in the research for this paper, the data developed from these sources, the definitions of key variables, and the displays of data. Finally, a Discussion and Conclusion section discusses the implications of the finding.

Data and Conjectures

(Insert Figures 1 to 6 around here)

According to some historians, in the transition period of the 15th to 16th Centuries, investment levels would still be predicted to be low since capitalism was still not the predominant economic system as mercantilism and trading still reigned. Economic surplus per capita would have also been lower when compared to the late medieval period (13th and 14th Centuries). See Figure 1 which is based upon Clark's estimates (2009) of pre-direct tax capital income, pre-direct tax land rent income, and indirect tax revenues which when combined give some approximation of the economic surplus over seven centuries.⁶ High labor costs (Clark 2009, Humphries and Weisdorf 2019) for several centuries might have prevented the formation of a large enough economic surplus to enable sufficient investment too. In the 17th Century, the economic surplus began to grow again thanks to a growth in capital income and a lowering of wages, and these events led to the beginning of a more consistent and greater level of capital investment in mostly productive endeavors.⁷ Figure 2 shows annual, real capital income (using Clark's base year of

⁶ By having direct taxes (income and property taxes mostly) included in gross capital and gross rental income amounts, Clark has local and national government revenues fully accounted for when he includes a separate category for local and national indirect taxes (sales and excise taxes, etc.). The income of unproductive segments (military pay, income of jesters, clergy, etc.) is not disclosed and is difficult to estimate over seven centuries without accurate estimates of their numbers employed or pay. Broadberry, et al (2015) give estimates of the size of clergy and nobility over time in England and the UK but only for a handful of years out of the seven centuries. They also do not give conjectures on rent, capital and taxation income as does Clark (2009).

⁷ Rimmer, Higgins, and Pollard (1971) assess the year-to-year rates of investment in the 18th and 19th Centuries in the UK and estimate it to be slower than other estimates and believe a lot of capital investment undertaken was due to the rapid deterioration of many forms of plant and equipment. They cite the frequency with which horseshoes and many farm tools had to be replaced. Nonetheless, such replacement was necessary to propel agricultural output to higher levels, and therefore the investment expenditures could still be considered productive.

1860) over seven centuries, and it is not until around the 17th and 18th Centuries that it begins to rise and then takes off dramatically during the 19th Century.

Estimating Capital Stock and Investment

Clark (2009) gives estimates on a yearly basis for a GDP price index (base year = 1860), estimates on a yearly basis of capital income (income from businesses, housing, live-stock, canals, mines, railroads, and so on), and decadal only estimates of the real rates of return to capital (see Figure A1 in the Appendix), and capital shares of national income for the years 1200 to 1860 for England and the UK. He mostly bases these estimates on tax on property and income records from various sources and estimates rates of return mostly by taking rental income from various assets and dividing this by property or asset values. Adjusting capital income according to the price index and using the formula

$$r = \text{Real Capital Income} / \text{Real Capital Stock},$$

where r is the real rate of return on capital or capital share of national income, the author rearranges the formula and solves for real capital stock using

$$\text{Real Capital Stock} = \text{Real Capital Income} / r$$

which can provide some type of general trend estimates of total English and UK aggregate capital stock amounts over the decades 1200 to 1860.⁸ Figure 3 illustrates the growth of the estimated trend, real capital stock in millions of pounds over several centuries decade by decade, and it is shown that growth in the real capital stock does not really begin to climb somewhat until the 17th and 18th centuries with accelerating growth in the 19th century.⁹ Real annual investment expenditures or change in the capital

⁸ Admittedly this is assuming that the real rate of interest is a reward to capital based on capital's productivity, which is a neoclassical economics tenet applied to pre-capitalist and capitalist time periods. And this neoclassical tenet is a debatable concept since it does not address interest rate setting or targeting by lenders or other factors that influence interest rates. However, this is one way to estimate a long run time series and to develop a trend of capital stock and investment spending over seven centuries absent other data which does not cover as long of a period. It should be emphasized that the goal of the conjectures developed in this paper is to develop general trends which can support other historical observations and accounts.

⁹ A listing of all the data estimated by the author is provided in the appendix of the paper.

stock in millions of pounds from one decade to the next estimated by the author show a similar pattern as displayed in Figure 3.¹⁰ It appears that investment and capital stock amounts do not really begin to be substantive until the 1600s or 1700s. It is around 1770 to 1780 and beyond when investment begins to climb dramatically (see Figure 4), a time period which corresponds to, citing one example, the rise of important textile innovations and their implementation in Britain (Caitling 1986).

For some years, real net investment is estimated to be negative perhaps because the depreciation of capital stock is greater than total investment or due to natural disasters, crop failures (a form of inventory), economic recession/depression, or war. If some scholars are correct, then the amounts for net investment in productive pursuits should be small from the 13th to the 16th centuries but should grow from the 17th to the 19th centuries. In the earlier period, during feudalism, and in the subsequent transition period from feudalism to capitalism, economic incentives were either mostly nonexistent or weak whereas in later periods they were much stronger. Much of the economic surplus of the 13th and 14th Centuries could have been saved or spent on military escapades, lavish churches, and/or palaces by the aristocracy. It is granted that such savings or expenditures had a certain logic for its epoch (e.g., spending on religious institutions by the aristocracy probably reinforced the societal status quo), yet they probably contributed little to a society's productive capacity or ability to produce more with existing resources. That is, there was little investment taking place which had long term consequences of a transformative nature. The estimates for capital stock and investment amounts are given in the Appendix for this article.

Estimating Government Revenues and Expenditures

¹⁰ Brezis (1995, page 57) gives estimates from Feinstein (1978, 1981) and Feinstein and Pollard (1988) of nominal investment in the UK from the 18th to 20th centuries. Although different in magnitude from the estimates for this paper, for 1740 to 1860 the Pearson correlation coefficient between Brezis' estimates and the estimates for this paper is +0.938, and after adjusting for serial correlation using Newey-West standard errors, the time series regression equation is $Predicted\ Brezis\ Estimates = -45.97 + 12.48\ Author\ Estimates$ with the independent variable being statistically significant at alpha = 0.05 and with the model having an adjusted r-square of around 0.87. Augmented Dickey-Fuller tests or unit root tests for each variable indicate failure to reject the null hypothesis of non-stationarity.

In the years where investment amounts are greater than the economic surplus, and this occurs mostly in the 18th and 19th centuries in the estimates, the differences in the amounts possibly can be explained by the macroeconomic equation

$$S + T = I + G$$

where S is savings, T is tax revenues, I is investment expenditures, and G is total government expenditures (Lippit 1985, Branson 1989). Since Clark provides indirect tax conjectures in his data files, and since direct taxes are part of the economic surplus of gross rents and capital income estimates, the left hand side of the equation above can be estimated.¹¹ With “I” estimated already, rearranging the previous equation yields

$$S + T - I = G$$

so that when approximated investment is taken from economic surplus (most of which is S), an estimate of total government expenditures can be made. This estimate can be considered mostly composed of government operating expenditures since the estimate of I is based upon Clark’s rate of return on capital which includes return on public investment in tunnels, roads, bridges, and ports, and this follows national income accounting methods. Figure 5 displays estimates of English and UK government surpluses and deficits depending on whether G is positive or negative over the 1210 to 1860 period in which government spending is normally in surplus until the late 18th Century and beyond.¹² Much of this

¹¹ Direct taxes such as national income taxes, wealth and gift taxes are not used to a large extent in England and/or the UK until toward the end of 18th and sometimes during the 19th Centuries to finance various wars and are not used on a consistent basis until the 20th century (Seely 1995, HM Revenues and Customs, 2010).

¹² The author could not find definitive sources for English and UK budget deficits and surpluses before 1800, although estimates of net public debt can be found from Mitchell (1988) and Chantrill (no date) that go back to 1692. The surplus and deficit estimates that are calculated in this paper have a +0.735 correlation coefficient with the inflation adjusted debt level (base year of 1860 using Clark’s price index) estimates from Mitchell when correlated on a decadal basis from 1700 to 1820 (no more estimates are provided after 1829 although debt as a percentage of GDP is presented). As deficits increased so did corresponding debt levels. The furthest Mitchell’s data goes back in time appears to be 1688, usually 1692. Predicting Mitchell’s estimates using the author’s deficit/surplus numbers yields a regression equation with Newey-West standard errors (to correct for serial correlation) of *Predicted Mitchell Debt* = 157.86 – 1.06 *Author Estimates* with an adjusted r-square of 0.498. The independent variable is statistically significant at alpha = 0.05. Augmented Dickey-Fuller tests or unit root tests for each variable indicate failure to reject the null hypothesis of non-stationarity.

is for military expenditures (Britain was in many wars and armed conflicts in the 18th and 19th Centuries), and data from Mitchell (1988, pages 578-580) shows a disproportionate amount of British net public expenditures from 1688 to 1801 to be for the army, navy, or ordnance with a low of 20% to a maximum of 96% and an average of 45%. Barro (1987) writes that most of Britain's deficits during the period of 1701 to 1918 comes from spending on wars with the exception of a budget deficit incurred to buy the freedom of slaves from slave owners in 1835-1836 and in a dispute over income taxes during 1909-1910. Barro's Figure 8 in his paper which plots public debt as a percentage of GDP looks very similar to Figure 6 in this paper because he mostly relies on the Mitchell data.¹³ Finally Figure 6, using Mitchell's data, shows UK net public debt as a percentage of GDP from 1692 to 1860 accelerating during the 18th and 19th Centuries.¹⁴ When investment amounts are greater than savings or economic surplus ($S < I$) then the difference can be explained either by taxes being greater than government spending or by investment coming from accumulated past savings or from governmental borrowing. Using Clark's data and the estimates yielded indicates that it is probably and mostly the latter. The estimates for government surpluses/deficit amounts are given in the Appendix for this article.

Analysis

(Insert Tables 1 and 2 around here)

To show some preliminary or tentative validity to or support for the conjectures and general trends developed for this paper, the variables estimated by the author are used in correlation analysis with some of Clark's and Broadberry's et al macroeconomic measurements and estimates. Table 1 shows a

¹³ Interestingly one thing that Barro finds is that as long as currency could be converted to gold, money supply growth and inflation are not problems resulting from the budget deficits or the temporary rises in government spending mostly due to military spending. He claims that such deficits are associated with increases in long term interest rates, however, except for the deficits associated with the slavery buy out and the income tax dispute. In those two cases, long term rates do not rise. Clark (2001) in estimating deficits from the 1720s to the 1830s finds no "crowding out" effects of British deficits. Figure A1 in the appendix also plots his estimates of real interest rates from 1200 to 1860.

¹⁴ Esteban (2001) writes that the French wars would have been very difficult for Britain to finance had it not been for trade credits from India.

Pearson correlation coefficient matrix among the variables real economic surplus, real investment, real government surpluses/deficits, Clark's estimates of real income-based GDP per head, Broadberry, et al's estimates of real output-based GDP per head and net public debt as a percentage of GDP (Mitchell 1988 and Chantrill n,d,) for the years 1200 to 1860. All coefficients are statistically significant at an alpha of 5% and show strong correlations. More importantly, the conjectures derived by the author from the Clark data for economic surplus and investment are strongly and positively associated with the Broadberry, et al output based real GDP estimates.¹⁵ Real government surpluses are negatively and strongly correlated with investment estimates and the Broadberry, et al real GDP values. The greater the real government surplus, the lower real investment, and the lower the real GDP on average. Conversely, the greater the deficit, the higher values of these variables on average.¹⁶ Finally, net public debt as a percentage of GDP is strongly correlated with the economic surplus and positively correlated with the two measurements of GDP, and real investment. It is inversely and moderately correlated with government surpluses/deficits in that larger deficits (negative numbers) correspond to larger debt percentage numbers which are all greater than zero, or have positive values. Despite contentions that Broadberry, et al take a different approach from Clark in doing their estimates, conjectures based on Clark's works appear to do well in predicting Broadberry, et al estimates of real GDP.

Augmented Dickey-Fuller tests indicate failure to reject the null hypothesis of each variable in Table 1 containing a unit root whether using 0, 1, 2, or 3 lags.¹⁷ Johansen (1995) tests for cointegration for the variables in Table 1 are displayed in Table 2 and show that with a lag of 1 there are at least 3 or fewer cointegrating equations among the variables.

(Insert Figures 7 to 9 around here)

¹⁵ There is of course a simultaneous relationship among many of these variables with investment not only leading to higher real output/income, but the latter also leads to higher investment, consumption, etc., in turn. That is, a feedback loop exists among investment and output.

¹⁶ The high negative correlation between investment and government surpluses/deficits is not surprising, of course, since surpluses/deficits were derived by taking the saving plus taxes minus investment estimates.

¹⁷ The results of these tests can be provided upon request.

When using regression to predict Broadberry, et al real GDP estimates by the variables developed in this paper Figures 7 to 9 show scatterplots that display the results. The variables generated by this paper are good predictors of the Broadberry, et al values for real GDP, which are separate estimates from the Clark database. When doing regression analysis, Breush-Godfrey tests indicate serial correlation, yet when using Newey-West standard errors, the statistical significance of the independent variables displayed in Figures 7 to 9 remain significant at $\alpha = 0.05$. Since higher/lower levels of real GDP can lead to higher/lower levels of economic surplus, higher/lower levels of investment, and possibly higher/lower levels of government surpluses/deficits, two-stage least squares regression is also performed using these variables to predict the Broadberry, et al measurement of real GDP using Clark's measurement of real net national income from 1270 to 1860 as an instrumental variable. These results yield bivariate regression equations where the independent variables are statistically significant at $\alpha = 0.05$, and the intercept and x-variable coefficient values are not that much different from those shown in Figures 7 to 9. Each figure shows both the OLS and 2SLS equations.¹⁸

Discussion and Conclusion

The results of this exploratory research note are based upon estimates made from records by economic historians using different techniques. One limitation of the results found in this paper is that during the time periods examined not nearly as many complete and thorough economic records existed then as they do in modern times. Some claim that Clark and his data are influenced by a Malthusian point of view of medieval times whereas Broadberry, et al see this time period as less stagnant. Yet, general estimates from these two of the most comprehensive sources of British economic history have to suffice in order to do any type of economic and quantitative analyses of the time period that covers the transition from feudalism to capitalism, although the data used is based upon after the fact reconstruction of certain events and circumstances.

¹⁸ Although the scatterplots show this somewhat, Chow (1960) tests indicate the year 1780 as the strongest demarcation or "break" in the time series versus other years.

Nonetheless, if the estimates of trends are reasonably accurate, and if one is solely focusing on trends, the results found in this paper lend some credence to various arguments regarding the transition from feudalism to mercantilism and then to capitalism in that the roles of economic surplus, investment, and government spending elevated the British economy to higher levels than what existed under a mercantilistic, quasi-capitalistic system that existed in the 16th to the 17th Centuries. That economic surplus, investment, investment rates, government spending and debt are largely ineffective or too small before the 16th or 17th centuries to impact standards of living or real GDP per capita is somewhat supported by the statistical analyses. This bolsters the work of Crafts and Mills (2017) which argues that trend growth in England and the UK up until the industrial revolution basically hovered around an average of zero and somewhat support Clark's (2007) writings on how the general economic efficiency and productivity of the British economy was basically static until 1600.¹⁹ As Clark (2001) noted, government deficits had no crowding out effects on the economy of the 1700s and 1800s, and one could speculate that the deficits actually had a "crowding in" effect on British economic growth given the results of the analysis of this paper.

One could also argue that the type and level of investment also mattered. If Baran is correct, then a lot of the economic surplus would have been wasted in the 13th and 14th centuries when feudalism was still the dominant form of the economic system. Even with feudalism in decline in subsequent centuries, some of the economic surplus may have been "wasted" by the aristocracy on cathedrals, palaces, and wars rather than spent on productive machinery and tools or on ports, canals and roadways. Various authors have noted that traders and merchants during the mercantilist era improved transportation technology but did not contribute much to changes in transformative and productive technology (Sweezy 1976 (1950)). As Brenner (1985) and Smith (2000) note, medieval and mercantile era guilds, through their monopoly power, also frustrated investment in innovative techniques, and it was not until petty producers came

¹⁹ Graphs of real GDP per capita using the Clark and Broadberry et al data showed pretty much a flat line trend during both feudalistic and mercantilistic (or transition period) epochs.

along that this began to change. Brenner also writes that until larger farms came about along with the development of large pastoral land holdings (thanks to enclosure), it was difficult for many yeoman farmers to innovate on smaller parcels of land. Larger land holdings and more advanced farming techniques yielded greater economies of scale than the typical smaller, medieval farms that featured mostly subsistence style farming (Brenner 1985, Heller 2011, Cockshot 2019).

Feudalism, mercantilism and their institutions only slowly gave way to capitalism as capitalism was built on the “ruins” of previous economic systems as those who were forced to leave common farm areas became the workers of the early manufacturers of the industrial revolution (Dobb 1946, McCloskey 1972, Marx and Engels 2004 (1848)). Property rights, investment, and global trade were established before the late 18th Century, but large gains were not seen in real GDP until 1780 and beyond as this paper tries to show.²⁰ Perhaps property rights are a necessary but not sufficient condition for economic development and takeoff. Just as important factors are the levels of public and private sector investments that need to reach a certain level before real economic growth occurs.

²⁰ Richardson (1987) and Etlis and Richardson (2008), among other scholars, estimate that the British slave trade of the 17th to 19th Centuries had a big impact on British economic growth.

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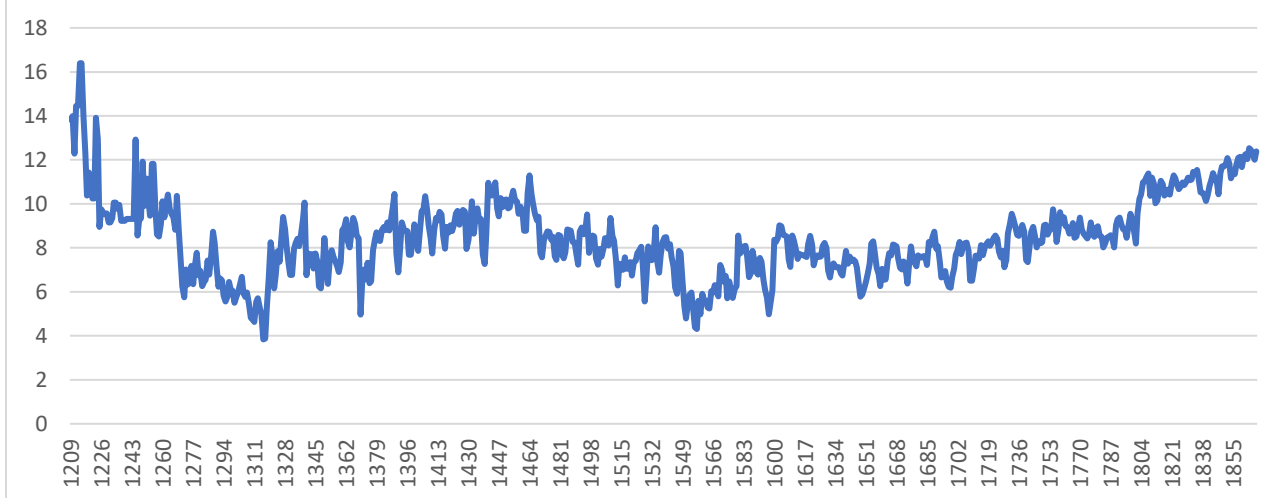
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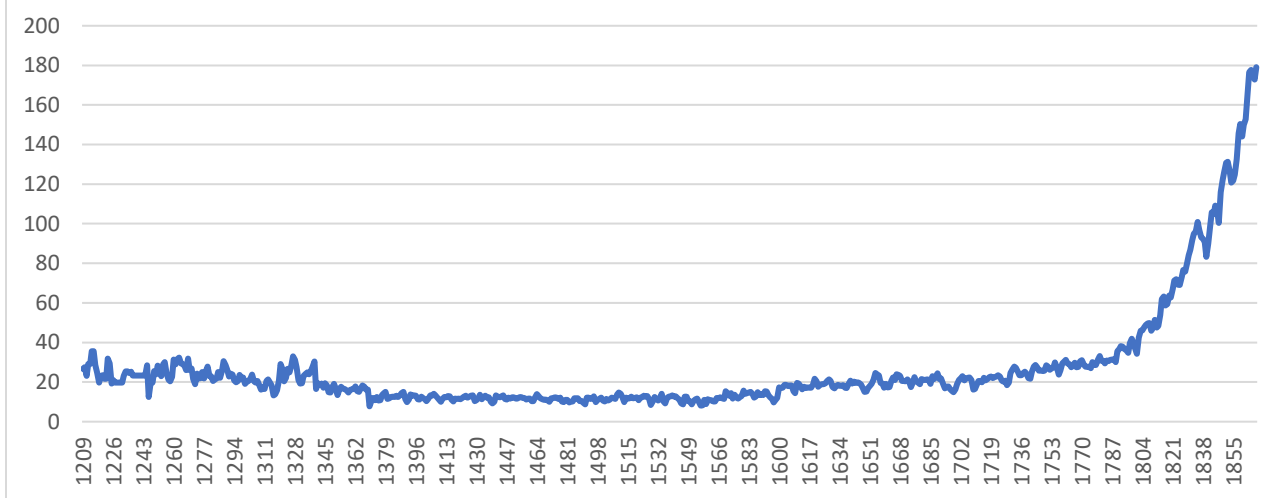
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Figure 1: Real Economic Surplus Per Capita, £

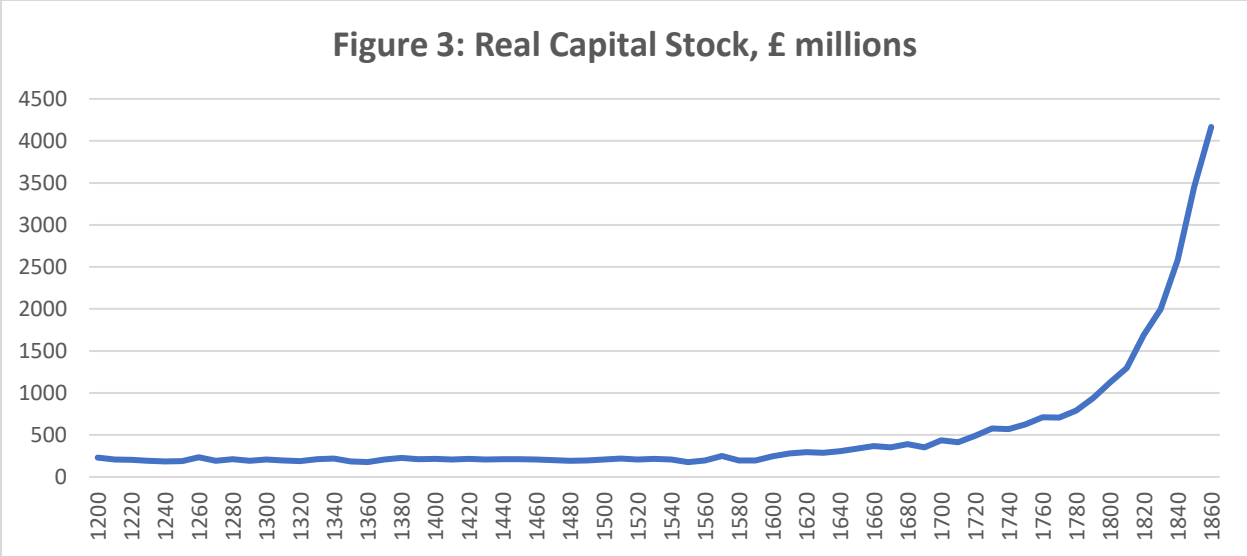


Source: Author's use of Gregory Clark, "National Income, Prices, Wages, Land Rents, Population, England, 1209-1869", from his website, <http://faculty.econ.ucdavis.edu/faculty/gclark/data.html>.

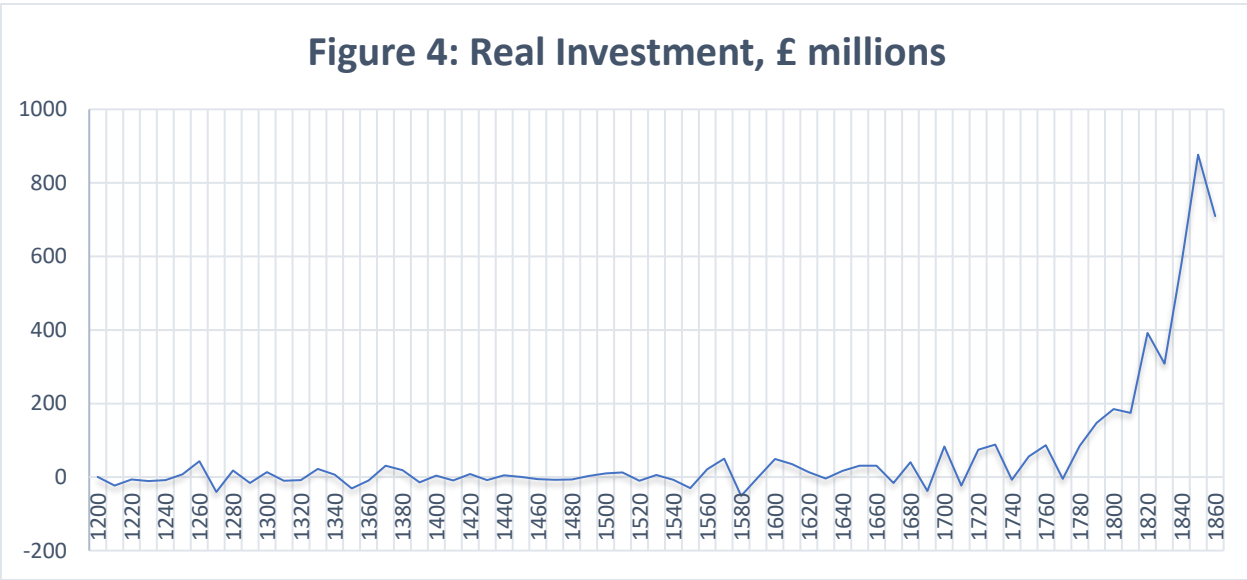
Fig. 2: Real Capital Income



Source: Gregory Clark, "National Income, Prices, Wages, Land Rents, Population, England, 1209-1869", from his website, <http://faculty.econ.ucdavis.edu/faculty/gclark/data.html>.

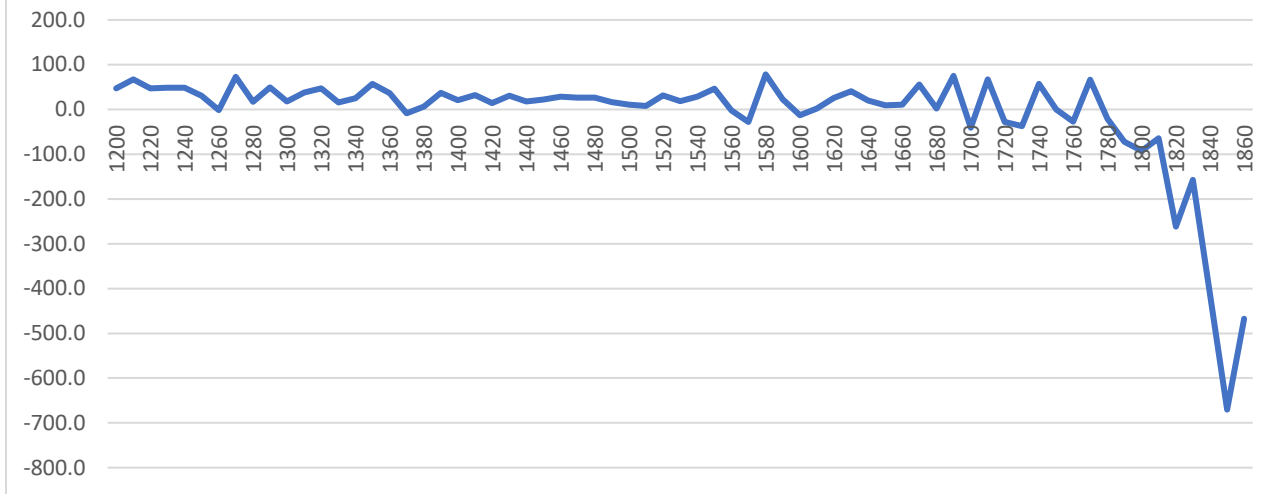


Source: Estimates by author and based on Gregory Clark, “National Income, Prices, Wages, Land Rents, Population, England, 1209-1869”, from his website, <http://faculty.econ.ucdavis.edu/faculty/gclark/data.html> .



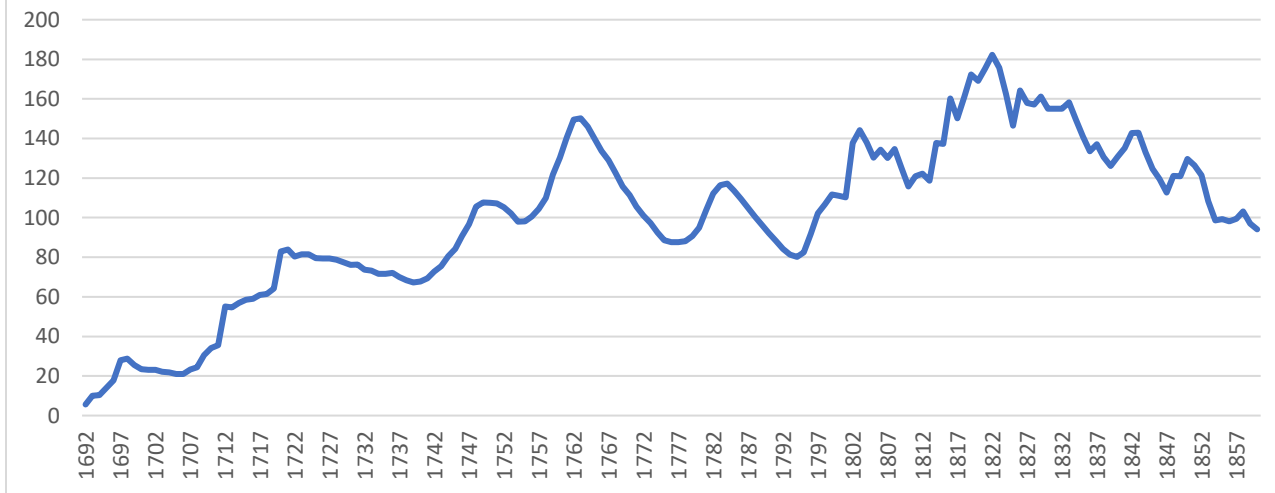
Source: Estimates by author and based on Gregory Clark, “National Income, Prices, Wages, Land Rents, Population, England, 1209-1869”, from his website, <http://faculty.econ.ucdavis.edu/faculty/gclark/data.html> .

Figure 5: Real Govt Deficit/Surplus, £ millions



Source: Author's estimates using data from Gregory Clark, "National Income, Prices, Wages, Land Rents, Population, England, 1209-1869", from his website, <http://faculty.econ.ucdavis.edu/faculty/gclark/data.html>.

Figure 6: Public Net Debt / GDP %, 1692-1860



Source: From B.R. Mitchell, British Historical Statistics (1988) and Christopher Chantrill (no date) UK Public Spending, <https://www.ukpublicspending.co.uk/>

Table 1—Correlation Matrix

	Real Economic Surplus	Clark Real Income	Investment	Govt Deficits/Surpluses	Debt Levels	Broadberry, et al Real GDP
Real Economic Surplus	1					
Clark Real Income	0.9914*	1				
Investment	0.9452*	0.9633*	1			
Govt Deficits/Surpluses	-0.9022*	-0.9290*	-0.9936*	1		
Debt Levels	0.9510*	0.9450*	0.8174*	-0.7350*	1	
Broadberry, et al Real GDP	0.9914*	0.9964*	0.9555*	-0.9198*	0.9705*	1

*p < 0.05

Table 2--Johansen tests for cointegration

Trend: constant Number of observations = 12

Sample: 52 - 63 Lags = 1

Maximum Rank	PARMS	LL	Eigenvalue	Trace Statistic	Critical Value, 5%
0	6	-220.248	.	389.7131	94.15
1	17	-77.4338	1	104.0853	68.52
2	26	-54.0924	0.97956	57.4025	47.21
3	33	-37.9926	0.93166	25.2029*	29.68
4	38	-28.9569	0.77819	7.1315	15.41
5	41	-25.3916	0.44801	0.0008	3.76
6	42	-25.3912	0.00007		

Fig. 7: Broadberry, et al Real GDP by Real Econ Surplus, Decades 1270-1860

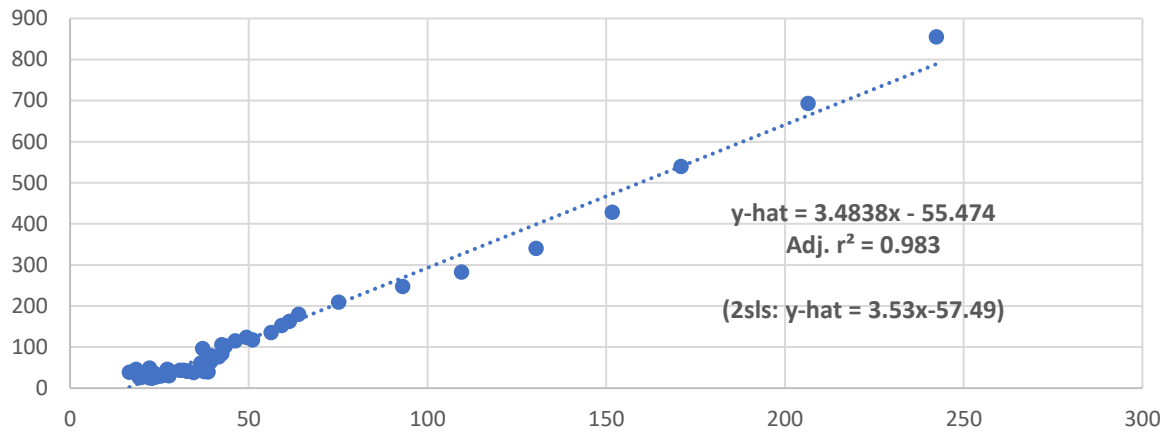
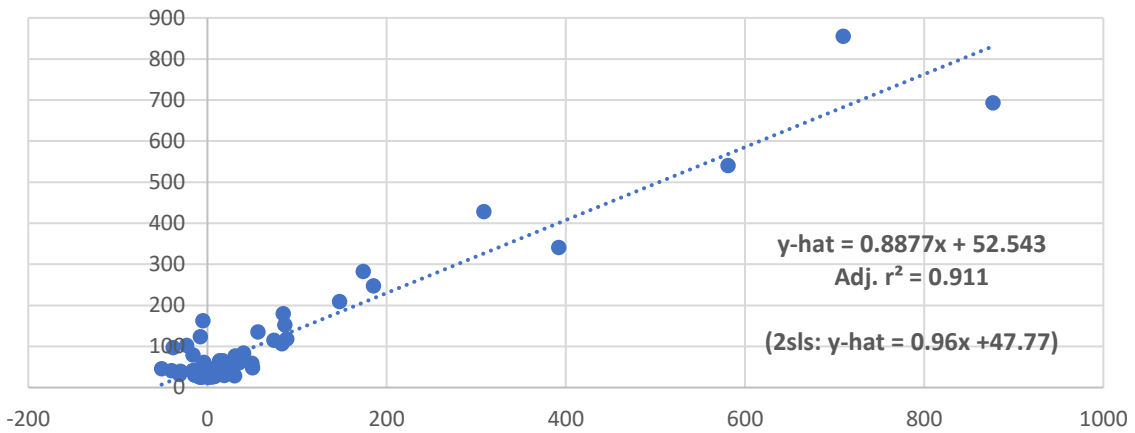
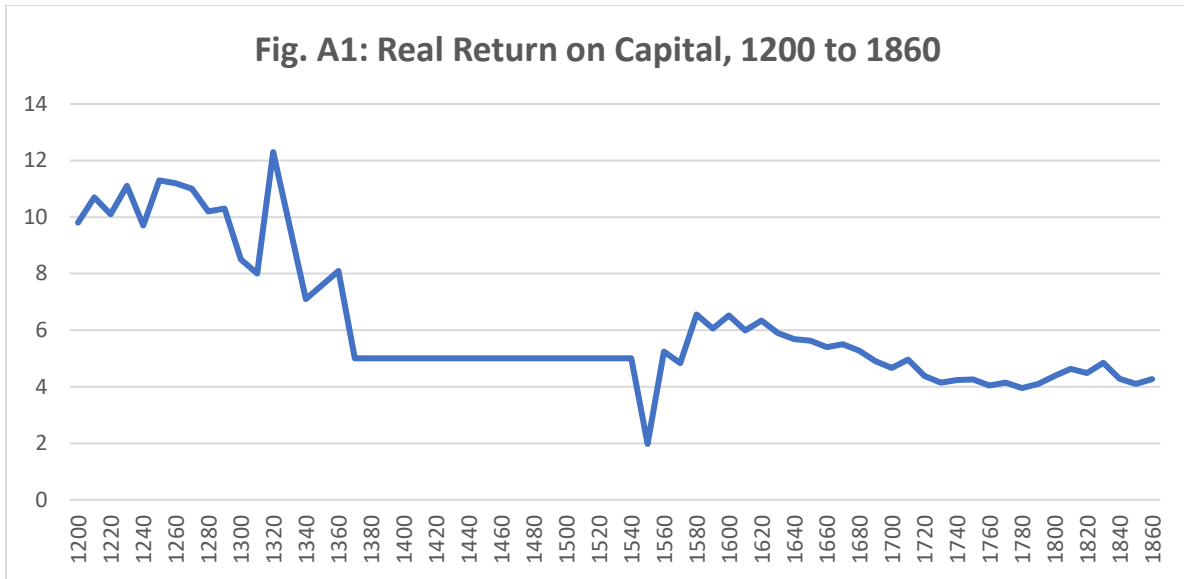


Fig. 8: Broadberry et al Real GDP by Investment, Decades 1270-1860



Appendix



Source: Gregory Clark, "National Income, Prices, Wages, Land Rents, Population, England, 1209-1869", from his website, <http://faculty.econ.ucdavis.edu/faculty/gclark/data.html> .

Table of Estimates Developed by Author

Decade	Real Econ Surplus	Real Capital Stock	Chg Real Cap Stock/Investment	Govt Deficit/Surplus
1200	46.97	231.86	---	47
1210	43.93	208.88	-22.98	66.9
1220	39.93	202.01	-6.87	46.8
1230	37.71	191.40	-10.61	48.3
1240	39.54	182.69	-8.70	48.2
1250	38.01	189.88	7.18	30.8
1260	41.49	232.80	42.92	-1.4
1270	32.82	192.59	-40.21	73
1280	34.60	210.17	17.58	17
1290	32.91	193.81	-16.37	49.3
1300	30.74	207.05	13.24	17.5
1310	27.60	197.08	-9.97	37.6
1320	38.57	188.35	-8.73	47.3
1330	37.56	210.35	22.00	15.6
1340	31.83	217.02	6.66	25.2
1350	26.09	185.81	-31.20	57.3
1360	27.68	176.98	-8.83	36.5
1370	21.65	207.39	30.41	-8.8
1380	25.40	226.22	18.83	6.6
1390	22.87	212.08	-14.14	37
1400	23.92	215.48	3.40	20.5
1410	22.35	205.87	-9.61	32
1420	22.59	214.19	8.32	14.3
1430	22.06	205.68	-8.51	30.6
1440	22.94	210.59	4.91	18
1450	22.90	211.35	0.76	22.1
1460	22.53	205.56	-5.79	28.3
1470	19.38	198.37	-7.19	26.6
1480	19.89	192.19	-6.17	26.1
1490	19.46	195.55	3.36	16.1
1500	20.59	205.34	9.78	10.8
1510	20.55	218.19	12.85	7.7
1520	20.93	207.76	-10.43	31.4
1530	23.67	213.08	5.31	18.4
1540	21.74	205.92	-7.16	28.9
1550	16.58	175.89	-30.02	46.6
1560	18.51	196.91	21.02	-2.5
1570	22.20	247.25	50.34	-28.1
1580	27.10	196.01	-51.23	78.3
1590	22.20	195.10	-0.92	23.1

1600	36.48	244.56	49.46	-13
1610	37.25	279.58	35.02	2.2
1620	39.36	292.98	13.40	26
1630	36.60	288.93	-4.04	40.6
1640	37.59	306.20	17.27	20.3
1650	39.54	336.84	30.64	8.9
1660	41.56	367.97	31.14	10.4
1670	39.38	351.71	-16.26	55.6
1680	42.46	391.88	40.17	2.3
1690	37.08	353.65	-38.23	75.3
1700	42.49	436.73	83.08	-40.6
1710	43.44	413.30	-23.42	66.9
1720	46.18	487.43	74.12	-27.9
1730	51.08	576.07	88.64	-37.6
1740	49.37	568.24	-7.82	57.2
1750	56.27	624.64	56.39	-0.1
1760	59.19	711.21	86.58	-27.4
1770	61.36	706.00	-5.21	66.6
1780	63.90	790.76	84.75	-20.8
1790	75.16	938.18	147.43	-72.3
1800	93.00	1123.43	185.25	-92.2
1810	109.47	1297.41	173.98	-64.5
1820	130.38	1689.52	392.11	-261.7
1830	151.67	1998.25	308.73	-157.1
1840	170.96	2579.47	581.22	-410.3
1850	206.42	3456.23	876.75	-670.3
1860	242.39	4165.89	709.66	-467.3